Cher Ping Lim
Charles R. Graham *Editors*

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Foreword

Mainstreaming Online and Blended Learning in Higher Education Through Supportive Ecosystems

Shortly after the launch of the Sustainable Development Goals in 2015, UNESCO Bangkok started to promote online and blended learning in partnership with a number of key universities in the region. This timely collaboration led to the publication of an important book, *Blended Learning for Quality Higher Education: Selected Case Studies on Implementation from Asia-Pacific* (UNESCO 2016), but our confidence in online learning was still nascent. At the time, online learning was still experimental and largely perceived as a supplement to "real learning" in a traditional classroom setting – something that can add a little bit of seasoning to the long-established routines and in-person practices of teaching and learning at colleges and universities.

Given the complex challenges we face today, the sceptics of online learning may be right. Collectively, we face significant gaps when it comes to ensuring universal access to well-functioning ecosystems to support the delivery of quality online and blended learning programs. The fundamental enablers, both internally and externally, are simply not present in many countries to make online delivery of learning programs "quality assured" and therefore officially recognized. To overcome these gaps in delivering high-quality teaching and learning, institution-supported rapid innovation is more critical than ever.

A Forced Reality

This book comes at a time when countries are fighting the far-reaching impacts of the COVID-19 pandemic. This crisis has called into question our priorities, our ways of life, and the functioning of our societies. With lockdowns, travel bans, and physical distancing having become the toolbox to contain the spread of the virus, we have seen an unprecedented scale and length of school closures, including colleges and universities in almost all countries. Campus- and classroom-based learning was unexpectedly disrupted, while higher education providers raced to develop solutions to ensure the continuity of learning.

In 2020, online learning has quickly become the most sought-after alternative to in-person instruction, even in countries where infrastructure and preparedness are underdeveloped. It is interesting to see that once there are no other choices, things can move forward in a more efficient way. What people need to think about is simply how to make things happen. Indeed, this forced reality has been much more powerful than advocacy or research outcomes presented before, and has generated significant momentum for scholars and the public to reimagine the role of technology in the delivery of quality higher education programs at scale.

The New Normal Post-pandemic

Before the COVID-19 pandemic, there was no lack of good practices to promote the effective use of technology in higher education. As we can see from our previous book jointly published with The Education University of Hong Kong, in many countries and systems in the region, massive open online courses (MOOCs) and blended learning strategies were well established and implemented by higher education institutions.

The outbreak of the pandemic has tremendously accelerated the process of mainstreaming online and blended learning in higher education. We cannot return to the old normal where in-person learning was the dominant modality and online learning only playing a supplemental or marginal role. It is also unrealistic to go for 100 percent online, as online learning has its own limitations. Offline learning still has its advantages in many ways and remains one of the most important sources of learning experiences for many students.

COVID-19 has exacerbated existing disparities in education, and technology has become central to our response to achieve SDG 4. Blended learning solutions are necessary in the post-pandemic era and have become the new normal. In this regard, mainstreaming online and blended learning is critical to ensure equitable access to quality higher education for all. This is not a contingency plan, but a fundamental principle for action. Going forward, UNESCO is working to redefine “normal” as we build a new understanding of inclusive quality higher education based on sustainability and supportive ecosystems.

Supportive Ecosystems

In line with SDG 4, mainstreaming requires different levels of new norms, including through regulating, institutionalizing, financing, empowering, and incentivizing. Mainstreaming involves policy support from the government, infrastructure development and upgrading, institutional capacity building, professional development of the faculty, partnership and networking, etc., which constitute the ecosystem to support the effective implementation of blended learning at higher education institutions.

In terms of policy support, it is essential that robust quality assurance mechanisms for online and blended learning be developed and implemented so that credits and qualifications obtained from online and blended learning modalities can be mainstreamed into the national qualifications systems. Infrastructure readiness is another key factor affecting online teaching and learning experiences for both teachers and students, such as the speed of internet connectivity and the availability of online learning platforms and learning resources. On top of the physical infrastructure, we may also need to strengthen academic infrastructure (qualifications frameworks, subject-specific quality standards, templates for program development, course planning, etc.) that support online and blended learning for colleges and universities.

At an institutional level, online and blended learning should be integrated into institutional strategic planning, budgeting, and administrative and capacity-building processes so that concrete platforms, templates, workflows, and internal regulations can be developed to empower and incentivize faculty. An institution-wide teaching and learning support center or its equivalent should be established within colleges and universities, with a mandate to facilitate the continuing and professional development of faculty to improve ICTs, pedagogy, and quality-assurance competencies.

Program Development and Course Planning

Down to the operational level, online and blended learning require faculty to bring online elements into their program development and course planning processes. It is important that these processes be aligned with many possible upstream frameworks, both external and internal, such as national qualifications frameworks, subject-specific quality standards, institutional vision and frameworks on teaching and learning, etc. Eventually, online and blended learning modalities should be reflected in different parts of all program and course profile documents that are developed.

As part of setting expected learning outcomes, whether through online or offline learning, the end results should be the same, or, if not, should include relevant online-related objectives and outcomes. Similarly, modules of learning can be the same. The most relevant parts are modalities of delivery, pedagogical considerations, assessment of learning achievements, and the availability of online learning resources. The percentage of online and offline learning should be decided depending on the nature and needs of the study programs and courses. Online learning pedagogy should be developed properly, taking into account the evolving dynamics between students, teachers, learning materials, parents, local communities, etc. Online learning assessment is quite different from in-person assessments, and concrete techniques should be developed to address these challenges. Faculty may also need to contribute to and make the most of available online open educational resources to benefit more students in their local education systems and beyond.

Main Features of the Book

Based on my observations, I am happy to see that the publication of this book is very timely and relevant with insightful features to share with our readers.

First, this book adopts a systems approach towards how online and blended learning could be driven and supported to improve access to quality higher education. At the same time, it focuses on subject and discipline levels to promote online and blended learning in different higher education institutions. From mapping ecological structures of blended learning in engineering to blending general education tutorials, the authors illustrate the vision and insights to drive much-needed innovation in teaching and learning in Asia.

Second, this book takes stock of promising policies and practices and lessons learned in Asia, focusing mainly on South Asia and North-East Asia, with cases from both advanced systems and emerging systems, including those facing a digital divide between urban and rural communities. I am sure readers from different backgrounds will find the cases relevant, inspiring, and useful.

Third, the book chapters are written by scholars, practitioners, policy-makers, and support staff, a perfect combination to make them not only well conceptualized, but also policy orientated and operationally relevant.

On behalf of UNESCO, I would like to thank Professor Cher Ping Lim from The Education University of Hong Kong and Professor Charles Graham from Brigham Young University for co-editing this important book. They are the leading international scholars in the area of online and blended learning for higher education, and we all have much to learn from them and this excellent collection.

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Libing Wang

Foreword

In 2020, the COVID-19 pandemic forced almost two billion learners globally to shift from traditional face-to-face instruction to mixed modes of learning. Up to this point, online learning, blended learning, flipped classroom, and other technology-mediated formats were options: we could decide whether or not to engage with or make use of them. However, with the need for academic continuity while the whole world was on lockdown, schools and learners had no choice but to pivot, and pivot quickly. Technology-mediated formats were no longer optional, not if we wanted our students to keep on learning.

Pivoting had many obvious implications, i.e., teachers needed to be trained and learning materials needed to be redesigned. However, there were less obvious implications as well: academic institutions needed to rethink their core values, curriculum itself had to be whittled down to the essentials, and technical and administrative structures had to be invented or reinforced to support learning online.

There were, of course, documented ways of proceeding. Literature was awash with frameworks, theories, and experience reports. The internet exploded with advice on how to teach online. A Google Scholar search of 2019 and 2020 articles about “education” and “COVID-19” yielded over 20,000 results. Of these, though, what many of my colleagues and myself seemed to value most were stories. How did teachers like us manage? How did institutions similar to ours cope? How did they continue to provide their services at scale?

Blended Learning for Inclusive and Quality Higher Education in Asia tells us stories about people like us and institutions such as ours. While it was not written in the context of COVID-19, it discusses a technology-mediated approach to learning – blended learning – that will no longer be optional in the years ahead. Indeed, in anticipation of rotating lockdowns, blended learning may need to be the go-to strategy for all of us in education.

The stories within this book are valuable for many reasons. Let me cite three. First, the chapters provide us with a systems-level view of blended learning. While tech-savvy, motivated individuals can share their successes, broad impact and extended reach requires university-level commitment and cooperation among different institutions. The chapter by Han and Wang, for example, identifies key drivers for blended learning within six educational institutions in China. These include alignment with strategic goals and the establishment of support infrastructure. Suraweera and colleagues, on the other hand, show how the educational ministry of Sri Lanka worked with university partners from three other countries to establish the National E-Learning Resource Center.

Second, context is king. Increasingly, researchers are recognizing that there is no one-size-fits-all solution to the complex problems of education. Culture – and I use this term broadly; this may refer to a national culture, a socio-political culture, a disciplinal culture – must influence the design of any intervention. Hence, the book's chapters discuss specific needs and nuances of their respective target audiences and show how solutions are customized accordingly. Lim, Yang, and Gao show a grassroots teacher professional development program that addresses individual training needs of teachers in Hong Kong. Dai narrates a flipped learning approach used to bring engineering students from two countries together in a collaborative project in order to build both engineering skills and competency in intercultural negotiation.

Finally, the book places emphasis on inclusivity while maintaining quality. The purpose of scaling is to reach those whose access to education is limited and thereby improve their life outcomes. Lim and colleagues describe how three universities in the Kingdom of Cambodia collaborated to offer blended learning STEM courses in rural areas. The approach extended their reach and closed the urban-rural quality gap of STEM teaching and learning. The chapter by So, Lee, and Lee elaborates on how Korean universities have transformed in response to social needs for greater access to quality higher education.

These and other stories from people like us and institutions like ours provide us with exemplars from which to learn and models to follow. They share their triumphs and their challenges. They provide us with guidance, inspiration, and hope, so that in turn we might provide guidance, inspiration, and hope to the many students under our care.

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Ma. Mercedes T. Rodrigo

Preface

Background of the Book

Blended learning, the integration of in-person and online learning, offers universities with opportunities to improve their students' access to quality higher education teaching and learning that enhances student engagement and their learning outcomes (Dziuban, Graham, Moskal, Norberg, & Sicilia, 2018; Garrison & Kanuka, 2004; Graham, 2006; Norberg, Dziuban, & Moskal, 2011; Wanner & Palmer, 2015). It positions universities towards achieving the United Nations' Sustainable Development Goal 4 of ensuring "inclusive and equitable quality education and promote lifelong learning opportunities for all" (United Nations, 2015, p. 19). Students in a blended learning environment are provided with more opportunities for monitoring and managing their own learning as they learn how to learn. However, universities may lack the capacity to take up these opportunities to design and implement blended learning that engages students and supports them to meet the learning outcomes of the course. This book aims to (1) examine the support mechanisms for blended learning in Asian universities and (2) document and examine the promising practices and lessons learned of blended learning in different disciplinary courses in Asian universities.

The book is divided into two main parts, university-level initiatives and policies, and disciplinary-level practices and lessons learnt. The first part, "University Approach to Blended Learning," contains five chapters that feature leading universities in the region driving and supporting blended learning at the faculty and institutional level. The second part, "Disciplinary-level Blended Learning Practices," has ten chapters that focus on the promising blended learning practices and lessons learned across different disciplines (including, humanities and language, science and engineering, social science and education, and others) in Asian universities. Additionally, the case studies presented in this book represent perspectives about blended learning in higher education from six different countries across Asia: Cambodia, China, Malaysia, Singapore, South Korea, and Sri Lanka. A final chapter by the two editors and their co-authors synthesizes the key themes and subthemes of the preceding chapters and charts the way forward for blended learning practices and policies. Through these two key parts, the book intends to provide readers with a sociocultural perspective of how blended learning is designed, implemented, and evaluated across courses of different disciplines, and how these practices are driven and supported at the faculty or university level.

University/Faculty Policies, Initiatives, and Strategies to Drive and Support Blended Learning

To ensure the sustainability and scalability of blended learning practices within and across courses in a university, there is a need to examine how the university policies, initiatives, and strategies drive and support these courses. In Chap. 1, Xibin Han and Yuping Wang investigate the three dimensions of strategies, structure, and support (Graham, Woodfield, & Harrison, 2013) for the planning and implementation of blended learning in six higher education institutions in remote areas in Mainland China. The chapter examines how system-driven blended learning has a positive impact on equitable quality education and lifelong learning across the different institutions, especially those in the remote regions of Mainland China. Chapter 4 by Isaac Chan, Muhammad Hafiz, Theresa Kwong, and Eva Y. W. Wong discusses how augmented reality (AR) is adopted with authentic scenarios of academic integrity and ethics (AIE) to enhance students' awareness towards AIE at a university in Hong Kong. The chapter explains how the university strategies, structure, and support are in place to sustain AR for AIE. More importantly, with the university-level support, this chapter highlights how such a blended learning practice is more likely to enhance the meaningful AIE learning experience of students with different cultural backgrounds. Similarly, Chap. 5 by Cheolil Lim, Young Hoan Cho, and Sunyoung Kim describes the three factors for effective blended learning implementation with the support of Learning Management System (LMS) and other online systems at a university in South Korea. The chapter highlights the pivotal role of LMS for effective blended learning and analyzes how blended learning is implemented for access to quality education at the university.

In terms of the capacity building of universities for blended learning, Lim and Wang (2016) developed a framework to support effective blended learning adoption in universities. The framework consists of eight dimensions, i.e. vision and philosophy, curriculum, professional development, learning support, infrastructure, facilities, resources and support, policy and institutional structure, partnerships, and research and evaluation (Lim & Wang, p. 4). Based on this framework, Chap. 2 by Cher Ping Lim, Danlin Yang, and Yu Gao focuses on the dimension of professional development. The chapter investigates how a grassroots approach to professional development is adopted in a faculty at a university in Hong Kong to enhance the capacity of teaching staff for blended learning. The case study highlights the role of the two key components of the grassroots approach – department-based blended learning ambassadors and needs-driven and just-in-time support. The key findings suggest that the grassroots approach to professional development develops the competencies of the teaching staff for blended learning by ensuring peer support and considering the professional learning needs of the staff.

Apart from the implementation of blended learning at the university level, the national initiatives for blended learning are documented in the book. Chapter 3 by Namali Suraweera, Kaushalya Yatigammana, Chathura Priyankara, Gamini Wijayarathna, and Upul Jayantha Ranepura introduces how the National E-Learning Resource Centre (NELRC) develops a collaborative partnership approach to enhance student learning experience with blended learning in Sri Lanka. The NELRC adopts the framework for building the blended learning capacity of universities developed by Lim and Wang (2016) for blended learning implementation in Sri Lanka. Based on the framework, the chapter describes how the NELRC promotes blended learning in partnership with different stakeholders to enhance access to quality higher education in Sri Lanka.

In Chap. 9, Hyo-Jeong So, Jihyang Lee and Eunyul Lee select three cases including university-level, inter-institutional-level, and national-level programs in science and engineering in the context of South Korean higher education. The chapter investigates how blended learning as a complex system is implemented for access to quality higher education. It highlights how blended learning provides higher education learning opportunities for a wide range of learners in science and engineering. In Chap. 14, Norazah Nordin, Helmi Norman, and Yasmin Zakaria discuss how Massive Open Online Courses (MOOCs) are adopted for blended learning in teacher education. The chapter highlights the development of MOOCs by Malaysian public universities with the support of the nationwide initiative, Malaysia MOOCs, and its impact on teacher education. Based on a local university as a case study, the chapter illustrates how the students and instructors collaboratively develop and adopt MOOCs to blend in the courses. The implementation of MOOCs in blended learning in Malaysian higher education context offers an exemplar of blended learning adoption at the national-level in Asia.

Blended Learning Implementation at the Course Level

The university-level policies, initiatives, and strategies drive and support blended learning implementation at the course level. They provide the necessary and sufficient conditions for teaching staff to design and implement blended learning in their courses. Chapter 6 by Lixun Wang adopts blended learning in a linguistics course at a university in Hong Kong by using the LMS Moodle to provide more flexibility for and interactions with and among students. The online lessons in the course consist of three levels of online activities: (1) high-quality lecture video clips as resource-based activities, (2) online quizzes for student responses, and (3) discussion forums for peer interactions as collaborative activities. Based on the post-lesson evaluation, such a blended learning practice provides students with a more meaningful and engaging learning experience. Chapter 8 by Cheung On Tam adopts a design-based approach to develop, experiment, and reflect on the online lessons in three iterations for the Bachelor of Education students specializing in visual arts. This chapter describes how an online lesson is developed, implemented, and evaluated in a course at a university in Hong Kong. The chapter highlights that the blended learning practices have a positive impact on student learning engagement by adopting public open learning courses and online collaborations.

Apart from developing online lessons, Chap. 15 by Ying Zhan, Daner Sun, Ngok Cheng Chan, Kam Wing Chan, Tak Shing Lam, and Tai Hoi Lee blends online learning activities for formative assessment in face-to-face tutorials and investigates the impact of formative e-assessment (FEA) on student learning engagement in terms of cognition, emotion, and behavior in a General Education (GE) course at a university in Hong Kong. The chapter examines the effectiveness of blending three online tools (i.e., Kahoot, Mentimeter, and Google+) as online formative assessment tools to facilitate student learning engagement in the GE course. The findings of the chapter provide teaching staff with insights of adopting formative e-assessment for enhancing student learning engagement. These three chapters (Chaps. 6, 8, and 15) demonstrate that various online learning tools blended with face-to-face classes in the courses provide more opportunities for students to interact and collaborate with peers. These chapters also highlight how blended learning can enhance student learning experience in humanities and language disciplines in the higher education context with well-established university-level blended learning strategies and support.

Chapter 7 by Bophan Khan, Soviphea Chenda, Sumethea Heng, and David Coniam discusses how the emerging blended learning approach is adopted to teach academic writing at a leading Cambodian university. Although the teaching team is at an early stage of adopting blended learning, the chapter provides valuable insights on the process of planning, implementing, and assessing blended learning in the Cambodian higher education context. More importantly, blended learning may have a positive impact on student learning engagement and learning outcomes.

Although teaching staff play a pivotal role in adopting blended learning, it is crucial to have the support mechanism to facilitate the redesign of blended learning to ensure that students can achieve their course learning outcomes. Several instructional design models are discussed in the following chapters to ensure the design of blended learning is in alignment with the course learning outcomes and student learning needs.

Chapter 10 by Donn Emmanuel Gonda, Jing Luo, Chi-Un Lei, and Tsz Yan Emily Leung discusses how blended learning is adopted in three engineering courses to accommodate student needs from novice to advanced engineering students. This case study focuses on the design and implementation stages in the Analysis Design Development Implementation Evaluation (ADDIE) instructional design model for the courses, and how to design blended learning in the courses in order to support the development of computational thinking among students. Chapter 11 by Yun Dai addresses the quality access to intercultural competency by adopting blended learning in an engineering course at a university in Mainland

China. The chapter describes the development of the iPodia Program that is guided by a sociotechnical framework of engineering education and Bloom's Taxonomy. The chapter discusses how blended learning can facilitate the levels of intercultural competency development by analyzing the program design and student feedback. This chapter contributes to our understanding of how intercultural competencies can be enhanced in engineering education.

Apart from the instructional design models for science courses, Chap. 13 by Seng Chee Tan, Helen Bound, and Xinghua Wang discusses a blended learning design model for collaborative knowledge building. The chapter suggests there are three elements of blended learning that include the design from a learning perspective, the dimensions of blended learning, and the components to integrate for quality learning. The chapter takes a graduate-level course as the case to illustrate the blended learning design approach and how the approach could facilitate the course design to engage students in knowledge building in a collaborative way.

Unlike HEIs (higher education institutions) with well-established blended learning support, Chap. 12 by Cher Ping Lim, Tianchong Wang, Bunlay Nith, and Ngoy Mak presents how blended learning is implemented in a Science, Technology, Engineering and Mathematics (STEM) course at the urban and rural universities in the Kingdom of Cambodia. The chapter highlights how the urban university collaborates with the provincial universities to facilitate the development of online resources and blended learning implementation. The chapter suggests blended learning strategies may address the quality and access challenges of teaching and learning in the courses. Regardless of the instructional design models, these chapters illustrate how universities design and adopt blended learning to address students' learning needs and facilitate their knowledge building.

In the final chapter (Chap. 16), Holt Zaugg, Charles R. Graham, Cher Ping Lim, and Tianchong Wang synthesize the discussions of each chapter, particularly on the blended learning practices and its impacts on inclusive and quality higher education in Asia. With the gaps identified from the synthesis, the chapter presents six key recommendations and directions for universities in Asia to develop their capacity for blended learning in the future. Such insights tend to offer perspectives which may be helpful to those adopting blended learning and those aiming to implement blended learning for inclusive and quality higher education in Asia and beyond.

Overall, the book is designed to be both informative and transformative in its coverage of approaches, enabling conditions, and impacts of blended learning from different disciplinary perspectives on quality and equity. It serves as an important resource for blended learning researchers and practitioners, higher education leaders and policy-makers, and international, regional, and national agencies and organizations.

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Contents

Chapter 1
System-Driven Blended Learning for Quality Education: A Collective Case Study of Universities and Vocational Colleges and Schools in China

Xibin Han and Yuping Wang

Abstract In today's education, blended learning (BL) has become integral to education transformation. This chapter continues to explore the drivers of BL for equitable access to quality education but using Chinese educational institutions as a collective case study. This aim was achieved by analyzing what drove the development of strategy, structure, and support for BL implementation across six educational institutions in China. These institutions include two universities, two vocational colleges, and two vocational schools. Their achievements in teaching and learning were also discussed to gauge the impact of their BL implementation. The results show that all the six institutions adopted an institution-wide, system-driven approach with clearly defined goals, coordinated approaches, and concerted support at different levels, despite the fact that their models and needs for BL are different. Their experiences and achievements in BL revealed the following key drivers for BL implementation in the Chinese education context: (1) the integration of BL implementation into their long-term goals for educational reform and the mobilization of the institution-wide involvement of the teachers and administrators at different levels, (2) conditioning the institution for the start of BL adoption at both the administrative and infrastructure levels, and (3) the provision of both technical and pedagogical support in a timely and ongoing manner at all levels. Among the six cases of BL implementation, the sustained improvement in learning and teaching quality of the three institutions from the poorer remote regions in China has particular implications for promoting accessible and equitable quality education and lifelong learning through BL.

Keywords Blended learning · Equitable education · Quality education · Higher education · Vocational education

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1.1 Introduction

Technologies, such as the Internet, cloud computing, big data, and artificial intelligence, are changing our society and our way of life in many profound ways, blending the real with the virtual, to say the least. As far as education is concerned, technologies are also enabling the blending of face-to-face learning with online learning to improve teaching and learning quality and equitable access to quality education as evidenced by a wealth of BL research and practice. A good example can be found in the collection of case studies recently published in the book titled *Blended Learning for Quality Higher Education: Selected Case Studies on Implementation from Asia-Pacific*, co-edited by Lim and Wang (2016). At the outset, as providing inclusive and equitable access to quality education is the utmost concern of this research, we would like to provide an operational definition of quality education for this research. It is defined here in line with the Sustainable Development Goals set by the United Nations General Assembly in 2015, in particular, goal 4, known as Education 2030, which emphasizes education for all. Thus quality education in this research means to provide "inclusive," "equitable," and "lifelong learning opportunities for all" through BL (UNESCO, 2015). We also recognize that for learners in different types of educational institutions, quality education offered though BL can present itself in different formats and scopes, face different challenges, and have different implications for teaching and learning. For example, BL in higher education can be a means to provide all learners with equitable access to educational experiences that are more engaging and effective than face-to-face learning alone. To vocational education, BL can be a means to "substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship" (UNESCO, 2015). This is one of the reasons that we have selected institutions from higher education, vocational colleges, and vocational schools to represent a wider spectrum of BL cases so that we can explore the roles of BL in a more holistic manner.

The potentials of BL in improving the quality of learning experiences and outcomes as well as learners' satisfaction in learning have been long recognized. For example, Forsey, Low, and Glance (2013) found more accountability of learning on the part of the learners when students studied in blended mode. Hsu and Hsieh (2014, p. 233) reported the development of "metacognitive ability in comprehension, argumentation, reasoning and various forms of higher order thinking." McLaughlin et al. (2013, p. 196) confirmed that BL facilitated "student empowerment, development and engagement." Nevertheless "despite promising practices, the sustainability and scalability of BL have been an enormous challenge," as pointed out by Lim and Wang (2016, p. XIV). This chapter looks at this challenge using a systems approach to explore the interaction between key drivers of BL.

The systems approach we adopted in this research was particularly informed by two studies. The first is the study by Wang et al. (2015), which proposed a framework that regards BL as a complex adaptive system of learning consisting of six key complex entities, namely, the learner, teacher, institution, content, technology, and learning support. What impacted the current study most was the idea that it is the constant interaction among these entities that pushes BL forward, forming a “fitness landscape that is constantly changing as they change” (Cleveland, 1994, cited in Wang et al., 2015, p. 382). The second study that inspired this research was by Lim and Wang (2016a) who also proposed a framework with a holistic view of building institutional capacity to drive, sustain, and scale up BL. Eight strategic dimensions are included in the framework: vision and philosophy; curriculum; professional development; learning support; infrastructure, facilities, resources, and support; policy and institutional structure; partnerships; and research and evaluation.

In the past 5 years, institution-wide BL implementation strategy and status in higher education have received increasing attention from scholars and BL practitioners (e.g., Overbaugh & Nickel, 2011; Owston, 2013; Porter & Graham, 2016), but as far as Chinese high education is concerned, only a few studies can be found reporting what has been achieved in BL in Chinese universities (e.g., Gu, 2016; Han, Wang, Li, & Cheng, 2016; Lim & Wang, 2016b). The same dire situation equally applies to research concerning BL in Chinese vocational education. Up to date, only one study (Wang & Han, 2017) can be found in English peer-reviewed journals. This is also why this research focuses on BL implementation in both higher and vocational education settings.

1.2 Methodology

The aims of this study, that is, to explore the drivers for BL implementation and the implications of BL to promote inclusive and equitable quality education for all, determined our adoption of a case study method of a qualitative nature. Here we followed Yin’s (1984, p. 23) guidelines for using a case study method with a particular reference to the investigation of a “contemporary phenomenon within its real-life context” and the use of “multiple sources of evidence.” These aims also informed our decision of choosing institutions from both higher education and vocational education. Vocational education in China is mainly state-run and consists of vocational colleges (postsecondary school level) and schools (secondary/high school levels). Most students in vocational colleges and schools are from a comparatively low socioeconomic background, and this is especially true for students in remote or underdeveloped areas in China.

1.2.1 Case Selection

Three criteria were used for selecting cases for this research. They are (1) institutions that we had in-depth knowledge about their BL development, as required by the case study method, (2) institutions that represent both remote and developed areas in China to gain a more comprehensive picture of the BL landscape in China, and (3) institutions that could be roughly assessed following the three categories of BL implementation proposed by Graham, Woodfield, and Harrison (2013), i.e., strategy, structure, and support (see discussion below).

Since 2012, our research team has been deeply involved in various institutions' BL implementation in China, especially those institutions using the Tsinghua Education Online (THEOL) as their learning management system (LMS). Our involvement included offering technical support for creating online learning environments for BL implementation, curriculum design guidance, ongoing teacher training, and professional development, among others (see Han et al., 2016; Wang & Han, 2017, for more details). Such firsthand knowledge facilitated our initial screening of 12 potential cases for this study, 4 from higher education, 4 from vocational colleges, and 4 from vocational schools.

This initial selection was further assessed using the BL implementation categories and indicators proposed by Graham et al. (2013). Table 1.1 summarizes these categories and indicators.

Eventually, six institutions that better matched these indicators were selected, with two universities, two vocational colleges, and two vocational high schools. As shown in Table 1.2, which contains some background information about these six institutions, these institutions represent a mixture of universities and vocational colleges and school from different parts of China.

1.2.2 Data Collection and Case Analysis

Data relating to strategy, structure, and support were collected from the policy library and announcements relating to BL implementation on each institution's LMS and interviews with administrative officers from the IT support center in each institution. The impact of BL implementation was also summarized for each institution using the statistics from each institution's LMS data such as students' evaluation data, log data for learning activities, and academic performance data such as students' grades.

Table 1.1 Categories and indicators of BL implementation

Category	Indicators
Strategy	Advocacy, the degree of implementation, purposes of BL, and policies
Structure	Governance, models, scheduling structures, and evaluation
Support	Technical and pedagogical support, faculty incentives

Graham et al. (2013)

Table 1.2 Background information of the six institutions in this research

Name of institution	Location in China	Year founded	No. of students	No. of teaching staff	No. of year of BL adoption up to 2018
Shandong University of Technology (SUT)	Zibo, Shandong province (east)	1956	62,300	2016	6
Inner Mongolia University for Nationalities (IMUN)	Tongliao, the Inner Mongolia Autonomous Region (north, remote area)	1958	22,591	1119	4
Bohai Shipbuilding Vocational College (BSVC)	Huludao, Liaoning province (northeast)	1959	8000	622	2
Guangxi Electrical Polytechnic Vocational College (GEPVC)	Nanning, the Guangxi Zhuang Autonomous Region (south, remote area)	1979	Over 10,000	491	3
Fujian Chemical Engineering Vocational School (FCEVS)	Xiamen, Fujian province (southeast)	1958	5000	100	6
Urumqi Physical Education and Sports Vocational School (UPESVS)	Urumqi, Xinjiang Uyghur Autonomous Region (northwest, remote area)	1989	1546	183	4

Owing to the aims of the study, data analysis is descriptive in nature showcasing the process and impact of the BL implementation in each institution in order to explore the factors that had systematically driven their BL adoption and implementation. To this end, we presented and analyzed our findings regarding each institution's BL implementation, in terms of the three categories of BL implementation, that is, strategy, structure, and support. This was then followed by a discussion on the impacts of each institution's BL adoption.

1.3 Results

1.3.1 Implementation of BL in Shandong University of Technology(SUT)

Since 2012 when they started BL, SUT has constantly improved its online and BL policies and promoted a new model of teaching that combines in-class with out-of-class learning, online with face-to-face learning, and on-campus with off-campus learning. Their mission is to improve student learning quality through university-wide teaching reform supported by technology.

1.3.1.1 Strategy

From the very start of its BL adoption, this university has adopted a coordinated approach to systematically advocate and institutionalize BL implementation. Such an approach is evident in the advocacy of BL concept and models by the university administration and in the formulation of BL-related policies. For example, BL implementation formed an integral part of the university's 13th 5-year strategic plan. The university published a series of policy documents regarding BL adoption, for example, *Blended Learning Implementation Strategies*, *Blended Learning Course Implementation Guidelines*, and *Reforming Assessments*. The university also revised all the programs and majors to include technology-supported self-learning and lifelong learning into their learning goals. A new model was advocated and implemented for reforming classroom teaching through blending in-class with out-of-class learning, online with face-to-face learning, and on-campus with off-campus learning.

1.3.1.2 Structure

In the early stage of their BL adoption, a BL working party was established, headed by the university president, in order to lead and coordinate the whole university's BL development. In addition, under the auspices of the academic affairs office, an educational technology center, headed by the deputy head of the academic affairs office, was established.

The university set a BL target with models at three levels of BL intensity. To be more specific, by 2020, 100% of courses will be offered in basic BL mode, with all course materials being digitized and placed online; 30% of its courses will be offered in the medium level of BL mode, with online teaching as part of its curriculum; and 20% of its courses will reach an advanced level of BL, fundamentally changing the ways of teaching and learning.

A distinctive feature of this university's BL implementation is its comprehensive BL evaluation mechanisms that systematically review its BL teaching practice by BL experts, teachers, and students. BL courses are regularly evaluated by peer reviews, student course satisfaction surveys, and BL experts through the observation of face-to-face and online teaching. Combined with data collected from students' online learning behaviors and assessment marks, results from these evaluation mechanisms inform the university's administration of the progress of their BL and help the university identify problems and areas for improvement and teacher support.

1.3.1.3 Support

Three levels of support are in place. At the university level, a facilitating environment has been created for BL implementation with the support of strong and clear policies, strategic plans, and regulations. At the department level, department heads were responsible for achieving blended course target quota and conducting the evaluation of blended courses. At the teaching level, BL concepts were defined and promoted throughout the university, and BL course development was guided, supported, and evaluated by experts. Students' learning needs were identified, and learning was scaffolded and supported. Incentives such as financial support for BL-related activities were also in place.

The university attaches great importance to teachers' ongoing professional development to keep teachers abreast with new developments in educational philosophy and pedagogy and to help teachers develop digital literacy and BL expertise. This is exemplified by the university's encouragement and financial support for teachers' participation in BL-related international conferences and training programs. In addition, various workshops have been organized to showcase good BL and teaching practices and curriculum design, with an emphasis on learner-centered learning as opposed to teacher-centered learning.

1.3.1.4 The Impacts of BL Implementation on Teaching and Learning

Between 2012 and July 2017, 1222 Web-based courses were developed, including 673 resource-sharing courses, 288 Web-facilitated courses, and 261 blended courses. All these courses were offered on the university's LMS which supports course building, resource sharing, course management, teacher-student interaction, student management, and evaluation tools. The total number of platform visits reached more than 52 million by July 2017, with an average annual increase of more than 10 million and an average of 320 annual visits by each student.

BL has proven to be effective in motivating students to learn. For example, the log data on the university's LMS show that in the 7 semesters between 2012 and August 2016, the number of times that students browsed the course contents online reached 3,597,837, and they posted 350,126 entries on the discussion boards, submitted 891,632 online homework items, and completed 162,736 online tests. Over this period, the course failure rate dropped by 4.6%, and high distinct and distinction rates increased by 18%. Student survey data also show that improvement had been achieved in self-learning skills (85.4% being positive), in oral expression and logical thinking (78.6% being positive), and in team spirit (70.9% being positive). In addition, improvement in written expression, critical thinking, and the sense of responsibility was also reported.

1.3.2 Implementation of BL in Inner Mongolia University for Nationalities (IMUN)

Different from the other 5 cases, 46% of the student population in IMUN is made up of learners from 34 of the 56 ethnic groups spread across China. This is also one of the reasons that this university was chosen as a case study to explore inclusive and equitable access to quality education for all. IMUN offers subjects in 11 disciplinary areas including economics, law and legal studies, education, literature, history, science, technology, agriculture, management, and arts. In 2014, this university started its BL adoption with the mission of transforming its classroom teaching and developing a new model for equitable quality higher education in remote areas in China.

1.3.2.1 Strategy

Before the rollout of BL, the university set clear goals for its BL implementation, that is, through reforming classroom teaching, to develop students' twenty-first century skills and teachers' professional competencies in supporting student learning. Their BL adoption started with the advocacy of new educational concepts and ideas to their teachers. These concepts include online learning, BL, active learning, and learner-centered approach. They also focused on developing the teachers' skills and competencies in motivating and engaging students in learning. Three transformations were expected to happen in the classroom: the transformation from teacher-centered to learner-centered learning, from passive learning to participatory and active learning, and from teachers being the sage on the stage to being the guide on the side.

These goals are supported by strong policies and clear guidelines. Several key policies were issued to guide and regulate the BL development such as *implementation strategies for reforming classroom teaching at IMUN* and *criteria for online course development at IMUN*. Five principles have been promoted throughout the university. That is, BL implementation should be "moral education prioritized, teacher led, student oriented, education quality focused, and technology supported." These principles have been realized through four specific strategies, i.e., supporting with grants, piloting before large-scale implementation, training before teaching reform, and reflecting in practice.

1.3.2.2 Structure

With such strong policy support and a clear mission, the university started to build and upgrade its infrastructure for BL adoption since 2014 and has now completed its digital campus building, providing a stable, effective, and efficient environment for BL and teaching. Evaluation mechanisms were established, and blended courses were regularly evaluated by BL experts and students through seminars and surveys.

1.3.2.3 Support

Teachers and students were fully supported. Apart from professional development and training, other forms of pedagogical support were also available to teachers involved in blended teaching. For example, the university engages the Institute of Educational Technology at Tsinghua University to provide ongoing support in terms of updating teachers on new developments in BL theories and practice and helping with course design and LMS management.

Another outstanding feature of the university's pedagogical support is its systematic and ongoing professional development programs. For example, external BL experts have been invited to the university to facilitate and guide professional development and training; teachers have been sent to other universities to attend training programs. Between May 29, 2015, and July 13, 2017, 61 training sessions were held, with a total of 2616 participants including administrators of all levels and teachers involved in BL. By July 13, 2017, 742 teachers had participated in various forms of BL training programs.

Another kind of support came in the form of incentive mechanisms. These include grants to support teaching reform, salary/payment increase, and teaching excellence awards.

Technical support was also readily available to both the teachers and the students, from various sources such as the university's IT support center, WeChat group service, and IT support hotlines.

1.3.2.4 The Impacts of BL Implementation on Teaching and Learning

Improved Learning Quality and Effectiveness on the Part of the Students By July 2017, there were 377 BL courses attended by over 20 thousand students. LMS visits reached 3.04 million. The surveys conducted to 6785 students between December 29, 2015, and January 13, 2017, show that 94.13% believed that BL motivated them to learn; 92.19% enjoyed BL; 91.79% believed that BL improved teaching quality in comparison with other forms of teaching; 96.48% said that they preferred ongoing assessments (e.g., attendance, discussions, homework, ongoing quizzes) to end-of-semester exams. Such a high level of engagement in learning forms a distinctive contrast to the students' lack of interest in learning before BL implementation.

Improved Pedagogy and Research Ability on the Part of the Teachers The use of technology in teaching and ongoing professional development in BL have advanced the teachers' understanding of new teaching philosophies and innovative pedagogies and elevated their academic knowledge and research capacity to a new level. A number of model BL teachers have emerged who had produced excellent evidence-based research outcomes relating to their BL teaching. The 2017 edition of Horizon Report released by the New Media Consortium: Higher Education in China published two case studies reporting BL implementation in this university: *BL implementation mechanisms and strategies in IMUN* and *A case study of teaching reform through BL in IMUN*. More than 60 teachers were invited to present their teaching innovations on various occasions, and over 10 universities visited this university to learn from them.

1.3.3 Implementation of BL in Bohai Shipbuilding Vocational College (BSVC)

BSVC is a vocational college of a postsecondary school level, offering 51 specialized disciplinary areas that cover shipbuilding engineering technology, military industry, mechanical engineering, information technology, service industry, and teacher education. Since 2016, it has been transforming its courses into BL mode, exploring a model of integrating teaching, learning, and practice through BL and extending learning outside the classroom.

1.3.3.1 Strategy

The BL adoption in BSVC started with a clear goal, that is, to develop a blended model of integrating teaching and learning with training and practice. Before the start of their BL, the model of integrating teaching and learning with training and practice had been practiced in this college, with classrooms equipped in accordance with this concept. Their BL mission is to use online technology to transform this model into a blended one, seamlessly blending online with face-to-face teaching, learning, training, and practice to offer the students a more effective environment for skill-based learning.

1.3.3.2 Structure

To achieve this goal, the college has invested heavily in the building of both physical and virtual training laboratories, blended courses, and immersive and 3D learning environments. Its online learning is supported by cloud computing allowing students to learn and practice wherever and whenever they have access to the LMS.

1.3.3.3 Support

Strong technical support from the college's IT department was a key feature of its BL adoption. All the essential infrastructure building with high-tech facilities and requirements were initiated, created, and supported by the IT department, for example, the integration of physical training laboratories with LMS, the building of virtual training laboratories, the production of immersive online resources, and the integration of 3D teaching materials with immersive teaching materials.

1.3.3.4 The Impacts of BL Implementation on Teaching and Learning

Since 2016, 88 blended courses have been offered and 38 are still being developed. These courses feature multimedia online learning resources, virtual training laboratories, physical training laboratories, and teaching staff with specialized knowledge and practical skills and competencies. A typical blended course would see the students learning in the immersive online environment and then entering the virtual training lab to practice before class. In class, the teacher would first answer questions and explain key and difficult points and then ask the students to scan the QR code on a piece of equipment to enter the online section of the course to learn and complete an online quiz. Those who have passed the quiz would start hands-on practice using the real equipment in the classroom. Those who have failed the quiz would continue to learn and start hands-on practice only after they have passed the quiz. They can scan the QR code on the equipment anytime to check their understanding whenever they encounter any difficulties. Clearly, technology has enabled the students to learn at their own pace in an authentic learning environment which effectively facilitates skill acquisition. The data from a student survey conducted in December 2017 show that 80% of the students would choose BL over traditional face-to-face classroom teaching in the future, indicating their preference of the model of technology supported integration of teaching and learning with training and practice.

1.3.4 Implementation of BL in Guangxi Electrical Polytechnic Vocational College (GEPVC)

GEPVC is a postsecondary school-level vocational college in a remote area in China. It offers 42 majors in 7 disciplinary areas including energy and power engineering, electronics and information engineering, finance and management, mechanical and electronic engineering and automation, architectural engineering, and automobile and transportation. Since 2015, it has been transforming its courses into BL mode to meet the needs of internal and external teaching in the Internet environment.

1.3.4.1 Strategy

The purpose of BL implementation in this college was clearly defined from the very start, that is, to invigorate teaching by developing a blended model of integrating learning with training. More specifically, the college aimed to develop a new mode of teaching and learning that takes advantage of the Internet. This mode is characterized by blending online learning with face-to-face learning in order to meet the needs of teaching within the college and training outside the college.

1.3.4.2 Structure

The college's BL adoption started with building an online ubiquitous platform integrating face-to-face teaching and learning activities, administration, and online teaching into one LMS. Individual online learning and teaching spaces have been created by the teachers and students, featuring online teaching, online delivery of learning resources, online enrolment management, learning journals, and tools supporting interaction between the college and home. Comprehensive evaluations by students and reviews of teaching by BL experts were conducted regularly to ensure an effective teaching and learning experience.

1.3.4.3 Support

To ensure the quality of blended teaching, professional development occurs regularly during a semester focusing on BL design and instruction. Incentives are offered for outstanding achievements in course reform using technology. For example, teachers are awarded for excellence in BL course design and the frequent use of the online platform for effective teaching.

1.3.4.4 The Impacts of BL Implementation on Teaching and Learning

Up until October 2017, 190 BL courses had been developed on the college's LMS, and LMS visits reached 1.6 million with average daily visits exceeding 300. Judging from the LMS log data, LMS visits peaked between 20:00–23:00, which is a non-teaching time period, indicating that learning had been extended to outside the class. A survey was conducted at the end of the fall semester of 2017 to students attending BL courses, and the results show that 90% of the students were satisfied with these courses.

Online learning has also enabled the college to train over 10,000 tuition-free students and teach external students, expanding access to education for more learners, especially those in remote areas. Supported by China's *Belt and Road Initiative*, the college has taken advantage of its BL environment to collaborate with vocational colleges in Thailand, Singapore, Laos, Vietnam, Hong Kong, and Taiwan and offer training programs online.

1.3.5 Implementation of BL in Fujian Chemical Engineering Vocational School (FCEVS)

FCEVS is a vocational high school offering 19 majors in 5 disciplinary areas including chemical environmental protection, mechanics, electronic instruments, information technology, and commerce, trade, and tourism. Its BL implementation started in 2012 with the mission to develop a "2 + 1 + N" blended vocational education model to address students' needs for campus-based learning, an internship with the industry, and lifelong learning after graduation.

1.3.5.1 Strategy

At the start of its BL implementation, this school proposed a "2 + 1 + N" model to guide its BL development. In brief, "2" represents its short-term objective to incorporate online learning into its 2-year on-campus courses. This is followed by "1," the mid-term objective to develop online support mechanisms for the 1-year internship with the industry, when the students are away from the campus. "N" refers to their long-term objective to offer their graduates, with the support of technology, continuous and lifelong learning opportunities after they graduate from the school.

1.3.5.2 Structure

A task force with members from different levels of the school administration was formed at the beginning of its BL adoption to lead and supervise the school's BL development. It consists of various project teams responsible for specific BL projects. Guided by a group of BL experts, these project teams work with the school's research and development teams and IT support teams to plan and develop BL initiatives and courses and offer training programs to teachers. The IT support center provides day-to-day technical support to teachers and students. Policies relating to BL evaluation, management, and incentives are being published as their BL implementation progresses.

1.3.5.3 Support

The school attaches great importance to the professional development of the teachers, and various training opportunities have been made available to help the teachers develop digital literacy and competency needed for blended teaching. For example, during summer vocations, the school sends teachers to the Institute of Educational Technology in Tsinghua University to attend an advanced training course on a regular basis and encourages teachers to participate in BL workshops organized by Fudan University in Shanghai. In addition, one-on-one supervision by senior and experienced teachers constitutes another form of professional development opportunity for teachers new to online and blended teaching. The school also urges its teachers to apply for grant-supported research projects to advance their research capacities in online education.

1.3.5.4 The Impacts of BL Implementation on Teaching and Learning

Outstanding improvements in students' learning behaviors and outcomes have been reported. The analysis of the platform data between 2014 and 2017 shows that 34.48% of teachers adopted the BL approach in their teaching practice; the average daily visits to their "learning spaces" were 3–5 times. Students' online learning process including class preparation, homework completion, discussion submission, and test completion can all be tracked online and analyzed. A student survey conducted in 2017 shows 67% of students believed that their learning strategies and skills were improved; 76% reported that their learning was supported by their teachers and peers; 84% confirmed their acceptance of assessments in BL mode.

Great improvements have been observed in teachers' research output and pedagogical competency relating to online and BL and teaching. Four research articles on BL have been published in academic journals, and ten articles relating to blended teaching were included in the case study repository of the *Research on the 13th Five-Year Strategic Plan by the Ministry of Education*. This is a great achievement for a vocational school as publication is not an essential job requirement in vocational schools in China.

The teachers also actively participated in local and national online learning and teaching competitions and won 18 awards at the provincial and municipal levels and 7 at the national level. The school has also edited *A Handbook for Digital Campus Building* and *A Guide to Blended Learning Practice*. Their achievements in BL implementation has been recorded in *A Report on the Development of IT in Education in China (2015).*

1.3.6 Implementation of BL in Urumqi Physical Education and Sports Vocational School (UPESVS)

This is a comparatively young vocational high school founded in the northwest region in China. It offers specialized education with 15 subjects in sports training, including shooting, track and field, wrestling, boxing, speed skating, Taekwondo, Judo, weight lifting, volleyball, basketball, women soccer, table tennis, aerobics, archery, and free combat. The school adopted BL in 2014 to meet students' needs and the challenges facing the school.

1.3.6.1 Strategy

Before starting BL, the school had faced some special challenges, such as student lack of self-learning skills, comparatively low literacy, preference of training to learning, and the lack of integration of learning with athletic training. In view of these challenges, the school initiated BL with the mission to reform sports education by achieving a better balance between training and learning through technology.

1.3.6.2 Structure

To develop a uniform and coordinated approach to ensure the quality of BL courses, an ICT center was created, dedicated to the support of the school's BL implementation. This center not only offers timely technical consultation to teachers but also has compiled a series of guidelines and handbooks guiding the school's pedagogical innovations through technology. *A Handbook for Course Development on the LMS* and *A Handbook for Using the LMS* are just two examples among many of the resources produced by this center.

1.3.6.3 Support

What characterizes the BL adoption in this school is the diverse opportunities it offers for professional development to advance the teachers' understanding of online teaching and learning, as well as their competency in using technology to support student learning. Seed teachers have been sent to other institutions for training in specific areas of online and BL. In Tsinghua University, they attended courses such as BL course design, developing online courses, and BL practices. In Nanjing Normal University, they attended training on the in-depth applications of educational technology to individual subject matters and information technology and innovative applications.

Teachers' active participation in various BL-related activities constitutes another form of professional development and training. These activities include BL course observation and evaluation, public lecture attendance, peer experience sharing, and participation in various competitions (e.g., multimedia courseware and course design). Teachers are encouraged to attend school-wide LMS training and online course development, which are scheduled every Tuesday and Thursday.

In addition to providing teachers with professional development opportunities, the school also supports the teachers in their application for external funding to reform their courses through technology. Since 2015, they have applied for funding from various bodies outside the school to support ten BL-related projects.

Ongoing professional development has also been offered to all the teachers in the special education section by external BL experts and seed BL teachers in the school. Seed teachers have been paired with less experienced teachers in special education to work together on BL course design and online course development.

1.3.6.4 The Impacts of BL Implementation on Teaching and Learning

By the end of 2017, 1883 learning spaces have been built for teachers and students on the LMS (THEOL). Thirty BL courses have been offered with the participation of 40% of the teachers in the school. Blended courses are offered in a variety of formats to meet the special needs of sports education. There are three basic kinds of blended courses: humanities, specialized, and special skill-oriented courses. A flowchart for blended course instruction has been designed for each course. For example, the rifle shooting courses usually start with watching online video demonstrations, which is followed by face-to-face training, error correction, in-class demonstration, and posting reflection online after class. An aerobics course requires the students to learn and test themselves online and then practice and demonstrate in the face-to-face class.

BL has transformed students from passive learners to active learners. They have become more engaged and more motivated, and their learning quality and outcomes have been improved to a great extent. For example, in the fall semester of 2017, the pass rate for the aerobics class was 100%, with 40% of the students achieving 85 out of 100. Notable improvements were observed in class attendance, student engagement, learning enthusiasm, and interaction between students and teachers.

1.4 Discussion

In this section, we will use the three markers of BL adoption, namely, strategy, structure, and support, proposed by Graham et al. (2013) as a reference to discuss the features and drivers of the BL implementation in the six cases. Wherever possible, we will make comparisons between what happened in these six institutions and what has been reported by existing research.

1.4.1 Strategy

As shown above, the six institutions discussed here each has their own clear and specific goals and had developed strong policies at the very beginning of their BL adoption. They also share the following features unique to Chinese institutions: (1) a clearly defined purpose of their BL adoption, (2) BL being integral to their long-term strategic plans, (3) BL being promoted from the top by the institutional leaders, and (4) BL catering to the special needs in their teaching and learning. These features clearly evidence a system-driven approach to BL implementation that mobilized all the eight dimensions proposed by Lim and Wang (2016a), i.e., vision and philosophy; curriculum; professional development; learning support; infrastructure, facilities, resources, and support; policy and institutional structure; partnerships; and research and evaluation. For example, at the very beginning of its BL adoption, SUT decided to overhaul the university's entire curriculum and developed a model that blended in-class with out-of-class learning, online with face-to-face learning, and on-campus with off-campus learning. This was followed by the publication of a series of relevant policies, reforms of its structures, and support mechanisms, ensuring that the model was successfully implemented at all levels of their programs. A similar system-driven approach was also manifested in IMUN's BL development. As a university for students from different ethnic backgrounds, it focuses on reforming its classroom teaching through three kinds of transformation supported by technology: the transformation from teacher-centered to learner-centered learning, from passive learning to active learning, and from teachers being the sage on the stage to being the guide on the side. Their BL experiences have particular implications for inclusive and equitable access to quality education for ethnic groups in China as most of these groups live in remote areas and online learning could be the only option for them to receive a quality education.

Similar to what happened in higher education in China, BL implementation in vocational education was also driven systematically with a distinct purpose to address their special needs and challenges, such as the needs for repetitive skill training and practice, students' lack of self-learning strategies, their lack of enthusiasm in learning, and a weak link between learning, training, and internship. The strong BL strategies adopted by FCEVS exemplify such a system-driven approach. Their blended education model, the "2 + 1 + N" model, should serve as an exemplar for other vocational schools and colleges, offering students with in-school learning in blended mode, outside school internship with online supervision, and lifelong learning by providing graduates with lifelong access to the school's online resources. This school is one of the first vocational institutions in China that have clearly and specifically integrated lifelong learning into their mission and curriculum.

What is also clearly evident in the process of BL adoption by all the six institutions is the strong leadership role played by the institutions in their BL implementation. To some extent, we could conclude that without such strong leadership, BL in the six institutions would not have achieved a large-scale implementation at an early stage in such a systematic fashion. However, whether such a top-down approach has implications for cultures other than Chinese needs further vigorous research to confirm. To the best of our knowledge, this approach has not received much attention by existing research. On the contrary, a bottom-up approach has been reported in studies relating to BL adoption in the US higher education (e.g., see Graham et al., 2013; Porter & Graham, 2016). In fact, Porter, Graham, Spring, and Welch (2014, p. 192) have warned us that "If administrators attempt to impose BL implementation without faculty and student advocates, they are likely to encounter significant resistance to what faculty may view as a primarily top-down initiative."

Different from the abovementioned studies, our study did not find any resistance from the grassroot level to the top-down approach. Instead, this approach has proven to be particularly effective in promoting institution-wide BL adoption, especially in the initial stages. This is especially true of institutions in vocational education as these institutions are mostly teaching and training focused and are not ready for BL in terms of vision, the capacity of the teaching staff, and infrastructure. BL initiated and supported from the above can not only accelerate institution-wide awareness but also ensure a uniform approach to teaching innovation. On the other side of the coin, a top-down approach could also adversely impact the BL development of an institution if the institution administration does not strongly support BL. This happened to one of the six institutions investigated in this study, where the new administration has shifted their focus from BL since 2017, resulting in a near halt in the institution's BL development.

1.4.2 Structure

A feature shared by the six institutions is the robust BL structures established prior to the rollout of their BL implementation. This forms a distinct contrast from what had happened in the US institutions as reported in the existing studies (see Graham et al., 2013; Porter et al., 2014; Porter, Graham, Bodily, & Sandberg, 2016; Porter & Graham, 2016). For example, among the 11 institutions surveyed in the study by Porter et al. (2014, p. 192), "only one university reported upgrading its servers and bandwidth to accommodate increased quantities of online materials." In contrast, a system-driven approach has been adopted to the development of the infrastructure needed for BL in all the six institutions, who had all built, rebuilt, or upgraded their intranet and user terminals before the pedagogical interventions occurred at the teaching level. At the same time, new teaching and learning environments at the course level have been created to meet the needs of BL and training. For example, BSVC built college-wide physical and virtual labs and developed immersive and 3D resources as well as cloud-based online learning materials, making learning and training possible wherever there is Internet access. Some key technical issues were solved during this infrastructure building/rebuilding phase, for example, the integration of physical labs with the college's LMS and the integration of 3D resources with immersive learning environments, making their BL course offerings less hindered by technical problems and more sustainable.

The same system-driven approach was also applied to the establishment of structures at various levels. In all the six institutions, BL task forces involving administrative and academic leaders were established well in advance of the start of blended teaching to guide and regulate BL development. BL policies and models were also promoted at the very beginning of their BL adoption. For example, in SUT and FCEVS, a BL working party was headed by the institutions' top leaders, and different levels of structures were established to lead and support their BL implementation.

Although the large-scale infrastructure building or upgrading was mostly supported by government funding, conditioning the institution for BL adoption both in terms of structures at different levels and institution-wide infrastructure building and rebuilding was proved to be crucial for the smooth and sustainable development of BL. It is apparent that the institution played a pivotal role in establishing structures needed for BL adoption.

1.4.3 Support

Strong and coordinated support also characterizes the BL implementation process of all the six institutions, in particular, in the forms of technical and pedagogical support and incentive mechanisms. Again, a system-driven approach was adopted in these types of support in that they were offered at the very start of the institutions BL adoption, at different levels, and in an ongoing manner. Such systematic support has not only sustained the teachers' and students' enthusiasm in BL but also ensured effective learning design from the very beginning. An IT support center has been established in each of the six institutions providing just-in-time technical support. Pedagogical support came in the forms of the provision of systematic and ongoing professional development for the teachers and BL curriculum design guided by BL handbooks and experts and evaluated by peers and external BL experts. Professional development in all the six institutions was institutionalized as evidenced by a variety of training opportunities offered to the teachers on an ongoing and regular basis. UPESVS is a case in point. They have developed a unique system for teachers' professional development characterized by seminars given by BL experts, theme-based training, external BL training opportunities, BL research opportunities, BL course evaluation, experience sharing, and one-on-one peer reviews. At the teaching level, innovation is supported by BL-related grants, awards, and monetary incentives in these institutions. Again, the strong leadership role of the institution was instrumental in offering such comprehensive and systematic support mechanisms. Evidently, most of these types of support were needed and offered in the earlier stages of BL development. However, how to support teachers after BL is normalized is an important issue that needs further research. For this purpose, we are still following these institutions to explore factors that promote or inhibit the sustainability of BL.

1.4.4 Impacts on Teaching and Learning

Although there exist levels of differences among the six institutions, in terms of BL implementation strategies, scales, and paces of progress, different levels of positive impact on student learning have been confirmed across all the six institutions. All the six institutions have ensured that their BL implementations are being evaluated regularly and, in most cases, quantitatively. For example, a student satisfaction survey at GEPVC demonstrates that 90% of the students were satisfied with their blended courses. In BSVC, 80% of the students chose the BL courses. Data from surveys in five semesters at IMUN show that over 90% of students perceived BL favorably, in terms of teaching quality, motivation, and ways of learning and testing. SUT also tracked students' academic performance over seven semesters and found an overall decrease of course failure rate and increase in the number of high-performance achievers. Better performance results were found in the aerobics courses in UPESVS, with 100% course pass rate. SUT also investigated the improvement in students' meta-cognitive abilities and found that the great majority of students believed that their self-regulated learning skills, oral expression skills, and logical thinking skills were all improved, along with an increased sense of team cooperation. FCEVS students also confirmed improvement in self-regulated learning skills and strategies.

In terms of BL curriculum, all six institutions have redesigned a number of their courses into BL mode, with SUT offering 1222 BL courses, the largest BL course provider among the six, and UPESVS offering 30 BL courses, the least number of BL courses being offered among the six institutions. Each has its own unique features. For example, the BL courses offered at BSVC take advantage of virtual laboratories to provide their students with an immersive learning environment, while the BL courses in UPESVS integrate online video demonstrations to cater for the learners' special needs for sports skills training.

1.5 Summary

Together, the six cases discussed in this chapter provided a comparatively comprehensive picture of BL implementation in education in China. Despite the fact that each has its own BL missions, agenda, and learners' needs and each needs to deal with its own challenges, all the six institutions showcased their system-driven BL implementation at an institutional level with clearly defined goals, coordinated approaches, and concerted support at different levels. Each has ensured that their missions of BL implementation are well-aligned with their goals for education reform and innovation, addressing their particular needs in teaching and learning. More importantly, the institutions have provided strong support to the teachers and students with technology, service, and policy on an ongoing basis. Such a system-driven approach ensured that the different dimensions within the system interacted with one another to constantly improve the quality of teaching and learning. The sustained improvement in teaching and learning quality of the three cases from poorer remote regions in China has particular implications for promoting equitable quality education in China through BL. Such implications deserve a series of further studies to adequately measure BL impact on quality education for all.

1.6 Implications, Challenges, and Future Directions

Using the three BL adoption markers proposed by Graham et al. (2013), i.e., strategy, structure, and support, we have been able to present what characterizes the BL adoption and development in the six institutions. In so doing, key drivers for BL development in these institutions were also unveiled. What is clearly evident is a system-driven approach that has been uniformly applied to the institutions' BL strategy, structure, and support. With regard to strategy, the system-driven approach was instrumental in ensuring that their BL implementation was integrated into their long-term goals for educational reform and in mobilizing the institution-wide involvement of the teachers and administration at different levels. As to structure, this system-driven approach is manifested in conditioning the institution for the start of BL adoption at both the administrative and infrastructure levels, resulting in the smooth rollout of institution-wide BL adoption. In regard to support, this system-driven approach ensured the provision of both technical and pedagogical support. Such support was offered timely, in an ongoing manner, and at all levels, especially at the course level, where course design was guided and evaluated by external BL experts in the earlier stages of their BL adoption. The strong leadership role played by the institution was the catalyst for the success of this system-driven approach.

BL adoption in institutions in poorer and remote regions in China has particular implications for promoting equitable and accessible quality education in a large country such as China. Of the six institutions investigated in this study, three are situated in remote areas, i.e., IMUN in Inner Mongolia, near the northern border of China, GEPVC in the southwestern border area, and UPESVS close to the northwestern border. The BL development in IMUN, a university for students from different ethnic backgrounds, could have a profoundly wider impact on access to quality education for ethnic groups throughout China. Unfortunately, it is beyond the scope of this research to explore such impacts further.

Despite their remarkable achievements, the six institutions are still facing some key challenges. At the implementation level, they have established effective strategies, structures, and support, enabling institution-wide BL adoption. However, how to sustain BL and how to support BL at the teaching and learning level are challenging issues that should take the priority over other issues. These challenges can lie in refining their policies and support mechanisms as new teaching and learning needs would emerge along with their BL development, developing more discipline-specific and ongoing professional development programs and teaching and learning evaluation systems that identify and reward excellence in teaching and teaching innovation. At the BL research level, they still need to find ways to form stronger partnerships with institutions who are stronger in BL research, to collect and investigate real data, including both teacher- and student-produced data to improve our understanding of the nuances of BL. These issues are also the key dimensions in the BL adoption framework proposed by Lim and Wang (2016). As these institutions are all leading institutions in their respective categories, their exemplary achievements and experiences in BL would serve as a useful reference to other institutions in their quest to provide accessible quality education through technology. These experiences are especially valuable to the sustainable and equitable development of education in the remote areas of China.

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Chapter 2
A Grassroots Approach Towards Professional Development in Blended Learning of a Faculty at a University in Hong Kong

Cher Ping Lim, Danlin Yang, and Yu Gao

Abstract Based on a case study of a faculty at a university in Hong Kong, this chapter examines how a grassroots approach to professional development enhances the capacity of the teaching staff for blended learning. Professional development plays a pivotal role in supporting the teaching staff to adopt blended learning in their courses to enhance the quality of learning and teaching. However, professional development policies and practices do not always meet the professional learning needs of staff, and many of them do not feel supported in their blended learning practices after attending the professional development sessions. This chapter first discusses how the grassroots approach to professional development in blended learning was developed and implemented in the faculty. Both qualitative and quantitative data were collected and analysed to document the impact of the professional development on staff's adoption of blended learning in their courses. Based on the key findings from this set of data from the faculty, the grassroots approach is refined and customised for each faculty at the university as part of the scaling-up process.

2.1 Introduction

Blended learning is the integration of in-class face-to-face (F2F) learning and online learning (Garrison & Kanuka, 2004). Blended learning provides opportunities for university teaching staff to enhance the quality of their courses by engaging their students and improving their learning outcomes (Graham, 2006; Norberg, Dziuban, & Moskal, 2011; Wanner & Palmer, 2015). For example, students may develop a deeper understanding of the topic by engaging in online interactions with their peers and teachers mediated by synchronous and asynchronous online communication tools. At the same time, the teaching staff may design F2F learning activities, based

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on the students' online interactions to accommodate student learning needs. Blended learning, therefore, is not simply the introduction of online technologies to existing F2F lessons. It requires the teaching staff to design the online and F2F learning in an integrative fashion. It is crucial for the capacity of the teaching staff to be built through professional development (PD) so that they could engage in blended learning practices to enhance the quality of learning and teaching in higher education.

The Faculty of Education and Human Development (FEHD) at the Education University of Hong Kong (EdUHK) envisions itself to be a leader of online and blended learning practices in teacher education and professional learning of education leaders, practitioners, and policymakers locally and internationally. The faculty expects all teaching staff to develop and implement courses and programmes that are mediated by online learning tools to support students in meeting the intended learning outcomes. Although the majority of the teaching staff uploaded digital resources onto the university learning management system (LMS), Moodle, to support F2F lessons, only a minority designed interactive online learning activities on Moodle that complement F2F learning activities in a course.

One of the main reasons why only a minority of the staff are engaged in blended learning practices is the lack of capacity to design and implement courses that take up the potential of online technologies (Gregory & Lodge, 2015). The teaching staff may excel in their own discipline areas, but they may not be equipped with the competencies for blended learning.

The PD sessions conducted for the teaching staff at the university level might address this lack of capacity. However, the existing PD approaches may not have a strong impact on blended learning practices. These PD sessions tended to be one-size-fits-all and focused on detailed demonstrations of specific technical features of the LMS or online learning tools. The teaching staff might not understand how the potential of online learning technologies could be taken up to complement F2F learning activities to engage students (Bennett, Agostinho, & Lockyer, 2017). Moreover, the PD sessions tended to be one-off, rather than ongoing, where the teaching staff would be engaged in the PD as they are adopting the blended learning approach in their courses. Therefore, it is necessary to develop a more sustainable and needs-driven approach for PD in blended learning so that teaching staff capacity for blended learning could be built. Based on the case study of FEHD at EdUHK, this chapter examines how a grassroots approach towards PD enhances the capacity of the teaching staff for blended learning at the faculty level.

2.2 Literature Review

In this section, the issues and challenges of PD in blended learning are first pointed out. To address the existing issues and challenges faced by PD in blended learning, two key principles for effective PD in blended learning are introduced. This section will shed light on the development of a grassroots approach towards PD in blended learning.

2.2.1 Issues and Challenges of PD in Blended Learning

Research studies of blended learning in higher education have highlighted the need to build the capacity of the teaching staff for blended learning to enhance access to quality higher education learning and teaching (Johnson, Becker, Cummins, & Estrada, 2014; Esterhuizen, Blignaut, & Ellis, 2013). However, many existing PD programmes focus on introducing online learning tools without explaining and providing examples of how they could be used to complement F2F learning activities to enhance learning and teaching (Maddux & Johnson, 2005; Porter & Graham, 2016). Such PD programmes may not support the teaching staff to adopt blended learning within their courses. Bolelens, Voet, and Wever (2018) explain how PD programmes could support the teaching staff to redesign their courses as they integrate online learning activities to complement F2F learning activities in their courses. When online and F2F learning activities support each other, students are more likely to be engaged.

One-off PD workshops that are often conducted in universities may not support the teaching staff to keep pace with the changing online technologies (van As, 2018). The teaching staff need ongoing PD opportunities to keep learning and exploring how emerging online technologies could be integrated in their courses. At the same time, many of the PD programmes offered in universities tend to be one-size-fits-all and may not meet the diverse professional learning needs of the teaching staff. Another challenge is the gap between PD in blended learning and the professional support for the blended learning practices (Vaughan, 2010; Kennedy, Jones, Chambers, & Peacock, 2011). That is, the follow-up PD support for blended learning is not in place for most PD programmes. Without ongoing professional support for staff's blended learning practices, they may give up or lose motivation to engage in such practices.

2.2.2 Key Principles of PD for Blended Learning

To address these issues and challenges, two key principles for effective PD are identified:

- Establishing a professional learning community
- Addressing the PD needs of the teaching staff

2.2.2.1 Establishing a Professional Learning Community

Establishing a professional learning community may provide ongoing support for the teaching staff to engage in blended learning practices. Professional learning communities are groups of professionals developing their competencies in a context with shared concerns and a shared vision, by learning from and with peers on an ongoing basis (Wenger, McDermott, & Snyder, 2002). Researchers explained that effective PD is iterative, social, and situated in teaching contexts (Trust, Krutka, & Carpenter, 2016; Van den Bergh, Ros, & Beijaard, 2014). Developing a professional learning community as part of the PD approach for blended learning provides better support for the teaching staff as they build their capacity for blended learning by being engaged in blended learning practices (van As, 2018).

When the teaching staff are making sense of and addressing the complexities of blended learning practices and the rapidly changing online technologies, they could learn from and support one another. More specifically, they could draw inspirations from one another by observing one another's blended learning practices (MacDonald & Campbell, 2012) and provide one another with support when encountering challenges of how to blend the online and F2F activities (Bohle Carbonell, Dailey-Hebert, & Gijselaers, 2013).

With the peer support, the teaching staff are more likely to keep on their PD and thus enhance their confidence and develop their competencies in blended learning by reflecting and experimenting blended learning in a collaborative way (Wicks, Craft, Mason, Gritter, & Bolding, 2015; Vaughan & Garrison, 2006). Apart from the peer support among the teaching staff, the shared vision and support at the leadership level about blended learning also matter (Ertmer & Ottenbreit-Leftwich, 2010). When leaders understand the potential of blended learning for learning and teaching enhancement, they are more likely to offer resources and support for the teaching staff and contribute to the sustainability of the professional learning community. Therefore, establishing a professional learning community is a key principle of PD in blended learning and supports the PD in blended learning in a sustainable way.

2.2.2.2 Addressing the PD Needs of the Teaching Staff

The first PD need of the teaching staff is the pedagogy for blended learning. The common focus of existing PD in blended learning is online technologies (Cowan, 2013). Blended learning requires the teaching staff not only to understand how to utilise online technologies but also to integrate online technologies for meaningful student learning experience. PD needs to switch from a technology-centric approach to how to blend online learning activities with F2F ones.

Second, blended learning needs thoughtful design on the integration of online technologies in a course. The teaching staff may need time and ongoing support as they engage in blended learning practices. However, existing one-off PD workshops do not take the busy schedule of the teaching staff into consideration (Philipsen, Tondeur, Pareja Roblin, Vanslambrouck, & Zhu, 2019). It is challenging for the teaching staff to allocate time for one-off PD due to the demanding workload for research, teaching, and administration (Bakah, Voogt, & Pieters, 2012). PD should be an iterative process for the teaching staff to build up their capacities for blended learning, and they engage in such practices. Therefore, the PD in blended learning should address the sustainable needs of the teaching staff in blended learning.

Moreover, the teaching staff need individualised PD in blended learning. Many of the PD programmes in blended learning are one-size-fits-all. It neglects the diverse beliefs and capacities of the teaching staff and the teaching context and thus may affect the effectiveness of the PD. The PD in blended learning should meet the diverse needs and contexts of the teaching staff. The teaching staff should engage in blended learning design, development, and implementation in their courses as they are undergoing the PD, where they reflect upon their own practices and share the practices and reflections with their peers. They could then have a deeper understanding of how they could use blended learning strategies in their own course context.

On the other hand, the rapid changes of online technologies require the teaching staff to develop their capacities to keep up to date and integrate online learning tools into their courses. As highlighted in Porter and Graham's study (2016), the availability of support, feedback, and guidance will motivate the teaching staff for blended learning. In sum, such a PD approach addressing the PD needs of the teaching staff in blended learning is more effective than existing PD approaches (Mirriahi, Alonzo, McIntyre, Kligyte & Fox, 2015; Hew & Brush, 2007, McGrail, 2005; Hunzicker, 2011).

Establishing a professional learning community and addressing the PD needs of the teaching staff are two key guiding principles for effective PD of higher education teaching staff. Drawing upon these principles, a grassroots approach towards PD in blended learning is developed and implemented to support the implementation of blended learning in FEHD.

2.3 Grassroots Approach Towards PD in Blended Learning in FEHD

The grassroots approach to PD in blended learning was adopted to enhance the learning and teaching in FEHD at EdUHK. The grassroots approach is a bottom-up approach towards PD, with a focus on meeting the individual PD needs of the teaching staff in FEHD (Bohle Carbonell et al. 2013). This approach consists of two key components. The first one is the professional learning community led and facilitated by the department-based blended learning ambassadors. The community aims to provide peer support for the teaching staff as they engage in blended learning practices in their course (MacDonald & Campbell, 2012). Another component is the needs-driven support offered by Technology-Enhanced Learning Hub (TEL-Hub). These two key components of the PD approach are situated in the sociocultural context of the faculty with a strong quality enhancement culture for learning and teaching.

2.3.1 The Establishment of the Faculty Professional Learning Community for Blended Learning

To establish a faculty professional learning community for blended learning, two essential components are required, namely, leadership support and blended learning ambassadors.

2.3.1.1 Leadership Support

Blended learning is an integrated part of the learning and teaching plan and strategies in FEHD. The faculty leaders were committed to the promotion and support of blended learning for learning and teaching enhancement (Laurillard, 2005; Porter & Graham, 2016; Moskal, Dziuban, & Hartman, 2013). The faculty leaders included the dean, associate deans, heads of department, and the departmental chairs of the learning and teaching committee. The establishment of the professional learning community was well-aligned with the leadership commitment to quality enhancement. As suggested by Graham, Woodfield, and Harrison (2013), the formal blended learning advocacy by faculty leaders is crucial for more teaching staff to adopt the blended learning practices. In order to establish the professional learning community, the teaching staff who have had engaged in blended learning practices were identified from the six departments in FEHD to serve as blended learning ambassadors. These blended learning ambassadors had one course relief from their teaching workload so that they could devote more time to build and support the professional learning community at the departmental and faculty levels.

2.3.1.2 Blended Learning Ambassadors

Blended learning ambassadors were the front runners of blended learning practices in the faculty. They were designated to share their practices and support their colleagues in their respective departments (Porter & Graham, 2016). The ambassadors shared not only their own promising practices but also the challenges that they encountered and how they addressed them. Moreover, they provided examples of how their students benefited from or struggled with blended learning in their courses.

At the departmental level, the ambassadors collaborated with the faculty-based supporting unit (TEL-Hub) to organise sharing sessions and hands-on workshops to discuss blended learning practices with their colleagues. The sharing sessions generally consisted of four parts, followed by hands-on workshops. First, the ambassadors introduced their course information and their background with online technologies. Second, the teaching staff shared the online tools they used and why they chose the tools. At the same time, they demonstrated the main features and how they integrated these tools in the courses. Then, they provided evidences of impacts on student learning engagement and outcomes. Finally, they shared the challenges and reflections of their blended learning practices. For the hands-on workshops, the participants were provided with the opportunities to use the online tools that were shared in the sessions with the support from the ambassadors and the TEL-Hub staff.

Such blended learning practices shared among their colleagues within the same department had a positive impact on the PD of the teaching staff. The teaching staff were more likely to relate to the blended learning practices shared by the ambassadors with their own teaching contexts (since they may be teaching similar courses). Moreover, the teaching staff were more likely to be convinced by the evidence shared by colleagues from their own department regarding student learning engagement and outcomes. Apart from the sharing sessions and workshops, the blended learning ambassadors were committed to record videos of their own promising blended learning practices and share their reflections. These videos provided all teaching staff with access to the blended learning experiences of the ambassadors.

In order to engage more teaching staff, the ambassadors also shared their experiences in different university learning and teaching events. These experiences were presented on posters to showcase their promising practices and share the benefits and challenges that they encountered. The vivid exemplars were likely to motivate and encourage the other colleagues to explore blended learning practices in their own courses, cultivating a blended learning culture within the faculty and departments.

2.3.2 Needs-Driven and Just-in-Time Support in FEHD: TEL-Hub

Generally, without ongoing support, the teaching staff may feel anxious about adopting online technologies in their courses. The support provided for them has to be based on their diverse professional needs and just-in-time support to adopt blended learning in their courses (Keengwe, Georgina, & Wachira, 2010). In terms of blended learning, the teaching staff need to learn how to integrate online technologies in their courses. However, the centrally administered PD only focuses on the features of the LMS Moodle, instead of how the features could be integrated into the learning and teaching activities in the course. Moreover, other online tools that are not part of the LMS are often left out from the PD programmes. In other words, the centralised PD programmes could not meet the diverse needs of the teaching staff in terms of the integration of Moodle and other emerging online technologies in their courses.

With the faculty leadership support for blended learning, TEL-Hub was established in 2015, as a faculty-based unit that supports the capacity building of the teaching staff in blended learning, develops online learning resources, and explores emerging online technologies for learning and teaching enhancement. To achieve these goals, the TEL-Hub staff with technological and pedagogical knowledge provide customised and just-in-time blended learning support for the teaching staff to meet their diverse needs, including PD sessions at the faculty, department, programme, course, and individual levels, just-in-time PD support, and quality blended learning PD resources.

At the same time, a blended learning survey was administered every semester to understand how the online technologies were adopted and the changing needs of the teaching staff. The survey was sent out via emails or hard copies to collect as many responses as possible in order to have a better understanding of the professional needs in the faculty. According to the survey responses from the last 2 years, three major types of support were requested by the teaching staff: (1) examples of online tools used by colleagues, (2) step-by-step written/video tutorials on how to use these tools, and (3) information about commonly used online tools. Based on the needs identified, TEL-Hub, together with the blended learning ambassadors, offered a variety of workshops, consultations, and sharing sessions for the teaching staff.

2.3.2.1 Customised PD for Teaching Staff: Teaching Context-Oriented and Adaptive Support

Flexible and pedagogical-oriented hands-on workshops and just-in-time support were part of the customised PD for teaching staff in FEHD. As Buchanan, Sainter, and Saunders (2013) indicated, it is crucial to customise the workshops to accommodate the needs of teaching staff. TEL-Hub customised hands-on workshops to support the teaching staff in FEHD. Unlike the centrally administered workshops, TEL-Hub regularly conducts 30-minute hands-on workshops on the design and development of specific blended learning activity. The workshops aim to build up the teaching staff's confidence and capacities to adopt online technologies in authentic teaching contexts. Lawless and Pellegrino's (2007) study emphasised that PD had to focus on supporting teaching staff in their teaching contexts with online technologies rather than isolating online technologies from their teaching contexts.

In order to address the PD needs of the teaching staff, TEL-Hub offered the workshops in two parts: technological hands-on practices and customised teaching strategies on how these online technologies could be adopted in their courses. That is, workshops emphasised on the strategies of adopting online technologies in the teaching contexts. For example, online quizzes allow students to receive immediate feedback of their responses of close-ended questions, and the teaching staff could provide more personalised and qualitative feedback accordingly. For enhancing student collaboration and reflection, online asynchronous and real-time discussions could be adopted. It is crucial to focus on the strategies for addressing the PD needs of the teaching staff in blended learning. Therefore, the teaching staff are more likely to be aware of the benefits of blended learning and are more willing to attend PD workshops.

As indicated in Davis and Fill's study (2007), the teaching staff need ongoing support to deal with the complex integration of online technologies in their teaching contexts. TEL-Hub offered individualised consultation sessions for the teaching staff to integrate blended learning in their courses. During the consultation sessions, the teaching staff designed blended learning activities and developed their competencies of using online technologies with the support from the TEL-Hub staff.

Just-in-time support was also provided for the implementation of blended learning. PD could be provided at each stage of the integration process from design to implementation and evaluation (Moskal et al., 2013). The teaching staff were provided with opportunities to share their experiences with their colleagues formally and informally in a professional learning community that nurtured the PD culture in blended learning at the faculty (Boelens, Voet, & Wever, 2018).

2.3.2.2 Accessible Quality Blended Learning PD Resources

Apart from the customised PD sessions, another element is the blended learning PD resources for the teaching staff. The online resources provide them with access anytime and anywhere. The resources allow the staff to explore at their own pace the emerging online learning tools for enhancing the quality of their courses (Torrisi-Steele & Drew, 2013; Moskal et al., 2013). The first category of the blended learning PD resources focuses mainly on the university LMS Moodle. Unlike the existing technical-oriented resources for Moodle, this set of PD resources focuses on how the Moodle features could be adopted for higher education learning and teaching. This set of online resources consists of Moodle features, short step-by-step guide video tutorial, and exemplars of how these Moodle features are used. The second category of PD resources is an online collection of emerging online technologies that could be used to enhance the quality of learning and teaching. It serves as a platform for the teaching staff to explore how online technologies could be integrated in their courses. Apart from addressing their needs of online technologies, it is necessary to provide evidences of the benefits of blended learning for the quality enhancement of learning and teaching. The third category of PD resources is the promising blended learning practices of the selected teaching staff. These promising practices demonstrate the pedagogical affordances of the online technologies for quality enhancement and are more likely to engage the teaching staff in PD in blended learning.

These resources were developed by the TEL-HUB staff with the input of the teaching staff. The professional learning community encouraged the teaching staff to make ongoing contributions. They were those who shared their promising practices as peer support and resources and those who engaged in the PD for exploring online technologies. In this way, the quality of the accessible blended learning PD resources was enhanced to meet the diverse professional learning needs of the teaching staff.

2.3.3 Impact of the Grassroots Approach to the PD in Blended Learning in FEHD

The grassroots approach to PD in blended learning in FEHD had a positive impact on the implementation of blended learning among the teaching staff, including the capacity building of blended learning among the staff, the variety of online learning activities in Moodle, and the culture development of blended learning as a professional learning community.

First, in the last 4 years, by understanding the needs and providing corresponding support for the teaching staff, TEL-Hub managed to establish buy-in among them with respect to blended learning. According to the logging record in TEL-Hub, a number of teaching staff sought support and participated in the hands-on workshops in a steady fashion. With the support provided, they were more willing to embrace a variety of online interactive learning activities in their courses. On the other hand, after implementing the blended learning practices, the majority of teaching staff was willing to share their experiences with their colleagues in formal and informal ways. For example, several teaching staff presented their promising blended learning practices in the university-level sharing sessions.

Second, since Moodle is the major learning and teaching platform at EdUHK, the analysis of the usage data on Moodle could shed light on the changes of using online learning activities among the teaching staff in FEHD. The Moodle LMS usage data was collected from the Office of the Chief Information Officer (OCIO) at the EdUHK from 2014 to 2015 academic year onwards. There were three different types of online learning and teaching activities based on the features of the Moodle: resource-based, response-based, and interactive. Resource-based type characterises courses in which the teaching staff use the system as a repository of learning and teaching resources that include files and web links. Response-based type refers to courses that make use of the assignments and quizzes on the platform, where students are required to complete quizzes and receive feedback based on their responses. The teaching staff may provide feedback by providing their students with online resources. The courses classified as interactive type often include activities that support student interactions and collaborations with peers, such as forums, chats, and wikis. Teaching staff and students could interact and collaborate synchronously and/or asynchronously. A fourth category titled "no activity" include courses where no online learning resources or activities were implemented or no one ever logged into the course.

The comparison of yearly results of the Moodle courses categorised by types of activity indicated an increase in the adoption of interactive online learning activities. A majority of the teaching staff used Moodle to engage their students in response-based and interactive online learning activities. Ninety-five per cent of the teaching staff used Moodle with response-based and interactive online learning activities. Almost half of the courses in FEHD integrated interactive activities on Moodle in 2017–2018, with an increase of around 20% compared to that 3 years ago (See Fig. 2.1).

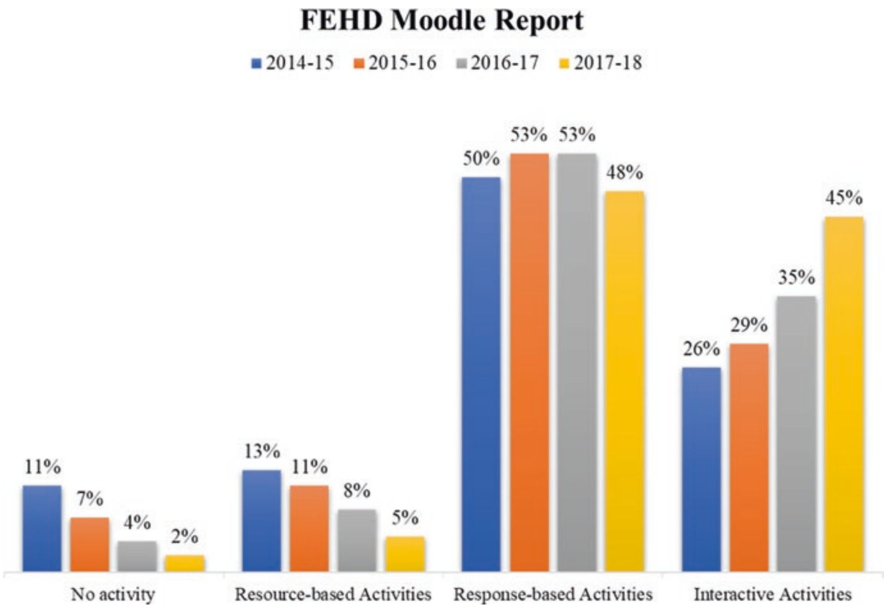

Fig. 2.1 FEHD Moodle usage report (2014–2015, 2015–2016, 2016–2017, and 2017–2018)

The increase of interactive activities may account for the ongoing pedagogical-oriented support provided by TEL-Hub and the blended learning ambassadors. The pedagogical-oriented workshops and consultation sessions were more likely to influence their perceived usefulness of online interactive activities in Moodle, as well as enhance their skills of blending online interaction in their courses. In the last 4 years, the majority of the teaching staff (approximately 60% out of 218) joined in the workshops several times to learn different features of Moodle. They were intrigued by how online technologies can be integrated in teaching and found it easy to understand. They found the workshops helpful and adopted the online technologies in their courses. On the other hand, the blended learning ambassadors shared with their colleagues how online technologies enhanced the student online learning experiences in poster format (Fig. 2.2). For example, one of the colleagues commented "Students considered this online multi-media toolkit inspiring and found the learning materials useful in their understanding of Positive Psychology". In sum, the professional learning community allowed the teaching staff to share their perceptions and practices on blended learning when learning from and with peers. It is more likely that they were motivated and convinced by the actual practices by their colleagues (MacDonald & Campbell, 2012).

Furthermore, over the last 4 years, the blended learning practices experienced a transition from engaging students online towards the redesign for linking up with F2F activities. Apart from using Moodle for online activities, the blended learning ambassadors and TEL-Hub staff shared how the easy-to-use online technologies enhanced the student engagement in class on an ongoing basis. As the lack of

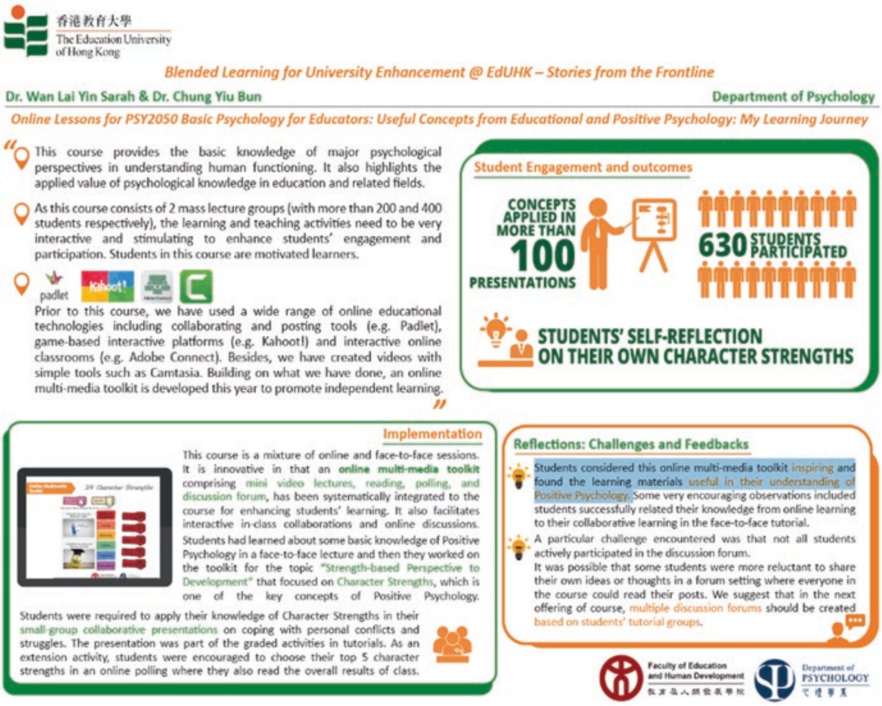

Fig. 2.2 Blended learning poster (with permissions from Dr. Wan Lai in, Sarah and Dr. Chung Yiu Bun)

interaction was one of the common barriers faced by the teaching staff, they were interested and joined the workshops and consultation sessions in TEL-Hub. As a result, they integrated online technologies such as *Mentimeter*, *Kahoot!*, and *Padlet* in the courses to enhance student in-class interaction.

It is important to have ongoing support from the professional learning community and the consultation sessions offered by the TEL-Hub staff. With the ongoing support, the teaching staff could share their struggles, reflect with peers, and consult with the TEL-Hub staff on how to adopt online technologies (Garrison & Vaughan, 2013). As a result, they gradually came to understand the interrelated relationship between F2F and online learning activities and developed a clearer concept of how to redesign the courses, which could help scaffold students' knowledge building process by providing them spaces to express their thoughts and exchange ideas in online settings and receive feedback from the teaching staff in online and F2F lessons.

The PD in blended learning not only influenced individuals but also contributed to the collaboration among the teaching staff for team-taught courses. They built up their teaching team as a professional learning community to share teaching resources in a common database, as well as had a team meeting to collaboratively redesign the courses to enhance student learning outcome achievement by adopting blended learning, while the TEL-Hub staff provided hands-on training for the online technologies and how to blend for them.

In sum, adopting the grassroots approach towards PD in blended learning built up the capacities for blended learning among the teaching staff and thus made a difference in transforming the blended learning practices in FEHD over the years.

2.4 Issues and Challenges

During the implementation process of the grassroots approach, there were some challenges:

- Unbalanced development in infrastructure
- Absence of recognition of the teaching staff who are proactively adopting blended learning
- Insufficient trust from the teaching staff
- Lack of student capacities for blended learning

First, the infrastructure may hinder the sustainability of PD (Porter & Graham, 2016). The infrastructure on campus may not keep up with the changing online technologies, such as low bandwidth. Although the emerging online technologies are appealing, the lack of infrastructure support made the teaching staff apprehensive to adopt them in the classroom, since the quality of learning and teaching might be compromised. Such issue goes beyond having sufficient hardware and network facilities in place. For example, in recent years, the majority of software offers ongoing updates for the users who subscribed to the products. However, the updated versions of the software may not be compatible with the existing devices used by the teaching staff, which may impede the teaching staff's continuous usage of emerging online technologies and discourage their motivation to participate in PD. Under such circumstances, it is difficult for the support staff to find suitable online technologies to meet the PD needs as well.

In addition, the absence of recognition of the teaching staff who proactively adopt blended learning may discourage their motivation to participate further PD in blended learning. Currently, one of the indicators of teaching appraisal in the faculty is the student evaluation of teaching (SET) scores. Although blended learning has the potential for learning and teaching enhancement, it could not ensure the appreciation from the students. As blended learning may affect the student satisfaction, the teaching staff may become hesitant to further implement blended learning and feel discouraged to participate in PD in blended learning. Blended learning requires the teaching staff to take risk on exploring online technologies, redesigning the lessons, and interacting with students online. It is important to recognise their efforts and provide ongoing support for them to explore blended learning (Garrison & Vaughan, 2013).

Furthermore, even though the TEL-Hub staff provided ongoing support in terms of introducing emerging online technologies, as well as how to blend with F2F lessons, the difficulty on building trust with teaching staff still persists. They may not be willing to discuss with the TEL-Hub staff about their ideas, since some of them consider the TEL-Hub staff lacking subject knowledge. On the other hand, the TEL-Hub staff found it difficult to start conversations with the teaching staff who feel less comfortable with online technologies (Porter & Graham, 2016).

Another challenge is the lack of student capacity for blended learning. Although the students were competent in using online technologies, they are less comfortable learning online independently (Al-Samarraie & Saeed, 2018). As a result, the teaching staff may be reluctant to implement blended learning. The engagement of students in the blended learning environment could be enhanced by providing them with appropriate support such as scaffolding them to learn how to learn online and providing them with guidance when using the different features of the online learning platform or application.

2.5 Conclusion and Implications

This chapter examines how the grassroots approach to PD was adopted to enhance the capacity of the teaching staff for blended learning in a faculty at the university. By taking a case study at the leading faculty at EdUHK, we explored the grassroots approach that was implemented via two key components, namely, department-based blended learning ambassadors and needs-driven and just-in-time support in FEHD. Overall, the efforts on these components of PD showed a positive impact on the teaching staff's adoption of blended learning, particularly their reflection on their blended learning capacity building and PD cultural development. The outcome showed that grassroots approach could be served as an effective method for scaling up blended learning adoption among teaching staff, because it encourages peer support, situates in the teaching contexts, and takes the teaching staff's needs into consideration.

Meanwhile, the challenges encountered in the process also allowed us to reflect upon the enabling and hindering factors when taking the grassroots approach of PD. With the lessons learnt, the following areas are emerged that need extra attention for the successful grassroots approach of PD for blended learning.

It is essential to build up trust and mutual understanding between the blended learning support staff and teaching staff. Despite the fact that blended learning support staff are experts in "how to blend", they may have insufficient understanding of the subject matter and clear ideas about the pedagogical focuses (i.e. "why to blend" and "what to blend"). This would require trust and mutual understanding between the blended learning support staff and teaching staff to facilitate effective communications and knowledge exchange so that PD for blended learning can be meaningful.

The support staff should constantly engage with blended learning ambassadors as they are the key driving force for the change. The blended learning ambassador system enriched the professional learning experience in the faculty and supported those who had doubts about blended learning to transform their beliefs. The professional learning community with the accompanying support for peers to tackle the issues of blended learning enhanced the belief as well as the skills for blended learning. The support staff constantly engaged with blended learning ambassadors can not only trigger a continuous, iterative process for more teaching staff to develop, implement, revise, and re-establish their blended learning activities but also allow us to gain timely feedback from first-hand experiences and adjust PD strategies accordingly.

Gaining recognition and support from the leadership team is cruical for sustainability and scaling up. The grassroots approach of PD is not a one-off event but a continuous process of change. This, from the pragmatic perspective, would require the mobilisation of financial and human resources. As the change often does not happen instantly or sometimes not occur in appearance, it is important to maintain the support from the leadership level. One way of achieving this is to keep the leadership level informed about the progress and the challenges so that the leadership can plan ahead about the input needed for moving into the next level.

In summary, our experience demonstrated that the grassroots approach of PD can enhance the capacity of the teaching staff for blended learning in higher education. The key lessons learned provided us with invaluable insights; we believe when the above-discussed areas are considered, it is likely to have a feasible grassroots approach of PD and ultimately sustain and scale up institutional blended learning adoptions.

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Chapter 3
Collaborative Partnership Approach to Improve Learning Through Interactive and Innovative Blended Learning: A Case Study of the National E-Learning Resource Centre (NELRC) at the University of Kelaniya, Sri Lanka

Suraweera Namali, Yatigammana Kaushalya, Priyankara Chathura, Wijayarathna Gamini, and Ranepura Upul Jayantha

Abstract The National E-Learning Resource Centre (NELRC) began promoting and supporting blended learning practices in 2017 with the aim of allowing the learners to be the centre of the education process and to foster necessary employable skilled human resources to the nation. The NELRC's main activities are engaged in blended learning-related research and testing of educational software, tools and resources, integration of audio-visual material and evaluation of the impact of new technology in education. The NELRC identified that lack of collaboration among academic staff within the university and lack of partnership among stakeholders have an impact on improving learning through interactive and innovative blended learning. Hence, the NELRC has been formed in collaboration with academic staff members from different faculties, i.e. technology, humanities, social sciences and management, in the University of Kelaniya who could work together as a strong team with their expertise. Moreover, the NELRC has national partnerships with the educational ministries of Sri Lankan government, Information and Communication Technology Industry Skills Council (ICTISC) and National Apprentice and Industrial Training Authority (NAITA) and international partnership with Sheffield Hallam University, United Kingdom; the Victoria University of Wellington, New Zealand; and The Education University of Hong Kong. This collaborative partnership approach has enabled the NELRC to promote interactive and innovative blended learning in Sri Lanka, and it is discussed in this chapter.

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3.1 Introduction

Since the NELRC was established in Sri Lanka, it is important to understand the relevant background information. Therefore, this section gives a brief introduction to Sri Lanka, including the country itself, the background of the Sri Lankan higher education system, drive for blended learning in higher education in Sri Lanka and relevant background information to the NELRC.

3.1.1 About Sri Lanka

The formal name of Sri Lanka is the Democratic Socialist Republic of Sri Lanka, formerly known as 'Ceylon'. The administrative capital city is Sri Jayawardenepura Kotte which is 5 kilometres away from Colombo, the biggest and commercial capital city. The total land area of Sri Lanka is approximately 65,610 square kilometres. According to a recent census of population and housing, the population of Sri Lanka was 20,970,000 (Department of Census and Statistics of Sri Lanka, 2013–2018). With a literacy level of 95.6%, Sri Lanka has one of the most literate populations in the South Asian region (Central Bank of Sri Lanka, 2014). Since the end of the civil war in mid-2009, Sri Lanka has been categorized as a middle-income country by the International Monetary Fund (Asian Development Bank, 2009). Moreover, Sri Lanka ranks at the 101st position in the Knowledge Economy Index (KEI) out of 145 countries (World Bank, 2012) and highest in KEI in the South Asian region.

Sri Lanka has a multi-ethnic and multi-religious population. The majority ethnic group is Sinhalese. Others are Sri Lankan Tamil, Indian Tamil, Sri Lankan Moor, Burgher, Malay and Vedda (Department of Census and Statistics of Sri Lanka, 2013–2018). Buddhism is the dominant religion, but there are others including Hinduism, Islam and Christianity. Over 86% of Sri Lankans currently live in rural areas, while 14% of the population lives in urban areas (Department of Census and Statistics of Sri Lanka, 2013–2018).

3.1.2 Sri Lankan Education System

The Sri Lankan education sector consists of three major stages: early childhood education, school education (primary and secondary) and tertiary education (Fig. 3.1). From school education to the first degree at university, education is free (Arunatilake, 2006). This helps to provide educational opportunities for all students in different socio-economic groups of Sri Lankan society.

The first stage is the early childhood development, catering to children aged 3 and 4. The second stage is school education including primary education, junior -secondary education and senior -secondary education. There are 9905 public

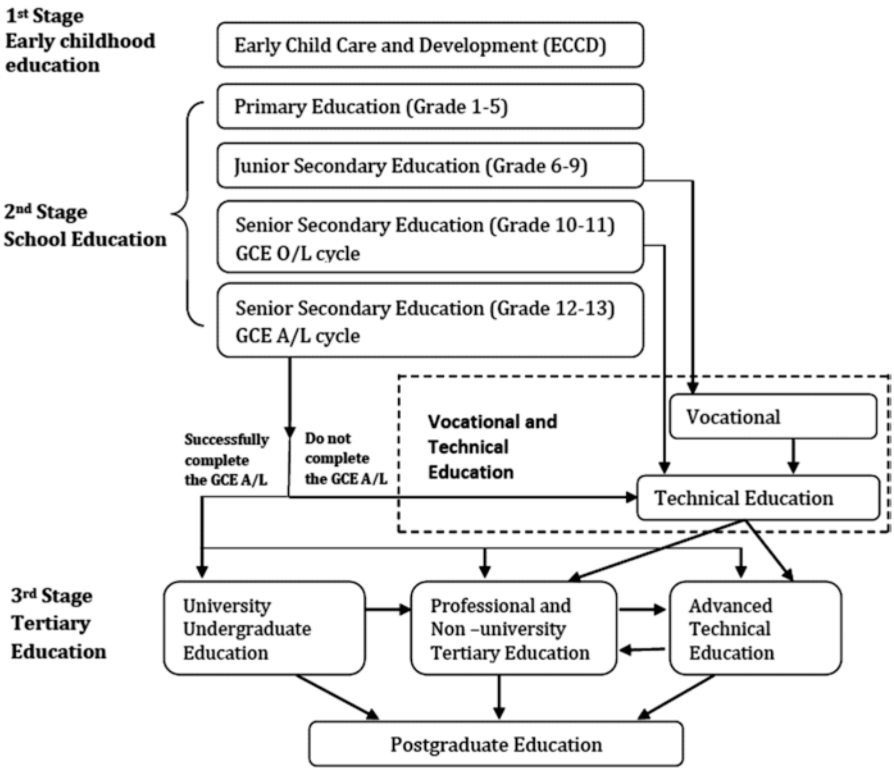

Fig. 3.1 Organizational structure showing three stages of the Sri Lankan education system. (Adapted from World Bank, 2005)

schools available for school education. This number includes 342 national schools and 9563 provincial schools (Ministry of Education Sri Lanka, 2012). Public schools fall into four categories:

(i) 1AB(753) – schools having advanced-level science stream classes
(ii) 1C (2013) – schools having advanced-level arts and/or commerce streams but no science stream
(iii) Type 2 (3869) – schools having classes only up to grade 11
(iv) Type 3 (3270) – schools having classes only up to grade 8 (Ministry of Education, 2012)

The compulsory education cycle in Sri Lanka ends at grade 13. Therefore, the Sri Lankan education system has introduced vocational education as an optional educational opportunity for students who leave school at grade 11. Senior secondary education includes two qualifications: General Certificate of Education Ordinary Level (G. C. E. O/L) and General Certificate of Education Advanced Level (G. C. E. A/L). Students who have not passed G. C. E. O/L can choose technical education, while those who pass can continue their school education up to G. C. E. A/L. The third stage is tertiary education; entry is restricted to students who have successfully completed the G. C. E. A/L examination or graduated from a technical institution. However, entrance to public universities is restricted to eligible applicants who have passed the G. C. E. A/L examination.

3.1.3 Sri Lankan Higher Education System

The higher education sector in Sri Lanka consists of both public and private sector higher education institutes as shown in Fig. 3.2.

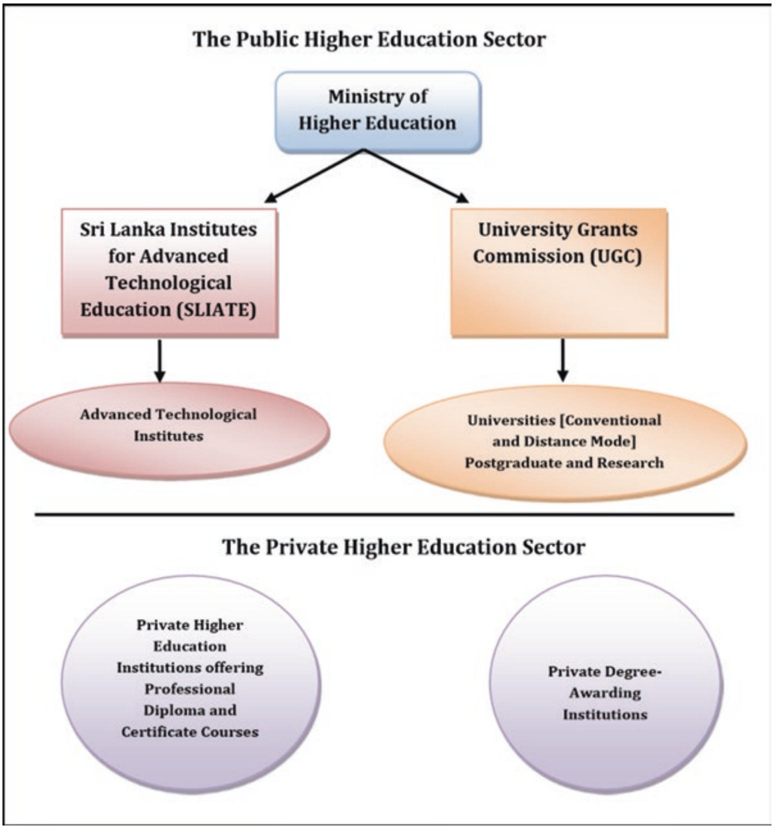

Fig. 3.2 The structure of the higher education sector in Sri Lanka. (World Bank, 2009)

3.1.3.1 The Public Higher Education Sector

The public higher education sector consists of universities, research and postgraduate institutes and advanced technical institutes. Both undergraduate and postgraduate degree programmes are conducted by universities. The postgraduate degrees range from diplomas to master's degrees and PhDs. All undergraduate degree programmes take 3 or 4 years, but medical degrees take 5 years. Further, universities offer conventional degree programmes as well as distance-mode degree programmes (World Bank, 2009).

The public higher education sector consists of 15 universities. Also, there are a number of institutes in the public higher education sector as shown in Table 3.1.

The above universities and institutes including Open University provide higher education for a student population of more than 100,000. The Open University provides flexible higher education opportunities especially for two kinds of students: (i) those who work and study part-time and (ii) those who enter higher education later in their lives.

In Sri Lanka, public universities are widely distributed across the country but not equally distributed. Most of the higher education providers are located in or around Colombo, the biggest city in the country.

3.1.3.2 The Private Higher Education Sector

The private higher education sector consists of (i) degree-granting institutions; (ii) institutions offering lower-level diplomas, certificates and short courses; and (iii) qualification-granting professional associations. They are all fee-charging private institutions and mostly located in large cities and towns such as Colombo and Kandy.

Table 3.1 Universities and higher education institutes in Sri Lanka

Category	No. of Universities and Institutes
Universities	15
Postgraduate Institutes	7
Affiliated Institutes	11
Degree Awarding Institutes	7
Campuses	3
Other government universities which are not under UGC	
Under Ministry of Defence	1
Under Ministry of Higher Education	2
Under Ministry of Vocational and Technical Training	1
Total	**47**

Adapted from University Grants Commission Sri Lanka (2015)

The private higher education sector in Sri Lanka is a relatively recent introduction. The World Bank (2009) states a number of factors which account for the growth of the private higher education sector in Sri Lanka. First is the limited number of places at public universities. Another factor is that private higher education institutes offer more job-oriented curricula. They produce graduates with a better command of English and develop ‘soft skills’ which are important to employers.

The degree-awarding institutions in the private higher education sector offer degrees through affiliations with foreign universities from countries such as the United Kingdom, the United States, Australia, China, Singapore and Malaysia (World Bank, 2009).

3.1.4 Drive for Blended Learning in Higher Education in Sri Lanka

One of the biggest problem of higher education sector is the unemployment of university graduates in Sri Lanka. According to the World Bank (2007), there is a mismatch between Sri Lanka’s tertiary education system outputs and its labour market needs. This mismatch has led to unemployment of university graduates (World Bank, 2005, 2009). For example, Ramanayake and Jayamanne (2012) found that 4170 students were unemployed and 2050 students were underemployed (not having enough paid work or not doing work that makes full use of their skills and abilities) out of a total number of 15,489 study participants.

Due to the above issue, the higher education sector in Sri Lanka is trying to improve the quality and relevance of university education. As the first step, the Ministry of Higher Education (MOHE) has launched the ‘Improving the Relevance and Quality of Undergraduate Education’ (IRQUE) project ‘to provide undergraduates with a complete and balanced tertiary education, which will mould them into responsible, educated citizens of Sri Lanka’ (IRQUE, 2009). This project is supported by the World Bank. The World Bank (2007) also suggests that Sri Lankan universities need to make their education system ‘more demand driven, quality conscious and forward looking’ in order to improve the quality and relevance of university education. Therefore, the University Grants Commission (UGC) has concerned about the need to expand, reform and restructure the entire system, accommodate the increasing number of qualified people seeking to gain admission to a university and improve the quality and relevance of university education.

Moreover, the government of Sri Lanka has identified that the development of the higher education sector is of central importance to enable Sri Lanka to make the transition from a lower-middle-income country (LMIC) to an upper-middle-income country (UMIC). Recognizing this, the government of Sri Lanka (GoSL) and the World Bank have agreed to support the higher education sector through a World Bank-funded Accelerating Higher Education Expansion and Development

(AHEAD) operation (AHEAD, 2018). The three result areas that the AHEAD operation will focus on are:

1. Increasing enrolment in higher education with special emphasis on study programmes required for an aspiring upper-middle-income economy
2. Broadening and deepening modern teaching and learning approaches that combine academic excellence with high-quality socio-emotional skills
3. Promoting a vibrant research and innovation culture that can support economic development, especially the growth of higher-value industries and services

Hence, blended learning approach combines traditional face-to-face classroom learning and online learning. It seems to be feasible, as it appeals to diverse learning styles, circumstances, needs and demands. The flexibility of online learning can increase the equity of access to the education in Sri Lankan universities, while the quality of traditional face-to-face learning can be improved with the support of multimedia learning resources.

3.1.5 About National E-Learning Resource Centre (NELRC)

The National E-Learning Resource Centre (NELRC) was established under the Faculty of Computing and Technology in the University of Kelaniya as one of the national budget proposals approved in 2017 with 250 million rupees allocation. With the NELRC's vision of becoming a centre of excellence in innovative teaching and learning to make everyone employable, the NELRC respects four values, including the followings:

(a) Sustainability. E-learning should last and develop to employable skilled human resources to the nation. It should also facilitate the smooth transference of students from high school to university providing training and education for life.
(b) Collaboration. The NELRC enhances the spirit of collaboration with all universities and outside university departments within the working team and the students to create the spirit of the team.
(c) Creativity. The NELRC establishes the principle of teaching and learning depending on self-learning, critical thinking and the involvement of higher-level thinking skills through intellectual activities, interactive tools, enrichment activities, research methods and other additional linking tools.
(d) Self-actualization. The NELRC establishes the principle of self-actualization for instructors, learners and workers in the field of e-learning. In addition, it enhances the values of competitiveness, professionalism, effectiveness, social responsibility and dedication and is experimenting and fulfilling the highest level of general interest.

The functions of the NELRC are divided into four phases. The NELRC is functioning mainly as a course provider and serving learner needs on a national basis through developing courses, certificates and programmes mostly in the field of computer science and education. The NELRC has a strong emphasis on the support of teachers in schools and academic staff in universities in the use of educational technologies through providing assistance and advices and by developing applications and resources in course development where e-learning is featured. The NELRC is also supporting innovation within the instructional process of e-learning. The underlying pedagogical model of this process is about collaborative learning in a problem-based curricula context. The NELRC is actively engaged in blended learning-related research and testing of educational software, tools and resources, integration of audio-visual material and evaluation about the impact of new technology in education. Other activities include consulting services, support for implementation and assessment and assistance with integration of e-learning processes to curricula.

3.2 Blended Learning Approaches in Sri Lanka

Blended learning approach has been used in Sri Lankan education system by many institutions such as schools and universities. According to Gunawardena et al. (2012), interaction was the most significant predictor of the learner satisfaction in online learning environment. They used Moodle as the online learning platform to engage with the users. Further, in another study by Kanaganayagam and Fernando (2013) in 15 state universities in Sri Lanka on collaborative online learning, the study revealed that the interactive functions in Moodle, i.e. wiki, social media, online conferencing, graphics and simulations, etc., tend to have a positive impact on students' learning. Similarly, Gamage and Fernando (2016) found that the university students perceived that there is a moderate positive linear relationship between interactivity and the quality of the learning. On the other hand, according to Abeysekara (2008), the quality of the online learning resources was one of the critical factors when effectively implementing blended learning approach in Sri Lankan universities.

As the interactivity of online learning tends to affect the student engagement as well as the quality of learning, it is crucial to understand how to design and develop interactive online learning to support learning. According to Abeysekara (2008), it was found that the organizational factors, course-related factors and human-related factors are vital for online learning in higher education in Sri Lanka. This is echoed by Nanayakkara and Kusumsiri (2013). The study emphasized an important area in user retention in online learning context for designing online learning resources. It includes the aesthetic look of the system and its alignment to the teaching, learning and assessment process. Regarding human-related factors, the study highlighted the IT skills of the designers are important as well.

A feedback survey was carried out for the second-year undergraduates of University of Kelaniya for the subject of science, technology and society after implementing blended learning approach. At the survey 90% of them agreed that the blended learning approach is more appropriate for today's teaching, while 70% of them recommend the blended learning approach for other courses as well.

Another feedback survey was also carried out for the subject of Management Information System (MIS) which used the blended learning approach through social media, and more than 80% agreed that the social media-integrated blended learning approach is highly appropriate.

In school education, the blended learning approach is also now becoming a prominent area in Sri Lanka. There are many initiatives taken by the government of Sri Lanka through smart classroom project to convert the traditional classroom into blended form. Further many researches have been conducted in primary and secondary education environment of Sri Lanka on blended learning approach. Thus, it was suggested that using educational games on a tablet or on a computer monitor through LMS will enhance learning experience of the children with fun and joy (Halloluwa, Usoof & Hewagamage, 2014). The Ministry of Education (MoE) of Sri Lanka has identified that the content preparation and delivery should be done based on the needs of the learners in Sri Lanka (Wijesiri, 2018).

As we found out from our experience, in the engagement of teaching with technologies over 10 years in the university system in Sri Lanka and also working closely with the school education system of Sri Lanka, developing a blended learning environment which attracts the user is a challenging task. The learners who use online learning platforms should get an interactive and joyful learning experience as they would get in face-to-face learning environment.

Thus, when developing blended learning resources, the creator should consider many factors which attract and retain the learner as follows (Pappas, 2018):

1. Conduct a comprehensive task analysis.
2. Develop a storyboard and a script.
3. Add audio and video.
4. Include additional resources.
5. Use flexible tools for creating.
6. Use microlearning concept.
7. Obtain feedback in every stage.

After carrying out an extensive research, the NELRC derived a model to develop interactive multimedia online learning resources, which could be replicated in any online learning content development.

The process in Fig. 3.3 explains the systematic way of developing interactive multimedia online learning resources at the NELRC. This path aims to ensure the quality of the product development. E-Lankapura, the first product where the NELRC followed this process, will be described later in Sect. 3.3.2

Yet, in order to develop quality online learning resources for blended learning, the design process described in Fig. 3.3 may not be adequate, so collaborative efforts with different expertises are deemed to be significant. National or international collaboration has been used to get experts to support the development (Bengtsson, Granmo & Krebs, 2015). The researchers revealed that the international collaboration on developing online learning resources was essential to

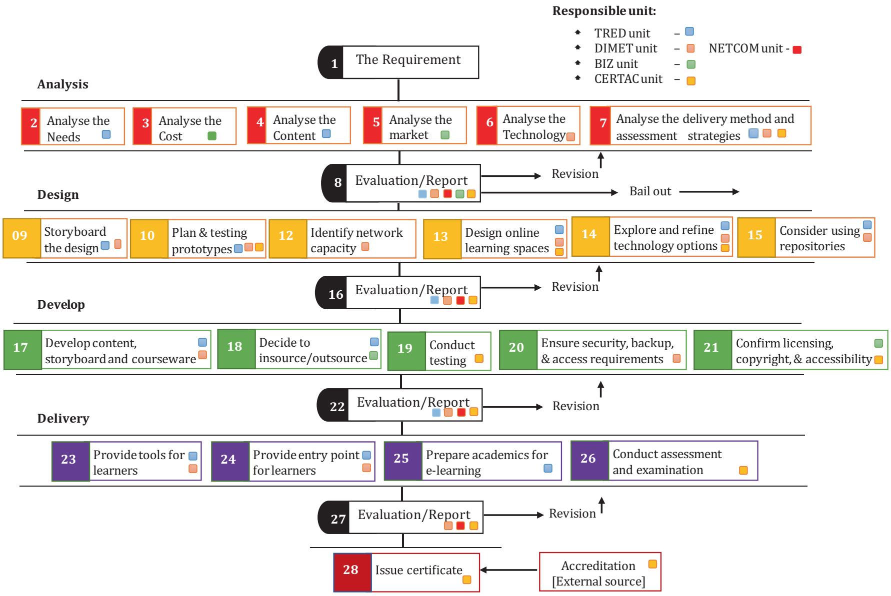

Fig. 3.3 The process of developing interactive multimedia online learning resources. (Suraweera et al., 2018)

reposition both how learners engage with materials and content in the course and also how they interact with their peers and their instructors. It is necessary for the NELRC to build up collaboration with experts for online learning design. Therefore, the next section discusses the collaborative partnership approach of the NELRC.

3.3 Collaborative Partnership Approach of the NELRC Towards Promoting Blended Learning in Sri Lanka

In order to tackle with the lack of diverse expertise for designing online resources and further blended learning in Sri Lankan higher education, the NELRC adopted the holistic framework for building the blended learning capacity of the higher education institutions (HEIs) developed by Lim and Wang (2016). According to the framework, eight aspects should be taken into account for planning the blended learning promotion in higher education, i.e. vision and philosophy; curriculum; professional development; learning support; infrastructure, facilities, resources and support; policy and institutional structure; partnerships; research and evaluation. This section presents how the NELRC collaborates with different stakeholders in Sri Lanka to adopt this framework for blended learning promotion.

3.3.1 Vision and Philosophy

3.3.1.1 Vision in the NELRC, University of Kelaniya, Sri Lanka

Owing to the continuous technological advancements, modern society has become complicated and competitive than ever before. Specifically, latest advancements of Information and Communication Technology (ICT) have contributed to education, in terms of access, equity, quality, management, governance and administration. It is important to understand and capitalize the capabilities of ICT to empower students, especially in developing countries where the disparities are becoming severe. Through integrating ICT into formal education, young generations would be able to use and adapt technology for lifelong learning. In light of this vision for blended learning, the NELRC looks forward to transforming technology-enhanced learning environments for the purposes of student engagement and the development of the twenty-first-century competencies.

The following objectives were identified by the NELRC to achieve through its blended learning workshops and programmes;

I. Demonstrate a clear understanding of concept, techniques and methods/principles of blended learning for education.
II. Analyse the learning context to match with blended learning approach.
III. Apply blended learning approach for education.
IV. Create best and suitable blended learning environment for selected contexts.
V. Perform as 'train the trainers' to train the fellow academics/teachers in blended learning.

3.3.1.2 Underlying Philosophy for Learning and Teaching in Sri Lankan System

One of the fundamental requirements of the Sri Lankan government is to move towards constructive and collaborative teaching and learning in the blended learning environment. However, the government has initiated several projects at national level as well as in the secondary- and tertiary-level education systems to help move towards constructive and collaborative teaching and learning environment. Among them, the Ministry of Education with the help of the Asian Development Bank started two phases of the Secondary Education Modernization Project (SEMP), phase I 2001–2006 and phase II 2005–2009. This project established a web portal called 'SchoolNet' that brings all organizations related to school online education and provides a novel learning and teaching environment for both students and teachers. Moreover, the government of Sri Lanka has formulated the National Policy on Information Technology in School Education (NPITSE) with the following vision, but there is no indication of how this vision will be facilitated.

> A generation of Sri Lankans empowered with Information and Communication Technology and to facilitate the planning, implementation, and sustenance of information technology education in schools to enhance students' learning and quality of teaching. (De Silva, 2007)

The NELRC therefore took initiatives to provide an effective blended learning environment through advanced Information and Communication Technologies to allow the learners to be the centre of the education process and to foster necessary employable skilled human resources to the nation.

3.3.1.3 The Role of Blended Learning in Sri Lanka

Under the Higher Education for Twenty-First Century (HETC) project, the Ministry of Higher Education (MOHE) in Sri Lanka (Ramanayake & Jayamanne, 2012) published the Sri Lanka Qualifications Framework (SLQF) which is a nationally consistent framework for all higher educational qualifications offered in the country. The SLQF applies to all higher educational institutions (HEIs) both public and private, which provide post-secondary education. It identifies the volume of learning of students and the learning outcomes that are to be achieved by the qualification holders. For each qualification, the generic outcomes and attributes indicate the expected capabilities from qualification holders defined in terms of the four main domains of learning: knowledge, skills, attitudes and mindset and paradigm, characterized as the K-SAM model. The classification of the learning outcomes according to the principal K-SAM components is given in Table 3.2:

The HEIs in Sri Lanka therefore focus on the development of student's twenty-first century competencies, i.e. K-SAM, to perform and survive in the present society. Blended learning practices should be aligned to meet the aforementioned educational focus.

Table 3.2 Classification of the learning outcomes according to the principle K-SAM components

Categories of learning outcomes	Core area
1. Subject/theoretical knowledge	**Knowledge**
2. Practical knowledge and application	
3. Communication	**Skills**
4. Teamwork and leadership	
5. Creativity and problem solving	
6. Managerial and entrepreneurship	
7. Information usage and management	
8. Networking and social skills	
9. Adaptability and flexibility	**Attitudes, values, professionalism and vision for life**
10. Attitudes, values and professionalism	
11. Vision for life	
12. Updating self/lifelong learning	**Mind-set and paradigm**

Ministry of Higher Education of Sri Lanka (2015)

3.3.2 Curriculum

The NELRC has been working closely with Information and Communication Technology Industry Skills Council (ICTISC) and National Apprentice and Industrial Training Authority (NAITA), especially in developing blended learning resources to enhance IT literacy of citizens in order to keep pace with the Internet penetration of the country and the international technological advancements. One of the first steps to meet this need is to build a national E-learning platform to educate citizens. The NELRC has signed a memorandum of understanding (MoU) with ICTISC to:

- Work with ICTISC to disseminate e-culture for awareness and media campaigns to prepare the community to accept and interact with e-learning/blended learning
- Act as a professional certification and accreditation authority
- Work with the Board of Management and Industry Working Arms of ICTISC for analysing the needs of ICT-related National Vocational Qualification (NVQ) courses in e-learning platform and to design, develop and deliver e-learning/blended learning programmes
- Work with the Board of Management and Industry Working Arms of ICTISC to identify courses of other sector council into e-learning/blended learning platform
- Create public and private sector partnership for professional and career development
- Promote anywhere-anytime learning in Sri Lanka and especially provide knowledge at doorstep for rural areas in Sri Lanka
- Increase employability of young people
- Attract overseas investors and outsourcing jobs by creating a national knowledge work force
- Be a centre of excellence in innovative teaching and learning.

After signing the MoU with ICTISC, the NELRC got opportunity to contribute to prepare the citizens for a digital Sri Lanka by promoting blended learning opportunities and make Sri Lanka an ICT skills hub for the global ICT industry. The part of future plans of the NELRC is to continue the partnership with ICTISC which is aligned with the government strategy of reaching a US$5 billion industry and creating 200,000 skilled labour force by 2022. For this purpose, the NELRC is looking forward to promoting learning anywhere, anytime in Sri Lanka and especially providing knowledge at doorstep for rural areas in Sri Lanka and thereby increasing employability of young people.

As mentioned above, the NELRC is working closely with NAITA looking for avenues to develop interactive e-leaning/blended learning resources for NVQ level-2 ICT syllabus to cater all the citizens in Sri Lanka to develop their basic ICT skills. The NVQ level-2 ICT syllabus is focused to develop a citizen who is equipped with basic ICT knowledge and skills which will be beneficial when working in the society. As most of the private and government sector organizations are moving towards digitalization, it is a national requirement to equip all Sri Lankans with basic ICT skills. Thus, as a result of the collaboration between ICTISC and NAITA, a proposal came from ICTISC to develop e-learning/blended learning resources for National Vocational Qualification (NVQ) level-2 Information and Communication Technology syllabus.

Thus, this project is named as e-citizen, and the NELRC has given the authority to develop the resources which can be accessed by any individual of the country to gain basic ICT skills and knowledge.

Therefore, to fulfil this national requirement, the NELRC developed the product called ‘E-Lankapura’, to teach the content in NVQ level-2 ICT syllabus to every citizen in Sri Lanka. ‘E-Lankapura’ is an online interactive multimedia learning resource which gives the user a unique experience in acquiring ICT knowledge and skills (Suraweera et al., 2018).

When designing online learning resources, maintaining the retention time of the learners is crucial. To achieve this, the NELRC adopted a storytelling concept with a mixture of multimedia such as voice, video, audio and text to deliver the content in an attractive way. For this effort, the NELRC collaborated with colleagues in different disciplines to obtain their expertise and knowledge as discussed in Fig. 3.4 and followed the process of developing interactive online learning resources as shown in Fig. 3.3.

Figure 3.5 explains the repetitive sequence of the production.

As depicted in Fig. 3.5, E-Lankapura production starts with a story which is based on an ancient story of Sri Lanka, named as ‘The Journey to E-Lankapura’. While the story continues, the learner will come across with certain problems

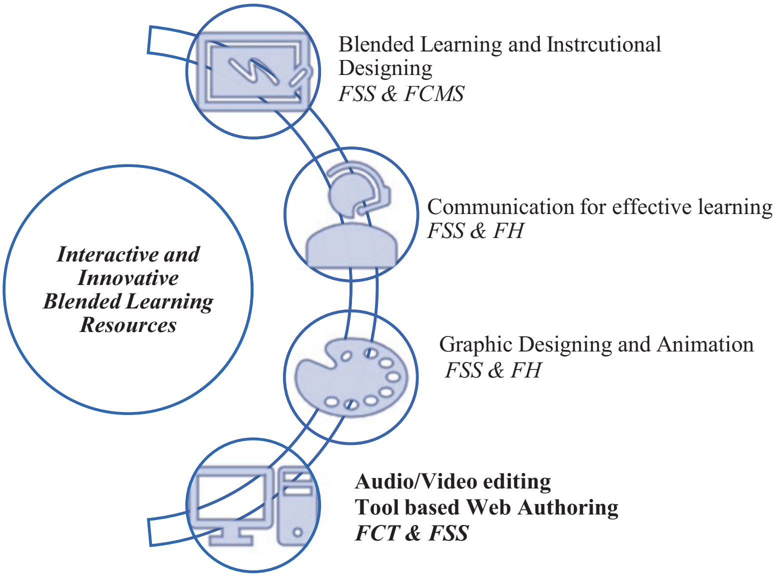

Fig. 3.4 Faculty-level collaboration for developing interactive and innovative blended learning resources

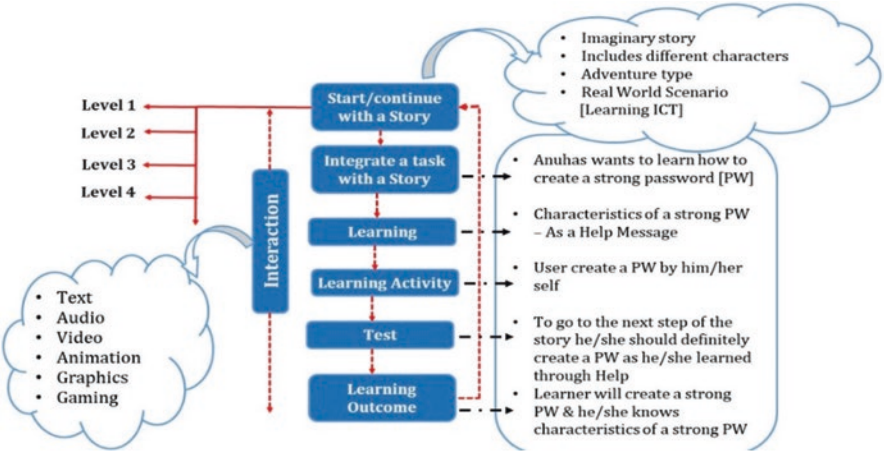

Fig. 3.5 Repetitive sequence of the production. (Suraweera et al., 2018)

Fig. 3.6 Example video from E-Lankapura

related to ICT (integrated tasks with the story), where he/she will then be directed to further explanation of the problems (advanced learning or deep learning) and given instructions on how to solve the problems (problem-based learning). The learning section is followed by the learning activity where the learner should solve a problem on his/her own. Based on the learner's performance in the activity, marks will be allocated as the testing part. At the end of each section, the learner will see the learning outcomes achieved by him/her along with the scores obtained. Figure 3.6 shows a section of a video of the production. This interactive multimedia-based production 'The Journey to E-Lankapura' has been marked as an innovative approach to teach many subjects in Sri Lankan education system. For more experience, please visit www.nelrc.kln.ac.lk/e-lankapura

This interactive multimedia-based resource benefited from the collaboration model of the NELRC. This whole effort is an outcome of experts who represent different fields such as instructional design, mass communication, fine arts and software engineering. To be specific, the story was written by the experts in mass communication, while the instructional designers focused on the learning objectives to be achieved through the scripts. The filming was finished under the supervision of experts from academics from the Faculty of Humanities in University of Kelaniya. The learning activities were designed by the experts in fine arts, while keeping on the track of achieving learning outcomes by the instructional designers. Finally, the learning sections and the learning activities were developed by the graphic designers and software developers, respectively.

Apart from fulfilling a national requirement, the E-Lankapura will be used by the secondary education system in Sri Lanka to teach and learn ICT and ICT-related subjects, which are free for Sri Lankans.

3.3.3 Professional Development: Partnership with Overseas Universities to Provide Training on Blended Learning

The NELRC identified that the introduction of blended learning challenges the teaching staff to revisit their roles in technology-enhanced learning environments. Therefore, the NELRC decided to provide continuing professional development for blended learning partnering with Sheffield Hallam University (SHU), United Kingdom; the Victoria University of Wellington (VUW), New Zealand; and the Education University of Hong Kong, Hong Kong.

The NELRC was also benefited from the MoU signed between the Faculty of Computing and Technology of Sheffield Hallam University, United Kingdom. As a result, the NELRC offered training opportunities for its three staff members on game and animation design and development. As a result of this training, a new specialization area was introduced as game and animation for Bachelor of ICT degree programme offered by the Faculty of Computing and Technology in the University of Kelaniya. The first batch will be graduating in 2021, which will fulfil the demand of the skilled workforce in game and animation industry in Sri Lanka. Further, a new degree programme on game designing is proposed to the Faculty of Social Sciences and Faculty of Humanities. This degree programme will start by 2020, and it is expected to contribute on reducing the unemployment of the arts graduates, as they will be nurtured with state-of-the-art skills to match with the modern jobs in the market. The collaboration with Sheffield Hallam University also helped for the success of E-Lankapura production, as the academics who were trained on game and animation design and development in Sheffield Hallam University by giving their expertise towards the production.

In addition, two staff members of the NELRC completed the certificate of proficiency in learning and teaching with digital technology at the Victoria University of

Wellington. The whole programme was followed in online mode, and that experience was greatly beneficial for training and implementing digital technology in teaching and learning process in the University of Kelaniya through the NELRC.

Furthermore, the NELRC collaborated with The Education University of Hong Kong and organized a national workshop on blended learning for education, as the first national-level blended learning workshop in Sri Lanka. A 3-day workshop was held based on the 'train the trainers' (ToT) concept. As a result, 45 university academics and 60 school teachers were trained with what blended learning is and how to design blended learning.

3.3.4 Learning Support

As discussed in Sect. 3.3.2, the NELRC developed its first interactive online multimedia product called 'E-Lankapura', to teach the content in NVQ level-2 ICT syllabus to every citizen in Sri Lanka. The official website (www.nelrc.kln.ac.lk/e-lankapura) provides educational guidance for students/users who require to use E-Lankapura strategically for their learning. This educational guidance was prepared to learn independently and at students/users own pace. Moreover, a dedicated academic team is available at the NELRC to provide their professional knowledge through workshops by visiting schools and other institutions on request to help students to become active, independent and self-regulated learners.

3.3.5 Infrastructure, Facilities, Resources and Support

To facilitate blended learning at the University of Kelaniya, the NELRC has a computer laboratory with 50 personal computers and Internet facilities. The University of Kelaniya provides very powerful campus-wide wireless networks which encourage staff and students to use online resources. Moreover, the Ministry of Higher Education (MoHE) in Sri Lanka further identified the importance of developing university students' IT skills to meet the needs of the labour market. For this purpose, it was recognized that the students should be supported to learn on their own to improve their knowledge, skills and capabilities in IT. As a result, MoHE launched a loan programme in 2011 with the support of public and private banks that enables university students to obtain laptop computers with connectivity. The University of Kelaniya also offered laptops for the academic staff. Hence, this digital learning device schemes for academic staff and students encouraged the bring-your-own-device approach and enabled individualized, self-paced learning and group collaboration in the blended learning environment.

Since the NELRC was established under the national budget proposals 2017 with 250 million rupees allocation, the NELRC was able to obtain audio and video recorders, digital video cameras and other relevant electronic devices to use in developing blended learning resources. They were free to use within the university by any faculty and staff members to promote blended learning. Technical and service supports were also provided by the NELRC, when required by the academic staff and students. The team would show students and staff how different ICT tools can be used in the blended learning environment.

3.3.6 Policy and Institutional Structure

Although a blended learning policy has not been formulated in Sri Lanka yet, educational organizations and institutions have positive drive towards encouraging their academic staff and students to engage in blended learning. For example, the University of Kelaniya operates with the vision of becoming a centre of excellence in creation and dissemination of knowledge for sustainable development. To achieve this vision, the University of Kelaniya establishes a mission to nurture intellectual citizens through creativity and innovation, who contribute to the national development. Hence, the university promotes innovative teaching through a wider adoption of blended learning.

On the other hand, the MoE possesses a broad vision of strengthening the blended learning approach among the primary and secondary education system in Sri Lanka. The NELRC strongly recognized that empowering teachers to develop their own blended learning content would improve the quality of the resource. As a result, MoE signed a MoU with the NELRC to train Sri Lankan school teachers on blended learning content development. The best content can be shared to 'E-thaksalawa' which is the national e-learning portal for general education hosted by MoE and is specially designed, according to syllabuses of the students from grade 1 to 13.

3.3.7 Partnerships

3.3.7.1 Faculty-Level Collaborative Partnership Approach for Developing Blended Learning Resources

The NELRC identified that developing an appealing blended learning resources should be a collaborative task of several personnel who are experts on different subject disciplines. In particular, drawing the storyboards, writing the scripts and adding audios and videos by using appropriate tools would not lie in the expertise area of the subject matter expert. Therefore, such activities should be developed under the guidance of the experts in relevant fields.

Therefore, developing attractive blended learning resources will be a collaborative task of a team which comprises different expertises. Accordingly, the University of Kelaniya established the NELRC with a team of people from different backgrounds representing several faculties at the university, such as Faculty of Computing and Technology (FCT), Faculty of Humanities (FH), Faculty of Social Sciences (FSS) and Faculty of Commerce and Management Studies (FCMS).

Regarding the faculty-level collaboration as internal collaboration, the NELRC purposefully collected all relevant expertise to develop interactive and innovative blended learning resources as shown in Fig. 3.4. The University of Kelaniya has specialists such as language experts in all three languages (Sinhala, Tamil and English) and unique capability of providing local (Sinhala) and foreign demand languages such as English, Hindi, Tamil, Chinese, French, German, Japanese, Korean, Russian, Spanish and Italian. For example, the University of Kelaniya is the first university in Sri Lanka which provided information via web in three languages (Sinhala, Tamil and Sinhala). Moreover, the University of Kelaniya has experts in fine arts, multimedia, digital graphics, animations, storytelling, storyboard designing, scriptwriting, audio-video editing, information technology and e-learning.

3.3.7.2 External Partnership to Share Good Practice on Blended Learning

In order to successfully implement of blended learning approach in Sri Lanka and strengthen the human resources and other facilities of the NELRC, it established strong partnerships with external institutions. However, collaborations between universities and external stakeholders are still expanding in the Sri Lankan University system. Nevertheless, since its inception, the NELRC identified that partnering with local and foreign stakeholders as external collaboration is an essential part of the success. This partnership provided collective knowledge of teaching and learning strategies and techniques, which enabled the NELRC to improve blended learning approach. Moreover, as discussed in Sects. 3.2 and 3.3, this external partnership exposure together with our different backgrounds and contexts provided us with a multifaceted approach covering most angles of blended learning.

The NELRC focused to achieve the following objectives by forming the collaboration with external stakeholders;

1. To develop human resources of the NELRC on blended learning (including train the trainers)
2. To provide consultancy services to the society
3. To disseminate knowledge on blended learning approach among the society
4. To develop e-learning course materials for the identified areas
5. To develop a revenue model for the NELRC for its sustainability

As a result, the NELRC developed collaboration with the following entities by signing a memorandum of understanding (MoU) or by collaboratively working due to previous contacts to achieve the above-mentioned objectives.

1. Ministry of Education (MoE), Sri Lanka
2. Information and Communication Technology Industry Skills Council (ICTISC), Sri Lanka

3. National Apprentice and Industrial Training Authority (NAITA), Sri Lanka
4. Sheffield Hallam University (SHU), United Kingdom
5. Victoria University of Wellington (VUW), New Zealand
6. The Education University of Hong Kong, Hong Kong, China

The collaborative partnership approach enabled the NELRC to promote interactive and innovative blended learning in Sri Lanka. As a result, the NELRC promoted and provided capacity building for blended learning within the university including university staff development programme as well as outside the university such as public and private school sectors as a part of professional development which was identified as one of the key strategies of promoting and supporting blended learning at the University of Kelaniya and in Sri Lanka.

3.3.8 Research and Evaluation

With the launch of E-Lankapura, the evaluation of the blended learning resources and the collaborative partnership approach to promote blended learning will be the next stage of the NELRC.

3.4 Challenges, Plans and Directions

The lack of best practices for blended learning is a challenge that hinders the scaling up of e-learning at the University of Kelaniya and in the educational sector in Sri Lanka. The lack of teaching staff competence in blended learning practices also presents a challenge. The staff commitment towards learning and practicing new teaching and learning approach also marks as a challenge. Hence, apart from providing best practices for blended learning, a supportive strategy will be implemented with a package of continuous professional development and competency-building solutions for academic staff including hands-on training, workshops, seminars and case studies, to promote and assist them how to apply blended learning solutions in their teaching.

Future plans and directions could include working more actively and collaboratively with existing internal and external stakeholders to promote blended learning in Sri Lanka. More importantly, further collaborative partnership approach can also be added into future plans and directions to improve learning through interactive and innovative blended learning.

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Chapter 4
Reinforcing the Importance of Academic Integrity and Ethics (AIE) Through Augmented Reality (AR) Learning Trails

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Abstract Most higher education institutions emphasise the importance of academic integrity and ethics (AIE). Despite various efforts to increase students' awareness towards AIE, even with the enforcement of student declarations and severe penalties for misconduct, cases of plagiarism, data fabrication, and breaches of rules still arise with alarming regularity. This chapter describes a project which utilises the latest technological advances in augmented reality (AR), coupled with mobile technologies, to bring to students scenarios of AIE in real-life situations. Students make use of their mobile devices to retrieve information, give responses, and even consider ethically related decisions in different circumstances and locations. The project focuses on finding out how students perceive the use of AR for learning AIE and the influence of cultural background on their perception and understanding of AIE. Student learning was assessed using quantitative and qualitative methods which involved the collection of data from multiple sources: user experience surveys, clickstream data, and analysis of pre- and post-trail understanding of AIE. Students were generally satisfied with the use of AR in the learning of AIE. The findings suggest that the blended learning approach using AR could be useful to enhance the learning of AIE. In addition, variations in learning AIE among students of different cultural backgrounds were found.

4.1 Introduction

Higher education institutions are expected to effectively prepare graduates to be creative, caring, and civil citizens of society (Harkavy, 2006). In addition to ensuring that graduates are nurtured as experts of their respective disciplines, higher education institutions are also tasked with equipping students with the relevant attitudinal skills to meet the various demands of society, including the workforce.

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Students who possess the ability to evaluate and analyse information and apply their knowledge to solve real-life problems are highly sought after by organisations (O'Sullivan & Dallas, 2017).

Hong Kong Baptist University (HKBU) is committed to the development of the whole person, building upon the heritage of Christian higher education. One of the key tenets of the university's strategic plan is to prepare its graduates to be future-ready with the best student learning experience by emphasising integrity, creativity, communication, employability, and a commitment to doing good for humankind. The university also aims to promote research excellence which advances knowledge, scholarship, and academic leadership (Hong Kong Baptist University, 2017).

The Centre for Holistic Teaching and Learning (CHTL) at HKBU works in partnership with academic colleagues to foster continuous quality learning and teaching at HKBU. In particular, it helps promote the university's long-standing whole person ethos alongside its more recent outcome-based teaching and learning approach through an institutional-wide evidence collection initiative, to show how HKBU's education adds value to its students and to enhance teaching and learning through eLearning and mobile learning. To reinforce the importance of whole person education at HKBU to new students, CHTL has been involved in the design and facilitation of one of the university orientation workshops (UOWs) entitled "Insight into HKBU's 7 Graduate Attributes" since 2012. In the initial 5 years, the format was a 50-min face-to-face workshop with some eLearning activities built-in. The aim of the workshop was to promote new students' awareness of the seven graduate attributes (GAs, as shown in Fig. 4.1) of HKBU. It was found that most students, around a month after the workshop, could just recall the names of one or two of the GAs; hardly any of them was able to state the exact meaning of each attribute. In

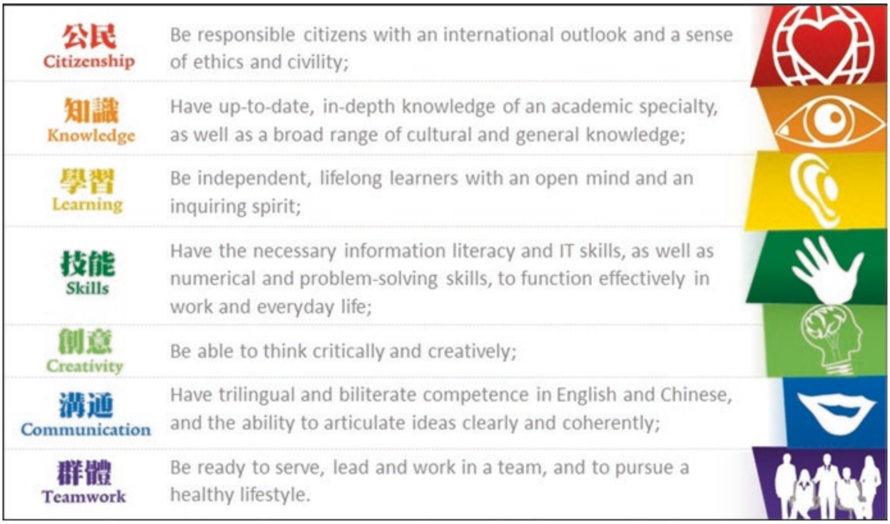


Fig. 4.1 HKBU's graduate attributes (for undergraduates)

view of that unsatisfactory outcome, the CHTL revamped the content and delivery method of the workshop in 2017. In order to be in line with the university's strategic focus in nurturing graduates who are creative, caring, and ethical leaders, the workshop was streamlined to focus on the first and most pertinent GA – "citizenship" – with an emphasis on issues related to academic integrity and ethics (AIE). To encourage students to learn through active participation, the delivery of the workshop was also switched from a face-to-face briefing to a blended learning approach with the incorporation of augmented reality (AR) coupled with mobile technologies.

The revamped (and current) orientation workshop consists of a 15-min briefing, followed by a 25-min augmented reality learning trail and a 10-min debriefing. The aim of the briefing is to highlight the importance of observing and upholding the highest standards of AIE throughout and beyond university study. After the briefing, new students, including local Hong Kong and non-local students, are required to explore the learning trail in groups using their own mobile devices. Requiring students to work in groups allows them to discuss the issues with their new schoolmates, from diverse disciplines and cultural backgrounds. A debriefing session follows the completion of the trail exploration, and students are required to finish some post-trail exercises and a survey.

The above-mentioned learning trail, known as the "Trail of Integrity and Ethics–General" (TIE-General), is designed to challenge students' awareness and general knowledge of AIE through the incorporation of AR technology using a blended learning approach. TIE-General is a short trail which consists of four checkpoint scenarios depicting four of the most common integrity issues in academia: (1) plagiarism, (2) citation and common knowledge, (3) ethical use of library resources, and (4) data falsification. The design of the scenarios is based on the situated learning theory where the learning is embedded within authentic activities (Lave & Wenger, 1990). The content of each checkpoint scenario relates to a specific physical location within the HKBU campus. Students are required to interact, collaborate, and reflect during the entire process. The trail also provides students with an opportunity to familiarise themselves with the campus because students are required to search for checkpoints located at various parts of the campus. Figure 4.2 displays the scenes in the *data falsification* scenario.

While the prevalence rate of academic dishonesty is not specific to any discipline, this problem has been perceived as a global issue affecting most institute of higher learning (Arhin & Jones, 2009). A qualitative study by Löfström, Trotman, Furnari, and Shephard (2015) found that there has been a lack of consensus among academics on who and how academic ethics should be taught in the university, in particular if there should be a formal module or whether informal education towards ethics education would be a more effective intervention. The current approach is intended to propose an innovative approach of using AR in academic integrity and ethics education in an informal/formal setting as part of the freshmen orientation activity.

Fig. 4.2 Scenes in the checkpoint "data falsification"

4.2 Literature Review

The transition from secondary school to university has been viewed as a period of vulnerability for youths since they have to adapt to both a new environment and take up new roles and responsibilities (Taylor, Doane, & Eisenberg, 2014). To help students cope with the transition, orientation programmes are, in general, intended to introduce students to the rigours of university life and help students familiarise with the campus. Wolfe and Kay (2011) found that students who completed the university orientation programme perceived themselves to be highly committed to the university and that the programme facilitated their transition, highlighting the importance of orientation programmes.

Despite the efforts to ensure that students are aware of the university's academic standards, an issue that continued to affect students is AIE. In recent years, the number of students failing to uphold the values of AIE has been on the rise (Tee & Curtis, 2018). AIE is defined as "a commitment to five fundamental values: honesty, trust, fairness, respect, and responsibility…. These five values, plus the courage to act on them even in the face of adversity, are truly foundational to the academy" (International Center for Academic Integrity, 2014, What is Academic Integrity section, para 2). Students committed academic misconduct unknowingly because they were unfamiliar with the concept of AIE and relied on supplementary information such as the instructions and guidelines given by their teachers as they prepare for assignments (Kwong, Ng, Mark, & Wong, 2010). The impact of AIE goes beyond a student's academic life. Students who commit academic misconduct in school are found to be more likely to be involved in professional misconduct later in life (LaDuke, 2013; Thomas, Jawahar, & Jennifer, 2009). This calls for the need to heighten student's awareness of AIE.

4.2.1 Culture and AIE

As universities across the world embrace internationalisation, there has been an increase in the number of international students on university campuses globally, facilitating learning environments where students with varying cultures come together and seek knowledge. Culture has been suggested as one of the factors influencing students' behaviour and decision-making in AIE (Hayes & Introna, 2005; Leask, 2006); and differences in cultural backgrounds contributed to varying perception and understanding of AIE (Grimes, 2004). For example, there have been reported cases of Asian students studying in North America having difficulties with proper academic citations (Rinnert & Kobayashi, 2005), and students who cheated were found to have misunderstanding of the local or contextual interpretation of the constitution of academic integrity or that they simply lacked the relevant concepts (Wette, 2010). A study conducted by Bikowski and Gui (2018) observed that Chinese students studying in America were more likely to cite academic sources or references properly as compared to those studying in Mainland China. While the Chinese students in China felt it was not necessary to paraphrase, the Chinese students in America described "copying and pasting" as unacceptable. In the local Hong Kong context, the diverse backgrounds of students may prevent them from having common understanding and awareness towards AIE.

However, it must be stressed that it would be unfair to stereotype individuals from a certain cultural background as more likely to be involved in academic misconduct. Chen and Van Ullen (2011) found that in most cases, international students were unaware of the academic integrity practices of their host countries. This contributed to the "higher" number of AIE violation cases involving foreign students in a US-based university. In addition, the absence of or inadequate training may also be responsible for some unintentional violations of AIE (Kwong et al., 2010). Nevertheless, such findings necessitate the need to actively engage students to improve their understanding of AIE.

4.2.2 Blended Learning

Attempting to engage students on the topic of AIE might be a challenge as they may perceive it as a complex subject (Thomas & Van Zyl, 2014). Academics have called for the use of innovative pedagogy to rejuvenate ethics education, such as the use of multimedia technologies (Kwong, Wong, & Yue, 2017; Schrier, 2015). The teaching of AIE can perhaps be achieved in the form of blended learning. Garrison and Kanuka (2004) defined blended learning at its simplest form as the thoughtful integration of classroom face-to-face learning experiences with online learning experiences. At the same time, it could also be a potentially complex process since its implementation can have virtually limitless design possibilities and be applicable to so many contexts. In the same paper, the authors further posit that unlike enhanced classroom or fully online learning experiences, blended learning requires a fundamental reconceptualisation and reorganisation of the teaching and learning dynamic, starting with various specific contextual needs and exigencies. Blended learning has been identified as one of the top trends in knowledge delivery methods (Halverson, Graham, Spring, & Drysdale, 2012) and has been adopted by different types of educational institutions, including institutes of higher learning and universities (Graham, 2013).

Blended learning is a student-centred learning approach (Lim & Wang, 2016). In traditional blended learning, students were able to access learning materials at their convenience, before or after face-to-face classes. Course instructors are also given the flexibility to use online technology to either “extend” or “reduce” their course duration. This is achieved through the utilisation of learning management systems such as Moodle or Blackboard, to either deliver content that otherwise could not be delivered during the course duration or use the tools to reduce face-to-face lesson time by posting them online (Saltan, 2017). These platforms provide students with opportunities to be engaged in virtual discussions and serve as a medium for instructors to upload course materials that complement subject content delivery through face-to-face teaching (Rodríguez-Triana et al., 2017).

In contrast to the traditional approach, the integration of mobile learning technologies enables formal learning to take place outside classroom settings (Pérez-Sanagustín, Hernández-Leo, Santos, Kloos, & Blat, 2014). The same study also highlights how careful integration of AR into blended learning approaches improves students’ learning. For example, students who were involved in blended learning consisting of mobile technology, such as the deployment of AR with mobile devices described here, attained a higher average score than those who were engaged in blended learning consisting only of online videos. However, the literature on the incorporation of AR technology with blended learning seems limited (Lin, Hsia, Sung, & Hwang, 2018). While these findings lend credence towards the use of AR in blended learning to enhance teaching and learning, more research in this area is needed.

4.2.3 Augmented Reality

AR may be defined as "a real-time direct or indirect view of a physical real-world environment that has been enhanced/augmented by adding virtual computer-generated information to it" (Carmigniani & Furht, 2011, p. 3). It has been widely used to allow students to see the environment around them in new ways and engage with real-world issues in a context with which they are already connected (Delello, McWhorter, & Camp, 2015; FitzGerald et al., 2013). Such augmentation is posited to enhance one's knowledge and understanding of one's surroundings (Yuen, Yaoyuneyong, & Johnson, 2011). Coupled with the easy access of mobile devices for most students, AR provides educational institutions with the opportunity to infuse technology to enhance teaching and learning (Hung, 2017).

When AR is deployed as a tool to enhance teaching and learning (van Krevelen & Poelman, 2010), it provides students with the opportunity to act as professionals and solve problems in a realistic, yet artificial, environment (Wasko, 2013). For example, Bower, Howe, McCredie, Robinson, and Grover (2014) reported that students enjoyed the process of learning through AR and appreciated the ability to experience activities that they could not otherwise experience in a classical classroom, such as creating virtual explosions. This allows students to improve their understanding and mastery of the desired knowledge and skills of the real world in a controlled environment (Hugues, Fuchs, & Nannipieri, 2011). However, these AR applications which enhance teaching and learning tend to be subject- or discipline-specific. For example, AR has been used as a training tool to simulate surgery in medicine-related disciplines, while the discipline of civil engineering utilises it for safety training. There remains a great and unharnessed potential for AR to be expanded from subject-specific applications to a university-wide application, such as a common AIE course for all students. However, there are barriers towards successful implementation of AR in an educational setting. In a systematic review of literature between 1980 and 2016, students' perceptions on the ease of use, cognitive overload, sensitivity of trigger recognition, and stability of the system were some of the barriers identified (Akçayır & Akçayır, 2017). They may prevent the successful implementation of AR in an educational setting. It is imperative that these issues are tackled when introducing AR.

4.2.4 Current Study

The current study utilises an AR application as a university-wide application in the form of a blended learning tool to reinforce students' learning of AIE. There have been suggestions that the use of ethical dilemmas increases students' interest and motivation in the learning of ethical concepts (Burr & King, 2012; Zucchero, 2008). In recent years, AR has been used in ethics education across different fields, such as nursing and medicine, engineering, and the arts (van Krevelen & Poelman, 2010). It was also found to enhance learning when utilised as a blended learning tool (Pérez-Sanagustín et al., 2014). This study aims to investigate the use of AR as a form of blended learning approach to introduce the abstract concept of AIE through scenarios. The research questions are as follows: (1) how do students perceive the use of AR for learning AIE and (2) how do students' cultural backgrounds affect their perception and understanding of AIE? Both quantitative and qualitative data from the user experience survey and an open-ended pre-/post-questionnaire relating to AIE were analysed. It is postulated that students will be more cognizant of AIE after participating in a campus-wide trail intended to create an awareness towards AIE.

4.3 Data Collection

4.3.1 Population

Over 900 first-year undergraduate students from all disciplines participated in the TIE-General at the UOW in September 2017 (905 students) and August 2018 (955 students), respectively. Table 4.1 shows the number of first-year students from different original locales who had successfully completed the event, The category, "non-local, non-Mainland China students", refers to those HKBU-enrolled students whose nationalities are from France, India, Indonesia, Japan, Kazakhstan, Malaysia, Mauritius, Myanmar, Nepal, Norway, the Philippines, Republic of Korea, Russia, Tajikistan, Thailand, the United Kingdom, the United States of America and Vietnam. The reason for analysing data with respect to different cultural backgrounds is that variation in cultural background contributed to varying perception and understanding of AIE (Grimes, 2004). The study has obtained ethics clearance through the established procedures at HKBU, and students were given the choice to opt out of data collection. Only those who consented to have their data collected and analysed, and had completed the voluntary post-trail user experience survey, were included in the data set.

Table 4.1 Number of first-year students from different origins who had successfully completed the UOW in 2017 and 2018

HKBU first-year students	Attendance of UOW	
	2017	2018
Local	762	804
Mainland China	115	123
Non-local, non-Mainland China students	28	28

Table 4.2 Questions asking students' perception about this learning experience on a 5-point Likert scale (5 = strongly agree, 1 = strongly disagree)

Questions in the user experience survey
1. I find the AR Learn app easy to use
2. My interaction with the AR Learn app is clear and understandable
3. The AR Learn app makes learning academic integrity and ethics more interesting
4. Working with the AR Learn app is fun
5. The Wi-Fi connection is stable
6. My overall usage experience with this learning trail is good

4.3.2 User Experience Survey

In order to examine (1) the association between students' satisfaction with the AR application and their learning of AIE and (2) whether the AR application helped students create awareness towards the HKBU campus, data was collected through a user experience survey and post-workshop interviews. Table 4.2 shows the questions used in the user experience survey. There were six questions on a 5-point Likert scale to collect quantitative data and one open-ended question which asked for participants' qualitative feedback on the learning experience.

4.3.3 Clickstream Data

Students learned the concepts of AIE at various checkpoint scenarios using the "AR Learn" app on their own mobile devices. When a student was within a scenario, every tap and selection made were automatically logged with a timestamp by the app. Such data are referred to as "clickstream data" which reveal the choice patterns made by the students. They are vital in determining students' total time spent on each checkpoint, the time spent on each part of the scenario, and their initial ethical decisions. However, due to random Wi-Fi disconnections during the trail exploration, some of the clickstream data either disappeared or were eliminated, but its effect to the overall results was not significant.

4.3.4 Analysis of Pre-/Post-trail AIE Understanding

Students' reflective responses on the understanding of the concepts of AIE or issues related to AIE before and after the trail were collected and utilised for analysing the learning experience of the trail. The pre- and post-trail data were collected from hardcopy worksheets and the AR Learn app, respectively. Students were allowed to write in either Chinese or English or a mix of these two languages. The data were then imported into an open-source search results clustering engine called Carrot[2]. This engine is able to automatically gather common words and phrases from the input data, which could be visualised into FoamTree diagrams.

4.4 Results

4.4.1 User Experience Survey

At the end of both orientation workshops held in 2017 and 2018, all participating new students were asked to complete the user experience survey. Compared with results published earlier (Kwong et al., 2017; Wong et al., 2016), most of the new students expressed that TIE-General made learning AIE concepts more interesting.

Students' score for Wi-Fi stability rose from 3.63 in 2017 to 4.19 in 2018. An independent T-test comparing the means of 2017 and 2018 Wi-Fi scores was performed. Significant difference was observed between the scores for the 2017 Wi-Fi scores ($M = 3.63$, $SD = 1.16$) and 2018 Wi-Fi scores ($M = 4.19$, $SD = 0.90$); $t\ (1858) = 11.67$, $p = 0.00$. In addition, the strongest correlation was observed between Wi-Fi score and overall satisfaction score (refer to Table 4.3). Compared to those collected in 2017, qualitative comments on students' satisfaction collected in 2018 seemed to focus less on the need for better Wi-Fi connectivity.

As shown in Table 4.4, the overall usage experience score of the learning trail for non-local, non-Mainland China students was higher than for their local counterparts in both years. Other qualitative comments from the new students included "It is useful for freshman [sic] and lets me understand more about HKBU", "It is easy for

Table 4.3 Correlation of Wi-Fi score with other survey items

	Q1 – Ease of use	Q2 – Clarity	Q3 – Interesting	Q4 – Fun	Q5 – Wi-Fi	Q6 – Overall
Q5 – Wi-Fi	0.35^{**}	0.35^{**}	0.32^{**}	0.34^{**}	1	0.444^{**}

$^{**}p < 0.05$

Table 4.4 Comparison of local and non-local students' overall usage experience scores with the learning trail on a 5-point Likert scale (5 = strongly agree, 1 = strongly disagree) in 2017 and 2018 orientation workshops

	Overall usage experience score of the learning trail	
HKBU first-year students	2017	2018
Local	3.87 (N = 762)	3.85 (N = 804)
Mainland China	4.35 (N = 115)	4.47 (N = 123)
Non-local, non-Mainland China students	3.96 (N = 28)	4.32 (N = 28)

Table 4.5 The average time spent on each checkpoint collected, respectively, in the 2017 and 2018 orientation workshops

	Average time spent on the scenario (seconds)	
Scenario	2017	2018
Plagiarism	119.78	113.98
Citation and common knowledge	72.93	66.14
Ethical use of library resources	53.13	51.99
Data falsification	96.23	86.75

freshman [sic] to fit into HKBU Campus", and "I think it is very good and lets me know more about the school". Some students also suggested that more languages should be incorporated into the AR Learn app.

4.4.2 Clickstream Data

According to the clickstream data collected from the workshops, among the four scenarios, students spent the longest time on the *plagiarism* scenario and spent the shortest time on the *ethical use of library resources* scenario (Table 4.5). This might be partly due to the fact that more detailed descriptions and explanations are presented in the *plagiarism* scenario. The average time spent by the students on each checkpoint in 2018 was shorter than that in 2017. This could be contributed by the enhanced Wi-Fi connection on the HKBU campus. On average, first-year students from Mainland China spent more time on each scenario, compared with their local and their non-local, non-Mainland China peers. An exception to this was the case of the *data falsification* scenario in 2017, where non-local, non-Mainland China students took more time, followed by the Mainland China students.

There are three sections in each scenario: the description of the scenario, decision-making in the ethical scenario, and the explanation of the outcomes for the decision made. The data collected in the 2017 and 2018 orientation workshops showed a similar pattern: students spent around 48% of their time focusing on making a decision about the ethical use of library resources, in which they had to choose "Who will be affected if I hide the book on a different shelf to keep it longer?" (Table 4.6 shows the details of the questions and options for each scenario). On the other hand, the time taken by all year 1 students to make decisions in the *citation and common knowledge* scenario is the shortest among the four – this could imply that the dilemma was relatively more straightforward to them. There was an observable variation in time spent on each section of a scenario among the three groups, as shown in Fig. 4.3. The local students always spent more time than the non-local students on reading the descriptions of the scenarios, but they generally spent the least amount of time reading the post-decision explanations. For instance, in the *citation and common knowledge* scenario, local students spent nearly the same amount of time reading the description of the scenario and reading the post-decision

Table 4.6 Summary of the scenario questions and possible options at various checkpoints of the TIE-General in both 2017 and 2018 orientation workshops

Plagiarism (Question:– How can Mandy finish the assignment on time?)		**Data falsification** (Question:– How should I advise Johnny on the data collection for his project?)	
Option 1	*Borrow Kelly's assignment for "quick reference"*	Option 1	*Well, the results are not affected by how you collect your data, so it should be ok not to mention it in the report…*
Option 2	*Borrow and combine parts of the assignment from different classmates*	Option 2	*That's completely unacceptable! You cannot change the method of data collection and sample population!!!*
Option 3	*Borrow somebody's assignment from a past year and make a few changes*	Option 3	*It is important that you state how your data are collected in your final report!*
Option 4	*Re-use another similar assignment from a previous course*	Option 4	*You should consult your tutor to find out if it's OK to change the method for data collection and the sample population!*
Citation and common knowledge (question – Does Amanda need to provide a citation for using the phrase "the world for all"?)		**Ethical use of library resources** (question – Who will be affected if I hide the book on a different shelf to keep it longer?)	
Option 1	*Yes*	Option 1	*Other students*
Option 2	*No*	Option 2	*Librarian*
Option 3	*Unsure*	Option 3	*Yourself*

explanation (about 40%), while the Mainland China students and non-local, non-Mainland China students spent a lot more time on the post-decision explanation (about 50%) than on the description of the scenario (about 30%).

In each scenario, the ethical incident and potential reactions were created to motivate students to critically review the designed dilemma (Table 4.6). The same set of questions and options were used in the 2017 and 2018 orientation workshops. To better facilitate learning, students could change their initial responses after reading the post-decision explanation. Thus, a variety of responses was logged in each case; however, only the first decision made in each case was considered for the data analysis. Table 4.7 illustrated the distribution of decisions made by students from various cultures in 2017 and 2018. The data revealed that there was a significant distinction among the three groups in their responses to the *plagiarism* scenario. In 2017, most of the local students (44%) responded to the question "How can Mandy finish the assignment on time?" with option 1: "Borrow Kelly's assignment for 'quick reference'". Contrarily, the largest percentage of Mainland China and non-local, non-Mainland China students (46% and 56%, respectively) chose option 4,

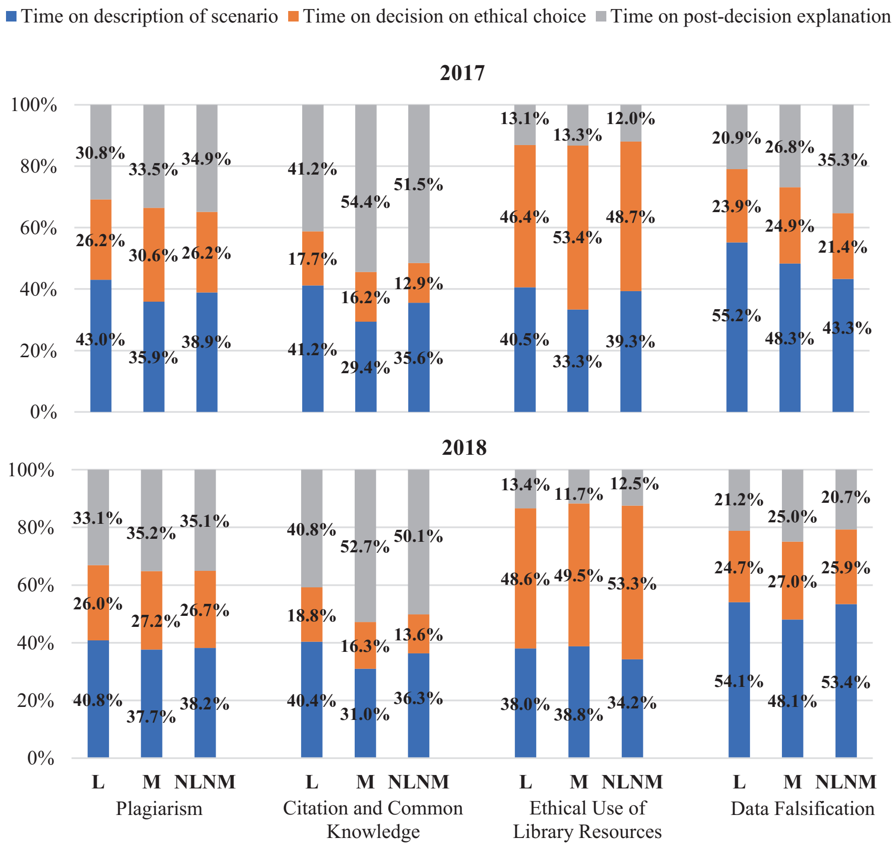
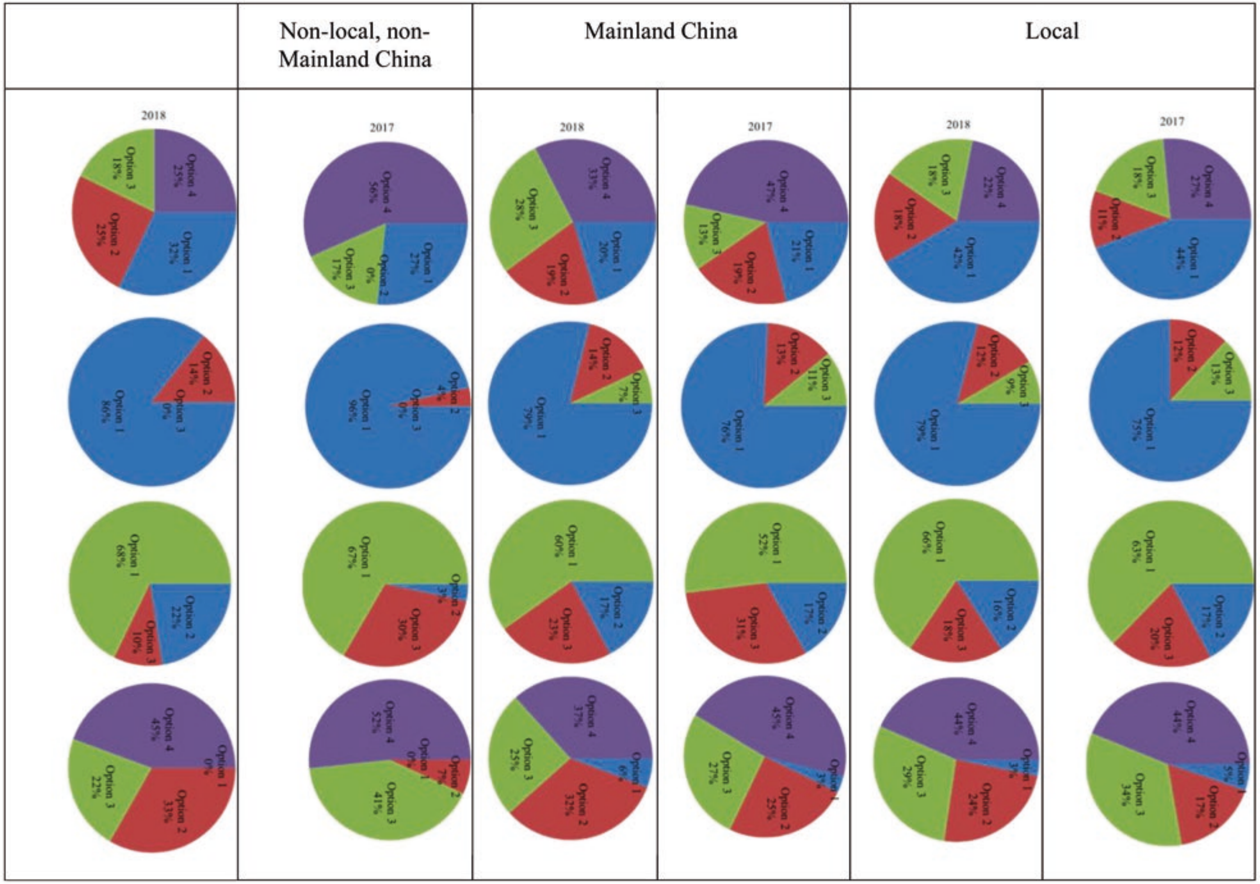


Fig. 4.3 First-year students' percentage of time spent on the three sections of each scenario in 2017 and 2018 (Note, *L* Local (Hong Kong) students, *M* Mainland China students, *NLNM* non-local, non-Mainland China students)

"Re-use another similar assignment from a previous course", to be the most appropriate action. This strongly suggests that these students can expose themselves to the risk of self-plagiarism in their future studies. The learning trail hence could be conceived as a first alert to these new students on the seriousness of this unintentional academic misconduct. In 2018, local students and Mainland China students displayed similar patterns to their respective groups in 2017, while about 30% of non-local, non-Mainland China students in 2018 had chosen option 1 in response to the dilemma situation in the *plagiarism* scenario.

For the other three scenarios, also shown in Table 4.7, the responses were similar among all three groups of students. Firstly, in the *citation and common knowledge* scenario, over three-quarters of all three groups of first-year students correctly selected option 1, "Yes", in response to this question: "Does Amanda need to provide a citation for using the phrase 'the world for all'?" Notably, the answer was

Table 4.7 First-year students' ethical choices in the four scenarios in 2017 and 2018



even more apparent to the non-local students; nearly all (96% in 2017 and 86% and 2018) chose "Yes". The reason could be that they were not as acquainted as the local and Mainland China students with the phrase "the world for all". These results tallied with the lowest percentage of time spent on this decision (Fig. 4.3), thereby allowing us to deduce that the solution to this dilemma is straightforward to students. In fact, providing a citation is definitely the learning outcome in this case, and all students seemed to have benefited from this.

Secondly, there were also observable degrees of commonality on the *ethical use of library resources* scenario, where the largest population of students in each group pointed out that other students would be most affected. Lastly, in the *data falsification* scenario, the majority of students in each group suggested they would consult the tutor when facing such a situation.

4.4.3 Analysis of Pre-/Post-Trail AIE Understanding

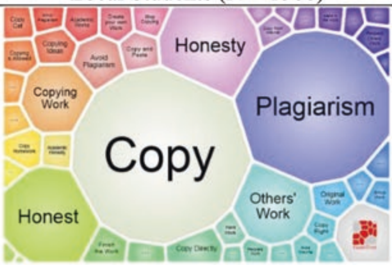
The students' pre- and post-trail understanding of AIE is displayed in Table 4.8. The captured responses displayed that students' knowledge and attitudes of AIE changed from general terms like "copy" and "honest" to higher variety of concrete terms such as "reference", "citation", and "quote" after going through the checkpoints of the learning trail. However, compared with the groups of local students and non-local, non-Mainland China students, the change of understanding of AIE among Mainland China students was not observable.

4.5 Discussion

TIE-General utilises the capability of AR applications to embed large amount of information (Contreras, Chimbo, Tello, & Espinoza, 2017) and turns the HKBU campus into a mobile learning environment which helps students grasp the concepts of AIE in an academic setting. With the scenarios based on everyday university life such as assignment completion and data collection with student surveys, students are more likely to connect their upcoming university studies with the concepts of AIE, benefitting from this design of situated learning. Such an enriching learning experience could also result in enhanced learning interest, which reinforces knowledge assimilation (Chou & ChanLin, 2012).

In regard to the perception and understanding of AIE via TIE-General, Table 4.8 presents the difference in clickstream data among the three groups of students. Local students and non-local, non-Mainland China students were able to provide more concrete keywords after learning with TIE-General. However, the perception of AIE among Mainland China students remained more or less the same after the trail. This result implies an apparent variation in learning AIE between different

Table 4.8 FoamTree diagram of pre- and post-trail understanding of academic integrity and ethics among local, Mainland China, and non-local, non-Mainland China (NLNM) students in 2017 and 2018 orientation workshops

Pre-trail	Post-trail
Overall Students (N = 1860)	Overall Students (N = 1860)
	
Local Students (N = 1566)	Local Students (N = 1566)
	
Mainland China Students (N = 238)	Mainland China Students (N = 238)
	
NLNM Students (N = 56)	NLNM Students (N = 56)
	

groups of students that seems to tally with those discussed in the literature in earlier sections. The result, however, also suggests that this relatively short intervention using an AR technology in blended learning approach may not be as effective with this culture group. Further investigation in the form of focus group interviews, for example, can be useful in identifying the reasons behind such result.

TIE-General was found to have an unintended influence on one's attachment towards given locations in the campus. Oleksy and Wnuk (2017) found that the emotions triggered when using location-based AR applications could either increase or decrease one's liking or personal attachment towards the place. This phenomenon is known as place attachment (Manzo & Perkins, 2006). In the trail, various campus features are associated with relevant concepts of AIE. For example, the *ethical use of library resources* scenario is associated with the library book drops, while the *citation and common knowledge* scenario is associated with the statue of Dr. Sun Yat-sen (a personal motto of Dr. Sun, "天下為公; The World for All", is engraved on the pedestal). As those features are either landmarks of HKBU or commonly found facilities on campus, students are more likely to recall the relevant concepts each time they see those campus features even after the trail. On the other hand, requiring students to move around the campus to locate the checkpoints for activating the AR triggers has an intended possible outcome that new HKBU students become more familiar with the HKBU environment, facilitating their immersion into university life.

Having high student satisfaction when utilising AR applications also reinforces learning in the long run. In order to ensure smooth operation of the orientation workshop so as to maintain a good learning experience, Wi-Fi stability plays a critical role. In this connection, the stability of Wi-Fi on the HKBU campus had improved between the two workshops offered in 2017 and 2018. The results of the user experience survey showed a 15% increment in the score of Wi-Fi stability in 2018 compared with 2017. The T-test results comparing the Wi-Fi scores between 2017 and 2018 demonstrated significant differences to the overall satisfaction score. Plus, the amount of negative comments regarding Wi-Fi stability has also decreased.

Both quantitative and qualitative data described above suggest that Wi-Fi stability contributes positively and has an advantageous effect on students' learning experience.

In terms of the choices that the students made as recorded with the clickstream data, past research has revealed the potential impact of students' cultural and educational backgrounds on their understanding of academic integrity, especially plagiarism (Hu & Lei, 2012; Kwong, Hafiz, Lau, & Chan, 2018). This could help explain the variation in the decisions made by students from different original locales as displayed in the *plagiarism* scenario in Table 4.7. The clickstream results also imply that cultural backgrounds or differences in previous learning experiences of students might affect their ethical decisions, as reflected in the time spent on different sections of the scenarios. Generally, first-year students from Mainland China spent larger portion of time to make the ethical decision in the checkpoints in TIE-General than their local and non-local, non-Mainland China counterparts. This may be due to the fact that Mainland China students' exposure to the concepts of

AIE in their prior studies was more limited leading to longer consideration time. One of the students from Mainland China commented in the post-workshop interview that he thought some new students from the Mainland did not understand AIE concepts very well – they even did not understand basic terms like “reference” and “bibliography”.

The results also suggest that the majority of first-year students may not have encountered the scenario of unethical use of library resources before. As shown in Fig. 4.3, students spent almost half of their total time deciding on the best option for the question “Who will be affected if I hide the book on a different shelf to keep it longer?” The results showed that the students were, in a limited degree, considerate about their peers because the majority of the students indicated that other students (option 1) would be affected. Only a small percentage of them thought that such an act would primarily affect librarians or themselves.

While the findings highlight the differences towards AIE understanding among the three groups of students, it is important to note that the number of non-local, non-Mainland China students is comparatively fewer than that of the local and Mainland China students. This may impose limitations when comparing the results from these three groups of students.

From an informal conversation with a group of Mainland China students, it was suggested that it might be helpful to present the scenarios in Chinese for better understanding. It has not been considered as an issue since the beginning of the project. However, with the previous discussion that this short blended learning approach using AR technology may not be as effective with the Mainland China students, the issue of language posing a barrier to effective learning should be explored.

4.6 Conclusion

This chapter reports students’ perception of the use of AR for learning AIE and the influence of cultural background on students’ perception and understanding of AIE. With HKBU’s strategic goal of nurturing students to become inspired professionals and ethical leaders, the TIE-General helps enhance students’ awareness of AIE. Students were generally satisfied with the use of AR in the learning of AIE, and variations in learning AIE among students of different cultural backgrounds were found.

Going forward, further studies could be done to further investigate the variation in learning AIE between different groups of students. In order to collect larger data sets for confirming our findings and to invite adoption of this trail at orientation in other universities in Hong Kong, HKBU will continue the TIE-General at orientation programme on an annual basis.

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Chapter 5
Factors and Challenges of Blended Learning with Learning Management Systems and Online Systems for Access to Quality Education in the Case of Seoul National University

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Abstract Blended learning with online systems and tools for university courses has been introduced to provide better interactivity and participation among learners and an instructor. Seoul National University (SNU) as a research-oriented university has worked on ways to provide quality education through the learning management system (LMS) and other online systems for effective blended learning. More access to quality in terms of interactivity could be efficiently acquired through LMS and other systems in SNU, as these systems have provided more opportunities for learners to have meaningful online interactions which might not be attained without them. After reviewing the development and status of LMS and other systems for blended learning in SNU, the factors of successful blended learning with LMS and other systems in SNU were analyzed into three areas: *university policy*, *reflection of user needs*, and *facilities and training programs*. Challenges of blended learning with LMS and online systems in SNU have been identified and discussed in the following aspects: *understanding blended learning in the context of teaching-learning methodological innovation* which could be realized through Center for Teaching and Learning (CTL) with institutional research functions, *the functional improvement of LMS* into an educational platform to provide optimal learning environments like dashboards, and *scaling up blended learning across diverse contexts* that have different pedagogical needs.

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5.1 Introduction

Many universities in the world have been increasingly adopting blended learning into their educational process for quality improvement. Although blended learning has multiple meanings, it usually refers to a teaching and learning approach that "combines face-to-face instruction with technology-mediated instruction" (Graham & Dziuban, 2008, p. 270). Blended learning also often indicates learning activities combining multiple modes of technology (e.g., video, simulation, and social networking service), diverse pedagogical approaches (e.g., teacher-directed instruction or student-centered learning), or technology with job tasks (Driscoll, 2002). Blended learning has been developed to overcome the limitations of online or face-to-face-only courses and to provide students with more flexible, convenient, and meaningful learning experience for quality education.

Universities have adopted blended learning because it can effectively improve learning experiences and student achievements by using online and face-to-face learning environments in a complementary way (Porter, Graham, Spring, & Welch, 2014). Online learning environments have different strengths and weaknesses when compared to face-to-face learning environments, and blended learning can optimize student learning experiences by taking advantage of the strengths from both learning environments. Blended learning also enables students to have more access to quality contents in higher education and to use their time flexibly. This way, students can participate in online learning activities without the limitations of time and space. Students who have grown up with digital technologies (e.g., digital natives) may prefer blended learning to face-to-face-only courses (Porter et al., 2014). In addition, institutions in higher education have adopted blended learning because it is more cost-effective than face-to-face learning. Blended learning tends to reduce dropout rates, promote student success, improve the utilization of facilities, and reduce costs (Graham & Dziuban, 2008).

Seoul National University (SNU), one of the top research universities in Asia, has adopted blended learning since 2001 in order to improve the quality of pedagogy (Center for Teaching and Learning, 2006). Traditional pedagogy or teacher-directed instruction is seldom effective in developing key competencies like creativity, critical thinking, and collaboration skills. Blended learning intends to promote student-centered activities and to improve key competencies as well as academic knowledge. To facilitate blended learning, SNU has provided professional development programs, rewards for pedagogical innovation, resources to develop online learning materials, LMS, and online tools. LMS and online tools have played a crucial role particularly in scaling up blended learning for quality access at SNU because more faculty and students could easily interact with each other through the LMS and online tools in and out of class. The LMS and online tools in SNU are perceived as a *key vehicle* to access quality online videos, learning materials, and resources, encouraging more interaction and engagement. SNU has made efforts to improve the function and usability of the LMS and online tools so that the faculty could efficiently prepare and implement blended learning and facilitate active student participation.

Blended learning of SNU mostly utilizes *eTL* (*e-teaching and learning*), which is the current name of LMS since 2006. In this system, it is common to manage classes in a combination form of online and face-to-face classes every week rather than providing online classes only in particular weeks. Active use of the LMS can be observed in the flipped classrooms with more student participation in online and offline environments (Lim, Cho, & Kim, 2016). For the flipped classroom project, two courses were selected as an experiment basis in the second semester in 2013. The number of courses applying the flipped classroom has been increasing during the past 5 years (12 courses in 2014, 16 courses in 2015, 33 courses in 2016, and 47 courses in 2017).

In addition to LMS as a key component to lead SNU blended learning for quality access, other systems or tools which have been developed and used at a university or college level should be also considered. The systems or tools have been used in order to achieve specific learning objectives of each course, while LMS supports general online activities such as student discussions of individual courses. For example, an online support system called the *Smart Support System for Creative Problem Solving* (S^3CPS) is developed to support learning activities that aim to develop and improve creativity with systematic engagement and is being used university-wide (Lim, Han, Jung, Yunus, & Hong, 2017). The College of Education within SNU utilizes another online support system (*SESS, Smart Education Support System*) to build the technology integration capacity of pre-service teachers through encouraging more online interaction among students. Thus, the SNU blended learning for quality access consists of both *activities based on the university-wide standard LMS* and *utilization of diverse online systems/tools* for the achievement of specific learning objectives.

This chapter describes the current status of blended learning for quality access in SNU from the perspective of the contributions of LMS and other systems and tools for specific objectives with more interactions among students and faculty. It also analyzes the contributing factors for the successful implementation of blended learning to access quality education through LMS and other systems, which is followed by the future directions of further efforts as a conclusion. Through this case, the point is made that LMS and other systems could play a critical role in making quality education with enhanced participation accessible to more faculty and students.

5.2 Blended Learning with the LMS

Blended learning in SNU has been mainly implemented with the support of LMS. The SNU LMS has been developed and revised since 2001 to respond to the various needs of students and faculty. The current version of SNU LMS, eTL, was launched in 2017 to combine online learning with face-to-face learning in an asynchronous way.

5.2.1 Development and Status of the LMS

Starting with the *WebClass* (the first version of LMS in SNU) in 2001, the LMS of SNU was developed into an upgraded version, *e-Class* in 2005. *WebClass* was not linked with other information systems such as an academic one at SNU. Therefore, *WebClass* had to separately set up the student registration and syllabus posting, which was disadvantageous in that the data set of the LMS could not be shared with other systems. To resolve these drawbacks, *e-Class* was developed by integrating *WebClass* with the community and knowledge sharing system operated by the Office of Information Systems and Technology, OIST, of SNU (Center for Teaching & Learning, 2006). In 2006, it was developed into *eTL* (the current version of LMS in SNU) that could support a variety of class activities including administration, management of course syllabus, assessment management, and implementation of course community (Center for Teaching & Learning, 2006, 2007). *eTL* has been developed on the basis of a commercial LMS, *Blackboard*, with additional features including a text messaging service, DRM (digital rights management) for plagiarism prevention, menu templates, course designing templates, and empowerment for teaching assistants (Center for Teaching & Learning, 2007). Later, *eTL* started to support various activities for instructors and students through the process of upgrade and feature modification of *Blackboard*.

Regular face-to-face courses and irregular online contents/courses were supported by the same system until 2008, whereas two different systems including regular course support system (*eTL*) and irregular content/course support system (*SNU OCW*, OpenCourseWare) were developed. They were operated separately starting from 2009. Later, some problems such as the cost of licensing and connection speed had been raised, so the demand for building a new LMS increased. To resolve these issues, three different types of LMS, separate-license-based LMS (*Blackboard*), open-source-based LMS (Moodle), and a company's self-developed LMS (*Cresys*), were tested out on a trial basis. The faculty and students of SNU used these LMSs throughout a semester and evaluated them. As a result, Moodle-based LMS was selected and developed in the fall semester of 2011. Although the system was based on *Moodle*, inconvenient features were modified, and extra features were added (Center for Teaching & Learning, 2012).

Meanwhile, *SNU OCW*, a support system for irregular contents/courses, was newly developed into SNU *open education* (*SNUON*) that was based on Moodle in 2013. Unlike the existing OCW-based system that just provided contents, *SNUON* was developed into a system that combined LMS providing various learning activities including quizzes and discussions and Learning Content Management System (LCMS) providing efficient management of various digital contents in modules and clips (Center for Teaching & Learning, 2014). In fact, considering the application of the flipped classroom at that time, SNU examined ways to reintegrate *eTL* with *SNU OCW*. However, they were developed separately because it was difficult to modify

Table 5.1 Number[a] and utilization rate of courses using *eTL* in 2013–2017

	2013	2014	2015	2016	2017
Total number of regular courses	10,944	11,063	11,140	11,563	11,919
Number of courses using *eTL*[b]	6,075	6,494	7,001	7,326	7,722
Utilization rate (%)	55.5	58.7	62.8	63.4	64.8

[a]Total number of courses includes regular courses (first and second semesters) and seasonal courses (summer and winter sessions), not graduate research courses
[b]Utilization rate was calculated depending on whether actual activities (e.g., posting, file upload, etc.) were involved rather than just logging on the network

the *eTL* just 2 years after its new development in 2011. In addition, the feature related to videos in *eTL* was restricted, and its hardware capacity was limited. In June 2017, SNU launched a new version of *eTL* combining the existing *eTL* with *SNUON* and developed an integrated LMS to connect and operate regular and irregular contents/courses (Center for Teaching & Learning, 2018). Unlike the earlier systems, where instructors and students should use both *SNUON* and *eTL* for flipped classrooms based on online contents, the new integrated *eTL* allows them to easily implement flipped classrooms.

The number of courses using the current LMS (*eTL*) has been increasing with the sophisticated development of the LMS. Table 5.1 shows the number and utilization rate of regular courses that used *eTL* with credit(s) awarded from 2013 to 2017 (Center for Teaching & Learning, 2014, 2015, 2016, 2017, 2018).

As shown in Table 5.1, the number and utilization rate of the courses using *eTL* have been on the rise from 2013 to 2017, but the increase rate tends to drop in the recent years.

5.2.2 Main Features and Roles of the LMS (eTL)

eTL has been used mainly to combine online learning with face-to-face learning in an asynchronous way. In asynchronous learning, online learning is conducted before or after face-to-face learning. Students go through lecture videos and learning materials followed by taking a quiz, submitting an assignment, and so on. Figure 5.1 shows the screenshot of lecture videos and quizzes in *eTL*.

Students can also interact with other students and an instructor through participation in the online discussion forums and email exchange. In discussion forums, they can pose a question about a face-to-face lesson, discuss with other students, share their experiences of applying what they have learned in class to real-world contexts, and exchange comments to each other (Wong, Chin, Tan, & Liu, 2010). Figure 5.2 demonstrates an online discussion using a discussion forum in *eTL*.

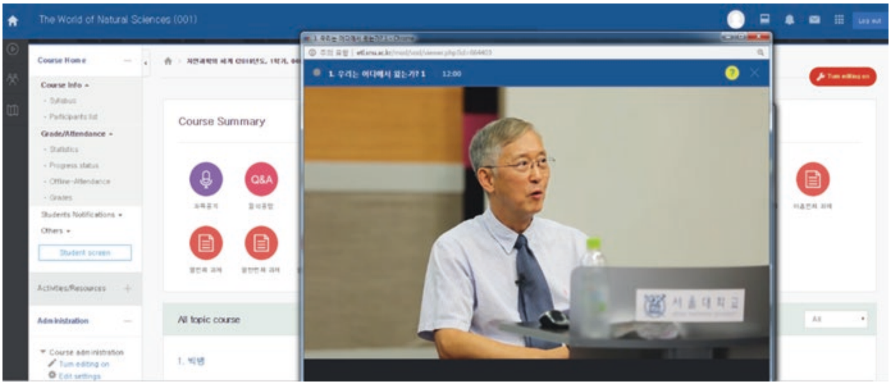

Fig. 5.1 *eTL* of SNU: lecture video

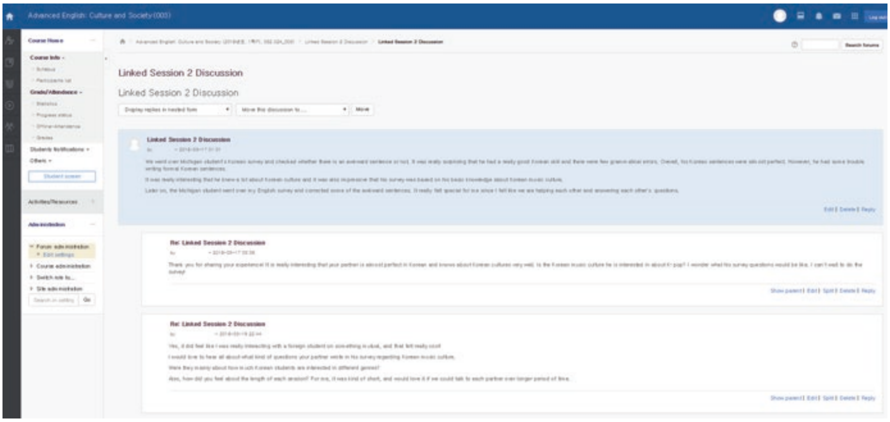

Fig. 5.2 eTL of SNU: discussion forum

5.3 Blended Learning with Other Systems

The roles and functions of LMS have been sufficiently emphasized because it helps blended learning be more effective. In order to meet the different needs of colleges and to achieve their learning objectives, however, using a specific system or tool has been raised in addition to general university-wide LMS. In the case of SNU, several attempts have been made in response to these demands.

One of them is a system developed to promote achievement of the learning objective of developing the creativity competence. The *Center for Teaching and Learning* (CTL) of SNU has developed a variety of programs that aim to enable students to improve their creativity. Specifically, the center developed an online activity support system (Smart Support System for Creative Problem Solving, *S*^{3}*CPS*) based on the Creative Problem-Solving Model 6.1 (Treffinger, Isaksen, &

Dorval, 2000) and has applied it to multiple courses since 2008 (see Fig. 5.3). *S³CPS* started to be used in the selected courses of the College of Education at the time of initial development (Lim, Youn, Park, & Hong, 2009). The scope of utilization has been expanded to other courses in the College of Fine Arts (Lim, Kim, Han, & Seo, 2014) and College of Engineering (Lim et al., 2016). Basically, in this online system, learners use tools such as *brainstorming* for generating ideas and *hit* for convergent thinking. Also, the results of online activities are reviewed and examined in the offline learning activities, thereby possibly enriching overall learning.

Another example of online systems, Smart Education Support System (SESS) for supporting face-to-face class activities (See Fig. 5.4), has been used in the College of Education (Lim et al., 2017). The purpose of this system was to improve the competency of pre-service teachers to use “smart” tools (mobile applications) for teaching. Using the system, the students as pre-service teachers have to design and carry out their own lesson plan using the smart tools, share the outputs with other students in online, and ultimately identify feedback from other students and in-service teachers. Students have the experience of accessing, analyzing, and reviewing various materials in digital forms (lesson plan, microteaching video, etc.). Through the process, the limitations of time and space of face-to-face activities in a course can be overcome, and students can effectively achieve their learning objectives.

Online tools for collaborative team works are also used in a course for blended learning. Instructors tend to use free online tools because of their special functions, which are not provided in the LMS. For instance, during the course of *e-learning and distance learning*, students were asked to apply the concepts and principles they had learned in class to real-world contexts and share them with each other in

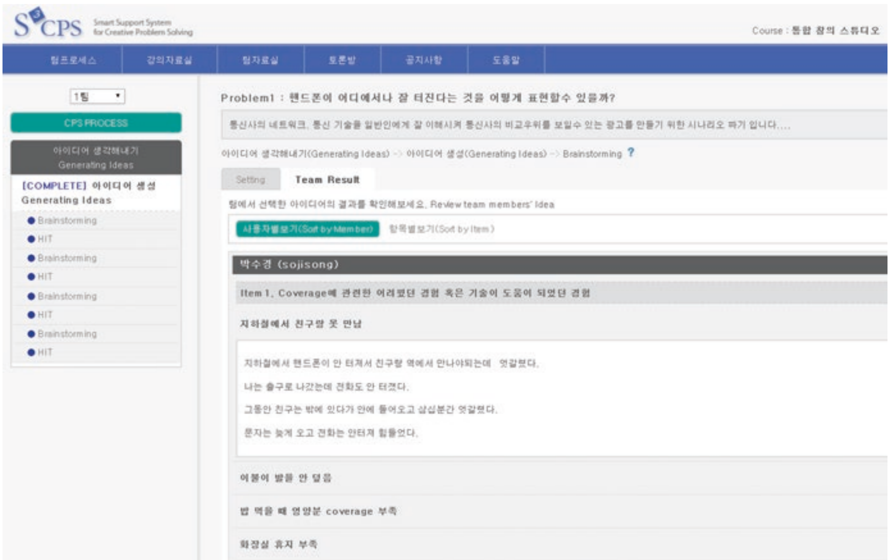

Fig. 5.3 A brainstorming activity of S³CPS in a course of the College of Liberal Arts

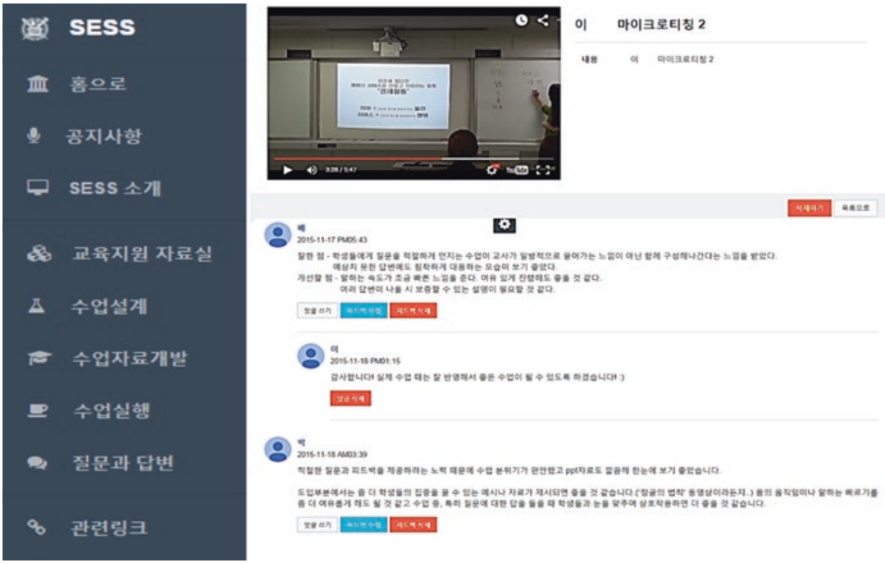

Fig. 5.4 Smart Education Support System: analysis and feedback from peers and in-service teachers

Fig. 5.5 Video cases shared in Slack

Slack (see Fig. 5.5). After a lesson, students created a video that showed an example or a case related to the main topic of the lesson (e.g., intrinsic motivation) and shared videos in the online environment. Slack enabled students not only to share their videos but also to exchange comments and questions with each other. The videos, comments, and questions were reviewed and discussed in a deeper way along with the guidance of an instructor in a classroom. Slack is a useful platform to encourage interactive learning in both online and face-to-face environments.

5.4 Growth and Expansion Factors of Blended Learning with LMS and Other Systems at SNU

The factors of successful blended learning with LMS and other systems in SNU could be analyzed into the three following areas: *university policy*, *reflection of user needs*, and *facilities and training programs.*

5.4.1 University Policy

5.4.1.1 Recognizing Blended Learning-Related Activities as Educational Innovation Efforts

SNU education awards have been given to professors who have contributed to the innovation and development of university education every year through the recommendation and evaluation process, and both the research and educational achievements are evaluated during the faculty tenure process. The main evaluation criteria for professors' educational activities are the experiences of online learning, the use of LMS, and other activities related to blended learning. In particular, the College of Engineering and the Graduate School of International Agricultural Technology collect documents to assess the performance of blended learning for tenure evaluation, allowing all faculty members to understand the importance of blended learning.

5.4.1.2 Growth of Blended Learning According to the Expansion of Online Lecture and Course Development Policy

Since 2013 after the year of massive open online course (MOOC) in 2012, as one of the hot issues in higher education, various projects associated with the development and implementation of video lectures have been conducted, such as the development project of professor lecture video sponsored by SNU alumni association (2013–2016), the activation project of online lecture video conducted by SNU (2014–present), edX operation project (2013–present) in which SNU participated as a partner university of edX MOOC, and Korea Massive Open Online Course sponsored by the Ministry of Education (*K-MOOC*, 2015–present).

The purpose of the projects that were related to the development and implementation of lecture video was to secure and share the great lecture assets of SNU. Indeed, many of the online course credits had not been recognized in SNU except a specific case (e.g., limited online courses only for students on a leave of absence for military service). In other words, the earlier projects tended to focus on public goals of sharing knowledge with general people rather than educational development within the university.

As the lecture videos accumulated, however, questions and new attempts regarding how to use such assets effectively in face-to-face classes emerged, which led to the expansion of blended learning with more student engagement in the courses at SNU. Likewise, since *SNUON*, online lecture support system, was launched in September 2013, blended learning has been rapidly expanded due to technical support by *SNUON* that would enable a variety of activities to be performed unlike the existing system, *SNU OCW*, which was only used to provide contents.

5.4.1.3 Partnership with Other Organizations for Activating Online Learning and Blended Learning

Being the first and only contractor of *edX* in Korea, SNU concluded the contract in 2013 and renewed it in 2016. After a preparatory period in 2013, SNU has operated *SNUx* as a type of *edX* lecture and opened 13 courses for a total of 18 times between 2014 and 2017. Through the *K-MOOC* project sponsored by the Ministry of Education in Korea, in addition, SNU implemented *SNU K-MOOC* and opened 13 courses for a total of 22 times between 2015 and 2017.

5.4.2 Reflection of User Needs

5.4.2.1 Developing LMS Based on Open Source Through Actual Usability Test

Each LMS product of three different companies was tested in a total of 15 classes in order to select an LMS as a replacement of the previously used one by *Blackboard* in 2011. When the previous version of LMS was built in 2005, there was just an advisory committee with the LMS experts and representatives from institutions like *CTL*, *Academic Office*, *Information Systems and Technology*, and *Library*. It was significant progress that the Moodle-based LMS was selected through the usability test conducted with the faculty and students in 2011. Furthermore, it was very desirable that content sharing and system versatility were considered by selecting open-source-based LMS rather than a specific license or product.

5.4.2.2 Updating System Considering Changes and Diversity of Blended Learning

In order to connect online with face-to-face learning environments and carry out various learning activities, *eTL*, an LMS for regular courses, and *SNUON*, an online course support system, were integrated, upgraded, and developed into a new *eTL*. By developing LMS to consistently operate a diversity of blended learning such as flipped classroom, effective class-run and support system has been developed. For example, when running a flipped classroom before integrating the old *eTL* and *SNUON*, the learner watched lecture videos at *SNUON* and discussed and solved problems on *eTL*. In the old *eTL*, students could not watch videos easily due to technical limitations, and *SNUON* was not suitable for running online activities supporting offline classes because it was a content-oriented system or Learning Content Management System (LCMS) rather than an activity-oriented LMS. By developing a new *eTL* that could integrate the functions of the two systems, it could solve the limitations and problems of the two systems, thereby enabling various blended learning environments to operate seamlessly without inconvenience.

5.4.2.3 Utilization of Support Systems/Tools of Various Blended Learning Other than LMS

Other than *eTL*, which is a type of LMS, SNU operates many different forms of blended learning using learning tools including application software such as *Socrative* and *Kahoot!*, bulletin board system provided by a separate website, and systems like S^3CPS and SESS separately developed based on specific target learners or teaching-learning methods. In order to raise the usability and unity of the system as well as operate various forms of blended learning, it is important to consider technological standards related to interoperability such as Learning Tools Interoperability (LTI). In addition, the use of systems other than *eTL* can support various blended learning activities and provide good examples in terms of additional functions and interface improvements when upgrading *eTL* in the future.

5.4.3 Facilities and Training Programs

5.4.3.1 Configuring the Support System

Institutions like CTL and Office of Information Systems and Technology (OIST) have been mainly responsible for blended learning at a university-wide level. CTL is responsible for the educational and logical dimension of LMS and blended learning, while OIST is in charge of the technical and physical dimension of LMS (Lim, Cho, & Kim, 2016).

Among four different CTL departments, the e-learning content development department takes charge of blended learning and LMS as well as online learning programs either inside or outside the university. To further elaborate, the department consists of one research professor working as the director responsible for all of the work in the department, three staff members who plan and manage contents and online lectures, two staff members who take care of related systems, two staff members who develop contents, and one staff member who is in charge of administrative work. In order to develop online contents, the department has a large-sized studio that can accommodate 180 students as well as a one-person studio, a chromakey studio, a black studio, and a mid-sized studio in which 50 students can take a class together at the same time.

In OIST, LMS usage status and user satisfaction have been investigated. Through the investigation related to LMS and blended learning, all issues found in the system have been identified, proposed, and improved for blended learning to be effectively operated. For example, one of the issues related to LMS and blended learning in recent years is the utilization of LMS in mobile environment, since the number and ratio of utilizing *eTL* through mobile devices are increasing each year. Prior to 2017, the existing *eTL* provided the mobile web, but there were limitations on the functions that could be implemented on the mobile web. However, after upgrading the *eTL* in 2017, instructors and students can use *eTL* more conveniently in a mobile environment including a mobile app as well as the mobile web.

CTL provides training programs including *eTL* workshops for new teaching staffs, teaching assistants, and students. CTL also develops and deploys LMS user manuals in the forms of documents and video. Through one-on-one telephone help desks and remote support services, in addition, CTL supports users on the basis of information they need and supporting methods in which they would feel more comfortable.

5.5 Challenges and Conclusion

Blended learning has been adopted in order to improve the quality of higher education at SNU through encouraging reciprocal interaction in both online and face-to-face environments. The interaction between an instructor and students is crucial for meaningful learning (Bernard et al., 2009; Cho & Cho, 2011). Blended learning has a lot of potentials to transform teacher-directed lessons into interactive learning because students can easily interact with their peers and an instructor in online environments. In addition, an instructor can flexibly design a lesson to enhance interactive learning through using both online and face-to-face learning environments. To foster the effectiveness of blended learning, SNU has systematically developed and utilized LMS for interactive learning. Since open-source-based LMS was developed to support online teaching and learning in 2011, the traditional ways of operating courses of the whole university have been changed. Flipped learning with free online lecture *(SNUON)* and digital lecture materials such as *edX (SNUx)* and nation-wide K-MOOC has been introduced and expanded from 2012. In addition, many different forms of blended learning have been promoted. In addition to official LMS and online contents of the university, blended learning has been performed in various ways by developing and utilizing separate university- or college-wide systems to achieve a particular goal.

Critical factors of the development process of SNU blended learning are roles and functions of CTL established to lead the change of university education. Instructional Media Center (IMC) founded in 1975 was changed into CTL in 2001, and a diversity of teaching methods with online materials by CTL have been introduced. Since more sophisticated LMS started to be used actively in 2011, CTL has supported university blended learning, leading online learning materials to be developed, managed, and utilized. The experience and leading position of CTL had positive impact on the expansion process of blended learning into other universities in Korea as well as its development within SNU.

Although CTL plays a positive role for blended learning to be developed, SNU faces new challenges for further development. Blended learning can be understood as a framework to improve the quality of university education. It emphasizes issues that cannot be resolved in a traditional face-to-face learning context by allowing them to be addressed with online components integrated adequately. In other words, it is desirable to understand blended learning in the context of teaching-learning methodological innovation. However, quality improvement of university education would require more than just finding improvements of blended learning. It needs to analyze institutional and structural factors in relation with differences among colleges.

In this light, establishing institutional research (IR) has been recently discussed in a few universities in Korea, and there is a demand to consider the IR in SNU. In major world-class universities, IR is working to collect and analyze data required to improve the quality of university education and establish operation direction. In order to obtain desirable and practical outcomes of blended learning, it is required not only to plan and operate it simply as a learning method but also to try an IR approach that includes linking blended learning with all other factors both in and out of a university and analyzing the results, and ultimately searching for its solutions. For this, it is expected that CTL would be able to carry out a few of IR features or conduct research through cooperation with newly established IR.

The development of SNU blended learning with more access to quality education can be realized through the functional improvement of LMS. It is expected that LMS should be developed into an educational platform (Lim et al., 2017) and include factors reacting and adapting to the demands of both instructors and students. For example, the educational platforms in these days visually present students' individual learning status through a dashboard and provide them advice according to their learning process. When visual feedback is given to students along with appropriate instructional supports, students can effectively improve their learning and interaction patterns, which leads to productive learning outcomes (Cho, Park, Kim, Suk, & Lee, 2015; Kirschner, Buckingham-Shum, & Carr, 2003). In addition, educational platforms provide practical assistance to instructors when assessing students' assignments using rubrics that can be easily set or modified. Utilizing LMS or an educational platform, instructors can optimally support learning, which might not be possible in traditional face-to-face learning contexts. As educational platforms (e.g., Canvas in the United States) are being made in diverse forms on the basis of the research results over the past 20 years, the successful realization of blended learning has become much easier than before.

Lastly, SNU also faces a challenge to scale up blended learning across diverse contexts. Although blended learning has been effectively implemented in a few courses through using the LMS and online systems, many faculty members still do not understand the importance of blended learning and interaction with students. Despite the efforts of CTL to provide professional development programs and workshops, it is difficult to scale up blended learning across colleges and departments that have different pedagogical needs. The one-size-fits-all approach is not effective in scaling up blended learning. Instructors need to develop blended learning methods that meet the needs of their students, and the university should help them to share their pedagogical innovation with other instructors. For example, instructors from different colleges can develop a community of practice in which they learn instructional methods and technologies for blended learning with the help of experts in CTL. The instructors should apply what they have learned in the community to their own classes and share the experience with other faculty members in their departments or colleges (Lee & Brett, 2015). The general principles of blended learning need to be modified and adjusted according to the purposes of an instruction and the needs of students. This approach can be helpful in scaling up blended learning in diverse contexts. In addition, the university can build a partnership with other universities in order to share experiences of blended learning as well as professional learning resources. Successful cases of blended learning in a university can be reused by other universities that intend to encourage blended learning. Failure cases, which show what not to do, are also helpful for universities that lack the experience of blended learning. The partnership of universities can scale up blended learning beyond a single university.

Blended learning with LMS and other online systems has changed the way of teaching and learning in SNU. It also encourages students to interact with their instructor and other students in and out of class. The change of pedagogy from teacher-directed instruction to interactive learning has contributed to the development of students' key competencies and domain-specific knowledge. The case of SNU implies that universities should develop policies and organizations like CTL to encourage blended learning with LMS and online tools in a systematic way. It is also important to develop and update the LMS or platform in order to provide optimal learning environments for blended learning. Moreover, professional development programs are necessary to improve instructors' knowledge of how to effectively design and implement blended learning activities in online and face-to-face learning environments. Considering these factors, universities should make a systematic effort to encourage instructors to apply blended learning in diverse contexts and to share their experience with other instructors.

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Chapter 6
Blending a Linguistics Course for Enhanced Student Learning Experiences in a Hong Kong Higher Education Institution

Lixun Wang

Abstract In this chapter, a case study of implementing blended learning in a linguistics course will be reported. Traditionally, this course was taught in the mode of a 1-hour face-to-face plenary lecture plus a 2-hour small group tutorial session each week for 13 weeks. To promote blended learning and give students an enhanced learning experience that allows more flexibility and more peer interaction, two of the plenary lectures were converted into online lessons, and Moodle was used as the online platform for hosting the online content. Three levels of online activities were designed and provided online: every online lesson consisted of 3–4 mass open online course (MOOC)-style high-quality lecture video clips (Level 1, resource-based activities) followed by online quizzes (Level 2, response-based activities) and discussion forums (Level 3, collaborative activities). Post-lesson analysis shows that over 320 threads were posted by students on the Moodle forums, suggesting that students were actively engaged in online discussions. A post-lesson survey was conducted after the first online lesson, and the feedback was very positive. The majority enjoyed the flexibility of the online lesson and felt more independent during the learning process. They found the video lectures attractive and effective and the online discussion engaging and beneficial. Other than the online lessons, other resources and activities such as stand-alone course-specific website, weekly online quizzes, and Wikibook projects have been adopted to further promote blended learning. To ensure a fulfilling learning experience, instructional design plays a crucial part, especially in arranging the online lessons and other blended learning experiences. Clear and detailed instructions and guidance were also vital for the success of blended learning.

Keywords Blended learning · Linguistics course · Higher education · Hong Kong

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6.1 Introduction

As blended learning is gaining increasing popularity in higher education, it is predicted to become the 'new norm' in course delivery (Norberg, Dziuban, & Moskal, 2011, p. 207). There are many different definitions of blended learning, and Graham (2013, p. 335) summarizes that a broader definition, i.e. 'learning experiences that combine face-to-face and online instruction', may be a better choice than some of the narrower definitions (such as the definition that includes the reduction in face-to-face contact or seat time (Mayadas & Picciano, 2007; Picciano, 2009; Vaughan, 2007)), as the broader definition can cover all forms of blended learning.

Garrison and Kanuka (2004) point out that blended learning is an effective and low-risk strategy that combines face-to-face learning with online learning, and what makes it particularly effective is its ability to facilitate a community of inquiry. Communities of inquiry, no matter face to face or online, consist of three elements: cognitive, social, and teaching presence, as the sense of community and belonging must be on a cognitive and social level in order to achieve higher levels of learning. Teaching presence manages the environment in which the focused learning experiences are facilitated.

For building institutional capacity to drive, sustain, and scale up blended learning in higher education institutions (HEIs), Lim and Wang (2016, p. 4) proposed a framework, which consists of eight strategic dimensions: vision and philosophy; curriculum; professional development; learning support; infrastructure, facilities, resources, and support; policy and institutional structure; partnerships; and research and evaluation. Such a framework outlines a holistic approach to the implementation of blended learning. Figure 6.1 is a visual of the framework created by Lim and Wang (2016, p.5).

Based on this framework, starting from the 2016–2017 academic year, a project titled 'Blended Learning for University Enhancement' (BLUE) was launched in the Education University of Hong Kong (EdUHK), aiming at promoting blended learning in the EdUHK courses and converting the traditional face-to-face course delivery mode into blended learning delivery mode. The slogan 'one course one online lesson' was adopted, and the university aimed at implementing blended learning stage by stage in all the traditional courses, so as to take full advantage of the benefits that blended learning would bring. The pedagogical benefits of blended learning are well established in terms of providing alternative learning space and increased use of written feedback from students and staff (Gommlich & Minick, 2007; Juwah, 2012; Kwan & Fong, 2005; Wang, 2010).

The author was one of the first selected lecturers who piloted 'one course one online lesson' in one of his traditional face-to-face courses, with the aim of promoting blended learning and giving students an enhanced learning experience that allows more flexibility and more peer interaction. The title of the course is 'Introduction to Linguistics', which is a year 1 English major course offered as a core course simultaneously in three different English major programmes, and at the same time, it is a popular free elective course for non-English major students. Every

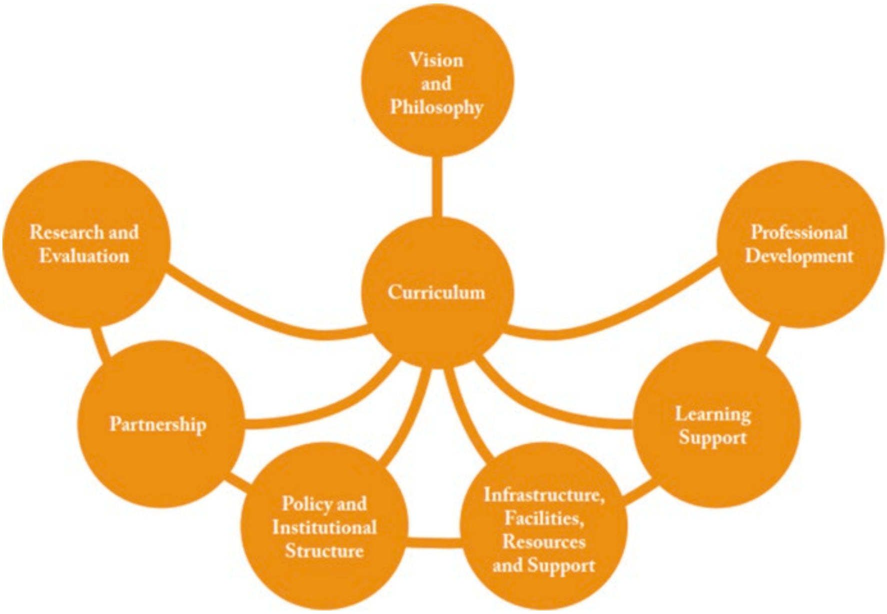

Fig. 6.1 A holistic framework for building the blended learning capacity of HEIs (Lim & Wang, 2016, p. 5)

year there are around 150 students attending the course. It is delivered in the mode of offering a 1-hour face-to-face plenary lecture plus a 2-hour small group (around 30 students per group) tutorial session each week for 13 weeks. In the 2016–2017 academic year, during the first stage of the BLUE project, the author converted the plenary lecture on 'World Englishes' into an online lesson. Due to the popularity of this first online lesson, another plenary lecture 'Pragmatics' was converted into an online lesson in the 2017–2018 academic year. After each online lesson, a face-to-face tutorial session would follow, which helped to consolidate the knowledge learned in that online lesson. Other than the online lessons, other blended learning resources/activities were introduced in the course as well, such as stand-alone course website for sharing a wide range of course materials, weekly online quizzes, and Wikibook projects to combine online peer interaction (online commenting, editing, etc.) with classroom presentation and discussion. This is in line with Garrison and Kanuka's (2004) concept of facilitating a community of inquiry through the blended learning environment.

6.2 The Online Lessons

Moodle (https://moodle.com), a popular online learning management system, was used as the online platform for hosting the online contents. According to the guidance stipulated in the BLUE project, an online lesson should include three levels of online activities: Level 1, resource-based activities (students accessing online content); Level 2, response-based activities (student interacting with online content, such as online quizzes); and Level 3, collaborative activities (students interacting with each other online). When designing the online lessons, the author made sure that all the three levels of activities are included and carefully organized.

6.2.1 Three Levels of Activities Included in the Online Lesson

6.2.1.1 Level 1 Activities: Resource-Based Activities

Every online lesson consisted of 3–4 MOOC-style high-quality lecture video clips. These are regarded as Level 1 activities: resource-based activities. In fact, before piloting the online lessons in this course, the author co-led a mass open online course (MOOC) project with a colleague and developed a MOOC titled 'The English you didn't learn in school'. Five academic staff contributed to the MOOC, and the author was responsible for two of the seven topics covered in the MOOC, which are two of the topics introduced in the course 'Introduction to Linguistics' as well. With sufficient funding support, the author was able to employ a skilled project officer to shoot the videos in a studio using advanced video shooting equipment. Originally, the author used many YouTube video clips to demonstrate different linguistic points in his traditional lectures in the past. Because of copyright issues, instead of including YouTube content, the author role-played many scenes to create original content and tried to make the lecture video clips as lively and attractive as possible. Advanced video editing software was used for post-production, and real-life backgrounds, images, animations, and texts were added to the recorded video scenes to create a vivid learning experience for the students. After a lot of effort, a series of high-quality MOOC-style lecture video clips were produced, which were then adopted in the course 'Introduction to Linguistics'. Figures 6.2, 6.3 and 6.4 show how the lecture video clips were shot, edited, and then posted on Moodle.

6.2.1.2 Level 2 Activities: Response-Based Activities

For Level 2 activities, response-based activities, the author designed a set of quiz questions for each video clip, so as to check students' comprehension of the video lecture content, as shown in Fig. 6.3. Also, to make sure that students have actually watched the Segment 1 lecture video clip before moving on to watch the Segment 2

Fig. 6.2 Studio for shooting the lecture video clips

Fig. 6.3 Role play in a lecture video clip

Fig. 6.4 A lecture video clip shown on Moodle

lecture video clip, parameters were set in Moodle so that students must answer at least 50% of the quiz questions correctly in Segment 1 before they can progress to Segment 2. They are allowed to re-take the quiz for several times until they meet the completion requirement (getting 50% correct). Students must watch the lecture video clips and complete the quiz questions in all the four segments to be considered as having completed the online lesson. One course grade out of 100 will be deducted if a student fails to complete all the required online lesson activities. This is to motivate students to complete the online lesson properly, as from past experiences, if no grade is given for completing the online activities, it is likely that a number of students will not complete these online tasks. Figure 6.5 shows how the segments are sequenced on Moodle and how students are required to complete them one by one. When students click on 'Segment 1 – video lecture', the lecture video clip and a set of quiz questions will be shown on the same page.

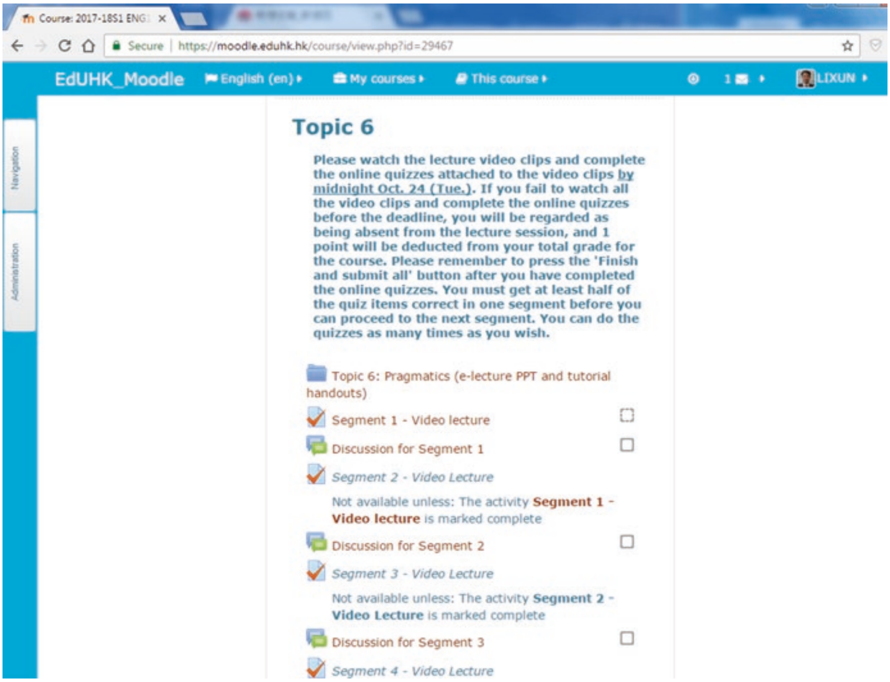

Fig. 6.5 Sequencing of segments on Moodle for students' completion

6.2.1.3 Level 3 Activities: Collaborative Activities

Other than requiring students to watch the lecture video clips and complete the attached quiz questions, a discussion forum is created for each segment, so that students can discuss interesting points introduced in the lecture video clips among themselves and with the teacher. This is Level 3 activities: collaborative activities. Figure 6.6 shows a series of messages posted by students on a discussion forum.

Having created these online forums for each segment, the author was uncertain if the students would make good use of them, as from past experiences, Hong Kong students tend not to post a lot of messages on online discussion forums in a course, especially when it is not compulsory.

To the author's surprise, post-lesson analysis shows that over 320 threads in total were posted by students on the Moodle forums for the two online lessons, and the majority of the students participated in the online discussion, suggesting that students were actively engaged in discussing topics of interests through these online forums. In a way, the lecture video clips were proved to be thought-provoking, as students had heated debates on some of the topics covered in the lecture video clips. The teacher played an important role as well, as some stimulating questions were posted on the discussion forums to arouse students' interests and encourage them to

Fig. 6.6 A series of messages posted by students on an online discussion forum

discuss. For example, in the online lesson 'Pragmatics', the author posted the following guiding question on the discussion forum:

> In daily life, we often hear people say strange things such as 'Are you the roast beef or chicken curry?' Can you post a few strange sentences that you heard from somewhere? Please explain the pragmatic meaning of the sentence(s), i.e., the speaker intended meaning.

Students were very interested in this topic and shared their own life experiences, for example:

> Student A wrote, 'It is very common to hear other people say 'what can I do for you?' in our daily life. But this common question may have different pragmatic meaning in different places. Now let me talk about one situation I have met before. Once I was traveling in another English speaking country. I visited a Library there. When I suddenly entered a place by accident where it did not allow visitors to go in, a guard came up to me and asked "what can I do for you?" Here, of course, the question doesn't mean "what would you like to eat?" It means that you cannot enter this place and please leave. There are still a lot of different situations. The pragmatic meaning of this question might depend on the places'.
>
> Student B responded, 'True. It's interesting how we use language to mean so much more than it's supposed to. If this guard were suspicious, he may have spoken in a threatening tone, and changed the meaning further. For example, "What can I do for you?" in a threatening tone can imply, "Unless you have good reasons to be here – you should leave immediately or you will be in trouble". This is an advantage that translates into communication.

Face to face is often clearer than written text, as spoken discourse can compact more meaning into fewer words with the aid of intonation, gestures and facial expressions'.

There are many exchanges like this on the discussion forums, demonstrating that students were truly engaged with the content of the lecture video clips and were able to reflect on their learning and come up with informed analysis of real-life examples based on their understanding of linguistic concepts.

6.2.2 *Post-Lesson Evaluation Survey*

To find out students' views towards the online lessons, an evaluation questionnaire was designed and administered online after the completion of the first online lesson. Sixty-seven students responded to the questionnaire, and the results are shown in Fig. 6.7.

As shown in Fig. 6.7, overall students were very positive about the online lesson. Eighty-seven per cent of the students indicated that online lesson of this kind was new to them, showing that blended learning of this kind was not that common back in their high school time (these are year 1 undergraduate students who just left high school); 92% of the students enjoyed the flexibility of the online lesson, as they claimed that they could study the course content anywhere and anytime (item 2); 94% of the students felt that they had greater independence and control over their learning (item 4); 86% believed they had learnt as much as they did in a face-to-face lesson (item 3). For the Level 1 activities (resource-based activities), 88% of the students found the lecture video clips attractive (item 8) and the graphics/

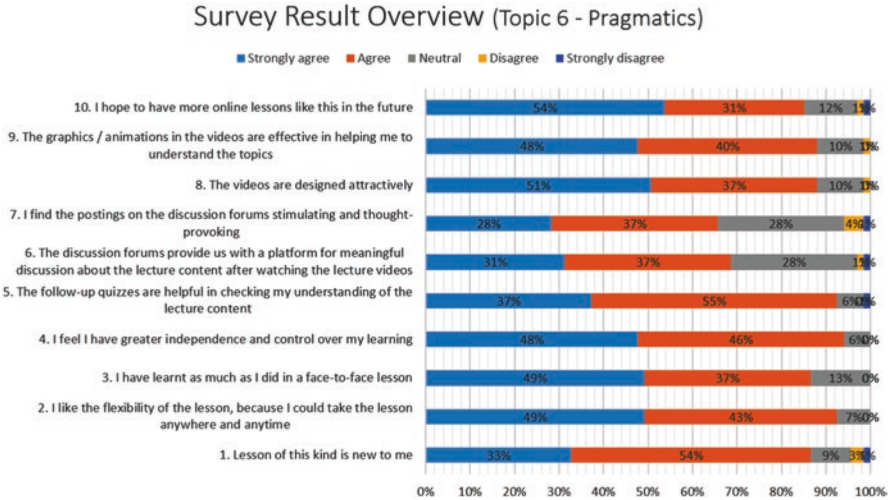

Fig. 6.7 Post-lesson evaluation survey results

animations in the video clips effective in helping them to understand the topics (item 9). For the Level 2 activities (response-based activities), i.e. the follow-up quizzes attached to the lecture video clips, 92% of the students found them helpful in checking their understanding of the lecture content. For the Level 3 activities (collaboration activities), i.e. the discussion forums, despite the high participation rate and the vast amount of messages posted, students seemed to be less positive, as 68% of the students found postings on the discussion forum meaningful (item 6) and 65% found the postings stimulating and thought-provoking. It is worth pointing out that 28% of the students gave the answer ‘neutral’ to these two items, so in fact very few students were truly negative about the online discussion forums. It is likely that the ones who held a neutral view were the ones who did not actively participate in the online discussion.

At the end of the questionnaire, an open-ended question was included to encourage students to give more specific written feedback (‘If you have further comments regarding the online lesson, please put down here. Thank you!’).

> Some of the written comments are extremely positive, for example: ‘The online lecture is so so so great!!!!!! Hope we can have online tutorial too!’ ‘Perfect! From teachers to resources, all the things are very good’. ‘These lectures are all very enjoyable and educational, I can always count on learning a thing or two from my linguistics classes’.

A student reported technical problems regarding the audio quality of the lecture video clip: ‘This online lecture has the potential to be an excellent learning tool. I, however, would suggest ensuring that the audio quality is perfect, as it was difficult to sit through the second segment of the lecture due to its sound only playing in one speaker, making it physically painful to listen to with headphones!’ Having checked the second segment of the online lecture video clip, no audio problem described by the student was found. It might be that the student’s headphones were faulty. Still, this comment reminded the author the importance of assuring the audio and video quality of the lecturer video clips, as it would indeed be a painful experience to watch or listen to an unclear/faulty video lecture and students would soon lose all the interests and motivation after watching or listening to the first few minutes of such a video lecture. Also, the presentation of the content of the video lecture needs to be lively and interactive: a very formal-talking head all the way through would be very boring, so a MOOC-style video lecture is very different from the recording of a face-to-face lecture in a lecture hall. An informal-talking head should be adopted, and many elements such as changing of backgrounds; insertion of texts, images, and animations; and inclusion of role plays, interviews, daily-life scenes, etc. should be considered when creating a MOOC-style video lecture. Only high-quality and attractive video lectures can catch students’ attention and sustain their interests. Also, the length of each lecture video clip should be limited: ideally each clip should be around 5–10 min long, as it will be hard for students to concentrate on a video lecture non-stop for too long. The above observations match with the research findings of Guo, Kim, and Rubin (2014). Through a large-scale empirical study, they found that shorter videos are much more engaging, that informal-talking head videos are more engaging, and that even high-quality pre-recorded classroom lectures might not make for engaging online videos.

Although the majority of the students were very positive about the online lesson, there were a few who still preferred the traditional face-to-face mode. One student stated, 'It's easier to understand (the lecture) in parts, broken down into smaller pieces. But I would still prefer to go (to a lecture) in person where possible. It helps build a ready mindset for gaining knowledge, that is not easy if I simply sit somewhere and take out a laptop to watch a video. It's just too... meaningless. The videos do make it interesting, thank you, but I prefer in-person much more'.

On the whole, 85% of the students hoped to have more online lessons of this kind (item 10), and 12% were neutral about this, showing that adopting blended learning in traditional face-to-face courses is welcomed by the majority of the students, as long as the online lessons are carefully designed and three levels of activities are introduced to give students an enhanced learning experience that allows more flexibility and more peer interaction.

6.3 Other Resources/Activities for Blended Learning

Other than the online lessons, some other resources/activities have been included in the course as well for blended learning, such as stand-alone course-specific website, weekly online quizzes, and Wikibook projects.

As mentioned earlier, Moodle has been adopted as the learning management system by most staff in the EdUHK over the past decade. A recent survey conducted in the university shows that almost every course offered in the university has a private course account on Moodle. The private nature of the course account means that only students and teachers who are registered for that course have the access rights and within the private course account they can upload and download course materials, post announcements or other messages on discussion forums, set or submit assignments, etc. Although Moodle is a powerful and efficient learning management system and it protects students' and teachers' privacy, the private nature of the course account also means that it is not convenient for teachers to share teaching and learning resources across courses and across academic years and indeed with the general public. There are also limitations for Moodle to manage hyperlinks between and within documents. In order to solve such problems, a stand-alone course-specific website was developed for the course 'Introduction to Linguistics'.

6.3.1 Stand-Alone Course-Specific Website

Under the category of Level 1 activities (resource-based activities), stand-alone course-specific websites have been commonly adopted in blended learning (Blake, Wilson, Cetto, & Pardo-Ballester, 2008; Thatcher, 2007). For the course 'Introduction to Linguistics', a course website (http://corpus.eduhk.hk/linguistics/linguistics.html) was developed with the following components: E-lectures, Online Readings, Multimedia Resources, Tasks, Online Quizzes, and Bibliography. The site serves as a stand-alone home for reusable course resources and is combined with the Moodle system to support course learning. Figure 6.8 shows a screenshot of the course-specific website.

Through the course-specific website, course resources can be shared easily by different teachers (or students) teaching (or studying) this same course and indeed by whoever is interested in the course content across the world. The website provides easy online access to the course materials, which is crucial for ensuring the flexibility and accessibility of the online learning environment (Anderson, 2018).

In the 'Introduction to Linguistics' course website, the Introduction section provides an overview of the course site. The E-lectures section intends to share some of the E-lectures in the course. The Multimedia Resources section offers links to a variety of online multimedia resources related to different topics covered in the course. The Online Readings section provides links to a large number of online academic articles related to the course topics, which are very useful for students' learning. The Tasks section gives details of different assessment tasks to students in the course. The Bibliography section provides a detailed bibliography for the relevant course topics. The Online Quizzes section hosts weekly online quizzes, which is an important component in the course that facilitates blended learning, and will

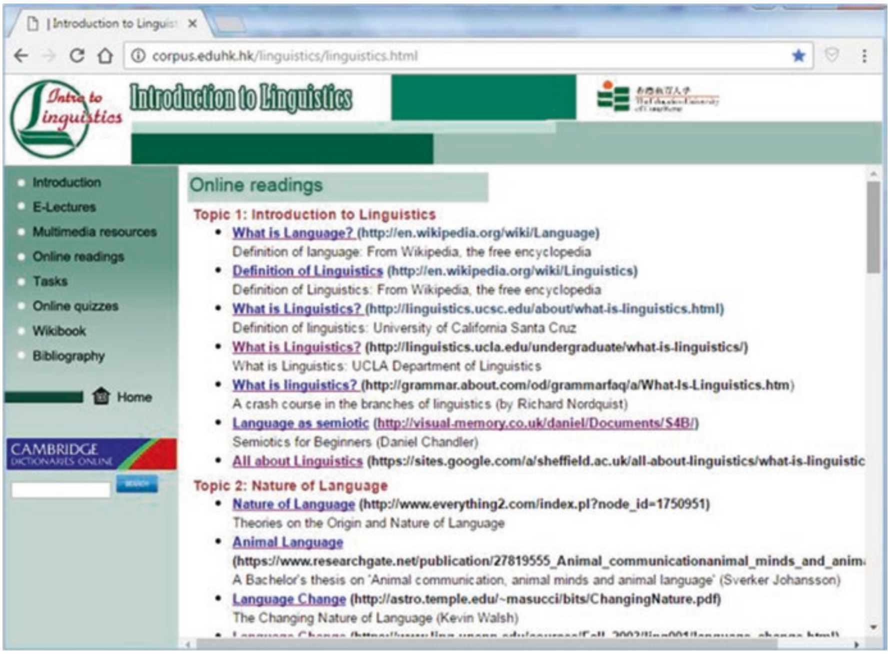

Fig. 6.8 A screenshot of the stand-alone 'Introduction to Linguistics' course site

be discussed in detail in Sect. 6.3.2. The Wikibook section introduces the Wikibook projects, a major innovation in the course that promotes blended learning, which will be discussed separately in detail in Sect. 6.3.3.

6.3.2 Weekly Online Quizzes: Self-Assessment for Learning

In the Online Quizzes section, originally, a self-developed quiz building program was used to provide weekly online quizzes to test students' comprehension of the course content. A programmer was employed to write the quiz program and design the online quiz interface. Although the self-developed online quiz program managed to help students to self-assess their learning, there were some technical issues (such as occasional bugs in the program) which negatively affected students' online learning experiences. In the 2016–2017 academic year, the BLUE project team provided technical support and explored the possibility of revamping the online quiz system. It was discovered that the quiz creation function in Moodle was very powerful and would allow us to create more user-friendly online quizzes and the quiz data bank and quiz grades could be stored, edited, and analysed more easily as well. As a result, around 600 quiz items (10 quizzes in total, around 60 items in the question bank for each quiz) were migrated onto the Moodle online quiz system. Figures 6.9

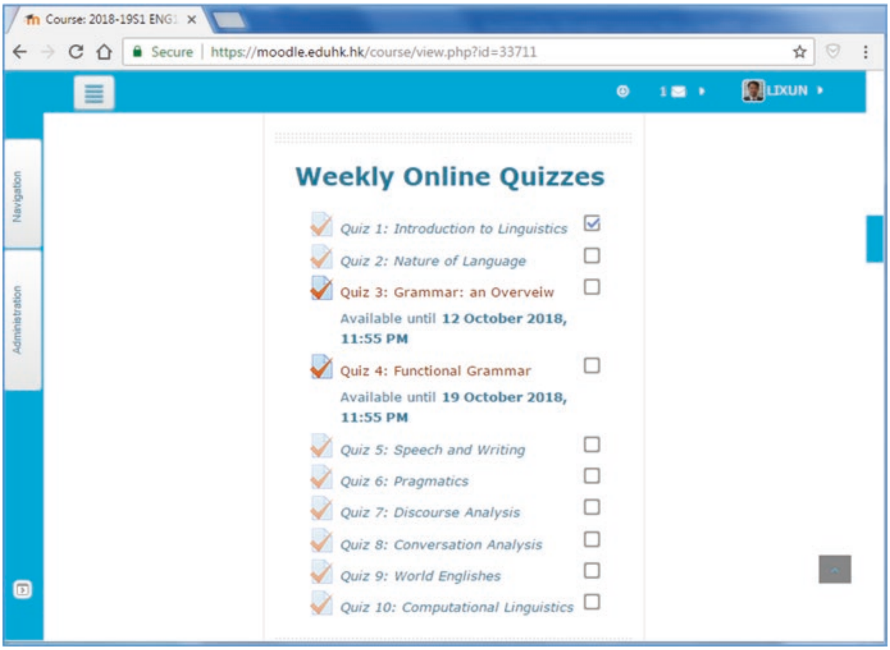

Fig. 6.9 Screenshot of the Online Quizzes page on Moodle

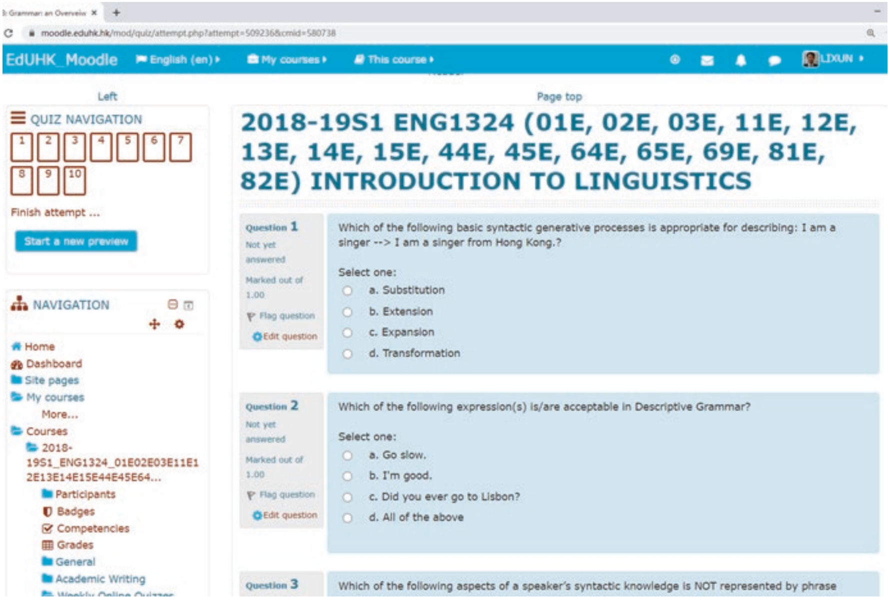

Fig. 6.10 Screenshot of the online quiz interface on Moodle

and 6.10 show screenshots of the online quiz system on Moodle. These Moodle quizzes, which are under the category of Level 2 activities (response-based activities), offer students a much improved experience of self-assessing their comprehension of the course content.

A unique feature of the Moodle weekly online quiz system is that students are allowed to re-take a quiz repeatedly within a 1-week period but, every time a student restarts a quiz, 10 items are randomly selected from a question bank database of around 60 items, which means that each time the student would be doing a quiz with new questions in it (it is possible that one or two items would reappear in the new quiz). This means that students will not be able to copy each other's (or even their own) answers, as each time they are answering a different set of questions. After students submit a quiz online, they receive immediate feedback on their answers and how many points they have scored, as shown in Fig. 6.11.

All the grading and feedback provision are done automatically by the online quiz system, which means that linking assignments with online quizzes is an effective way to introduce homework into courses with large number of students, as it will not overload instructors with excessive grading (Cooper, Tyser, & Sandheinrich, 2007). Of course, designing a large number of quiz items and coming up with feedback messages for each item were very time-consuming, but these were done by a team of teachers and research assistants through the support of Teaching Development Grant projects over a period of time, and the question bank can be continuously expanded gradually over the years, and the end product is a

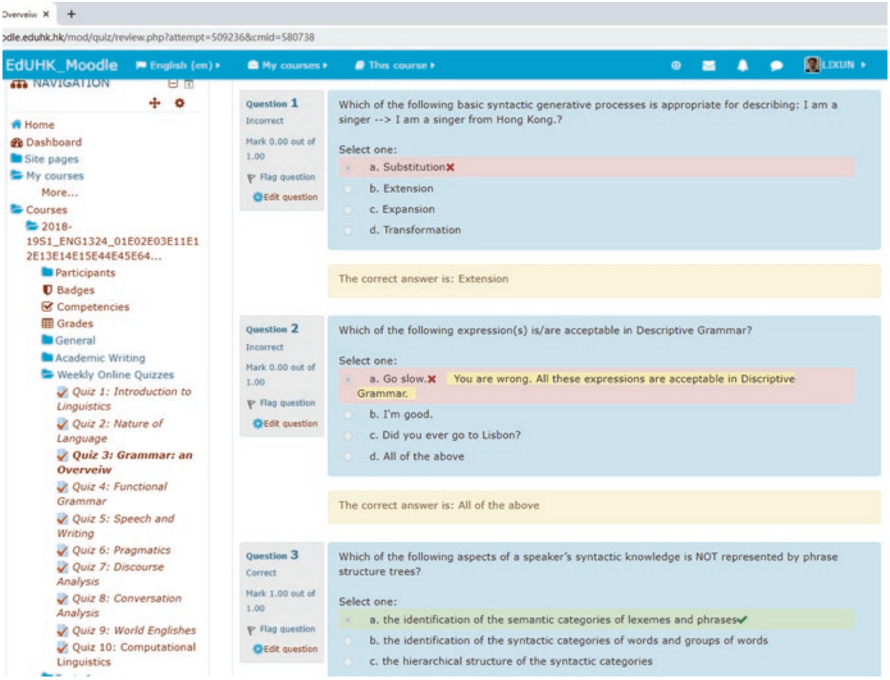

Fig. 6.11 Immediate feedback and grading after students have completed a quiz

comprehensive and effective online quiz system which can be enjoyed by a large number of students and teachers for many years to come.

A quiz is made available online after a lecture on the topic has been given to the students. Although they have gained some basic understanding of the topic, in order to be able to answer all the quiz questions, they need to study the textbook of the course and other recommended readings. Quite often, when doing the quiz, students would try to find answers in their textbook or relevant readings. Students can take the quiz repeatedly before a given deadline, and only the highest score will be formally recorded. Since the ten weekly online quizzes are part of the formal assessment of the course (10% of the overall grade), most students are willing to do the quiz as many times as necessary in order to achieve the highest possible score. The Moodle quiz system records all the attempts of the students, and past statistics show that a student is likely to take a quiz 5–8 times on average in order to obtain a high score. As shown in Fig. 6.12, this student did the quiz nine times and scored 10 out of 10 eventually.

This is a great example of self-assessment for learning (Black, Harrison, Lee, Marshall, & Wiliam, 2003; Carless, 2005), as students are constantly learning from the instant online written feedback provided to them when they repeatedly take the quiz. Student feedback suggests that they are extremely positive about this type of online assessment, as one student commented, ‘The weekly online quizzes in this course were the most enjoyable and beneficial assessment task I have experienced, as I was very motivated to take the quiz repeatedly in order to obtain a high score,

Fig. 6.12 Repeated attempts made by a student when completing an online quiz

and there was no real pressure which I would feel when taking a paper-based quiz in a formal classroom situation. Most importantly, I learned so much from the quizzes, and I was more aware of my study progress in this course'.

6.3.3 Wikibook Project: Collaborative Writing and Community of Inquiry Online

Kimmons (2018) proposed a pedagogical model called 'PICRAT' regarding effective integration of technology in educational settings. PIC stands for 'passive', 'interactive', and 'creative', which describe students' different types of relationship with technology, and RAT stands for 'replaces', 'amplifies', and 'transforms', which describe teachers' different types of use of technology. Figure 6.13 shows a visual of the PICRAT model.

Kimmons gave an example about this model: if a history teacher replaces the writing class notes on chalkboard with a PowerPoint presentation on screen, this would be categorized in the bottom-left (PR) section of the grid, as the teacher is just using the technology to replace a traditional practice. However, if an English teacher guides students to develop a creative writing blog, which they use to get feedback from their peers and the online community on their short stories, this would belong to the top-right (CT) section, as the teacher is employing the technology to transform his/her practice to conduct something that would not have been possible without relying on technology and the students are making use of the technology as a tool for creation. With reference to the PICRAT model, Wikibook projects were

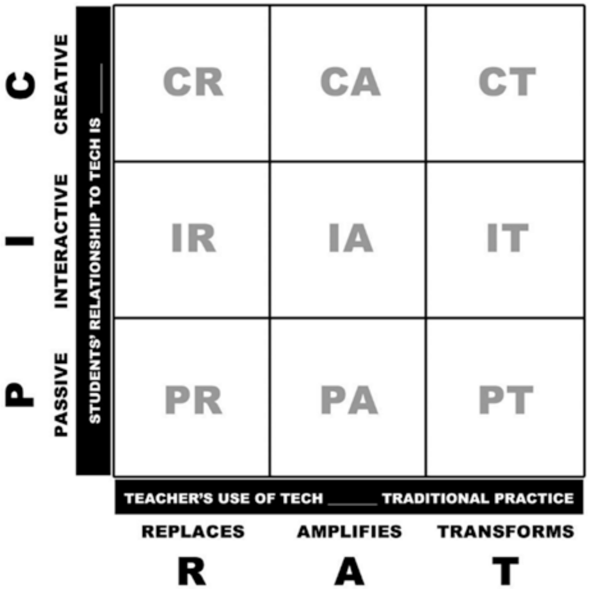

Fig. 6.13 The PICRAT model of technology integration (Kimmons, 2018)

implemented in this case study, which could be categorized in the top-right (CT) section of the model, as students are using the technology as a tool for creating a Wikibook. Details of the Wikibook project are given in the following section.

When students first enter the university, they normally face the challenge of being required to complete a lot of academic writing assignments without being very familiar with the academic writing conventions. Instead of taking exams like they did in the secondary school, they find themselves scratching their heads trying to complete academic essays on their own before a given deadline. Although they desperately need support regarding their academic writing, it is not possible for the course lecturers to spend unlimited hours commenting on every student's drafts. As a result, lecturers often receive written assignments of poor quality from students, and both sides feel frustrated about this process.

To address the above-mentioned problems, Wikibook projects have been implemented in the course 'Introduction to Linguistics' to promote academic reading and writing among first-year undergraduate students. According to Wikipedia, a wiki is 'a page or collection of Web pages designed to enable anyone who accesses it to contribute or modify content, using a simplified markup language' (Wikipedia: Wiki, n.d.). In the education field, more and more scholars and educators have realized the value and potential of wiki in education (Konieczny, p. 2012).

When designing a blended mode course, assessment should be allowed to play a major role (Herron & Wright, 2006), and Wikibook projects can be adopted as a great tool for authentic assessment in an online environment. A Wikibook project requires students to undertake academic reading/study in small groups to complete the joint authoring of an academic book (Wang, 2016).

In the Wikibook project for the course ‘Introduction to Linguistics’, students work in groups of four, and each group member contributes around 900 words to a chapter of a student-authored academic book titled ‘Introduction to Linguistics’ based on the topics introduced in the course. Each chapter must also include ten multiple-choice comprehension questions based on the content of the chapter. Through designing these comprehension questions, the authors of the chapter will be able to reflect on the content of the chapter and identify the key concepts in the chapter that should be understood by the readers. Peer editing among group members is required, and members in the same group receive the same group grade (30% of the total grade). A draft of one group’s Wikibook chapter must be posted on the Wikibook website online according to a prescribed schedule. One chapter draft will be posted online every week throughout the semester according to the order in which the topics are introduced in the course. It is essential for students to post the chapter draft online before the given deadlines, so as to allow the tutor and students to provide online comments within a period of time. Figure 6.14 shows a screenshot of a Wikibook ‘Introduction to Linguistics’.

Wikibook is an open-content online textbook that can be edited by anyone who has been given the editing rights (Wikibooks: About, n.d.). For the Wikibook project, the Google Sites website provides free Wikibook hosting: https://sites.google.com/. Students study the course content through a mixture of face-to-face instruction and online learning, and they work collaboratively online to complete the chapters in groups. Figure 6.15 shows a screenshot of a Wikibook chapter online. In order to enable students to help each other with their academic writing, peer editing was required in the course.

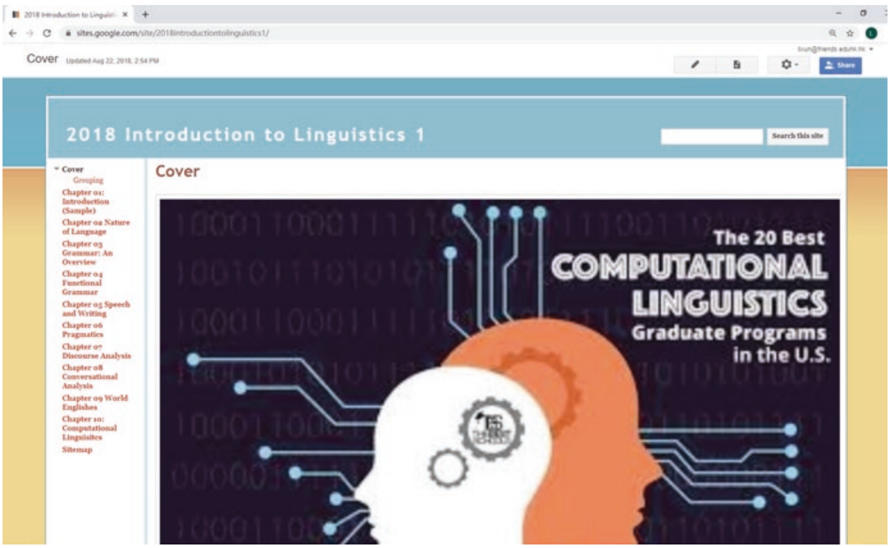

Fig. 6.14 Screenshot of a Wikibook ‘Introduction to Linguistics’

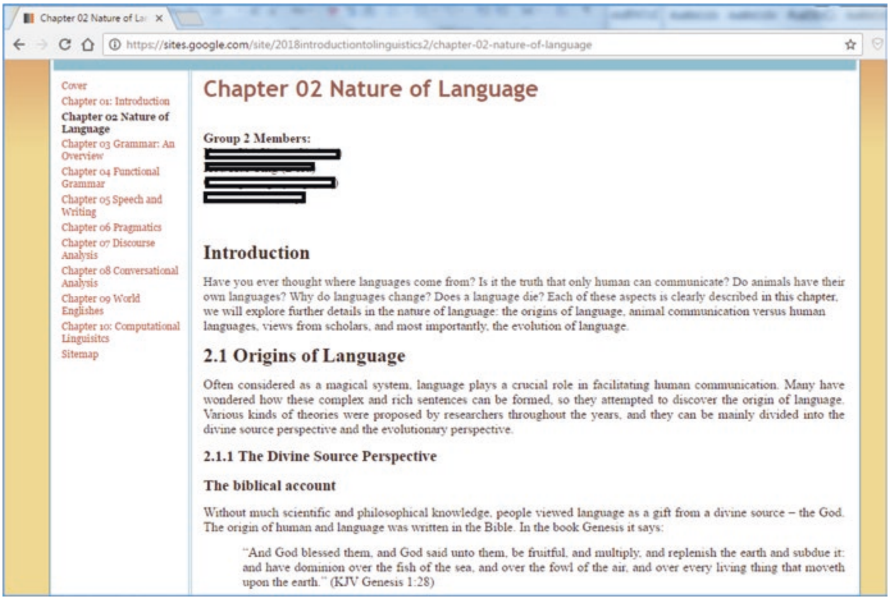

Fig. 6.15 Screenshot of a Wikibook chapter

Group members are required to peer edit each other's section in the corresponding chapter of the book so as to help ensure that each section includes sufficient detail, that the writing is polished, and that the whole chapter is coherent (the content of each section links together logically and smoothly). At the same time, other students must comment on the draft Wikibook chapter online, as shown in Fig. 6.16.

When giving online comments, students are required to include the following content: (1) what the student has learned from reading the chapter, and what she/he finds most interesting/beneficial; (2) what can be improved, or what other content/subtopics can be included in such a chapter; (3) rate the chapter on a 1–5 scale (1 = low quality; 5 = high quality). Every week, one group of students will give an oral presentation on their Wikibook chapter in front of their classmates, and the audience can take out their mobile devices and comment on the draft Wikibook chapter online while listening to the presentation or after the presentation. In the Asian context, normally students are not willing to give oral feedback to their peers' work, as they worry about saying the wrong things. However, our experience in the Wikibook project shows that students are far more willing to leave written comments online for their peers, as it is less threatening/stressful both to themselves and to their peers. As a formal assessment task, one point will be deducted each time when a student fails to provide a proper written comment on a Wikibook chapter. This is an important motivator for students to provide meaningful online comments to others, as empty general comments such as 'well done' will not help the authors of the chapter to further improve the quality of the chapter.

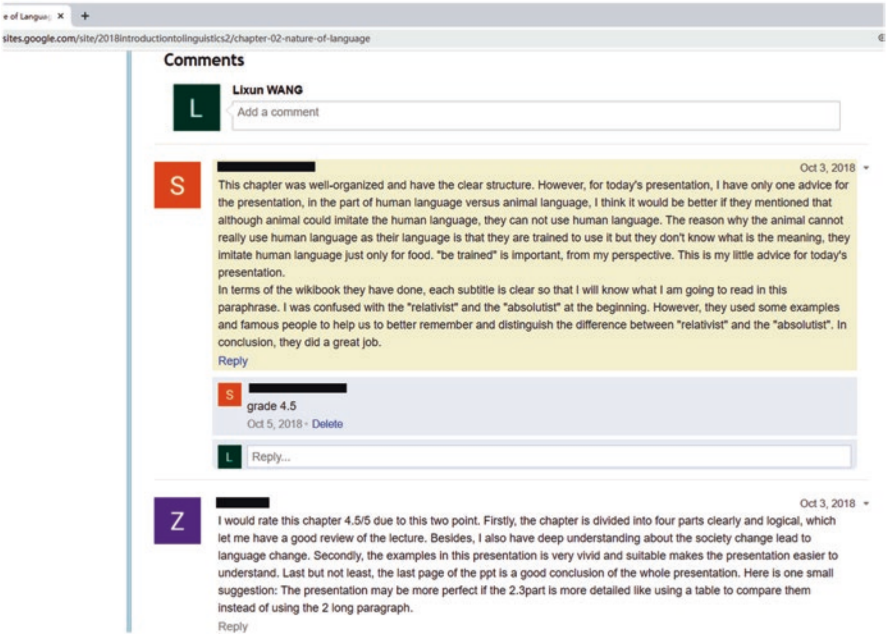

Fig. 6.16 Screenshot of students' online peer comments on a Wikibook chapter

The Wikibook project helps to create a group work scenario. Through online peer commenting and peer editing, an online community of inquiry is formed, which complements traditional face-to-face learning. It also helps to enhance the communicative and collaborative components of a blended learning environment, which is under the category of Level 3 activities (collaborative activities) mentioned earlier.

To discover the effectiveness of the Wikibook project, an end-of-course survey was carried out in one academic year, and a number of individual interviews were also conducted. The overall findings indicate that although some students found the Wikibook project quite challenging, most of them found the blended learning experience very rewarding and believed they had improved their academic reading and writing skills significantly through participation in the Wikibook project. The online community of inquiry that students built together enabled them to form a close bond with each other and learn more from each other.

6.4 Conclusion

This chapter discussed the adoption of blended learning in a traditional face-to-face tertiary-level English major course. A number of observations have been made: tertiary students are ready to accept blended learning as a normal course delivery mode, on the condition that the online lessons and other learning activities are designed carefully which would incorporate three levels of activities: resource-based activities (Level 1), response-based activities (Level 2), and collaborative activities (Level 3). This matches the theoretical underpinnings of the PICRAT model mentioned earlier, as students play different roles in the learning process (from being a passive receiver of information, to being actively interacting with the course content and with each other, to being creatively producing learning outcomes), while teachers also implement different strategies while helping students to learn through employment of technology (from merely replacing traditional practices using technology to transforming students' learning by employing technological tools to allow students to be creative in their learning). For resource-based activities, high-quality interactive lecture video clips of limited length (around 5–10 min) are crucial for the success of an online lecture; stand-alone course-specific websites serve as a stand-alone home for reusable course resources which provide great online support for course learning. Response-based activities such as online quizzes and collaborative activities such as online discussion forums and Wikibook projects are essential as well to provide students with abundant opportunities to interact with the content (via online quizzes) and among themselves (via online discussion forums and Wikibook projects). The post-lesson evaluation suggested that the majority of the students enjoyed the flexibility of the online lesson and felt more independent during the learning process. They found the video lectures attractive and effective, the online quizzes highly beneficial, the online discussion engaging and beneficial, and the Wikibook project challenging but very rewarding. To ensure a fulfilling learning experience, instructional design plays a crucial part, especially in arranging the online lessons and designing assessment tasks such as the online quizzes and Wikibook project. Clear and detailed instructions and guidance are also vital for the success of blended learning. Through this case study, it is hoped that this chapter can shed some light on how blended learning can be integrated into traditional face-to-face courses effectively.

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Chapter 7
“Doing a Quiz in Pyjamas”: Successes and Challenges of Blended Learning in Cambodian Higher English Language Education

Bophan Khan, Soviphea Chenda, Sumethea Heng, and David Coniam

Abstract Computer-assisted and technology-enhanced learning such as blended learning, e-learning and other technology-enhanced innovations are increasingly being used more widely in both developed and developing nations with the aim of improving students’ learning experience and raising the quality and reach of education. Cambodia has a relatively low enrolment rate in tertiary education, and delivery methods have always been conventional and face-to-face. While Cambodia is beginning to make inroads into the adoption of blended learning, it has a lot of catching up to do in order to take advantage of such technology. One of the Sustainable Development Goals of Education 2030 (UNESCO, Unpacking sustainable development goal 4 education 2030, 2017) addresses the issues of quality and accessibility of education as well as the promotion of lifelong learning. In the context of technology being envisaged as being part of the potential solution, the current chapter describes the emerging blended learning approach to teaching academic writing at a leading Cambodian higher education institution, the Royal University of Phnom Penh (RUPP). This chapter sheds light on the roles of teachers in the process of planning, implementing, and assessing blended learning and investigates the impact of blended learning on student engagement and learning outcomes as well as the challenges faced at an early stage of implementation. Areas for improvement and suggestions for a more informed approach are also discussed as expansion of blended learning at RUPP is considered.

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7.1 Introduction to Blended Learning at the Royal University of Phnom Penh

Driven by population growth and increasing demand for university graduates as the country's economy continues to expand, Cambodia, like other countries in the region (Williams, Kitamura, & Keng, 2014), has experienced exponential growth in higher education (HE), enrolling 13% of the country's population in 2017 as compared with 3.6% in 2005 (UNESCO Institute of Statistics, 2018). This began as an unregulated rapid expansion (Ford, 2006; Williams et al., 2014) with many institutions plagued by development, quality, and accessibility issues, especially in the private sector. The government of Cambodia has now recognised HE as an important part of its development strategy (Sam & Dahles, 2017) to achieve high middle-income status by 2030. The Ministry of Education, Youth, and Sport's (MoEYS) policy paper on its vision for HE by 2030 (Ministry of Education, Youth and Sport, 2014) is intended to serve as a roadmap to guide both public and private HE institutions in improving quality, equity, and access to HE for the purpose of equipping university graduates with the requisite skills and knowledge to meet the country's socio-economic development and labour demands. With the economic expansion, a number of HE institutions have been established in provincial towns. However, Phnom Penh remains the national epicentre for higher education and, as the capital city, continues to attract students for both higher education and employment to the extent that a growing disparity has been emerging between rural and urban skilled workforces.

In an attempt to improve the quality of learning and of accessibility to HE, a blended learning (BL) project was implemented at the Royal University of Phnom Penh (RUPP) as a collaboration between RUPP and the Department of Higher Education, Cambodia, supported by The Education University of Hong Kong.[1] The project saw teachers from the Department of English (DOE) and Faculty of Engineering run a BL pilot where classes continued with regular face-to-face teaching along with online learning activities; hence the course was a mix, a blend, of face-to-face and online learning and teaching.

In the DOE, before the start of the BL project, a survey of teachers was conducted to ascertain the degree of information communication technology (ICT) used in the classroom by the department's faculty members and second-year students – the latter being the target group of students invited to participate in the project. The survey findings showed that while online learning resources and activities were incorporated in teaching at varying degrees, and students had devices (principally smartphones and laptops) to access the Internet and online learning, the very concept of BL was new to both faculty members and students.

[1] The research reported on in this chapter was supported by grant R2150 (International Development Research Centre and HEAD Foundation): Building the Capacity of Cambodian Universities for Blended Learning to Enhance the Equity, Quality, and Efficiency of Higher Education.

The project ran for one academic year, over two semesters. Its principal aims were to promote equal access to language learning; to explore alternative approaches to language teaching and assessment; to increase learner autonomy and involvement in course development and implementation; to train students in relevant twenty-first century skills; and to equip students to be able to use ICT in their workplace. From the perspective of staff capacity building, the study aims to develop expertise among the budding Cambodian research community in terms of investigating how educational resources, learning activities, pedagogy, and curricula may be coordinated and utilised to help learners consume and manipulate technology for BL more effectively, responsibly, and ethically.

7.2 Literature Review

7.2.1 Internet and Mobile Phone Penetration in Cambodia

In contemporary Phnom Penh, the capital and largest city in Cambodia, high-tech multimodal materials and devices are beginning to populate learning spaces, and it is not uncommon to see students using their smartphones to help them with their learning activities. Almost two thirds of Cambodia's population is under 30 years of age (United Nations Population Cambodia, 2016), and this is the demographic group which is most active on social media for both personal consumption and learning purposes. A face-to-face survey with 2597 Cambodians aged between 15 and 24 across the country (Phong & Solá, 2015) revealed that 92% had access to TV, 70% of whom watched TV every day. Further, 65% of participants in urban areas used the Internet regularly, with 73% using it to access news and 63% for social networks (Harris & Gowland, 2014). Another study on the use of mobile phones and Internet among 2064 Cambodians aged between 15 and 65 reported near-universal access to a mobile phone (Phong & Solá, 2015). In the same study, close to 40% of participants reported owning at least one smartphone, while one in three had access to the Internet and one in three also had a Facebook account. Figures released by the Ministry of Posts and Telecommunications for 2016 indicate that over 7 million of the country's population of 15.8 million accessed the Internet through a mobile phone (Ministry of Posts and Telecommunications, 2016). The high penetration Internet rate and growth of social media such as Facebook among the Cambodian population suggest that the everyday life of a good proportion of Cambodians, language learners included, may be filled with the use of technology to access knowledge and information.

7.2.2 ICT, Online, and BL in Cambodia

In response to the ASEAN ICT Master Plan 2020, which aims to achieve a "digitally-enabled economy that is secure, sustainable, and transformative; and to enable an innovative, inclusive and integrated ASEAN Community" (The ASEAN Secretariat, 2015, p. 8), MoEYS has developed its own ICT master plan 2020 for the country's education programs. In this plan, the ministry identifies a lack of effectiveness of current programs for ICT teacher training and for student e-learning due to the lack of technological infrastructure and limited financial resources (KOICA, 2014). Furthermore, MoEYS proposes a more robust plan for integrating technology in secondary and tertiary education and teacher education – a recommendation also mentioned in UNESCO's Sustainable Development Goal 4 (Education 2030) (UNESCO, 2017).

7.2.3 Conceptualisation of Key Constructs and BL Framework

There are many factors that are important to study in blended learning environments. In this study, the focus has been on learner autonomy, learning engagement, and challenges in implementing BL as perceived and demonstrated by a group of teachers and their students.

Benson (2006) documents the development of learner autonomy as a concept. He states that while learner autonomy may be hard to define, all variations of the definitions in the literature share two common characteristics: that learner autonomy varies in degrees from learner to learner and that autonomy can be manifested through learners' behaviours in different forms. Based on their study with a group of English language teachers, Borg and Al-Busaidi (2012) extended Benson's broad conceptualisation of learner autonomy to include a teacher's perspective, in which they include technical, psychological, social, and political aspects of learner autonomy.

Learning engagement may, in broad terms, be classified in three areas – behavioural, cognitive, and emotional (Fredricks et al., 2004, cited in Tay, 2016) – or as "triadic reciprocality" (Bandura, 2001, cited in Tay, 2016), which includes behavioural, environmental, and personal factors.

BL as a construct is still being explored from different perspectives (Halverson, Graham, Spring, Drysdale, & Henrie, 2014), with little actual clear direction offered in the literature. Tay (2016) captures the issue well, observing that BL appears to be defined variedly in terms of activities, locations, delivery modes, and experiences. In the current study, BL constitutes "a deliberate fusion of the online (asynchronous and/or synchronous) and face to face contact time between teaching staff and students and/or between students in a course" (Lim & Wang, 2017, p. 3). This definition guided the planning, implementation, and evaluation of BL in the current study, the framework of which was also guided by Lim and Wang's (2017) detailed framework as suggested in the UNESCO-Shenzhen Funds-in-Trust Framework (SFIT) consultations provided to RUPP in 2017 (ITC, 2017). Situated above this framework lies social constructivism (Cole et al., 1978), which proposes that learning occurs in a collaborative yet individualised way, with knowledge being co-constructed as learners engage in various forms of interaction both face-to-face and online.

7.2.4 BL Implementation Framework

Figure 7.1 displays a framework proposed by Lim and Wang (2017) for implementing BL capacity building in HE institutions. In the case of RUPP, the framework was only partially applied as some key factors were not developed highly enough by the launch of the project. For example, learning support was close to non-existent, and infrastructure facilities, resources, and support were far from ready for BL. The pilot project was piloted as an initiative of the Department of Higher Education, MoEYS, in partnership with The Education University of Hong Kong.

Crews and Parker (2017) in their project attempting to use BL via Moodle among students and teachers in a provincial town in Cambodia reported that while many student participants were enthusiastic and engaged in online learning, they failed to complete the online tasks they had been set. Teacher participants viewed the online activities as supplemental and engaged very little in the online discussions with the students – what Garrison and Vaughan (2008, p. 202) refers to as the

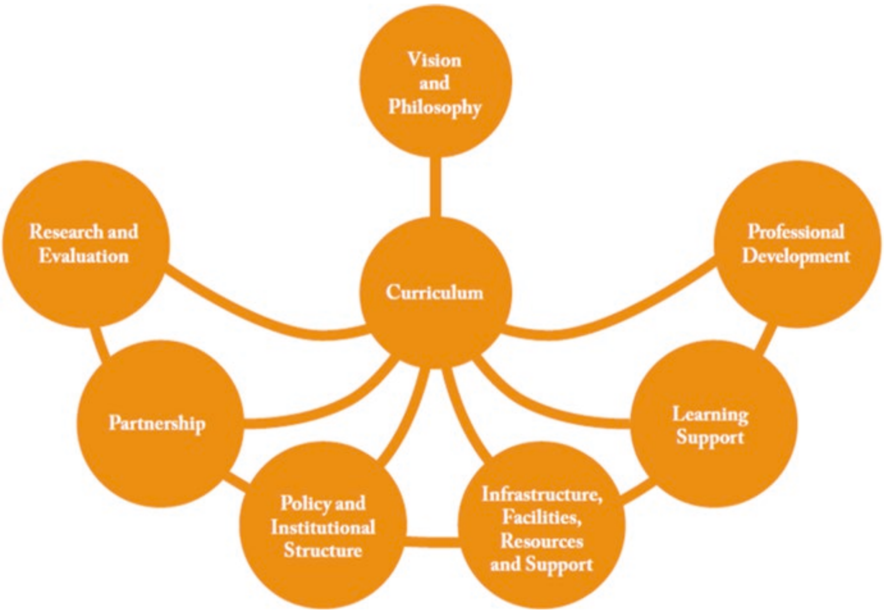

Fig. 7.1 Holistic framework for building BL capacity in HE institutions. (Lim & Wang, 2017)

“course-and-a-half syndrome.” In the context of the use of blended learning in higher education institutions in Malaysia, Azizan (2010) and Singh and Taurt (2017) present the issues and challenges facing all stakeholders – teachers, students, and as well as administrators.

Crews and Parker (2017) conclude that, if an online project is to be successful, the social, cultural, and learning needs of students need to be considered; for future BL projects, they proposed a more participatory approach to involving the teacher participants more in learner-centred pedagogies.

7.3 Methodology

7.3.1 Study Context

Language learning in Cambodia displays an interesting plethora of “stripes and colours” (Khan, 2011); the closer the institutions are to the city centre of Phnom Penh, the more pedagogically sound the teaching and learning are (Igawa, 2008; Khan, 2011), given that the most established language learning and teacher training institutions are located in Phnom Penh. In many ways, the Royal University of Phnom Penh (RUPP), as one of the only two ASEAN University Network member universities in the country, represents the pinnacle of Cambodian higher education. RUPP is a quasi-public (Ford, 2006) and semiautonomous (Williams et al., 2014) institution providing a limited number of scholarships across faculties and major disciplines and accepts fee-paying students in order to supplement the funding it receives from the government.

The Department of English (DOE) was established as a part of the Cambodian English Language Training Program (CELT) under the support financially and academically of the Quaker Service Australia (QSA) in 1993. In 1997, DOE introduced a 4-year bachelor’s degree program and a 2-year master’s degree program, of which one core subject is writing skills 2 (WS2). While three WS2 classes were selected to run in a pilot blended learning mode, only learning experiences of two classes are documented in this chapter. Data from the third class were collected through pre- and post-questionnaires and thus were not comparable to those generated in the two classes reported in this chapter.

WS2 adopts a process writing approach (Reither, 1985; Zamel, 1982), whereby students work in pairs and groups and help each other to produce multiple drafts of their writing. Currently WS2 is delivered through a pen-and-paper face-to-face mode of learning, with the main learning content being academic essay writing, citation and referencing, summarising and paraphrasing, and graph interpretation. (See Appendix A for the course syllabus.)

From September 2017 to June 2018, the WS2 course was taught both in class and on the online Schoology platform. Schoology was a new experience for students because all homework and assignments had to be submitted online, with some lessons actually delivered online. For the first time in the DOE’s history, online, off-campus sessions were offered in place of certain face-to-face meetings. Earlier, online learning had been seen as supplemental and was never recognised as a substitute for face-to-face learning. Participation, both in-class and online, was essential to students’ success in the BL course. Students were required to participate in discussions and complete lesson assignments and quizzes online at different stages in the course, and a consistent failure to do so would result in a failing grade for the course. Respect and thoughtfulness were two key protocols underpinning students’ online blended activities.

The study is situated in the pragmatic, deconstructive research paradigm (Creswell, 2014; Glesne, 2011) and adopts a “sequential explanatory” (Creswell, 2014) mixed-method approach to collect data. Quantitative data such as a presurvey about availability of devices to perform BL functions and students’ writing scores were first collected; this was then followed by the qualitative data generated via focus group discussions and reflective writing.

The data analysis in this study follows the interpretive paradigm (Richards, 2003) in which complex human activity is investigated through multiple methods to enable an informed and well-reasoned interpretation of the research findings (Dörnyei, 2007; Stake, 2010; Yin, 2011). The issue under focus is BL in Cambodian HE – a research topic which has not been explored in an empirical study on this scale before – and is of comparatively high complexity because of the nature of the topic and the number of sub-issues to be investigated. To untangle the issue in the most logical manner entails an extended collection of opinions, attitudes, and beliefs, through multiple methods triangulated among various groups of direct practitioners – students and teachers – as they implemented BL in their learning environments.

Learning in Cambodian HE is under-researched, and as BL is a relatively new phenomenon in Cambodia, there is little corresponding research in the local literature. Unsurprisingly, research into BL within English language education research and focussed on writing is sparse in Cambodia.

Adopting an interpretive paradigm enabled the researchers to investigate the phenomenon from the social and educational perspectives of the participants based on the researchers’ professional experience as teachers in the target research context for at least 5 years.

7.3.2 Case Study Design

A case study design fits well with the current study’s research objectives and its methodological plurality in that it enabled both researchers and participants to generate a rich set of data to better reflect the reality of BL and the accompanying pedagogy in the target study context. In the current dataset, a number of data collection methods were also used to complement each other (i.e. focus group interviews, checklists, and reflective writing).

7.3.3 Learning Management System Adopted

With a view to measuring the impact of uptake of the project, *Schoology* was adopted as the means to connect students and teachers in the context of studying, discussing, submitting, reading, and teaching online. In terms of assessment, essay rubrics (Appendix B) were used to score students' essay as reliably and efficiently as possible; checklists were used by students to assess their learning outcomes; e-portfolios were used to help students keep track of their progress; and reflective writing was used to get students' opinions regarding *Schoology* and the BL process.

The academic year 2017–2018 involved a lot of time and effort on the part of the teachers in terms of designing materials in advance; dealing with the technical side of – and problems associated with – *Schoology*; marking weekly assignments; giving feedback; marking quizzes and exams; and attempting to help students' with BL-related problems such as about the concept of synchronous and asynchronous online learning, as well as familiarising students with the *Schoology* interface and its affordances. Despite the assumption that the students were very familiar with digital media platforms, there was nonetheless a real need to conduct training for students in order to hone necessary technology skills so that they might optimise their online learning experiences.

7.3.4 Research Questions

In light of the sometimes varied findings and gaps in the literature regarding BL in HE in Cambodia, the current study aims to answer the following research questions:

1. Whether and in what ways does the blended version of the WS2 course help promote learner autonomy and engagement among a group of second-year English major students at RUPP?
2. Whether and in what ways does BL help the students achieve the expected learning outcomes, as stated in the WS syllabus?
3. What challenges and opportunities does BL create for teachers, students, administrators, and curriculum developers at RUPP?

7.3.5 Participants

There are two 5-month semesters in the Cambodian academic year, which begins in September. Semester 1 runs from September to January; Semester 2 runs from February to June.

The Year 2 Writing Skills (WS2) course is delivered in two three-credit modules. Each module lasted for 15 weeks, with a 3-hour face-to-face meeting per week. In the case of a blended lesson, online attendance was measured based on students' productivity rather than duration. As mentioned, two classes of students participated in the study – each representing a case study: Case Study One (Class One) consisted of 26 students and Case Study Two (Class Two) of 28 students.

7.3.6 Data Collection and Analysis

7.3.6.1 Case Study One

In the academic year 2017–2018, the study was conducted in both semesters, with the data collected via essay-scoring rubrics, checklists, e-portfolios, reflective writing, and focus group discussions (See Appendix C). The essay rubrics and checklists were used to measure the learning outcomes of the BL course over the two-semester period while e-portfolios, reflective writing, and focus group discussions were used to measure learner autonomy and student engagement, along with the opportunities and challenges which students, teachers, and the management team encountered on the BL course. For Case Study One, there were two focus group sessions – one at the end of Semester 1 and the other one at the end of Semester 2. Students were also asked to write at least two diary entries (at 4-week intervals) reflecting on their learning. Table 7.1 presents details of Case Study One focus group participants.

7.3.6.2 Case Study Two

Data collection for Case Study Two was conducted 2 weeks before Semester 2 of the academic year 2017–2018 came to an end. A member of the research team facilitated the focus group discussion of five participants who were chosen randomly from the class list. Table 7.2 provides details of Case Study Two focus group participants.

In total then, there were three focus group discussions – one session with Cohort 1 with six participants, and two sessions with Cohort 2 with five participants. Participants in all three focus group discussions were asked to share their experiences and perspectives on the BL course, their perceived challenges, and the

Table 7.1 Case Study One focus group participant details

Participants (P)	Sex	Age	Years learning English
P1	M	20	10 years
P2	F	18	10 years
P3	F	20	12 years
P4	F	20	11 years
P5	M	21	10 years
P6	M	18	12 years

Table 7.2 Case Study Two focus group participant details

Participants (P)	Sex	Age	Years learning English
P7	M	21	10 years
P8	F	21	10 years
P9	F	21	11 years
P10	M	26	12 years
P11	M	20	12 years

advantages and drawbacks of BL. They were also asked to comment on how they felt the blended course might be improved. The researcher sat with the group of participants and attempted to ensure that each participant had a fair chance to voice their opinions. The discussion was conducted in English and audio-recorded with the agreement of all participants. The discussion covered the three research questions laid out in 7.3.3 above and lasted approximately 40 min.

The data from the focus group discussions were transcribed, and each participant received a copy of the transcripts to confirm reliability of the transcription. Transcriptions were then analysed by the researchers themselves through a cyclical thematic analysis (Creswell, 2014; Stake, 2010; Yin, 2011) over each line of the discussions. Similar themes were merged and compared among the researchers for consistency in analysing the findings.

In the Findings presented below, the reporting of the quotes is such that **P** stands for **P**articipant; **CS** for **C**ase **S**tudy; **FGD** for **F**ocus **G**roup **D**iscussion; and **RW** for **R**eflective **W**riting.

7.4 Findings

7.4.1 Case Study One

In Case Study One, student sentiment and attitudes shifted from being negative at the beginning of Semester 1 to positive at the end of Semester 2. This was evidenced from a question posed by students who were waiting for class to commence at the end of the semester as to whether there would be BL in the following year since they had got used to BL and enjoyed the advantages it offered, as narrated in their reflective writing entries and discussed in the student focus group discussions, presented under the following themes.

7.4.1.1 Learner Autonomy

Compared to on-campus sessions, Class One students stated in the focus group that they initially had no idea of the purpose of off-campus sessions since off-campus sessions and BL were a new concept to them. Initially, they therefore felt that off-campus sessions were a burden and would be stressful – with a lot of material to read and assignments to complete. After two off-campus sessions, however, they changed their perspectives. A participant from Class One stated:

> From my experience, the off-campus sessions helped students a lot because they could save time, giving students more time to do their assignments. For example, if they are busy on the weekend, they can use the off-campus sessions to do it [the assignment]. [P1, CS1, 1st FGD]

Further, the off-campus sessions enabled students to get in touch with their teacher quickly and allowed students to focus more on their studies, thereby experiencing less pressure when they did homework and assignments. Another student in the group commented that:

> When we work at home, we can stay calm, and have more time to think of ideas. So we usually spend more time on an assignment; we don't need to worry so much about time management. And our ideas come out gradually. [P2, CS1, 1st FGD]

Class One students first complained that there were too many documents, videos, and quizzes uploaded in Schoology to be studied before class and for further study after class. Students later appreciated, however, how those uploaded materials helped them prepare for a class at any time. Because everything was up there, all they had to do was study on their own.

> We can have self-study at home because things have been uploaded in advance since Semester 1. [P5, CS1, 2nd FGD]

It was perhaps not surprising that initially students disliked online quizzes and assignments, as well as experiencing unexpected errors through their Wi-Fi getting disconnected. It first took them several – rather frustrating – weeks to work out how to deal with these problems.

> The quizzes made me more and more frustrated due to technical errors. Initially I was mad, but I've changed my attitude now. I really like Schoology because I feel more independent. I don't need to come to school and submit [work] to the teacher. I just upload it on the Internet and that's it. It's more convenient and easy. [P4, CS1, 1st FGD]
>
> I was so shocked when I was doing the quiz, and I got an Internet error. My quiz was automatically submitted, and I got zero. However, luckily I was allowed a second attempt, and I got a full score. [P6, CS1, 1st RW]

7.4.1.2 Student Engagement

With the implementation of BL, Class One students were actively involved in both on-campus and off-campus sessions. During the on-campus sessions, students worked in various ways – individually, in pairs, and in groups. Regarding these different modes of interaction, they preferred group work both in and out of the class to complete assignments. They also mentioned they really enjoyed the BL class, where everyone put in a lot of effort.

> When the teacher puts us into groups, and we take turns to explain each other, I enjoy this mode of working a lot. Yes, and I get less nervous when asking the teacher. [P3, CS1, 1st FGD]
>
> Also, when it comes to writing, there's less pressure because we have group members to help us with things like checking word uses, structures, and content. That's what I want. [P4, CS1, 2nd FGD]

Surprisingly, BL promoted learning engagement in a comfortable environment for students no matter where or when they were. Hence, with an Internet connection, students were, for example, able to do the quizzes very easily. In the words of one of the Class One students:

> I also have the same opinion as P1. You know, I don't have to wear a uniform or ride a motorbike in to the campus to do a quiz. I can wear my pyjamas and do the quiz at home. I think that's what I enjoy the most. [P2, CS1, 1st FGD]

One of the best things about BL mentioned by Class One students was that, when they were absent, they could still access all documents in *Schoology* as well as approach their teacher for further explanations. Also, the discussion forum was a platform where they were able to seek answers or clarify issues. Students then had no excuse for submitting late assignments because *Schoology* was able to track students' submission.

> … at first I did not really like Schoology, and I complained to my teacher because I'm not used to studying online. I have always been used to studying with my teacher. But now after studying in Schoology, I find it quite easy to submit an assignment, and when I don't understand, or when I am absent, I just go to Schoology, search for documents, or discuss on the discussion forum. [P2, CS1, 2nd RW]
>
> I would like to say that the first time that I was introduced to Schoology by my teacher, I was actually really angry. I really hated it… And yes, but now I've got used to it, and I quite like it, too, because, just as P2 mentioned, it is a very convenient way for us to submit our assignments. [P3, CS1, 1st FGD]

7.4.1.3 Achievement of Learning Outcomes

Matched against the essay-scoring rubric and course syllabus in Semester 1, BL – through both on-campus and off-campus sessions – enabled Class One students to identify the structures of and write the four types of academic essay: to develop language accuracy and proficiency; to develop ICT competencies; to be able to brainstorm and outline the four types of essay; and to generally achieve the intended learning outcomes laid down for WS course.

> What I learned in my academic writing class is that I'm now more able to express my ideas. I'm able to expand them more. Also, I'm able to read others' [writing] in peer editing and am able to understand their ideas and points of view better. [P6, CS1, 1st FGD]
>
> What I enjoy about learning in the academic writing class is that I can expand my knowledge about writing an essay and also I have learnt a lot of types of different essays. All this not only taught me how to write a good essay but also improved my vocabulary and grammar and so on. [P1, CS1, 1st FGD]

> I have learned how to use online materials, do online quizzes, discuss online; I have been given the chance to have pair and group revising and editing. [P1, CS1, 1st FGD]

Moreover, the e-portfolio concept gave students the opportunity to look back and to be proud of what they had done so far. They commented that they felt more professional in terms of using the online platform in their BL writing class compared to the other non-BL writing classes they had taken previously in DOE.

> Just like my other classmates, I was new to Schoology, but when I see how many works I have done so far, I am so proud, like I can survive with my classmates when I put my works in order from the beginning, what I have learned about and can put them in the right order from the beginning to the end of semester. [P2, CS1, 2nd FGD]
>
> It actually makes me feel like I am a professional because it is a new technology. [P5, CS1, 2nd FGD]

By the end of Semester 2 in 2017–2018, Class One students were able to avoid plagiarism through proper paraphrasing, summarising, citation, references, reconstructing an argumentative essay into an extended essay, and upgrading ICT competency, which matched the course's intended learning outcomes.

> APA has been one of the most difficult things for us to get, but it will be very useful in the future or in the next year in the subject called Research Methodology. [P6, CS1, 2nd FGD]
>
> It is like a milestone towards research methodology. APA is a major achievement for us so far. [P5, CS1, 2nd FGD]
>
> The main things we have learnt have been paraphrasing, summarizing, how to avoid plagiarism, and APA styles, but like I mentioned APA has been the most important achievement and also the most challenging – since sometimes we had no idea how to do it properly. [P5, CS1, 2nd RW]

As for editing skills, before the BL project, students would edit their friends' writings manually on paper. However, students were happy to have been taught how to use track changes and comments due to its effectiveness and efficiency.

> I think track changes and comments is helpful because it makes me feel like a teacher that checks others' documents. Wow, it's good. So when we can see others' mistakes, it's like I see my own mistakes, too. [P5, CS1, 1st FGD]

Because BL was new to DOE, both teachers and students struggled with a number of issues over the course of the academic year. Nonetheless, overall, things turned out much better than expected. Luckily, teachers and students received motivation and emotional support from the management team, with teachers being paid as usual during off-campus sessions. It is important to note at this juncture that, in Cambodia, many teachers are paid by the hour for the number of hours they teach. With the BL course, without the agreement of senior management, teachers would have been marked absent, and their salary would have been cut because they had not been in class during the off-campus sessions.

7.4.1.4 Challenges for Students, Teachers, and Management Team

Though blending learning was piloted successfully in Class One, there were issues which students and teachers had to deal with: the biggest being Internet access inside and outside the university campus. On this issue, the participants complained they needed to log in all the time and were not able to find documents or where to submit assignments.

> What I did not enjoy is that I needed the Internet to access the BL stuff, so I needed to, like, tell my family to give me the Wi-Fi connection at home, and I had to use my own cell phone to access the Internet in class. [P4, CS1, 1st FGD]
>
> With BL, we needed to log in every time we opened it. Sometimes I forgot to log in and did not see what the teacher had posted. Sometimes she posted information in Schoology, but I missed it. [P3, CS1, 1st FGD]
>
> Sometimes I found it a little bit confusing. It was not really as convenient as other social media apps. Sometimes it was hard to find the correct materials and places to submit the assignments and other stuff. [P4, CS1, 2nd FGD]

The majority of the students were happy with BL, but not with *Schoology* because especially at the beginning of the semester, they were not familiar with the platform. For instance, one of them did not set the time zone to Cambodian time, and they were then disappointed that, when it came to the group assignment, only the one who had submitted the assignment could view the submission posts. The solution here was that the teacher checked everyone's *Schoology* accounts and made students change their time zone.

> … [For a group assignment] I was so shocked because I saw that the assignment was overdue, but when I asked the other group members, they said they had already submitted it. There was also another problem – the thing about time zones. [P1, CS1, 1st FGD]

In the BL course, teachers must be very well-prepared since everything has to be uploaded and assigned before class. Thus, teachers regularly had to stay up late just to prepare and mark student work. Similarly, with there being so many assignments to write both in and outside class, Class One students also had trouble with time management – a typical problem related to self-regulation. Although there had been a lot of explanation and practice, some students still could not keep up with the schedule.

> One big challenge that I faced was time management. I found it frustrating when I needed to write something in class during the test. I didn't manage my time well, so when it came to the last minute, I was shaking and everything got all messed up. [P4, CS1, 2nd FGD]

7.4.1.5 Opportunities for Students, Teachers, and Management Team

The teaching team felt exhilarated when asked by students at the end of the BL course whether they would have another chance to experience BL in the next academic year. There had been a considerable number of positive comments from students in both focus group discussions and their reflective writing. Key issues here were that BL was good for the environment in that students could read online, and they did not need to continually bring a lot of documents to class.

> For a better environment, we don't want to waste paper. To me, I tend to lose handouts a lot. After the teacher's handed it to me, I don't know where I put it. So, it is better that I keep it in my laptop in one place. [P4, CS1, 2nd FGD]
>
> It is very convenient for us if we want to go back to our work. We can show it to other people who can look at it, and since it has already uploaded, we don't have to carry it with us. [P5, CS1, 2nd FGD]
>
> I didn't have to spend time looking for documents on shelves; it was very easy for me just to find documents in Schoology. [P2, CS1, 2nd FGD]

One comment was that, in WS2, students' work on the BL course had a better chance of being revised and edited in terms of word use, structures, content, citations, and references by peers and teacher via Microsoft Word's Track Changes and Comment feature.

> I would like to add that for me I'm not very good at sentence structuring, but I'm getting better. I have learned a lot from the WS class. One thing is that I'm able to think faster now. I know how to brainstorm or do free writing or listing. So, I have a lot of ideas to write about. I revised, edited, and each of my writings was revised and edited by my group members. [P6, CS1, 1st FGD]

Because Cambodia is a developing country, its educational system is undergoing considerable transformation. Thus, BL in DOE could be seen in part as preparing students to aim higher and consider going for higher education, which would involve face-to-face and online learning and researching, which required being adept at technology. A positive comment on this regard by one participant was:

> The BL course prepared me a lot because I plan to pursue higher education, where a lot of the requirements include writing academic papers. Knowing about APA, and how to use it appropriately in a formal academic paper, maybe I will get a chance to pursue that dream. It [BL] helps me a lot to get insights into what students inside and outside our country learn. Learning by ourselves or by posting and submitting our assignment through the Internet, well, this has helped push me towards my goal. [P5, CS1, 2nd FGD]

7.4.2 Case Study Two

7.4.2.1 Student Autonomy and Engagement

According to participants, BL allows easier and more flexible access to learning materials. All participants agreed on its advantage: that it helps them to find documents, learn from videos, and submit their work quickly and conveniently. In addition to accessibility, BL provides students with the opportunity to do research and self-study related to the topic they are studying or they are about to study. It encourages them to read about the topic beforehand before coming to class.

> For self-study, we can access the application, for example, Schoology, anywhere anytime that we want to review our lesson or wondering about some parts that we're not clear about. We can access it and review it again. [P10, CS2, FGD]

Besides positive opinions on BL, participants also mentioned a key disadvantage: that BL comes with potential distractions. Since using BL requires access to the Internet and technology, students at times got distracted as they could not keep their focus solely on the topic at hand and began checking social media and entertainment sites available online.

7.4.2.2 Blended Learning Experiences and Challenges

Participants were asked to comment on the challenges they had faced during the BL course. One of the challenges was gadget affordability. One participant mentioned the cost of technology needed to accommodate BL, while another participant added that some students cannot afford expensive gadgets, not even smartphones. Therefore, as BL depends considerably on technology, it makes learning accessibility hard for students who do not own such gadgets.

> …If students come from the provinces, they are likely to be quite poor; they cannot afford a computer, or a phone. This can make life difficult for them. For me, at that time, I didn't have a smartphone, that's why it was difficult for me to access the e-learning platform." [P12, CS2, FGD]

Internet access posed a big challenge to participants. All participants noted how it was frustrating and difficult to access the learning platform when Internet connections were unreliable, mentioning errors which occurred when Internet connections were interrupted. For example, they were not able to finish their online quizzes due to Internet connections being unstable, which resulted in the system submitting their quizzes automatically, but unfinished. Frequent connection errors made BL less attractive to them as users and learners. The state of the DOE's computer lab did not help in this regard: the computers were old and Internet access was slow, and teachers and students essentially avoided using them. By the time the research reported in this chapter was written, the university's resolution to upgrade its ICT infrastructure has still not been translated into reality. Students and teachers were left to find solutions to technology challenges on their own as technical assistance and devices conducive for BL were not in place.

The FGD students noted that sometimes the platform was not compatible with the browser they were using, which caused another set of hiccups. Some participants also commented on how learning on computer and reading on screen were not that easy on their eyes.

> For me, I have problem with reading on screen. The longer I read, I feel more stressed and it affects my eyes… like a headache or something like that. Sometimes I print out the documents that can be printed out. [P9, CS2, FGD]

Motivation was also a challenge for some participants. Most agreed that they were motivated by the scores given on completing the task on the online platform. However, without continual reinforcement from the teacher, some felt that it is not always necessary to access the platform – the self-regulation issue again.

For teachers, initially, the implementation caused a bit of confusion as students whose classes were to be blended had no knowledge of what BL was and why the implementation was needed or was going to take place at all. Teachers, therefore, organised some introductory sessions at the beginning of Semester 1 to introduce students to BL and to the *Schoology* platform. Students’ responses were both positive and negative, although positive for the most part. The majority of students were interested and engaged because BL is an innovation in the Cambodian education system and they hoped that with the new platform and system, their learning would be better enabled with the help of technology. A few students expressed doubts towards BL as they thought that the old system suited their needs perfectly well and such innovation was unnecessary. It was, therefore, the teacher’s role to convince them as to how BL could help them in their studies and why it was worth integrating technology into education at this juncture.

There were a few hiccups during the integration. For one thing, since the platform was free, functions were limited, meaning that certain activities and assessments – assessment analytics, recording audios/videos into students’ homework, assignments and teacher comments, tracking students’ progress against expected learning outcomes – were not able to be conducted online. This put a restriction on what it as possible to do to make the most of the blended environment. Secondly, teacher readiness was also one of the challenges. Because BL was integrated in the current project without any technical support, teachers, for the most part, had to rely heavily on peer support and to learn from each other more than they needed to in the face-to-face classroom. Lessons and activities had to be prepared weeks in advance to make sure that students could access the materials before coming to class. From this perspective, less actual classroom time did not result in less work for teachers.

As the BL course progressed, there were inevitable problems – a lot of which were technical issues faced by students. Unstable Internet connections and incompatible web browsers led to many technical errors which had to be solved by the teachers since there was no technical support.

Challenges aside, the BL did, however, offer a significant number of advantages. With the integration of BL, more learning activities were able to be conducted in actual classroom time as learning materials were made available online and students had the opportunity to go through the topic before coming to class. This saved a considerable amount of time which could then be devoted to practising and producing the learning outcomes instead of spending a lot of time simply reading during class hours.

Submitting homework and assignments was much more convenient for students through the online platform. Students did not have to meet face to face to hand in their homework; they could submit it all online at any given time. If technical errors can, in future, be overcome, quizzes can be administered online, with results provided immediately after students have submitted their answers. From this angle, BL can be seen to help relieve teachers’ workloads and provided a more engaging classroom experience.

7.4.2.3 Suggested Improvements

As has been mentioned previously, all participants commented on how the technology problems need to be addressed, commenting on issues such as page reloading, automatic answer submission, and unsupported browsers. Furthermore, reminders could profitably be sent out to notify them about tasks that need to be completed. Finally, participants suggested that a workshop should be conducted for first-time users in order to familiarise them with the functions of the platform.

Participants were asked how the BL course might be improved. All commented that the first requirement was a more user-friendly interface which was easier to use. Additionally, live stream learning was also suggested as a possible improvement. The idea behind live stream learning is that all students participate in an online conference at a set time with the teacher (Herron, 2017; Parilo & Parsh, 2014). This enables students to attend class without having to be physically present in class.

It was also suggested that the assessment of online participation needed to be taken more seriously. In other words, homework and activities provided online should be assessed. Participants mentioned how, without proper assessment, it is not really necessary to log in to the platform.

7.4.3 Implications from the Case Studies

After a year of integrating BL into WS2, there have been some notable improvements and initiatives for its continuation in the following academic year. After a somewhat rocky start, the BL course was implemented with considerable success – so much so that the BL course did continue in the following academic year (2018–2019). The program caught the attention of a number of both WS2 and non-WS2 teachers, who wished to go blended in the new academic year. All these factors put the integration into a positive light, with more teachers becoming interested and more supportive of the innovation. BL received support from senior management and the administration; and blended lessons are now accepted as equivalent to face-to-face lessons.

Contrary to students' initial reactions during the first stage of implementation, where they were somewhat sceptical about BL, students showed a more positive attitude towards WS2 itself, towards the role of technology in learning and in real-life communication. Students who participated in the first wave have also become more adept at utilising available technologies to assist their learning.

Teachers, in using BL, felt more empowered and at ease in leading students' learning. Since students had early access to learning materials, they had a lot of ideas to discuss in the class – which helped create a more engaging and meaningful learning environment.

The issues laid out above in this section are typical of the "J Curve Type" of experience (see Graham et al., 2019) where, initially, a new intervention has problems that cause outcomes/satisfaction to drop somewhat before rising.

7.5 Conclusion and Limitations

This study set out to document the experiences of both teacher researchers and students in integrating BL into the teaching of an academic writing course. Feedback from participants was generally positive, indicating the positivity of BL in helping students become more engaged and autonomous and learn online and from one another in a more collaborative way – even when they are in their pyjamas. The study has been a qualitative one, which is a limitation. To support the case for BL improving language learning, quantitative follow-up research on BL in Cambodia involving evidence such as survey responses as well as analyses of the student participants’ academic writing performances is called for – so that the Cambodian experience can be compared with results reported in the literature. Another limitation lies in the fact that the technological infrastructure of RUPP – the participating university – was not developed to a level which could support the seamless integration of BL. Some of the negative experiences of some student participants may have been the result of resource limitations, such as slow-speed Wi-Fi, old devices, and even the lack of availability of necessary equipment for optimal use of a learning management system such as *Schoology*.

The privatisation of public HE in Cambodia since 1997 has generated resources which have been targeted at the improvement of facilities and technological infrastructure; however, in the case of RUPP, the situation is still somewhat lacking with respect to BL. In order to improve the quality of learning and equitable access – set as priorities by MoEYS (2014) through ICT, online learning and BL – the Cambodian government needs to allocate more resources to improve facilities and the technology available to students. As part of today’s knowledge- and information-based economy, Cambodian youth are highly enthusiastic and engaged in technology-assisted learning yet are at times frustrated due to technological problems. With this issue dealt with, issues of quality and access will improve, and Cambodian university graduates will be more ready to function and contribute more to twenty-first century personal, academic, and professional community spaces.

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Appendices

Appendix A: WS2 Course Syllabus

Course Title: Blended Writing Skills 202
Number of Credits: 3 credit points (45 h)

Course Description

Writing Skills 202 combines on-campus and off-campus learning and is designed to equip students with necessary academic writing skills such as paraphrasing, summarising, quoting, and documenting sources to enable them to write extended academic essays to discuss a thesis with sound arguments and references. This course also teaches students to write paragraphs/essays to interpret line graphs.

Course Structure

This course is conducted on-campus and off-campus, which means students do not have to be on campus in all sessions. For off-campus learning, students will use Schoology (https://www.schoology.com/), an online platform for discussion, independent study, and assessments.

Expected Learning Outcomes

By the end of the course, learners should gain the following *knowledge*:

- What constitutes plagiarism
- Styles and structures of academic essays
- APA sixth edition referencing
- Different types of references (journal articles, book chapters, books, etc.)
- Different sources to enhance arguments
- Component parts of line graphs
- ICT competencies necessary for planning and writing, i.e. using ICT facilities and skills to write an essay

  By the end of the course, learners should be able to use the following *skills*:

- Locate, select, and evaluate relevant sources for extended essays.
- Apply academic skills (paraphrasing, summarising, quoting and documenting sources) to avoid plagiarism.
- Integrate different sources into their writing.
- Use relevant software programs (e.g. MS Word and/or EndNote, etc.) for documenting sources.
- Apply proper language conventions in writing academic essays.
- Describe and interpret line graphs.
- Develop time management skills to complete writing tasks.
- Integrate additional inputs and various sources of reliable information by using ICT facilities and competencies.
- Review, edit, and revise multiple drafts of essays effectively.

By the end of the course, learners should develop the following *attitudes*:

- Work effectively as a team to complete a joint task.
- Appreciate/value extensive reading.
- Appreciate/value a community of learners.
- Appreciate/value culture of learning and sharing resources/knowledge.
- Value persistency and openness to constructive feedback.
- Positively conceive of writing as a process (not just a product).
- Value collaborative, independent, and lifelong learning.
- Appreciate the employment of ICT in producing a piece of formal/academic written work.
- Actively participate in online discussion.

Teaching Methods

- Blended learning method: a combination between in-class and online learning
- A process writing approach: developing, reviewing, editing and revising multiple drafts
- Text modelling, joint construction, and independent practice (genre-based approach)
- A practice-oriented approach

Student Responsibilities

- Creating an account of "Schoology".
- Reading materials in the textbook and online
- Posting and responding to questions for discussions in the Discussion Forum
- Developing, reviewing, editing, and revising multiple drafts of essays
- Monitoring one's own learning, i.e. active participation in online discussions, writing practices in class, and evaluating own learning progress
- Submitting multiple drafts of essays according to the due dates

Computer or Smart Device Requirements

You will need an up-to-date browser, operating system, and some additional software programs on your computer or applications on their smart devices (e.g. smartphones, tablets, etc.) to attend the online platform. You will be given an access code in order to register for the course in the online learning platform, *Schoology*. Documents will be available as Microsoft Word files, PDF's, videos, images, or URLs.

Description of Assessment Tasks

Course Assignments

- ***Weekly lessons and essay writing assignments***

  Each week, you will need to complete the following:

- Reading the weekly lesson. This will be available before the class starts.
- Posting in the weekly Discussion Forum.
- Responding to other students' posts in the Discussion Forum.
- Completing the lesson assignments in each course lesson by the due dates.

Each essay will be graded on content, spelling, punctuation, grammar, and format, as in the Essay Scoring Rubric (see Appendix B).

Major Assignment

The Argumentative Essay will be the major assignment task. This task is an independent work by following a process writing approach, i.e. completing multiple drafts.

- ***Grading Scale***

Letters	Percentage	GPA
A	85–100%	4.00
B	80–84%	3.50
C	70–79%	3.00
D	65–69%	2.50
E	50–64%	2.00
F	49% and below	1.50

Appendix B: Essay Scoring Rubric

Performance Areas	Excellent	Good	Need Improvement	Unacceptable
	10–7	6–4	3–2	1–0
Introduction	Essay starts with interesting hook, provides general background, and has a good thesis statement having interesting main ideas	Essay starts with good hook, provides general information, and has indirect thesis statement having unclear or not enough main ideas	Essay starts with boring hook and lacks of general information or unclear thesis statement	Essay has no hook and starts with general information or bad thesis statement
Body	Each body paragraph contains a good topic sentence, good supporting ideas and examples placed in logical order, and good concluding sentence	Some body paragraphs contain poor good topic sentences, do not place supporting ideas and examples in logical order, or poor concluding sentence	Some body paragraphs lack of topic sentences, supporting ideas and examples, or concluding sentence	Each body paragraph lacks of topic sentences, supporting ideas, supporting evidence or examples, or concluding sentence
Conclusion	Essay is ended with interesting restatement, summary, prediction, suggestion, or evaluation making the reader want to recommend to others	Essay is ended with good restatement, summary, prediction, suggestion, or evaluation, but the reader has no intention to recommend to others	Essay is ended with boring restatement, summary, prediction, suggestion, or evaluation. It is too short or too long	Essay is ended with poor restatement, summary, prediction, suggestion, or evaluation. The writer gives irrelevant ending ideas. Concluding sentence is too short or too long
Grammar	Writer makes no or very few errors in grammar such as verb tense, fragment, punctuation, parallelism, capitalization, subject-verb agreement, etc.	Writer makes some errors in grammar such as verb tense, fragment, punctuation, parallelism, capitalization, subject-verb agreement, etc.	Writer makes lots of errors in grammar such as verb tense, fragment, punctuation, parallelism, capitalization, subject-verb agreement, etc.	Writer is poor in grammar such as verb tense, fragment, punctuation, parallelism, capitalization, subject-verb agreement, etc.

(continued)

Performance Areas	Excellent	Good	Need Improvement	Unacceptable
Word choices	Writer uses advance-level word choices effectively, makes no or very few errors in spelling, uses words in the right context, and uses literal and metaphor words correctly	Writer uses intermediate-level word choices effectively, makes few errors in spelling, uses words in the right context, and uses literal and metaphor words correctly	Writer uses elementary-level word choices effectively, makes some errors in spelling, uses words in the wrong context, and cannot use literal and metaphor words correctly	Writer uses beginner-level word choices effectively, makes many errors in spelling, uses words in the wrong context, and cannot use literal and metaphor words correctly
Transition uses	Each paragraph is linked smoothly because from one idea to the next, the writer uses correct transition words and subtle transitions to show relationships between ideas	Each paragraph is linked from one idea to the next, but the writer may lack or misuse transition words to show relationships between ideas	Some paragraphs have problems with transitions because transitions may be missing; connections between ideas are fuzzy or illogical	Most paragraphs have problems with transitions because many transitions may be missing; connections between ideas are fuzzy or illogical
Essay format/ structure	The format/ structure is perfectly matched to the essay type standard	Some parts of the essay do not match to the essay type standard	Many parts of the essay do not match to the essay type standard	The whole essay is written in the wrong style

Appendix C: Focus Group Discussion Prompt

- Remind participants about discussion procedures: encourage participants to comment on each other's ideas/responses; to be courteous in their comments/ rebuttals; and to respect differences, confidentiality, and pseudonym issues.
- Allow participants to ask any questions they may have before starting the discussion.

Questions

- What did you enjoy about learning in the academic writing class?
- What major achievements did you obtain in your study this year?
- What did you learn from the e-portfolio sessions in Semester 1? What did you like about the e-portfolio in Semesters 1 and 2?
- Did you have any difficulties on producing e-portfolios in Semester 1?

- What did you learn from Schoology in Semesters 1 and 2?
- Compare your difficulties of using Schoology in Semesters 1 and 2.
- What were your major achievements in the academic writing class in Semester 2?
- What were your challenges in the academic writing class in Semester 2?
- What was the most difficult lesson you encountered – among APA styles, extended essays, and graph interpretation?
- How far did blended learning help you to deal with any challenges you encountered?
- Interactivity on Schoology.
- Autonomy, agency, engagement, motivation, life skills.
- Compare your learning outcomes in Semesters 1 and 2 in the blended learning class.
- Would you like to continue with blended learning in Year 3? Why?
- Do you have any advice for future blended learning classes?

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Chapter 8
Development, Implementation, and Effectiveness of Using an Online Lesson in Visual Arts Education: A Design-Based Study

Cheung On Tam

Abstract This chapter critically reflects on the development, implementation, and evaluation of an online lesson. This online lesson was transformed from a 3-hour session of a course entitled "Aesthetics and Art Criticism" originally delivered in a direct in-person contact mode. The course was for a group of Year Three Bachelor of Education students specializing in visual arts. Blending online lessons with traditional face-to-face teaching has become increasingly common, especially in the higher education context with adult learners. The online lesson consisted of narrated PowerPoint presentations, a quiz, Coursera participation, and construction of a Wiki document. The chapter begins with a discussion of the possibilities, advantages, and examples of online lessons. The second part of the chapter is a description of the methods used to create, conduct, and evaluate an online lesson. A design-based research was the methodology used to develop, experiment, and reflect on the online lessons in three iterations. The last part of the chapter is a presentation and discussion of the findings obtained. Views on the benefits of the online lesson, areas where improvements could be made, and student preferences for the types of activity were collected through an online questionnaire consisting of a survey and open-ended questions. Convenience, flexibility, and autonomy of learning and the reviewability of online lessons were the main advantages recognized by the students. The students also valued the opportunity to learn through public open learning courses and collaboratively construct resources which would be useful in their future teaching. Problems were identified, and ways of improvements in areas including difficulty in downloading, lack of interaction, incomplete participation, and easy distraction were discussed.

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8.1 Introduction

This chapter is a critical reflection on the development, implementation, and evaluation of an online lesson in visual arts education. The chapter begins with a discussion of the possibilities and challenges of blending online lessons with traditional face-to-face teaching, an increasingly common practice in the higher education context. Several advantages of online lessons have been identified: flexibility that transcends learning time and space; independence, autonomy, and ownership of learning; engagement in interactive learning and knowledge construction; and the facilitation of the liberation and dissemination of knowledge. The second part of the chapter is a description of the methods used to create, conduct, and evaluate an online lesson. Issues such as the search for and solicitation of examples of digital learning in visual arts, considerations of the type of content which would be appropriate for delivery in a digital format, the development of online learning activities and tasks, collection of student feedback, and the effectiveness of online lessons are addressed. In addition to providing the theoretical background to online teaching and learning, the above discussion includes an example of the use of museum resources in visual arts education to illustrate the case. This online lesson is one session of a course entitled *Aesthetics and Art Criticism* developed for a group of undergraduate students enrolled on a Bachelor of Education programme. Design-based research, a method of systematically identifying improvements from experiments in learning situations, was the methodology employed to identify the effectiveness, areas to be improved, and student preferences for the activities and tasks of the online lesson. The last part of the chapter is a presentation and discussion of the findings obtained, followed by a reflection and conclusion.

8.2 Background

8.2.1 Why Online Lessons?

Although there are numerous ways in which the latest digital technology can be introduced in teaching and learning, the use of online lessons to replace some of the face-to-face lectures that take place in traditional classroom settings has become increasingly common, particularly with adult learners in higher education (Bullen & Morgan, 2015; Garrison & Kanuka, 2004; Meyer, 2014; Sun & Chen, 2016). There are several advantages of engaging students in an online lesson over a traditional lecture. With an online lesson, students can learn wherever and whenever they like. Online lessons allow *flexibility* that transcends time and space in learning. Because of the self-paced nature of online lessons, students' *independence, autonomy, and ownership of learning* are also fostered. Online lessons usually involve media-oriented learning materials and tasks; students are provided with various opportunities for *interactive learning and knowledge construction*. The convenience of disseminating an online lesson also facilitates the *liberation of knowledge*. Online lessons have the potential to reach a worldwide audience.

In 2016, my university (The Education University of Hong Kong) embarked on a university-wide project entitled *Blended Learning for University Enhancement (BLUE)* to promote digital teaching and learning. The project promoted a "One Course One Online Lesson" initiative and encouraged faculty members to develop high-quality online lessons using the pedagogical features of the Moodle Learning Management System. In general, all courses at my university consist of 39 h of face-to-face teaching (thirteen three-hour sessions) and account for three credit points. With the support of the project, I redesigned one lecture in one of my courses as a 3-hour online lesson, and it became a replacement for the traditional lecture. An online lesson is not simply an unedited video recording of a lecture presentation that is uploaded for student use at an electronic learning platform. At my university, an online lesson must contain all the three activities listed below to engage students (Table 8.1).

8.2.2 Examples of Online Lessons

The first step in the preparation of my online lesson was to look for examples of online learning in the field of visual arts. *Knowledge and Education Exchange Platform* (KEEP: keep.edu.hk) is a Hong Kong University Grant Committee initiative to support "the development of innovative teaching and learning with cutting-edge technology" (retrieved from the KEEP website). It contains rich educational resources that users can easily find, subscribe to, and access. *Massive Open Online Course* (MOOC) is another platform that provides open access to digital courses created by academics and public organizations. I visited the following free online courses related to visual arts found by searching the KEEP:

- Coursera – *Sexing the Canvas: Art and Gender*
- CourseBuilder – *Information Visualization MOOC*

Table 8.1 The three types of activity that constitute an online lesson

Activity	Aim	Example
Resource-based	To provide information and materials for students to learn and understand	PowerPoint presentation Notes Demonstration video
Response-based	To capture student response or feedback for formative and summative assessment purposes	Short quiz Questionnaire Assignment
Collaborative	To allow students to collaborate and construct knowledge	Forum Wiki Google Forms

- FutureLearn – *Commercial Photography: Still and Moving Image*
- edX – *Western and Chinese Art: Masters and Classics*
- ewant – *Postmodern Metropolitan Movies: Taipei*
- XuetangX – *Appreciation and Analysis of European Paintings between 1400 and 1800*

The above courses are open online courses that are developed for public users from all kinds of backgrounds. Each course may consist of five to ten sessions, and participants will need an extended period to complete it. They are very different from the online lesson that I wanted to develop in terms of user background (in my case, targeted), course duration (in my case, short), and user engagement (in my case, compulsory). However, these examples gave me ideas about ways of structuring content, creating self-learning materials, evaluating learning, and collecting feedback on an online lesson. The online lesson that I developed was close to Fox's (2013) definition of a Small Private Online Course (SPOC). The lesson was "an online course that offers a limited number of places and therefore requires some form of formal enrolment" (Kaplan & Haenlein, 2016, p. 444). This was exactly the situation of the students who were taking my course. My online lesson can be classified as "University-Based Online Education" and the participants as "individuals enrolled in universities for the purpose of obtaining degrees and diplomas" (Sun & Chen, 2016, p. 161).

8.3 Methods

8.3.1 Design-Based Research

Design-based research (DBR), a method which "is used to study learning in environments that are designed and systematically changed by the researcher" (Barab, 2014, p. 151), was the methodology used for this study. DBR has been used in a large number of studies in the field of education (Anderson & Shattuck, 2012). The main reason for adopting DBR was its emphasis on translating theories into practice in authentic educational contexts, which is always a challenge in educational research (Shah, Ensminger, & Thier, 2015). The pragmatic nature of DBR was another reason, since it would allow me to employ "an eclectic approach in the design and implementation of research methods by drawing on all research designs … depending on the immediate need within the DBR study" (Shah et al., 2015, p. 159). The final reason for adopting DBR was its characteristic of incorporating progressive refinement. As noted by Pool and Laubscher (2016, p. 42), "design-based research is a long-term approach which contains multiple iterations of design, development and revision." Every reflection and iteration included in an experiment will provide the investigators with more accurate and meaningful results. The above features of DBR meant that it was possible for me to try out the experimental online lessons several times, with a view to improving the ways in which it could be implemented at my university. Specifically, the aims of the study were to:

1. Develop and implement an online lesson for a group of undergraduate students specializing in visual arts education.
2. Examine the effectiveness of the online lesson and improve it over three iterations.
3. Collect and analyze data provided by students on the strengths and weaknesses of the online lessons, their preferred activities and tasks, and areas where improvements could be made.
4. Reflect on the implementation of the lesson and propose recommendations for future practice.

8.3.2 Development and Implementation

8.3.2.1 Considerations of Which Course/Lecture to Implement an Online Lesson

Instead of developing a new course that relied entirely on non-face-to-face learning, I chose one lecture of a course I am currently teaching and transformed that lecture into an online lesson. It was a form of blended learning in the sense that the online lesson would complement the rest of the traditional lectures that made up the course. A reduction of sitting time or face-to-face contact are features of some of the definitions of blended learning (Graham, 2013). Therefore I decided that the newly developed online lesson would replace the face-to-face lecture. Students were freed of 3 h of direct contact time, but they were expected to complete all the online activities and tasks that would take approximately the same amount of time. The following were my considerations regarding which course to choose and which lecture to develop into an online lesson.

Course Content That Is more Theoretical than Practical

I am a visual arts teacher. I teach courses on theories such as aesthetics and art criticism as well as practical studio courses such as ceramics and sculpture. I considered that most of the digital learning activities would be more appropriate for the learning of theoretical knowledge or two-dimensional art. Much of the content of three-dimensional studio courses rely on demonstration and personal coaching. Some examples of online teaching in visual arts can be found, but most of them are in areas such as visual culture (Bajardi, Della Porta, Álvarez-Rodríguez, & Francucci, 2015), digital communication (Buhl & Ejsing-Duun, 2015), drawing (Miiller, Cohen, & Smith, 2013), and arts appreciation (Lai, 2002; Wohlpart, Rademacher, Karakas, Courcier, & Lindsey, 2006), and not in three-dimensional studio arts learning that requires the manipulation of tangible media and materials.

Course Content That Requires Relatively Little Teamwork/Discussion

The major aim of the online lesson was for the students to view all my PowerPoint presentations and to complete the online tasks. Online lessons may involve interactive activities that engage students in teamwork and discussion, but it is difficult to guarantee participation unless they are given marks or grades. Therefore I chose to structure all the activities so that the students could complete them on their own. I did include some collaborative activities in the online lesson, but the collaboration was more in the nature of individual contributions that would result in the construction of collective resources that could then be used by all students.

Course Content That Can Be Simply Evaluated

Ensuring that all the students participate in the lesson and that their learning is properly evaluated are two of the challenges in implementing an online lesson. As my online lesson would replace one face-to-face teaching session, it was important to engage the students in some small-scale assessment activities to make sure they understood the content and to ensure that their understanding could be evaluated by simple measures such as quizzes or asking them to provide reflective accounts or short reports.

8.3.2.2 Description of the Course and the Lecture

Finally, I decided to select one lecture from the *Aesthetics and Art Criticism* course and redesign it as an online lesson. The course was for a group of Year Three Bachelor of Education students specializing in visual arts. The class sizes of the three iterations that took place in 2016, 2017, and 2018 were 44, 27, and 31 respectively. These students would become primary or secondary school teachers on graduation. The aim of the course is to develop students' ability to make informed responses to visual artworks and to articulate the roles of aesthetics and criticism in art learning. By providing them with knowledge of aesthetic and art criticism theories, the course equips students with the concepts and skills that are required to teach the domains of art appreciation and criticism. Among the 13 meetings (3 h each) that make up the whole course, there are ten face-to-face lectures, one museum visit, one group presentation, and one consultation session. The lecture on the functions of art museums and using museum resources was selected to be transformed into an online lesson.

8.3.2.3 Students' Engagement and Activities

The online lesson consisted of three parts and was delivered through the Moodle platform. Each part began with a narrated PowerPoint presentation and was followed with activities designed to consolidate and evaluate the students' learning. Students were required to view and listen to the PowerPoint and participate in the follow-up activities that included answering a quiz, writing a journal, and constructing a Wiki. All six parts (three presentations and three tasks) of the online lesson were structured as prerequisites for the next part, and therefore the students needed to follow the sequence exactly. The first online lesson was implemented in the 2015–2016 academic year. After the students had completed the online lesson, they filled in a questionnaire consisting of 15 questions to provide feedback on the effectiveness of the lesson, the major benefits, and areas where improvements could be made. After the first round of implementation, I revised the presentation and activities of the lesson. The lesson was implemented for the second and third rounds in the 2016–2017 and 2017–2018 academic years, respectively. The presentation content, follow-up activities, and revisions made are displayed in Table 8.2. Major revisions included changing the format and content of the PowerPoint presentations, introducing Coursera participation, and providing clearer and more detailed guidelines regarding how to complete the activities.

Table 8.2 Content, activity, and major revision of the online lesson

Part	PowerPoint presentation	Activities/evaluation	Major revision made
1	Typography of museums Different orientations of the function of art museums Philosophy of art museum education	Quiz – 5 multiple choice questions	More photos in the PowerPoint
2	Two functions of art museum education Planning of museum visit – pre and post-visit activities	Short reflective essay – reflect on a meaningful museum learning experience in not less than 100 words	Enroll on a Coursera course, attend the Week 2 section and complete a quiz
3	Planning of museum activities Observation and questioning techniques in museums	Wiki – locate one online educational resource of an art museum website. Write an introduction and comment on its usefulness in around 100 words. Students are able to view each other's entries, facilitating the construction of a shared list of resources	More detailed instruction on how students completed the Wiki activity

8.3.2.4 Changes in the Second and Third Iterations

In response to the students' comments, more images and videos relevant to the theme (the use of museums in teaching art appreciation and criticism) were included in the first PowerPoint. For example, images of different museum settings, artworks as illustrations of museum philosophies, videos of virtual visits, and examples of online museum resources were added.

The second activity – writing a short reflective essay on a learning experience in an art museum – did not receive positive feedback from the students. I decided to replace the activity with participation in a Coursera course in the second iteration. During the search for examples of online lessons, I found a Coursera course entitled *Art & Inquiry: Museum Teaching Strategies For Your Classroom*. The course has been created by the New York Museum of Modern Art. It contains numerous examples of ways to engage people in learning in the museum setting, and it is highly relevant to my course content. I therefore asked the students to enroll on the course and experience participation in open course learning. Specifically, students were required to watch the Week 2 videos and complete a quiz on the content of the videos.

Additional feedback collected from the students indicated that they would like to engage in interactive activities such as forums or discussion boards. Therefore, a discussion forum was set up so that the students could share memorable or difficult experiences in art museums. They were encouraged to upload photographs of museums that they had visited recently and provide a caption or write a few lines about it. Participation in the forum was voluntary, however.

8.3.3 Data Collection and Analysis

An online questionnaire consisting of a survey and open-ended questions was administered to all those students who had enrolled on the course. The students were asked to complete the questionnaire within 1 week after the online lesson. The response rate was high, with more than 93% of the students responding in each round. As their completion of all the three tasks of the online lesson was the requirement for them to be marked present for the lesson, in general the students had a high motivation to complete the tasks as well as the questionnaire. Descriptive statistics were generated from the survey, and a thematic analysis was conducted of the responses to the open-ended questions.

8.4 Findings and Discussion

Student feedback was collected on the content, implementation, and usefulness of the online lesson through the Feedback function in Moodle. In the form of an online questionnaire, Feedback questions 1 to 10 were multiple-choice questions on the effectiveness and implementation of the online lesson. Questions 11 to 15 were open-ended questions designed to collect the students' views on the benefits of the online lesson, areas where improvements could be made, and their preferences for the types of activity included in the lesson.

8.4.1 *Perceived Effectiveness*

Eighty-eight percent of the students agreed or strongly agreed that the content and activities of the online lesson were useful. Around 70% said they would like to have one or two online lessons in the course. The students enjoyed the flexibility and convenience in time and space of having an online lesson. They also liked the opportunity to revisit the PowerPoint if they wished. A summary of the results obtained from questions 1 to 10 is presented in Table 8.3.

8.4.2 *Perceived Benefits*

From the results of the evaluation and feedback from the students, it is clear that the online lesson had brought them benefits in learning. Convenience, flexibility, and autonomy of learning and the reviewability of online lessons were the main advantages recognized by the students. They were able to determine the time, place, and pace of their own learning. They also found the new learning format exciting, and it motivated them to engage in the online activities.

8.4.2.1 Flexibility of Time and Space to Learn

Among the qualitative comments collected from the questionnaire, a flexible learning time and space were the items most commonly mentioned by the students. They valued the opportunity to learn beyond the fixed timetable and the campus boundary. For example, one student mentioned that "you can spend as much time as you like [on the online lesson] and [do it] whenever you want, and this makes me concentrate on the content." Another student mentioned, "I can complete the tasks when I am free." Our university is situated in a rather remote area of Hong Kong, and it can take some students more than 90 min to travel to the campus. University campus accommodation is usually available only to year one students and to those students who participate actively in hall activities. These students therefore highly appreciated being able to learn in a comfortable space and at a time convenient to them. A reduction in the time spent and in the cost of traveling was another reason, as reflected in responses such as "no need to come back to the campus and it saves time," "can learn anywhere," and "can do it at home."

Table 8.3 Results of online questionnaire

	Year of implementation	2016	2017	2018	*Mean*
	Number of students enrolled on the course	44	27	31	*34*
	Number of respondents **Response rate**	42 96%	25 93%	29 94%	*32* *94%*
	Number of questions	15	15	15	*15*
1.	**Have you completed all the activities of the online lesson?**				
	Yes	100%	100%	97%	*99%*
	No	0%	0	3%	*1%*
2.	**In general, I found the content and activities of the online lesson useful.**				
	Strongly agree	21%	24%	23%	*23%*
	Agree	74%	60%	62%	*65%*
	Neutral	5%	12%	10%	*9%*
	Disagree	0%	0%	4%	*1%*
	Strongly disagree	0%	4%	1%	*2%*
3.	**Which part of the content did you find most useful?**				
	PowerPoint presentation 1	52%	56%	38%	*49%*
	PowerPoint presentation 2	29%	32%	24%	*28%*
	PowerPoint presentation 3	19%	12%	38%	*23%*
4.	**Which activities did you find most useful?**				
	Quiz	60%	40%	28%	/[a]
	Journal (2016)/Coursera (2017 and 2018)	14%	52%	55%	/[a]
	Wiki	26%	8%	17%	/[a]
5.	**How much time (in total) did you spend completing the online lesson?**				
	Less than half an hour	5%	0%	0%	*2%*
	Half an hour to less than 1 h	12%	4%	7%	*8%*
	1 h to less than 2 h	43%	12%	41%	*32%*
	2 h to less than 3 h	30%	32%	38%	*33%*
	3 h to less than 4 h	10%	20%	10%	*13%*
	More than 4 h	0%	32%	4%	*12%*
6.	**Did you complete all the activities at one time or work on them on a few different occasions?**				
	1 time	14%	4%	35%	*18%*
	2 to 3 times	52%	64%	41%	*52%*
	4 to 5 times	24%	24%	24%	*24%*
	6 to 7 times	10%	8%	0%	*6%*
	More than 7 times	0%	0%	0%	*0%*
7.	**The instructions for the online lesson are clear and easy to follow.**				
	Strongly agree	22%	24%	35%	*27%*
	Agree	57%	52%	41%	*50%*
	Neutral	19%	20%	24%	*21%*
	Disagree	2%	4%	0%	*2%*
	Strongly disagree	0%	0%	0%	*0%*

(continued)

Table 8.3 (continued)

	Year of implementation	2016	2017	2018	*Mean*
8.	**Which devices did you use to view and complete the online lesson?**				
	Desktop computer at the University	12%	12%	14%	*12%*
	Personal notebook at the University	24%	32%	17%	*24%*
	Desktop computer at home	32%	20%	28%	*32%*
	Personal notebook at home	49%	60%	59%	*49%*
	Tablet (e.g., iPad)	2%	4%	0%	*2%*
	Mobile phone	6%	16%	4%	*6%*
9.	**Would you like to have more online lessons in the future?**				
	No.	10%	16%	21%	*16%*
	Yes, 1 online lesson in this course would be good.	38%	36%	45%	*40%*
	Yes, 2 online lessons in this course would be good.	38%	28%	28%	*31%*
	Yes, 3 online lessons in this course would be good.	10%	4%	4%	*6%*
	Yes, 4 online lessons in this course would be good.	2%	0%	0%	*1%*
	Yes, 5 online lessons in this course would be good.	2%	12%	4%	*6%*
10.	**If more online lessons were to be developed in addition to lecture 9, which of the following lectures do you think could be transformed into online lesson(s)?**				
	1. Course introduction	22%	20%	4%	*16%*
	2. Paradigms of aesthetics	12%	16%	21%	*16%*
	3. Western aesthetics: imitation, formalism, expression	17%	20%	21%	*19%*
	4. Western aesthetics: social production, text	10%	20%	25%	*17%*
	5. Chinese aesthetics: Confucianism, Taoism	32%	28%	25%	*28%*
	6. Art criticism models: Feldman, Broudy	15%	16%	43%	*23%*
	7. Child aesthetic development	29%	28%	18%	*25%*
	8. Integration of art criticism and making	22%	28%	25%	*24%*
	10. Use of community resources to teach art criticism	37%	68%	50%	*48%*

[a]Participation in Coursera replaced the writing of a Journal in 2017 and 2018 as the follow-up activity to the second PowerPoint presentation. An average is therefore not given since it would not be meaningful to add up the results for activities that are different in nature

8.4.2.2 Reviewability

The online lesson was designed to replace one traditional face-to-face lecture. The students were given a period of 2 weeks to view the presentations and complete the three tasks. Only if they completed all the tasks and the Feedback questionnaire would they be marked as present for the lesson. The availability of the presentations over an extended period of time allowed the students to review them as many times and for as long as they liked. One student specifically stated that "we cannot assimilate all the new knowledge in a short period of time and will miss some of the important information in a traditional lecture. An online lesson lets us review the content again and again. It helps me remember more about what I've learned. Less information will be missed." The "review" function also allowed better retention of knowledge: the students stated that the online lesson was "convenient and memorable" and that it helped them "to memorize and recall the knowledge better."

8.4.2.3 Autonomy and Independence in Learning

Learner autonomy was not only recognized in the space, time, and frequency of the learning but also in the pace of learning. Students could control how much time they spent on a particular learning task and how quickly they did it; for example, one student mentioned that "I can learn and work at my own pace." The online lesson also encouraged them to search for information and encouraged them to engage in independent learning. Some students thought it was "easy to follow the content and explore additional content" that interested them. They could pause whenever they found particular parts interesting and surf the Internet for further information. One related benefit was the students' improved digital competence, since they had more opportunities to work with online resources. The students experienced the process of exploration and thus had a sense of acting on their own. The "pause" function of the online lesson gave them the opportunity to think, to ponder, and to reflect. It was apparent that the online lesson fostered independent and self-motivated learning.

8.4.2.4 Novel and Interesting

Students who engaged in the online lesson were motivated, and they enjoyed doing it. Some students mentioned, for example, "I can learn by myself and can search for information immediately. It makes a lesson more fun," "It makes learning more interesting, improves students' engagement," and "Have fun and easy learning."

8.4.3 Students' Preference for Presentations and Activities

In the questionnaire, students were asked to state their preferences and provide reasons for their preferences for the different components of the online lesson. The students' comments on the presentations and tasks were also a good reference for me to use when planning the revised version in the next round iteration. Among all the follow-up activities of the online lesson, the one the students valued most was the opportunity to learn through public open learning courses and collaboratively construct resources which would be useful in their future teaching.

8.4.3.1 PowerPoint Presentation

The students found the PowerPoint presentations informative, clear, and convenient to read or watch. One student said they were comparable to face-to-face lectures: "The PowerPoint runs with sound tracks. It is the first time I've used it and it's just like having a lesson in the classroom." Another reason for the students' preference for PowerPoint presentations was that they "can note things down easily while listening to the recording" and when they "missed some points, [they] can replay it and make a note." However, quite a number of students mentioned that the files were very big and it took a long time to download them.

8.4.3.2 Quiz

Among the three activities or tasks, the quiz was the most preferred one in the first iteration; it was replaced in popularity by participation in Coursera in the second and third iterations. There were five questions in the quiz, focusing mainly on four different philosophies of art museum education. The students indicated that the quiz helped them to check whether they had really understood the course content. Other students stated that the quiz summed up the key points of what they had learned and that it served as a form of revision.

8.4.3.3 Participation in MOOC

Participation in the Coursera course entitled *Art & Inquiry: Museum Teaching Strategies For Your Classroom* was introduced in the second iteration. This course is about inquiry-based teaching methods developed for teachers and students in art galleries. There are four modules in the course, and the students were asked to focus on the second module, entitled "Close-Looking and Open-Ended Inquiry". Various ways of helping learners to look at artworks and of engaging them in inquiry-based conversation around artworks are introduced. There are three videos to watch and the course ends with a quiz as an evaluation of learning. I specifically chose this module as a part of the online lesson because it is highly relevant to the content of the lesson.

The students preferred Coursera participation to other tasks because it was interesting, useful, and informative. They pointed out that many authentic examples and materials were provided by the professional and practical tutors on the MOMA course. Some students mentioned that they had not heard of or enrolled on open learning courses before and it was a completely new learning experience. One student noted that "it is like an interaction with a foreign art school" or like "taking a course in another country."

8.4.3.4 Wiki

Wiki is a function of the Moodle that allows participants to collaborate in authorship. To complete the Wiki task, students were required to visit an art museum website and write an introduction and evaluation of the online teaching and learning resources available. They then collaborated in creating a document that included a contribution by each of them. By the end of the activity, all the students had a list of art museum online resources that they could use in their future teaching. The students liked Wiki because it gave them the opportunity to search for information by themselves. Through examining the websites of art museums and looking into their online teaching resources, they collected resources which "[would] be very useful when [they] are teaching students [themselves]." They also benefited from the list of museum resources they themselves had constructed because they could "learn from the contributions of others."

8.4.4 Perceived Problems and Areas Where Improvements Could Be Made

In response to the difficulties and problems identified by the students in the evaluation questionnaire, a number of improvements had been made in the different iterations, including reducing the file size of uploaded materials, creating a discussion forum, improving the connections between presentations and tasks, and providing clear instructions on how to complete the follow-up tasks.

8.4.4.1 Difficulty in Downloading

The PowerPoint presentations in the first iteration were created using the PPT function of voice recording. This had made the PPT exceptional large in terms of file size. It took the students a long time to download them, and they could not download them using smartphones or tablets. Therefore, many students suggested exporting the PPT as a video which would create a file much smaller in size and be quicker to download. This was done in the second iteration.

8.4.4.2 Add Interactive Forum

Some students suggested that a forum could be set up to allow them to discuss and ask questions on the topic. According to my previous experience, if participation in a forum discussion is voluntary and not connected to getting marks or a prerequisite for engaging in other activities, very few students will give feedback in the forum. Indeed, the first principle of the successful implementation of online discussion boards suggested by Comer and Lenaghan (2012) is that they should count toward course grades. Since there were already three tasks that students needed to complete, I decided not to add an extra task and make the workload too heavy. However, a discussion forum on museum experience was created in the second iteration, and participation was voluntary.

8.4.4.3 Incomplete Participation

Students needed to open and download the PowerPoint before they could go on to the next activity or task. This was made as a prerequisite. It was observed that some students did not watch the whole PPT but only opened it. One student reported that "the major problem is that some students can ignore the PowerPoint. They just click to download the PowerPoint and jump to the next task. I know some of my classmates have done that." Therefore, some students suggested adding a command in the playing time so that students would have to play the whole PPT before they could start on the next task. There were problems with this idea, however. First, it was not technically possible to do it within the Moodle system. Second, even if it could have been done, it would still have been difficult to make sure that the students really watched the whole PPT. As an alternative way of solving the problem, therefore, I tried to make the PPT as informative and interesting as possible. Another remedial action I took was to make the tasks after each PPT as relevant as possible. For example, the answers to the quiz could be found at different intervals of the PPT, thereby encouraging the students to watch the whole of it.

8.4.4.4 Technical Problems

The students experienced some technical problems, especially in the first and second iterations. For example, some students noted that the Moodle system could not check whether they had completed a part, and therefore they could not proceed to the next. As Wiki is a collaborative document that only allows one person to work on it at any one time, some students mentioned that they needed to wait a long time for other students to finish using it. Another problem was that some students accidentally deleted all or some of the previous entries made by others. This had happened twice in the first and once in the second iteration. In the third iteration, I provided an example for the students, and I inserted a number before the example. The students followed and inserted the next number sequentially before their own entry. In this way, the students were aware of which number they were working on and the problem was resolved.

8.4.4.5 Lack of Interaction

Another major drawback of online lessons identified by the students was that they could not ask the teacher any questions and get an immediate response. The students could not have discussions and interactions among themselves. Although real-time discussion and feedback sessions could be arranged in an online lesson, this would counteract the advantage of being able to have the lesson at any time and at any place. Even if a Discussion or Forum is created, the student participation rate will be low if it is not a part of the assessment. Nevertheless, in the forthcoming implementation, I will create a Q&A Forum for the students if they have any questions to raise or share. The forum will not solve the problem of a lack of immediate response, but it will address some common questions raised by students.

8.4.4.6 Easily Distracted

On the one hand, an online lesson promotes autonomy and independence of learning. On the other hand, the success of an online lesson rests partly on students' self-discipline. One student rightly pointed out that "the major problem of having an online lesson is that students have to be responsible for themselves. They need to have good self-control and time management when going through the presentations and complete the tasks without getting distracted by other websites on the computer." A few other students concurred with this observation and said "students may easily be distracted by other websites." Students' commitment to self-regulated learning should be considered when planning online learning. This is consistent with the findings of a study conducted by Alter (2014, p. 58) on a group of BEd visual arts students who responded that they had "to be very self disciplined when it came to completing work."

8.5 Reflection and Conclusion

8.5.1 Recommendation Regarding the Number of Online Lessons

On average across the three iterations, 71% of the students indicated that they would like to have one to two online lessons, while only 13% of students would consider having three or more online lessons. In the context of a 39-hour course in my university, therefore, I would recommend having 3–6 h of online lessons that would replace face-to-face contact hours. I would also make reference to the results of Feedback question 10 regarding which lecture would go best online if I decided to create another online lesson. We can introduce as many online learning activities in a traditional classroom lecture as we find appropriate. However, if the online lesson is going to replace a complete lecture, we have to consider whether there is a government requirement regarding the percentage of face-to-face contact hours in a recognized degree programme.

8.5.2 Consideration of Context in Planning

After reflecting on the entire planning and implementation process, I would suggest that the teaching and learning context is the most important factor to consider for the success of the project. For instance:

- What is the nature of the content of the online lesson, and how will it impact on the design of the online learning activities?
- Will the online lesson be a replacement of or a supplement to face-to-face lectures? If yes, what will be the proportion?
- What measures should be taken to ensure student participation of the online lesson?
- How should students' performance in the online lesson be evaluated?
- How can we collect evidence of learning and evaluate student performance?
- How can we collect feedback from students?
- What possible technical difficulties will students have in completing the online learning activities and tasks?

Most of the above questions are pedagogical questions rooted in an online learning context. Developing an effective online lesson is the same as developing a face-to-face lesson in that it requires consideration of the prior knowledge, experience and ability of students, their interests and motivation, class size and student composition, the physical learning environment, the nature of the disciplinary knowledge to be obtained, the objective and goals of that particular lesson, etc. However, in addition to this very long list, a good understanding of the strengths, possibilities, and limitations of the medium of delivery – the unique characteristics of teaching and learning online – is required. It is not the online nature or properties of an online lesson that make it effective but rather the thoughtful pedagogical decisions that make the meaningful use of the online technology. As Alter (2014, p. 62) aptly points out, "[i]mprovements to education through the use of new technologies might be largely to do with teacher's rethinking of their teaching, rather than the technologies themselves."

8.5.3 Reconsidering the Use of Discussion Forums

Based on my previous experience of engaging students in discussion forums, I have been skeptical about the effectiveness and interactive nature of these forums that have been suggested by quite a number of researchers (e.g., Comer & Lenaghan, 2012; Garrison & Kanuka, 2004; Lai, 2002; Miiller et al., 2013). The major argument in these studies is that written comments, which are the usual form of communication in online learning, allow students to reflect, and therefore the comments will be more precise and thoughtful compared with face-to-face discussion. However, my experience was that not only the student participation rate but also the quality of their comments was low, particularly when their participation was not graded. In the first iteration of the study referred to here, no interactive forum was created. However, in response to the feedback collected from students, a discussion forum was added in the second and third iterations. Students were asked to share their recent experiences of visiting an art gallery or a museum. They were encouraged to upload photos and write two to three lines explaining what they had visited. The students' responses were good, especially after I shared photos of art museums that I had visited during the summer vacation. Some students talked about the most impressive artwork they had come across and some mentioned the rather alienating experience of visiting contemporary art exhibitions. Giving examples and apprising the students of the teacher's expectations are important, as this can kick-start the conversation among students.

8.5.4 Cost-Effectiveness in Terms of Time and Human Resources

Inevitably, more time is needed to develop an online lesson than to conduct a traditional face-to-face lesson. From trying to learn about new technologies that can be used on the course to overcoming various technical difficulties, and from designing e-learning activities to establishing new channels of communication that can accommodate the online learning context, the teacher needs to spend a great deal of time and effort on making the changes. This is one of the reasons why some faculty members are reluctant to do so. Incentives, professional development opportunities, and support from the university (Lim & Wang, 2016) are indispensable at this stage. The trial and error nature of design-based research makes it one of the best ways to create an online lesson that suits the specific context of a higher education institution. The testing, reflecting, and enhancing cycle of design-based research ensures that both the researcher (the teacher) and the participants (the students) will benefit. Investment in time and human resources in the development of an online lesson is worthwhile only if faculty members have the vision and are properly rewarded.

8.5.5 Support for Students

Most of the technical problems experienced by the students were partly owing to the limitations of the learning platform and partly because they were not used to using technology to learn. As noted by Lim and Wang (2016), we cannot assume that students are good users of technology in learning even though they use technology widely for entertainment and communication. "Students require technical support and educational guidance to use technological tools strategically for their learning" (Lim & Wang, 2016, p. 12). However, I would expect that technical problems will become less prominent as technology advances and with the increasingly popular use of blended learning at my university.

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Chapter 9
Multilayered Ecological Structure of Blended Learning in Science and Engineering Education in Korea

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Abstract This chapter examines how blended learning has been implemented and impacted access to quality higher education. Historically, blended learning in Korea has taken varying degrees and configurations with the increasing adoption of online learning as an important means to enhance access to higher education and lifelong learning opportunities. In this chapter, blended learning is viewed as a complex system with multi-actors and multilayers spanning from policy initiatives (macro) to implementation practices (micro). To illustrate the multilayered structure of blended learning in the disciplines of science and engineering education in the Korean context, we selected cases that represent vertical and horizontal moves of blended learning in three groups: (a) university-level blended learning programs such as cyber universities and brick-and-mortar universities specialized in the science and engineering fields, (b) cluster-level initiatives where a cluster of universities specialized in science and technology collaborates to provide blended learning courses to both students and the general public, and (c) nationwide programs of blended learning (e.g., K-MOOC, KIRD). Overall, this chapter shows that the Korean universities have undergone the transformative process to restructure and redesign their curricula to meet the social needs and changes through educational innovations to train creative talents in the workforce of science and technology. With the descriptions of blended learning at each scale, this chapter contributes to advance our knowledge concerning how a whole nation can move toward the adoption of blended learning to educate the science and technology workforce with the multilayered ecological structure.

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9.1 Introduction

Over the past decade, with the development of emerging technologies, blended learning has received much attention in science and engineering education at higher education institutions (HEIs) (Karabulut-Ilgu, Jaramillo Cherrez, & Jahren, 2018). Many HEIs around the world are offering online courses on the topics of science and engineering or are in the process of redesigning their curricula with the integration of online learning components. By definition, blended learning is a hybrid form of learning that attempts to deliver "the best of both worlds" (Christensen, Horn, & Staker, 2013, p. 3), integrating the advantages of traditional classroom-based face-to-face learning and the benefits of online learning components to help students achieve their desired learning goals in flexible ways. Blended learning has evolved into a student-centered teaching paradigm in science and engineering education, supported by a variety of pedagogical approaches, including collaborative learning, problem- or project-based learning, case-based learning, and the use of immersive scenarios and virtual laboratories (National Research Council, 2012).

Despite increasing interests toward blended learning, many studies reported in the existing literature have mainly focused on the implementation at a course level initiated by the interested individual faculty. Thus, little is known about macro-level implementations such as how HEI policies and nationwide initiatives about blended learning are implemented (Graham, Woodfield, & Harrison, 2013). Further, science and engineering are the disciplinary areas that students tend to face challenges in learning fundamental concepts and understanding domain-specific representations (e.g., graphs, models), which often lead students to develop incorrect understanding and misconceptions that are difficult to change at a later stage (National Research Council, 2012; Singer & Smith, 2013). How blended learning can function to tackle or minimize such learning difficulties in science and engineering education is less understood and needs future investigations.

With this backdrop, this chapter examines how blended learning has been implemented in the disciplinary learning of science and engineering in the higher education context in Korea. Historically, blended learning in Korea has taken varying degrees and configurations with the increasing adoption of online learning as an important means to enhance access to higher education and lifelong learning opportunities. We illustrate blended learning in the disciplines of science and engineering education with selected cases that represent the multilayered structure of blended learning from the university level to the nationwide initiatives. Then, based on the analysis and synthesis of the cases, we attempt to provide insights about how blended learning at different scales addresses the instructional problems and issues that science and engineering education in HEIs have been facing with. This chapter concludes with some future research directions that may impact the successful implementation and adoption of blended learning in the science and engineering education disciplines.

9.2 Literature Review

9.2.1 Blended Learning: Concepts and Features

While face-to-face education has been the most dominant mode of teaching and learning in higher education, traditional brick-and-mortar universities are increasingly reducing the amount of seat time with online courses. Different modes and modalities of learning have been implemented under the idea of flexible learning that provides students with more options and control over how and where they learn. Blended learning is not a completely new nor a simple concept. Many different definitions and conceptualization of blended learning exist in the literature. Graham et al. (2013) contend that while many HEIs have a clear definition of traditional courses versus online courses, what lies between the two extremes is not clearly categorized. Similarly, Christensen et al. (2013) pointed out the fuzziness of the existing definitions and attempt to provide a clear definition that highlights core features of blended learning as "a formal education program in which a student learns at least in part through online delivery of content and instruction with some elements of student control over time, place, path, and/or pace and at least in part at a supervised brick-and-mortar location away from home" (p. 3).

Further, different configurations in terms of design elements, technologies, and methods make blended learning more complex and diverse. Blended learning can be broadly classified into four types, depending on what components are blended (Mantyla, 2001; Osguthorpe & Graham, 2003): (1) blending between different learning modes (e.g., online, offline, field-based learning); (2) blending learning styles (e.g., individual learning, group learning, self-directed learning, and tutoring); (3) blending pedagogical approaches (e.g., behaviorism, cognitivism, and constructivism) and learning methods (e.g., lectures, case studies, discussions, coaching, and mentoring); and (4) blending learning places (e.g., on-site training and offline classes).

Several studies have demonstrated that blended learning is a more preferable option than fully online learning. For instance, Chandler, Park, Levin, and Morse (2013) conducted a research study on perceptions about blended learning with 6000 participants and found that online learning combined with face-to-face activities showed better performance and satisfaction than fully online learning. Similarly, Allen and Seaman (2011) presented a report on the US online education based on the responses from more than 2500 colleges and universities. Overall, the participants perceived negatively about fully online courses but indicated that blended learning could have positive impacts on learning outcomes.

Blended learning has many advantages over single mode-dependent learning (e.g., face-to-face learning, fully online learning). First, blended learning is a pedagogical approach that combines the benefits of face-to-face learning and online learning, enabling diverse learning modes, activities, and interaction types (Graham, 2006). Second, blended learning is a learning method that meets the needs of learners since it attempts to increase learners' satisfaction by providing flexible learning opportunities with learners' control over time, pace, path, and place for learning (Aspden & Helm, 2004; Osguthorpe & Graham, 2003). Third, in blended learning, cost and time can be efficiently reduced by combining various methods such as e-learning, classroom instruction, case studies, textbooks, and multimedia-based instruction, depending on learning content and context (Singh, 2003).

While blended learning has been used mainly as a term for learning that combines face-to-face learning and online learning, recently, the term has been expanded to include various learning methods and strategies. For instance, recognizing the fast adoption of flipped learning, Thai, Wever, and Valcke (2017) attempt to compare and differentiate traditional learning, e-learning, blended learning, and flipped classroom. As shown in Table 9.1, both blended learning and flipped classroom are grouped under "blended learning conditions" since they include both online and face-to-face learning components. The key difference between the two is reversing the order of online and face-to-face settings in presenting lectures and guiding questions and the way of providing feedback. In this framework, blended learning is viewed as an approach to provide lectures in a face-to-face mode and guiding questions and feedback in an online mode. On the contrary, flipped classroom delivers lectures in an online mode and guiding questions in a face-to-face classroom to help student understanding about knowledge acquired from pre-class lecture videos.

9.2.2 Blended Learning Systems: Multilayered Structure

Following the definition of blended learning by Christensen et al. (2013) and the framework by Thai et al. (2017), discussed in the preceding section, blended learning in this chapter is defined as *learning experiences in which a student learns at least in part through online delivery of content and instruction and at least in part at a supervised brick-and-mortar location, including flipped classroom or flipped learning*. In addition, this chapter takes a learning ecology view to define blended learning as ecology with multi-actors and multi-interactions spanning from implementation practices (micro) to policy initiatives (macro). Some scholars have emphasized the complex ecological nature of blended learning. For instance, Martin (2012) states that modern universities are a large ecosystem where students participate in diverse activities on campus besides taking courses. Garrison and Kanuka (2004) argue that "blended learning is both simple and complex" (p. 96). As a simple form, blended learning is a combination of online learning and face-to-face

Table 9.1 Comparison of the main characteristics of various learning approaches (Thai et al., 2017)

			Blended learning conditions	
	Traditional learning	E-learning	Blended learning	Flipped classroom
Lecture	F2F	Online	F2F	Online
Guiding questions	F2F	Online	Online	F2F
Feedback	F2F, immediate	Online, delayed	Online, delayed	F2F, immediate

learning components. Different configurations and degrees of online and face-to-face learning, however, make the design of blended learning complex. On a similar note, Graham (2006) suggests that blended learning systems can take different forms depending on the focus and goal of why to blend. His classification includes three types of blended learning: (a) enabling blend that focuses on the issue of access and convenience, (b) enhancing blend that focuses on the incremental changes in the pedagogy, and (c) transforming blend that focuses on a radical transformation of the pedagogy.

A learning ecological view enables us to examine multiple levels and scales of blended learning systems and the interweaved nature of multiple factors involved in the adoption and diffusion of blended learning. For instance, blended learning can happen at varying levels: activity level, course level, program level, and institutional level (Graham, 2006). However, one of the lacking areas in blended learning research is to examine institutional- or organizational-level blends beyond a course-level implementation. The analysis of research trends in blended learning (Drysdale, Graham, Spring, & Halverson, 2013) reveals that only 10% of the research examined program-level and institution-wide blending and attributes the lack of such research to the extensive planning and coordination among multiple stakeholders. Emphasizing a need for more research on macro-level issues such as institutional-level blending, policy issues, and adoption process, Drysdale et al. (2013) contend that "if there continues to be a disconnect between the top-down policy and the bottom-up culture, then blended learning growth will struggle" (p. 98).

While the volume is still small, some researchers have examined issues associated with institutional-level blended learning. For instance, Moskal, Dziuban, and Hartman (2013) present a case study of the blended learning initiative at the University of Florida to illustrate the optimal balance between micro (course) and macro (institutional strategy) requirements. Similarly, Taylor and Newton (2013) present a case study about how blended learning at Southern Cross University in Australia impacted institutional changes. A recently published book on "Blended learning for quality higher education" (Lim & Wang, 2016) also presents a collection of case studies on blended learning initiatives in various higher education institutions in the Asia-Pacific region. Collectively, these studies highlight the criticality of the shared vision about blended learning and the alignment with institutional, faculty, and student needs. This point is consistent with the blended learning adoption framework at an institutional level proposed by Graham et al. (2013), which includes strategy, structure, and support as key components.

The lens of innovation adoption and diffusion is also useful to better understand and unpack the complex nature of blended learning. From the lens of disruptive innovation theory, Christensen et al. (2013) argue that there are two types of innovation: sustaining innovation and disruptive innovation. They state that blended learning is a form of hybrid innovation that has both sustaining and disruptive features, depending on the model of blended learning. They classify four types of blended learning, namely, (a) rotation model, (b) flex model, (c) a La Carte model, and (d) the enriched virtual model. Christensen et al. (2013) argue that simply rotating learning sequences or modalities as seen in the rotation model is a sustaining innovation relative to the traditional classroom. In contrast, the flex model, the a La Carte model, the enriched virtual model, and the individual rotation model have the potential to be disruptive innovations relative to the traditional classroom. These models tend to serve pockets of unmet demands of nontraditional customers (learners) and do not necessarily aim to sustain traditional learning experiences at a brick-and-mortar school in its full form. While the framework by Christensen et al. (2013) is based on K–12 education, it is relevant to discuss and predict the emergence of innovative forms of blended learning in higher education.

9.2.3 Blended Learning in Science and Engineering Education

9.2.3.1 Learning and Instructional Issues

Engineering is considered to be one of the most difficult disciplines to learn in higher education (Rahman & Al-Amin, 2015). Learning difficulties faced by engineering students include (a) lack of mathematical knowledge, (b) inadequate understanding due to theory-oriented lectures, (c) demands on ill-structured problem solving and collaborative learning, and (d) a shift toward interdisciplinary and integrated learning.

First, it has been reported that undergraduate courses in engineering are challenging because of the level of mathematical knowledge (Alam, Tang, & Tu, 2004). Fairly high levels of conceptual understanding are needed to apply mathematical knowledge, involving the use of a large number of variables with relatively complex equations. For this reason, engineering students tend to experience the lack of background knowledge in mathematics necessary to understand many concepts involved in fluid mechanics, resulting in frequent failures in the early stages of learning (Rahman & Al-Amin, 2015). Second, inadequate understandings of specific knowledge lead to the difficulty in practical applications since engineering education curricula in universities are primarily structured around the understanding of theories and principles related to actual applications (Davies, Dean, & Ball, 2013). Theory-oriented lectures mainly focusing on understanding high-level concepts and theories tend to be sequentially structured so students who do not fully understand the concept discussed in a previous lecture have difficulties to follow in subsequent sessions if no supplementary tutoring sessions are provided. Third, since emerging technologies are created on the basis of collaborative teamwork, the curriculum of engineering colleges has been increasingly demanding group activities that are complicated and ill-defined. It is important to support complex teamwork and problem-solving processes effectively (Salas, Cooke, & Rosen, 2008). Fourth, due to the expansion of the engineering field, engineering education has changed to require interdisciplinary system-based activities. This means that engineers need nontechnical knowledge and skills in addition to technical knowledge and skills within their areas, requiring the paradigm change from major-centered education to convergent integrated approaches (Hastings, 2015). Despite the paradigm change, it has been challenging to allocate enough time for engineering students to engage interdisciplinary and convergent learning activities in practices (Warter-Perez & Dong, 2012).

9.2.3.2 New Teaching and Learning Methods

To address the abovementioned instructional and learning issues, a wide range of teaching and learning methods have been applied in science and engineering education. Four notable approaches in the changing pedagogy include (a) student-centered learning (e.g., collaborative learning, problem-based or project-based learning, and field-based learning), (b) blended learning, (c) flipped learning, and (d) MOOCs.

First, Armstrong (2012) stressed that a traditional instructor-centered pedagogy has been shifted toward a learner-centered pedagogy, which is effective for developing competencies in engineering education. Baldock and Chanson (2006) presented an approach combining problem-based learning and project-based learning in the field of modeling and found that this approach led to better student performance than traditional lectures. Chanson (2004) highlighted the importance of field-based learning and found that university students taking a hydraulics course in Australia were highly positive about the combination of lectures and fieldwork, which also led to better learning outcomes. The redesign of the engineering curriculum can happen at a university level. For instance, Olin College of Engineering in the USA implemented design-oriented education in the Senior Capstone Program in Engineering (SCOPE). The redesigned curriculum required 20–60% of learning experiences in each semester to be design oriented to help students develop problem-solving abilities and participate in a project with industry partners.

Second, the efficiency and value of blended learning have been emphasized in science and engineering education, requiring the integration of various concepts and knowledge with theories (Warter-Perez & Dong, 2012). Oerther (2017) applied blended learning in the engineering class with 450 students and reported that blended learning showed the possibility of reducing costs but maintaining student satisfaction because it meets learners' needs through the dual mode of learning (i.e., online and offline). In Korea, Hong (2017) applied blended learning in a basic mathematic class at an engineering college and found that self-efficacy, self-regulated learning, and learning persistence in blended learning courses were higher than traditional classroom courses. In particular, a huge disparity in self-regulated learning was observed between blended learning and traditional courses. Blended learning environments supported the learners to repeat their learning according to the understanding level with the continuous support from instructors. Overall, several studies support that using various forms of blended learning can provide learners with richer learning experiences and a higher level of participation in science and engineering education than single-mode learning (Smyth, Houghton, Cooney, & Casey, 2012).

Third, there have been increasing interests toward flipped learning in science and engineering education. As discussed earlier, flipped learning is a type of blended learning conditions in which learners acquire content knowledge before class through video lectures and supplementary materials provided by an instructor, and then in class, they expand knowledge by participating in various activities, such as discussion and collaborative work (Bergmann & Sams, 2012; Thai et al., 2017). While blended learning focuses on self-directed learning through the combination of online and offline learning components, flipped learning focuses on learner-centered, activity-based instruction (Bang & Lee, 2014), and students have the opportunity to participate more actively in problem-solving, discussion, and debate activities (Bishop & Verleger, 2013). Several studies have reported the positive efficacy of flipped learning in science and engineering courses. Roach (2014) reported that pre-learning through online lectures could lead to high levels of student participation and understanding in a classroom. The provision of immediate feedback during learning engagement in class was perceived to be more effective than the feedback mechanism in fully online learning (Gilboy, Heinerichs, & Pazzaglia, 2015). In Korea, Kang (2015) conducted a study where flipped learning was used for 136 engineering students over 2 years and found that a flipped learning model was appropriate for experiment-oriented lessons in engineering. With the flipped learning approach, the time duration for conducting experiments was dramatically reduced, while student understanding about theories was improved. Similarly, Kim and Ahn (2016) reported a case study about flipped learning for engineering students in the "System Modeling and Control" course required in the mechanical engineering department. They found that the flipped learning approach was effective for enhancing the level of students' academic performance.

Lastly, MOOCs have brought several changes to science and engineering education. In particular, blended MOOCs (also called b-MOOCs) have emerged as a new teaching method that reuses and repurposes MOOCs' rich resources in traditional face-to-face instruction. There are two types of blending MOOCs in traditional courses: (a) prior learning that uses MOOCs before enrolling in a program and (b) supplementing or replacing segments with MOOCs content (Bralić & Divjak, 2018). Currently, the latter type of blended MOOCs is more frequently used in the higher education context. Recognizing the increasing trend of reusing MOOC resources in higher education, Pérez-Sanagustín, Hilliger, Alario-Hoyos, Kloos, and Rayyan (2017) propose a framework that describes various forms of hybrid MOOC-based initiatives on a continuum with two factors: (a) institutional support to reuse existing MOOCs and (b) curricula content alignment between the MOOCs and the course hybridized. Griffiths, Mulhern, Spies, and Chingos (2015) conducted a large-scale study that examined the use of MOOCs in 14 campus-based courses at the University System of Maryland. Their study revealed six benefits of repurposing MOOCs in hybrid courses: replacing lectures, augmenting or replacing secondary materials, filling gaps in expertise, exposing students to other types of teaching and learning discussion, reinforcing key skills such as critical thinking, and teaching students how to learn online. On the other hand, implementation challenges perceived by faculty members include content fit, intellectual property, technology integration, and faculty experience.

Blended MOOCs have been used to teach various topics in science and engineering education, such as physics pre-courses (Raffaghelli et al., 2018), systems programming (Alario-Hoyos, Estévez-Ayres, Kloos, & Villena-Román, 2017), discrete mathematics with graph theory (Bralić & Divjak, 2018), machine learning (Bruff, Fisher, McEwen, & Smith, 2013), system engineering (Shafaat, Marbouti, & Rodgers, 2014), and electronics and circuits (Ghadiri, Qayoumi, Junn, & Hsu, 2014). For instance, Bruff et al. (2013) reported a study about the graduate course at Vanderbilt University that integrated the MOOC on Machine Learning by Stanford University. While overall reactions from students and instructors were positive, they suggest that the content cohesion and coupling online and in-class components were challenging issues and the need for more complex forms of blended learning such as using course materials from multiple MOOCs.

9.3 Multilayered Structure of Blended Learning in Korea

In this section, we illustrate the multilayered structure of blended learning in the disciplines of science and engineering education in the Korean higher education context. To do so, we adopt the notion of innovation becoming trajectory (Hung, Toh, Jamaludin, & So, 2017) that explains innovation diffusion processes from the interaction of vertical and horizontal moves. Here, lateral moves mean the heterarchical movements or interactions among grassroots entities on the ground such as individual faculty members, policymakers, and industry players, whereas the vertical move refers to the hierarchical movements or interactions with entities.

When blended learning is viewed as an innovation, this framework allows us to understand the complex interaction at different scales and among multiple actors. In the context of blended learning, vertical moves refer to the different scales of blended learning that include individual course-level, university-level, cluster-level, and system-level implementations. On the other hand, lateral moves refer to various actors and stakeholders that include individual faculty, administrators, policymakers, and industry and community players. Based on this framework, we present cases that represent vertical and horizontal moves of blended learning from the university-level programs to the nationwide initiatives. Figure 9.1 depicts three groups of selected cases on the mapping of lateral and vertical moves:

- *Group A*: university-level blended learning programs such as cyber universities and brick-and-mortar universities specialized in the science and engineering fields
- *Group B*: cluster-level initiatives where a cluster of universities specialized in science and technology collaborates to provide blended learning courses to both students and the general public
- *Group C*: nationwide programs of blended learning, illustrated with the cases of Korean-Massive Open Online Course (K-MOOC) and Korea Institute of Human Resources Development in Science & Technology (KIRD)

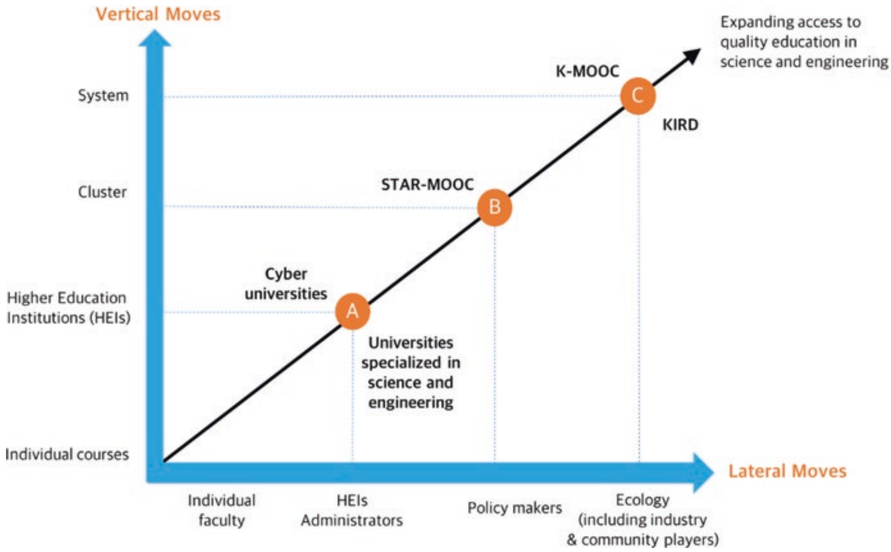

Fig. 9.1 Lateral and vertical moves in the multilayered structure of blended learning in Korea. (Adapted from Hung et al., 2017)

In the subsequent section, we describe how each program or initiative has been implemented to enhance access to quality higher education in the science and engineering fields.

9.3.1 Group A: University-Level Blended Learning

9.3.1.1 Cyber University

In South Korea, distance education institutions at a higher education level include Korea National Open University (KNOU), 21 cyber universities, and other lifelong learning institutions. While KNOU uses broadcasting and communication media (e.g., television) as the main means of delivery, cyber university is a unique distance learning system in Korea that uses the Internet to provide online teaching and learning environments and administrative service (Joo, Joo, & Kim, 2016). Initiated under the Lifelong Education Act in 2001 as academic credit approval institutions, cyber universities have contributed to expanding learning opportunities to higher education for adult learners. Since the Higher Education Act in 2009, 21 cyber universities have been established and are currently in operation. The number of cyber universities in Korea has continuously increased despite the decrease in the school-age population and the high competition with other educational institutions such as traditional brick-and-mortar universities, lifelong learning institutions, and academic credit bank systems. Cyber universities in Korea are playing an imperative role in meeting the demands for higher education degrees, especially for nontraditional learners such as adult workers, people with disabilities, and adult learners who passed the school age.

Table 9.2 shows the range of academic departments offered by cyber universities. As the table indicates, most academic departments are oriented toward humanities and social sciences disciplines. Cyber universities offer 31 academic departments in the engineering field and only six departments in natural sciences. This may be due to the limitation of online education in operating academic departments in science and engineering that need relatively higher levels of field-based and lab-based learning experiences.

Currently, cyber universities are in a transition to a "blended learning campus" to overcome the limitation of online education, coupled with the recognition of a need for converging online and offline learning. Students can attend 10–30% of their coursework in a face-to-face mode at regional learning centers, use on-campus libraries and lab facilities, and join informal learning activities for social interaction. Under blended learning initiatives, some cyber universities operate courses that allow students to transfer credits across different campuses. As an example, Hanyang Cyber University, which is the largest cyber university in Korea, has actively set up comprehensive engineering departments based on their expertise from the School of Engineering at Hanyang University. The range of engineering departments at Hanyang Cyber University includes electrical and electronic engineering, machine/automotive engineering, and digital architectural urban engineering. Hanyang Cyber University has attempted to build a blended learning campus through the alliance between offline and online colleges. Students can exchange academic credits with Hanyang University, take offline courses, and use various facilities like libraries on campus. Recently, Hanyang Cyber University has redesigned the curricula in engineering departments with the integration of emerging technologies such as virtual reality, augmented reality, and drones. Technology-integrated curricula are expected to help students better develop abilities to solve problems in various practical situations and also to improve field-based learning experiences that are provided two to three times per month.

Table 9.2 The present status of academic departments at cyber universities in Korea

	Humanities	Social sciences	Education	Engineering	Natural sciences	Public health and welfare	Art, music, and physical education	Total
No	72	176	15	31	6	9	40	349
%	19.0	46.4	4.0	8.2	1.6	2.4	10.6	100

Source: KERIS (2018)

9.3.1.2 Brick-and-Mortar Universities Specializing in Science and Technology

At a university level, blended learning has increased with the utilization of Open Education Resources (OER) in connection with the existing offline classes (Choi & Kim, 2015; Leem, 2016; Park, 2017). In Korea, five higher education institutions (i.e., KAIST, GIST, DGIST, UNIST, and POSTECH) have been established specifically to educate students in the disciplines of science and engineering. In this section, we present the exemplary cases of flipped learning implemented at UNIST and KAIST.

UNIST e-Education

Ulsan National Institute of Science and Technology (UNIST) has introduced flipped learning as part of the educational innovation project "e-Education" since its foundation in 2009. UNIST has strived to promote creative and innovative pedagogical approaches (e.g., 100% English courses, problem-solving, and discussion-oriented methods). UNIST is the first university in Korea that adopted flipped learning as a campus-wide pedagogy. The number of flipped learning courses has increased dramatically from 20 courses in 2009 to about 120 courses in 2018, which is about 25% of total courses offered at UNIST. Learning space design is also an important factor affecting the success of flipped learning. UNIST has established the technology-integrated space called "Learning Commons" in 2018 for open debate and project-based learning activities. The space is equipped with cloud computing where over 100 students can interact at the same time.

To support flipped learning, the e-Education initiative provides instructors with the consulting service in instructional design and training on various software programs for creating online learning content and materials. Instructors produce own online courses or utilize videos from other online learning platforms such as edX, Coursera, and YouTube. Figure 9.2 shows the typical structure of flipped learning courses at UNIST. In flipped learning courses, students participate in pre-class learning to learn concepts and theories in advance via the relevant materials and

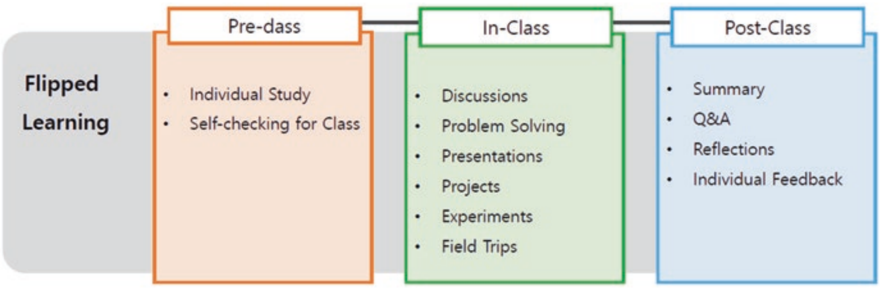

Fig. 9.2 Flipped learning in UNIST e-Education. (Source: http://ctl.unist.ac.kr)

lecture videos and then engage in in-depth group discussions of topics in an offline class held once a week. After the class, the learning progress of each student is examined through reflections and individual feedback. Kim (2018) reported the impact of and student satisfaction with flipped learning in the Energy and Chemical Engineering course at UNIST. The benefits perceived by the students include personal involvement in learning, enhanced understanding of related subjects, convenience in time and place, better content understanding, and increased interactions.

KAIST Education 4.0

Korea Advanced Institute of Science and Technology (KAIST) has successfully operated flipped learning, starting with the "Education 3.0" initiative in 2012 that aimed to connect online and offline learning experiences. This transition to flipped learning was driven by the recognition that the existing methods of teaching and learning did not adequately meet the demand of the industry sector. For the implementation of flipped learning, KAIST developed a video-based course management system to facilitate interactions between instructors and students and wallboards for sharing ideas in class. Started with three courses in 2012, flipped learning has been expanded to about 150 courses in 2018, and the plan is to convert 50% of courses to a flipped learning model by 2031.

In addition, KAIST has promoted the sharing of science and technology knowledge to the general public through own MOOC platform called KOOC (KAIST Open Online Course).[1] KOOC offers courses in a micro-learning format (within 15 min) to support self-directed learning. Both the general public and KAIST students use KOOC to take courses on the various topics in science and engineering fields. In flipped learning with KOOC, instructors design online classes and offline activities through the consultation with the Center for Innovation in Teaching and Learning. The service helps instructors decide on interaction methods suitable for the characteristics of the subject matter and students (e.g., class topics, lab experiments, and group tasks). At the online pre-learning stage, students are engaged in self-directed learning on the KOOC platform to learn about theoretical concepts and to take quizzes. In the offline class, students participate in the review of key concepts, practices, and hands-on lab activities, scaffolded by instructors.

[1] https://kooc.kaist.ac.kr/

9.3.2 Group B: Cluster-Level Blended Learning

9.3.2.1 STAR-MOOC

Specific to the science and engineering education, the Korean government has initiated the "Science & Technology Advanced Research-MOOC (STAR-MOOC)".[2] STAR-MOOC (see Fig. 9.3) is the online learning service that integrates online extension course services operated by brick-and-mortar universities specializing in science and technology to provide those courses to the public. STAR-MOOC was launched by the collaboration among the Ministry of Science and ICT, five universities specializing in scientific technology (KAIST, GIST, DGIST, UNIST, and POSTECH), and the University of Science and Technology (UST) to utilize their K-MOOCs in the field of science and technology.

In STAR-MOOCs, instructors can use MOOC resources to supplement their courses, whereas students can take courses beyond their institutions. Since STAR-MOOC is at an early stage of the implementation, the range of course topics available in the platform is still limited. Hence, STAR-MOOC plans to increase the service quality such as (a) to increase the number of online courses to more than 100 by 2021 and (b) to develop courses on diverse emerging topics such as artificial intelligence, big data, and renewable energy, responding to the demands of the fourth industrial revolution. While the development of a domain-specific MOOC is laudable, the efficacy of STAR-MOOC remains to be seen.

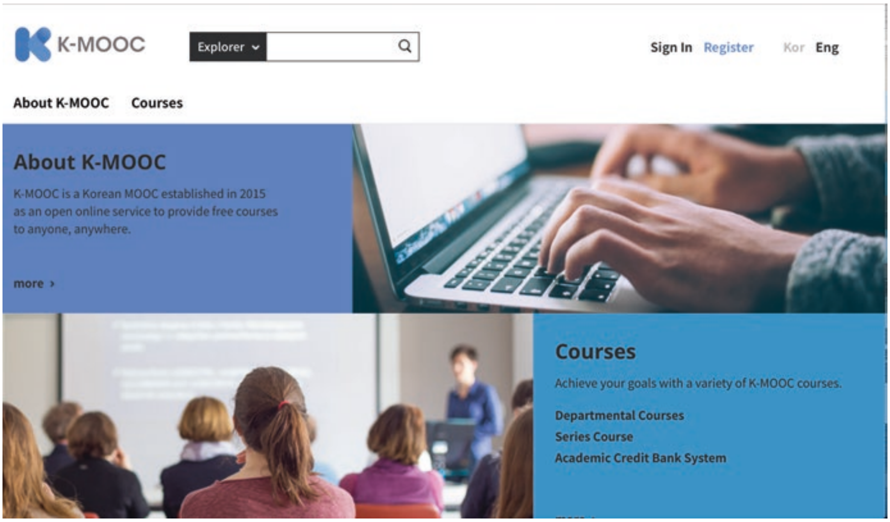

Fig. 9.3 STAR-MOOC

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[2] https://www.starmooc.kr/

9.3.3 *Group C: System-Level Blended Learning*

9.3.3.1 K-MOOC

Following the global trend, the Korean government has initiated the nationwide OER movement with the Korean-Massive Open Online Course (K-MOOC) (Kim, 2015). K-MOOC (see Fig. 9.4) was established in 2015 to contribute to the national human resources development. Consistent with the underlying philosophy of MOOC, K-MOOC aims to promote the culture of "openness and sharing" in learning. Leading universities participated in the government-funded projects to develop K-MOOC courses. As of 2018, 403 courses are offered in K-MOOC. The number of engineering courses is 78 (19%), including fluid mechanics, dynamics, electronic circuits, service robots, big data, artificial intelligence and machine learning, and computer architecture. A "bundled lecture," which is to bundle four to five courses on related topics into one single lecture, is a new initiative in K-MOOC. As of 2018, 25 "bundled lectures" in the five main fields of the fourth industrial revolution (i.e., big data, AI, IoT, blockchain, and cloud computing) have been developed. Table 9.3 shows the status of K-MOOC and STAR-MOOC as examples of the nationwide level implementation.

Blended learning with K-MOOC is active in brick-and-mortar universities that have participated in the development of K-MOOC content. These institutions acknowledge academic credits from their K-MOOC courses. Generally, students engage in online learning through the K-MOOC platform, and the components of face-to-face interaction include attending a course orientation, taking midterm/final

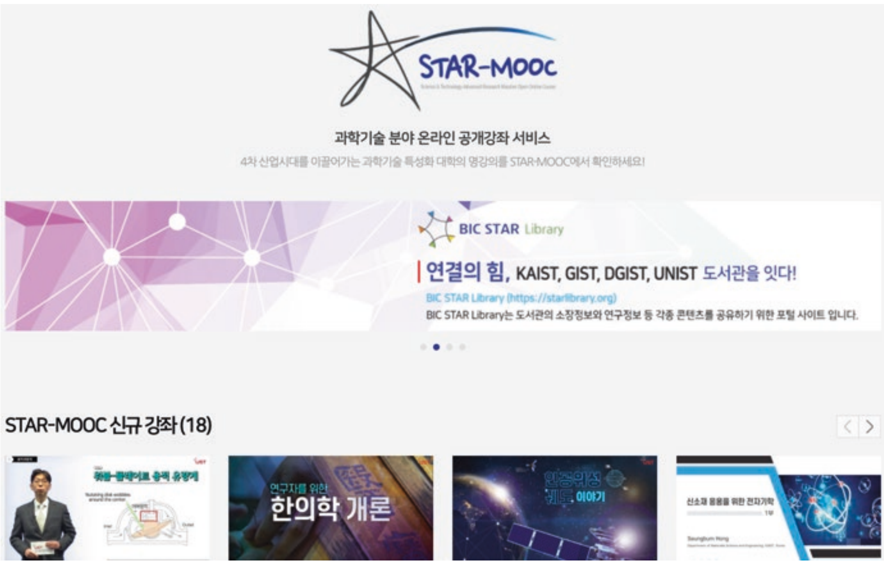

Fig. 9.4 K-MOOC

Table 9.3 Status of K-MOOC and STAR-MOOC in 2018

	K-MOOC	STAR-MOOC
Website	http://www.kmooc.kr	http://www.starmooc.kr
Purpose	To establish the Korean model of MOOCs	To provide science and technology courses to the public free of charge through the integration of the MOOC service by five universities specializing in scientific technology
Year launched	Oct. 2015	Mar. 2018
Ownership	Ministry of Education National Institute for Lifelong Education (NILE)	Ministry of Science and ICT
Disciplinary areas	All areas	Science and technology
Number of courses	403 Engineering courses: 78 (19%) (as of September 2018)	26 (as of September 2018)
Platform	Open edX	Edwith (nonprofit foundation: https://www.edwith.org)
Delivery mode	PC and mobile	PC and mobile

exams in a lecture room, and participating in special workshops or lectures by field experts. Another noteworthy initiative at the national level is the introduction of the Korean Nano-Degree utilizing K-MOOC courses. As a response to the drastic job changes in the fourth industrial revolution, the Ministry of Education (2017) has announced the introduction of the Korean Nano-Degree program that aims to meet the demands in the field of information and communication technologies (e.g., VR/AR, Internet of things, cloud technology and artificial intelligence, transportation, and energy environment technology). The program will adopt blended learning with K-MOOCs and offline training for field-based practices. In February 2018, the Ministry of Education started the pilot operation of the Korean Nano-Degree in AI with a partnership with the Korean Telecom (KT).

9.3.3.2 Government Agency: KIRD

The Korean government has recognized the importance of growing the science and engineering workforce to secure national competitiveness. Korea Institute of Human Resources Development in Science & Technology (KIRD) is a representative institution specifically established to serve the purpose of educating the workforce in the science and engineering fields. Founded in 2007, KIRD has provided customized learning programs reflecting national policies and demands of the various groups of people working in the science and technology fields, including graduate students, researchers, and industry people.

Table 9.4 KIRD blended learning system

Face-to-face learning	Job training	Education for improving the job competency of the R&D personnel in science and technology fields	Common competency
			Researchers
			Research managers
			Policymakers
	Customized education	Education tailored to support national policy initiatives	Customized education program
			Outreach program
			Policymaking
			Small-medium business
Online learning	R&D competency	R&D essentials, promoting research competency throughout the research life cycles	
	Leadership competency	Strengthening leadership skills and self-management	
	Empathy competency	Enhancing the competency for social empathy required as a researcher	

Source: http://www.kird.re.kr/

KIRD operates a blended learning system through the provision of face-to-face courses and e-learning platforms. As depicted in Table 9.4, the KIRD blended learning system encompasses an offline learning mechanism with 150 courses to address core job competencies in each field and to deliver information and knowledge related to major national policies and initiatives. The online learning mechanism provides courses in the areas of research and development (R&D) competency, leadership competency, and empathy competency in the field of science and technology. Currently, the KIRD e-learning platform offers 111 courses based on the "Scientist Development Framework (SDF)," which is an integrated competency-based learning model. As of 2017, 22,661 people completed KIRD offline courses. The reach of online learning is larger and more comprehensive that 158,750 people have taken online learning courses from KIRD. The number of online learners is high because some courses such as the laboratory safety and research ethics are mandatory for all graduate students and researchers working in the science and technology fields to complete online and to get a certificate.

In 2017, KIRD announced a plan for "designing a synchronous online education platform" that supports blended learning and flipped learning. Accordingly, KIRD will implement an interactive blended learning model with three educational scenarios: (1) blended learning courses by experts in the field, (2) synchronous blended learning, and (3) convergent learning community of practices. Courses will be divided into "standard learning type" and "deep learning type" according to the knowledge levels and needs of individual learners.

9.4 Discussion

In this chapter, we attempted to unpack the blended learning system in Korea at different scales with lateral and vertical moves. This chapter presents how HEIs in Korea have adopted blended learning to address several instructional issues and challenges in science and engineering education, such as students' lack of fundamental knowledge (e.g., mathematics), theory-oriented lectures, demand on collaborative learning, and a shift toward integrated learning approaches. Overall, flipped learning is the most notable trend in blended learning adopted in many HEIs in Korea. As seen in the case of UNIST and KAIST, universities have been integrating blended learning to move away from lecture-oriented teaching to understanding-oriented learning. One of the reasons for the fast adoption of flipped learning as a university pedagogy lies in the potential for developing students' high-level cognitive competence (Hwang, Lai, & Wang, 2015). Flipped learning is particularly relevant to science and engineering education where students tend to face difficulties with conceptual understanding. By moving a traditional lecture from a classroom to an online platform, instructors can secure more in-class time to help students deepen conceptual understanding and allocate time for practical lab sessions.

In addition, the MOOC movement was another notable trend to help students and instructors to access rich and diverse resources in the discipline of science and engineering. Students and the general public can take quality online courses on various topics in the science and engineering field and even receive academic credits and certificates for accreditation. This chapter introduced three MOOC initiatives at different scales: KOOC at a university level, STAR-MOOC at a cluster level, and K-MOOC at a system level. The MOOC movement at different scales indicates that while brick-and-mortar universities with residential education are still the main mode of higher education, these universities have begun to seriously consider the integration of online learning pedagogy to on-campus courses. In particular, the MOOC movement is advantageous to science and engineering students for their pre-learning or supplementary learning and for having access to diverse courses across multiple institutions. However, the form of blended learning with MOOCs is mainly at a course level by interested faculty members, and student activities in face-to-face instruction remain in the form of orientation, exams, and workshops. As pointed by some scholars, simply using MOOCs in traditionally taught courses is unlikely to be successful (Bruff et al., 2013; Pérez-Sanagustín et al., 2017). It is imperative to consider how to achieve the cohesion between MOOC content and offline materials for optimal blended learning experiences.

With the descriptions of blended learning at each scale, this chapter contributes to advance our knowledge of blended learning concerning how a whole nation can move toward the adoption of blended learning to educate the science and technology workforce within the multilayered ecological structure. Overall, the Korean experience demonstrates the critical interaction of vertical and lateral moves, enabling the diffusion of innovative approaches of blended learning from the individual-course level to the nationwide implementation. This chapter also shows that the multilayered structure is advantageous to expand and enhance access to quality courses in science and engineering education, impacting not only undergraduate and graduate students in universities but also nontraditional learners such as adult learners attending part-time and working full-time.

The Korean experience provides some learned lessons about macro-level blended learning initiatives to nations on a similar trajectory. First, a multilayered approach is important to plan for the longer-term development of blended learning ecology. In particular, nationwide platforms and programs that provide quality online learning content are essential to promote the diffusion of blended learning. One of the unique structures of blended learning in Korea is the implementation of nationwide programs, some of which are mandatory for students and R&D employees in the science and technology field. With the global demand for the science and technology workforce, other nations may consider the establishment of such central government agencies and programs (e.g., KIRD) for the systematic human resource development to ensure that students are well trained and competitive for the new jobs created with the expansion of the science and technology fields.

Second, the goal of blended learning should be clearly articulated. That is, "if blended learning is the answer, what is the goal to be achieved?" Blended learning can be used to promote the change of learning culture as well as the enhanced access to higher education. Applying the types of blended learning by Graham (2006), blended learning in Korean HEIs can be described as both enabling blend and enhancing blend. Cyber universities and government organizations such as KIRD use blended learning to enable access to and convenience of learning of the wide population of nontraditional learners. On the contrary, traditional brick-and-mortar universities employ blended learning to change their pedagogical approaches. Other institutions and nations that plan for blended learning should articulate the focus of blending, from the issue of access and convenience to the transformation of pedagogy, and then subsequently plan for enabling conditions and strategies.

Third, adequate support and resources should be in place to help instructors accept and implement blended learning. More than a decade, Garrison and Kanuka (2004) argued that blended learning has the potential to support deep and meaningful learning. The transformative potential, however, is realized only when there is a shift to rethink and redesign learning environments. It is predicted that more universities will adopt blended learning to redesign their traditional courses. During the transitory period, some instructors may be resistant to this idea of moving toward a more flexible learning structure. The Korean cases show that the successful transition to blended learning at the university-level implementation was facilitated by the administrative and financial support such as teaching assistants, financial support for course development, space (classroom redesign), and the provision of specialized teaching-learning support for instructional design and production of course content. Sharing successful cases of blended learning can be another consideration to help instructors adopt approaches toward more flexible alternatives to traditional teaching and learning.

In conclusion, this chapter shows that the Korean universities have undergone the transformative process to restructure and redesign their curricula to meet the social needs and changes through educational innovations to train creative talents in the workforce of science and technology. Several initiatives for national-level lifelong learning also demonstrate the possibility to expand learning opportunities to a wider range of learners interested in the field of science and engineering. While whether their blended learning initiatives can bring a radical transformation of the pedagogy remains to be seen, we believe that this chapter can provide useful knowledge to countries taking a similar trajectory of blended learning to support science and engineering education.

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Chapter 10
Teaching Computational Thinking: Designing Students' Learning Experience Through Blended Learning in Higher Education Engineering Courses in HKU

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Abstract This chapter will anchor the discussion on designing a blended learning environment in The University of Hong Kong through the lens of instructional design support offered by the Technology-Enriched Learning Initiative. This case study focuses on three pioneering Engineering courses from three various projects, which adopted blended learning in their course delivery, and we will unpack how the design of the courses facilitates computational thinking skills. We will look at the entanglement of different layers of intricacies involved using an instructional design model called ADDIE. In particular, we will zoom into the design and implementation phases of the Engineering courses. These courses include a Common Core course *Everyday Computing and the Internet (CCST 9003)*, an elective engineering course *Advanced Programming and Application Development (ELEC 3542)*, and a general engineering course *Calculus and Ordinary Differential Equations (MATH 1851)*. These courses are offered to different types of learners, from novice to advanced engineering students. Finally, we will offer recommendations on: (1) how to develop quality blended learning courses; and (2) how to design both online and face-to-face courses that facilitate computational thinking using a four-element framework identified in the literature.

10.1 Introduction

Computational thinking (CT), or "algorithmic thinking" (Denning, 2009), is reformulating a real-world problem using abstraction and decomposition to come up with a solution (Wing, 2006). In another perspective, scholars argued that CT is a mental process of coming up with an algorithm design rather than programing a computer (Lu & Fletcher, 2009; Lye & Koh, 2014; Wing, 2006). CT as a skill has

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become increasingly relevant in the educational field and workplace (Mohtadi, Kim, & Schlosser, 2013). This push to consider CT as a skill has been established a few years back when Wing mentioned that CT is a "fundamental skill used by everyone in the world by the middle of the 21st Century" (Wing, 2006). In a similar thought, Denning supported her idea by further arguing that "computation had become the third leg of science, joining the traditional legs of theory and experiment" (Denning, 2009, p. 29).

In the education field, Settle et al. (2012) reported how educators used Denning's "Principles of computing" in eliciting CT skill in the field of history, graphic arts, and literature. In their study, they pointed out the key procedures in various non-STEM courses and matched them with relevant CT sub-skills. For example, "identifying intuition" for literature is equivalent to abstraction, "classification and recall" for history corresponds to recollection, while "product design and development" requires abstraction. These courses use various online applications such as TagCrown for text tagging and SketchUp for 3D design to help students visualize their work. This study pointed out that CT as a skill exists even in non-STEM courses and careful learning design is essential to elicit it. In another research done by Kazimoglu, Kiernan, Bacon, and MacKinnon (2011), they created a set of guidelines in developing game-based learning design such as scaffolding strategies, conceptual integrity, and collaboration to develop students' CT skills. These same guidelines are embedded in Garrison and Vaughan's (2007) principles of designing a blended learning experience.

Indeed, CT finds its way in education. However, scholars argued that teaching CT as a concept in higher education is still scattered and its application is loosely based on the interest of the practitioner or the instructor (Czerkawski & Lyman, 2015). In particular, there is no streamlined or formal integration of CT in technology and engineering education (Hacker, 2017). These arguments that CT as a "third leg of science", as "fundamental skills" like arithmetic or writing, or its relevance to both K12 and higher education, makes CT as an important issue that should be looked into by educators across all levels.

In The University of Hong Kong's (HKU) teaching and learning landscape, its Senate, in 2011, recommended an institutional review to keep its e-learning strategy up to date and to adapt to the rapid changes in higher education. Following this recommendation in 2011, the Senate released its strategy for 2015. These policies led to the formation of a central unit called Technology-Enriched Learning Initiative (TELI). Within 4 years, TELI was able to launch 11 Massive Open Online Courses (MOOCs) reaching 33,000 learners across 183 countries, blended eight Small Private Online Course (SPOCs) across five Faculties, and produced more than a hundred learning videos. On top of these, the team has also initiated knowledge exchange, research, app development, and other technology-enriched teaching and learning artifacts.

In this chapter, we will look into three Engineering courses that were supported by TELI, and we will look at how blended learning was maximized to ensure that quality education, particularly the development of CT skills, was made available for all types of students. In Sect. 10.2, we will probe into the existing literature regarding the essential elements of computational thinking as described by Bartholomew, Zhang, and Weitlauf (2018) and we will map it out with the specific skills related to each element. Section 10.3 will dive into the three cases by borrowing the well-received concept from the instructional design field - the ADDIE model (Hew & Cheung, 2014). Each case will start with a background (Analyze) that will provide us with the setting and the considerations made that led to the use of blended learning. Then, the design of the course (Design and Develop) will show how the instructional designers and the course team developed the course. The implementation (Implement) will provide the challenges and quick wins that were experienced by the course team. Finally, in Sect. 10.4, we will look at the evaluation (Evaluate) of the course by examining the data collected from surveys and interviews; and the recommendations that the authors would like to share for the readers of this chapter.

10.2 Teaching Computational Thinking in an Engineering Course

In the current setting, the instructors of Engineering courses are usually professional engineers or trained engineers who are experts in their field while the teaching assistants are research-postgraduate students who are currently enrolled in the engineering department. Consequently, the course team, both the instructors and teaching assistants, are experts in their subject matter but may lack some theoretical knowledge and practical skills in teaching, particularly in the instructional design process. In a similar study, Grossman (1992) cited that these instructors will most likely deliver the course based on how their teachers taught them during their studies. As for the case of an engineering instructor, it is most likely that they will not receive any course or training that will prepare them for the teaching profession. This thinking relates to Cochran-Smith and Lytle's (1999) idea on teacher training, where they mentioned that knowledge-for-practice refers to the foundational or formal knowledge of the teacher. In this case, the instructors' knowledge-for-practice will be coming from their undergraduate and postgraduate training which focuses on the fundamental know-how needed for the engineering profession. Therefore, it is likely that the mode of teaching for these instructors are didactic or leaning towards the traditional lecture format. However, Cochran-Smith and Lytle (1999) also mentioned that the instructors could obtain knowledge-in-practice when they get their experience from their teaching assistant work during their post-graduate program and as they go through their on-the-job experience. Further, we can assume that the instructors will pick-up the skills as they go through the process of constant evaluation and self-reflection in their teaching.

However, in the recent decades where scholars are emphasizing the importance of student-centered learning, from the pedagogical shift from teacher-centered to student-centered (Holdsworth & Hegarty, 2016) to the positive effects of student-centered pedagogy (Hake, 1998; Kogan & Laursen, 2014), there is a need for the instructors to revisit their methodologies in delivering their lessons. In addition, students in today's classroom known as the digital natives (Prensky, 2001) or Gen C (Hardey, 2011) are growing up in a fast-paced digital world where the opportunities for them to think critically, be active in their learning, and to take ownership of their work are available right at their fingertips. This students' frame of mind raises the bar of expectations inside the classroom to be more student-centered and personalized.

As for the three cases, moving from a lecture-based type of delivery and creating meaningful student-centered activities has been a pressing concern for these instructors. For this reason, these instructors used a blended learning approach to deliver their course content to make room for engaging activities for the students. In this paper, we will use the four elements of computational thinking as identified by Google (as cited in Bartholomew et al., 2018) and we will map out (see Table 10.1) with the current literature the specific skills that address these elements.

10.2.1 Breaking a Problem into Parts or Steps

The first element of CT is to learn how to break the problem into smaller pieces. Wing (2006) labeled this as decomposition or the process of tackling a massively complex problem. The critical idea at this level is for the students to learn how to look at the problem from different angles and be able to deconstruct the problem into a manageable task. For example, in Biology, scientists classify a particular animal under a taxonomy using its distinct characteristic. This classification is through breaking down its distinct parts and matching it with the existing taxonomy. In a similar study, Hacker (2017) looked at the various implementation CT in K12 curriculum, and he considered this element as one of the focuses of the curriculum in Australia, China, Israel, Singapore, South Korea, UK, and the US. The literature also tells us that this process requires analyzing each part of the problem (Asunda, 2018; Weintrop et al., 2016; Wing, 2006) and being able to see it in a systematic way (Sung, 2019; Wing, 2006).

Table 10.1 Computational thinking element with its corresponding skills

Element of computational thinking			
Break a problem into parts or steps	Recognize and find patterns or trends	Identifying process	Generalizing patterns
Analyzing problems and artifacts Systems thinking	Using abstractions and models Creating computational artifacts Modeling Data practices Modeling Abstractions	Evaluate and apply Data practices	Analyzing (the effects of) computation Design Data practices Develop algorithms Generating solutions

10.2.2 Recognizing and Finding Patterns or Trends

Recognizing patterns or trends shares some similarities in terms of the skills, like analyzing artifacts, needed with the first element. However, this element focuses primarily on the ability of the student to transpose the breakdown problem into an abstract concept or the process of abstraction (Denning, 2009; Wing, 2006). In another perspective, Hacker (2017) defined this as the ability to understand and apply the fundamental concept to represent it logically. However, abstraction is just one part of the pattern recognition; for example, in a mathematics word problem, we represent the real object with a variable to enable us to represent it in a formula. This process of representing the real object into a formula is called creating computational artifacts (Snyder, Barnes, Garcia, Paul, & Simon, 2012) or modeling (Rossouw, Hacker, & de Vries, 2011). The process of abstracting the problem and creating a model to represent it is the essence of CT (Basawapatna, 2016).

10.2.3 Identifying Process

This element describes the actual execution of the problem. For example, in a diet program, typically we will set our target or goal weight. Moreover, by examining our movement and eating habits (breaking the problem), we will be able to pinpoint a pattern (recognizing pattern) where we will try to implement our chosen diet program (identifying process). Weintrop et al. (2016) called this as data practices where we collect, analyze, and manipulate the data to solve the problem. Similarly, Hacker (Hacker, 2017) mentioned that evaluating and applying the solution to both known and unknown problems is a skill that is being put forth in the K12 curriculum.

10.2.4 Generalizing Patterns

Finally, generalizing patterns look at how students can scale the solution to a much bigger problem or be able to apply the process learned to other problems with a similar pattern. Wing (2006, p. 34) mentioned that "Computational thinking is thinking in terms of prevention, protection, and recovery from worst-case scenarios through redundancy, damage containment, and error correction." Also, for us to be able to prevent, protect, and recover, we should be able to analyze the effect of the computation (Snyder et al., 2012) and see if it applies to other problems. Further, using the various data practices (Weintrop et al., 2016), we should be able to design (Rossouw et al., 2011) and develop an algorithm in generating solutions (Denning, 2009).

10.3 Computational Thinking in Engineering Courses

Engineering education can be challenging for an instructional designer. Estes (2005), in his study about a Civil Engineering classroom, started his argument by saying that there is no "drama," referring to the rigidness of engineering education in an engineering classroom. He further added that skeptics might argue that the role of these professional engineers is to deliver knowledge and not to entertain inside their classroom. In the following three cases, we will analyze the use of blended learning and how they complement the delivery of the course content in various settings. We will unpack each of the cases' design with regards to the four elements of CT and how each of these cases was able to make meaningful activities for the students.

10.3.1 CCST 9003: Flipping a Common Core Course to Make Meaningful Activities

Everyday Computing and the Internet (CCST 9003) is a Common Core computer science course in HKU, which is open to both engineering and non-engineering students. The course was originally delivered as a traditional face-to-face (F2F) lecture with weekly tutorials. The course delivery format aims at equipping the students with the CT mindset and skill. However, in order to develop students' CT skill, real-world problems or scenarios should be provided to the students in the learning process (Wing, 2006). In the former course delivery, the learning activities and quizzes focused more on the in-depth mathematics questions. Students without an engineering background found it challenging, and mastering the CT skill in this method of learning was too difficult for them. Therefore, the course team together with TELI revisited the course and transformed it into a blended learning mode. The major revisions in the course included integrating gamification, peer instruction and e-learning elements to address the following learning outcomes:

1. Describe and explain, in a high-level manner, various representative computational algorithm;
2. Use the understanding of limitations on computability to judge whether a certain problem is computable;
3. Apply the algorithms learned to come up with a solution to a new problem.

By blending different elements, the course became modular and repurposable. It adapted to students with diversified backgrounds, and the use of technology enabled efficient delivery – within 2 years, five different course iterations had been implemented, reaching roughly 450 active students.

10.3.1.1 Design

In the design of the blended learning for this course, six out of thirteen weeks of teaching were flipped and converted into bite-sized, five to six minutes, online lecture videos. These videos are supported with MCQs to provide quick feedback to the students. Each of the six flipped sessions focuses on one 120–180-minute classwork or in-class activities that assess the students learning based on the topics covered during that week. These activities were designed by the four course team members who have an engineering background while the gamification part of the activity was designed by an instructional designer. As for the technical correctness and assessment alignment for these activities, both online and F2F, the subject-matter expert or the course teacher goes through every activity with the course team to check and fine-tune the details.

These activities are the main highlight of this case for two reasons. First, these activities were able to distill the CT skill of a computer science course and make it available through tangible examples for all non-engineering students. As mentioned earlier, these tangible examples make learning CT straightforward for the students (Weintrop et al., 2016; Wing, 2006). Second, the gamification element was integrated to increase students' engagement (Kazimoglu et al., 2011). To fully understand how blended learning elements and CT elements intertwined, we will look into the overall design of these activities (see Table 10.2) and unpack each computational thinking element and discuss how blended learning plays its role in each CT element.

10.3.1.2 Breaking Down the Problem

At the beginning of each in-class activity, a key question gives the students a direction of what the in-class activity is all about. In particular, this key question sets the tone for students to look at the problem holistically and to understand the

Table 10.2 Breakdown of CT skill with CCST 9003 blended learning elements

Computational thinking elements	Blended learning elements	Specific CT skills addressed
Breakdown the problem	Designed key guiding questions in F2F activities based on the online lecture videos	– Analyzing problems – Systems thinking
Recognizing the patterns	Using various learning activities such as serious games, puzzles, and computer programs	– Abstraction – Modeling
Identifying the process	Using smartphone as a way to record learning	– Evaluation
Generalizing the pattern	Set bonus challenge question in F2F activities	– Analyzing – Develop algorithms – Generating solutions

relationship among each part of the problem. This process is known as system thinking (Rossouw et al., 2011; Weintrop et al., 2016). For example, in activity one, they were given a puzzle question, and they were asked to arrange it. These puzzles are similar in pattern, but the sizes are different. This example is in line with the first element where the students need to break down the problem in order to analyze it to be able to come up with a solution. By using the puzzle, the topic recursion, which is an abstract concept, becomes tangible for students.

10.3.1.3 Recognizing Pattern

After the key question, the activity sheet will provide different scenarios for the students to recognize the patterns. In in-class activity six, dynamic programming, the team used a serious game called "Stop Talking and Nobody Explodes" as a vehicle to learn the concept of table look-up approach. The students need to explain and relate to the dynamic programming concept. These various scenarios allow them to see the problem from different angles and let them discover the pattern. Applying gamification or serious game in education can enhance not only students' engagement (Kazimoglu et al., 2011) but also their behaviors towards learning (Dormann & Biddle, 2008).

10.3.1.4 Identifying Process

After completing the in-class activities, the students need to film a three-minute video using their smartphones to explain how they understand the concepts. Their understanding is measured by the quality of their analysis as guided by three to five questions. Hacker (2017) further defined this process as evaluating and applying, where the students need to evaluate the problem and identify a solution. For example, in the in-class activity four, the students were asked the following questions:

1. How would you characterize the time-complexity of solving the Rubik's cube?
2. Where is(are) the bottleneck(s) in the solving process?
3. How can we further speed up the process of solving the Rubik's cube?

10.3.1.5 Generalizing Pattern

After students complete filming the videos, the instructor will provide a bonus challenge question to students, which is a scenario that is slightly different from the several scenarios in the in-class activities. This question is to encourage students to generalize the patterns they learned during the in-class activities and transfer the patterns to a new situation. This transferring of patterns to a new situation is governed by developing algorithm (Denning, 2009) and generating solution (Mohtadi et al., 2013). For example, in the in-class activity two, the bonus question added an obstacle that was not in the original puzzle but used the patterned learned from the main activity, and the students should be able to draw out their answer given the new situation.

10.3.1.6 Implementation

Three-hour F2F sessions with the well designed in-class activities were conducted every Saturday in the semester. As for the online learning activities, all of them were conducted in a Learning Management System (LMS) named Open edX. The weekly online lecture videos were released to the students every Monday, so that they would have 5 days before the F2F sessions to finish watching the videos. Formative assessments were conducted at the same time: around five questions after each lecture videos were designed for the students as the quizzes. The students were required to complete the quizzes by every Friday, so that they would be well prepared for the F2F sessions conducted on every Saturday. These precise schedules set by the course team adhere to the fifth principle of Chickering and Gamson's (1987) seven principles for good teaching. Since the online learning activities were designed to be aligned with the in-class activities conducted in each F2F sessions, it is observed that the learning design reinforced students' understanding of the concepts being delivered, as well as the CT skill development.

10.3.2 ELEC 3542: Using a Blended Learning Approach as a Complement to the Final Project

Advanced Programming and Application Development (ELEC 3542) is an advanced course about the Internet of Things (IoT) in the Faculty of Engineering in HKU. The IoT is a technical concept that integrating electronic devices to the network, which would provide real-time information and enable the interaction with users (Gómez, Huete, Hoyos, Perez, & Grigori, 2013). Some famous applications of the IoT are mobile devices, wearable devices, "smart" everyday objects such as smart appliances. The course outline describes the Intended Learning Outcomes (ILOs) in this course are as below:

1. Introduce the principles of application development in portable and wearable devices;
2. Study the new opportunities offered by portable and wearable devices, such as the Internet of Things (IoT), push notification, remote control, etc.;
3. Equip students with the necessary programming skill and CT skill to develop their applications through extensive hands-on experience.

The use of blended learning in this course helps the students are to acquire not only the technical concepts, but also the programming, development skills as well as the

CT skill in both software and hardware development. In order to improve students' learning quality and experience, a large number of hands-on practices in both software and hardware are necessary for the course (Sung, 2019), which cannot be provided in the traditional way of teaching and learning that focuses on the transition of knowledge from teacher to student. Hence, the teaching and design team decided to adopt blended learning in this course, as to create more meaningful time for in-class hands-on practices and to serve the teaching and learning purposes better (Gikandi, 2010).

10.3.2.1 Design

The blended learning design of this course includes two main parts: (1) the online learning activities and (2) the hands-on programming practices. The online learning activities are taken as the pre-class activities, while the hands-on programming practices distributed across different sessions, in both F2F sessions as the in-class activities, and after the class as an assignment. On the one hand, the idea of adopting the online learning part is to move the basic technical concepts away from the F2F time. The use of technology, such as online lectures, allows the students to learn the subject matter at their own pace making their learning personalized (Gonda, Luo, Wong, & Lei, 2018; Wing, 2008). While on the other hand, hands-on practice is essential in developing students' programming and CT skill. Hence, a series of hands-on activities were designed for this course. These activities build up throughout the course, and it accounts for the students' final project. By distributing the final project workload into a series of F2F activities and homework, students can focus and grasp the concept effectively (Bell & Federman, 2013). The learning design of the whole programming final project links back to the four elements of the CT as illustrated in Table 10.3.

Table 10.3 Breakdown of CT skill with ELEC 3542 blended learning elements

Computational thinking elements	Blended learning elements	Specific CT skills addressed
Breakdown the problem	– Introduced the final project at first F2F session; – Encouraged students to plan systematically	– Analyzing problems – Systems thinking
Recognizing the patterns	Designed weekly online videos and weekly labs	– Abstraction – Modeling
Identifying the process	Required students to write project proposal after completing the weekly online videos and weekly labs	– Evaluation and apply patterns recognized
Generalizing the pattern	Students need to design and develop the final project individually	– Analyzing – Develop algorithms – Generating solutions

10.3.2.2 Breaking Down the Problem

At the beginning of the course, the teaching team would introduce the final programming project to the students. They were asked to think of a real-world problem that they encountered and start thinking by breaking down their chosen issue. Then, their entire course will revolve around creating an application that will augment the chosen problem. This scaffolded process of solving a real-world issue makes it more meaningful and engaging for the students (Lye & Koh, 2014). In this stage, through the support from the teaching team, students were able to break down the problem systematically. Breaking down the problem is essential in analyzing the different elements of the problem (Snyder et al., 2012) which will lead to systematically coming up with a solution (Weintrop et al., 2016).

10.3.2.3 Recognizing Pattern

After breaking down the problems, a series of online lecture videos and in-class hands-on practices in different F2F sessions will equip the students with programming skills that they need to solve their chosen problem. At this point, the students need to link the concept that they have learned online to the problem that they are trying to solve. Snyder (2012) called this process as abstraction, where the elements of the problem and concepts are reduced into manageable details and information for further analysis. The information will then be subjected to pattern recognition which is important in solution modeling (Denning, 2009). All these solutions will add back to the original problem, and they will consolidate it at the end of the semester.

10.3.2.4 Identifying Process

At the latter stage of the semester, after the students finish all of the online lecture videos and in-class hands-on programming practices, one F2F session about project initiation will be conducted. This session aims to help and guide students to come up with the application development plan, including setting their goals, identifying the process, as well as the resources needed. Evaluating and applying patterns, similar to most CT skills, requires practice (Sung, 2019) and students at this point would require support in addressing their concerns. This guiding process is facilitated through one-on-one consultation during the F2F activities and the use of online means such as discussion forum and email. Chickering and Gamson (1987) highlighted the importance of this support mechanism in enhancing students learning.

10.3.2.5 Generalizing Pattern

After the last F2F session, the students would have around one month to develop an application to solve a real-world problem they meet in everyday life, based on what they have learned in this course. Adopting the real-world problem-based project as the final assessment is a common practice in the Engineering courses, as it helps to enhance students' academic achievement as well as to increase students' engagement level in the learning process (Macías-Guarasa, Montero, San-Segundo, Araujo, & Nieto-Taladriz, 2006). Also, it can help to reflect students' ability to generalize the patterns related to the application development.

10.3.2.6 Implementation

The course team, consisted of two lecturers and one teaching assistant (TA), facilitated 12 weekly online learning activities and F2F sessions with in-class hands-on programming practices. For the online learning component, the teaching team produced 27 short lecture videos, 153 minutes in total, about technical concepts. Three to five questions were designed for each video as the quiz to test out students' understanding of the concepts. By having these short quizzes, students were able to enhance their learning through demonstration as articulated by Merrill in his *First Principle of Instruction* (Cheung & Hew, 2015). These weekly activities were provided to students through a Learning Management System (LMS), Open edX, and students need to finish them before each week's F2F session. As for the hands-on programming practices, the in-class activities were conducted during the 12 weekly F2F sessions, and students can bring the hardware kits back home after the F2F sessions to continue the practices for their final projects, and to apply their knowledge in the real-life situation. Merrill noted that this process can further strengthen students' learning as they use their new knowledge in the real-world application (Cheung & Hew, 2015).

10.3.3 MATH 1851: Scaling-Up Through the Use of MOOC Materials for On-Campus Teaching

MATH 1851: Calculus and Ordinary Differential Equations is a compulsory general engineering course for all engineering students in HKU. Six professors are handling the entire course of 700 students every semester, and they divide the 700 students into four cohorts for easier class management. In recent years, with the affordance of technology and availability of support, the course underwent a major revamp and several course improvements since 2014. It started with a teaching development grant entitled "A Feasibility Study on Employing Online Learning Feedback and Monitoring in *MATH 1851 Calculus and Differential Equations*" that was initiated by the course instructor. Due to the large enrolment of the course, the course team leveraged the use of technology to provide a better course content delivery, such as creating online lecture videos in Khan Academy style. Around the same time, another project was initiated by the mathematics department, focusing on developing a library of teaching and learning resources for mathematics courses. In the end, this project designed and created an open-source software called GeoGebra, which is an interactive application allowing visualization of mathematical theories and concepts. In late 2017, the course team decided to embark on a new journey to scale-up the production of their online materials and to produce a MOOC for public consumption. This initiative enables the team to redesign the produced lecture videos and integrate GeoGebra as an interactive learning component of the course.

10.3.3.1 Design

The critical question for the course team during the design stage was how to make the content interesting enough for the students after moving it to the online platform. Moreover, looking closely at the topic as an instructional designer, on the one hand, one might think that there is a need to add real-world problems to teach CT skill effectively (Weintrop et al., 2016). On the other hand, Hoffmann (2004) argued that educators and engineers have a different vocabulary and there is a gap in the learning theories in terms of engineering education. In addition, he mentioned that "mathematics gives a unique decision on right or wrong" (Hoffmann, 2004, p. 92).

After the analysis of the course and the capacity of the course team, the team decided to go for Khan-style lecture videos to deliver the following course outcomes:

1. Demonstrate the basic calculus and ordinary differential equations as well as their relationship with some typical physical/engineering applications;
2. Apply mathematical skills and model to solve some fundamental physical/engineering problems;
3. Identify the occurrence of resonance where large amplitude displacements can be expected;
4. Appreciate the power of integral transform in initial value problems and applications like vibrations and signal processing.

The team also focused on an important strategy in learning mathematics which is practicing. The on-campus course and the MOOC shared a similar pattern: (1) starting with key topic or the relatively easy problem to be solved; (2) followed by a set of problems in various format like MCQs or using GeoGebra to expand the students understanding of the concept; and (3) providing a problem or set of problems with a variation in the parameters that would challenge their knowledge. To get a better understanding of how blended learning elements and CT element intertwined, we will look into the overall design of the learning activities (see Table 10.4) and unpack each computational thinking element and discuss how blended learning play its role in each CT element.

Table 10.4 Breakdown of CT skill with MATH 1851 blended learning elements

Computational thinking elements	Blended learning elements	Specific CT skills addressed
Breakdown the problem	Designed key leading questions in online lecture videos	– Analyzing problems – Systems thinking
Recognizing the patterns	Designed problems for students to recognize and identify the algorithms both online and during F2F sessions	– Abstraction – Modeling
Identifying the process		
Generalizing the pattern	Set new problems for students to apply learned algorithms and generate solutions	– Analyzing – Develop algorithms – Generating solutions

10.3.3.2 Breaking Down the Problem

In Chap. 1, the instructor discussed the concept of limits, and he introduced the key question through a video and followed by a series of GeoGebra sample problems. These GeoGebra activities allowed the students to change a specific parameter and then visualize the changes in graphs in real-time. Adopting visualization tools in math teaching can not only enhance student's maths learning (Seloraji & Leong, 2017), but also inspire the students to think through the problem systematically (Sung, 2019). Therefore, the course team designed such activities to enable the students to manipulate the problem and to see and analyze the problem from different perspectives. It also allowed the students to explore the problem that the instructor explained in the video.

10.3.3.3 Recognizing Patterns and Identifying Process

After introducing the main problem, the students were exposed to several problems using GeoGebra. The instructor gave at least 4–5 different questions to the students, which enabled them to figure out the pattern through abstraction, and emerge as they solve it. These designed follow-up questions and practices are for students to consolidate their knowledge and promote their learning (Merrill, 2006). Moreover, this set of practice activities will also help them identify a process or solution that will be generalized.

10.3.3.4 Generalizing the Pattern

It is believed that enabling students to apply existing knowledge to solve various new problems promotes students learning (Cheung & Hew, 2015). Therefore, the course team designed each chapter ending with an activity solving science or engineering related questions. This activity will test the students to apply what they have learned from the learning contents provided and the solution that they have discovered by going through a series of problems.

10.3.3.5 Implementation

The team handled 700 students every year and divided them into different cohorts. At least one instructor handled each cohort. During the first week, the instructor would introduce to students a set of lecture videos and a set of activities that will be used both as online activity and as F2F activity. In the first cohort, the course team developed 65 instructional videos (6.56 hours in total) and 336 questions for assessments. Different from typical questions after lecture videos, most of the questions designed require students to solve mathematical questions, which requires higher-order thinking skills, rather than recalling what concepts or theories in the video had been taught, which requires lower-order thinking skills. Learners are also guided to solve questions through appropriate feedback, with these coaching is gradually withdrawn in the later stage. Furthermore, one exciting development in this course is that the team was able to build the course material every year. The course team continuously improve a part of the course by adding new technology or elements that will be beneficial to the students. One example is the addition of GeoGebra, which was a resource created from another project. The distinct feature of this application enables the students to interact with an abstract problem.

The following pattern: (1) key problem, (2) practices, and (3) assessment are repeated throughout the entire course. F2F sessions focus more on solving a complex problem and allow the students to ask questions to the instructors directly.

10.4 Evaluation and Recommendation

In all the three cases mentioned in this book chapter, the design of the learning activities fulfills and illustrates all the four main elements in CT, which are breaking down the problem, recognizing the patterns, identifying the process and generalizing the pattern. These elements benefited from the adoption of blended learning design in these engineering courses.

In the implementation of blended learning, three key areas emerged where the impact of blended learning design was evident. These areas are developing students' CT skills, acquiring subject content, and engaging in the learning experience. These findings are the results from the interview and surveys that were done with the students and the teaching team.

10.4.1 Impact on Developing Students' CT Skill

In developing CT skill, providing problems or scenarios to students are necessary during the learning process (Wing, 2008), while conducting learning activities based on provided problems or scenarios usually takes a lot of classroom time. The blended learning design, which moves the basic concepts in the traditional lecturing before the F2F session, creates more time for instructors to conduct problem-based and scenario-based activities during the F2F session, and so to help facilitate the development of students' CT skill.

In the case study of *CCST9003*, students considered blended learning as an effective approach to developing their CT skill: "*(blended learning approach,) ah, effective. I really learned a lot… and the problems given to us make us think more and spend more time searching and learning by ourselves… it's very effective.*" – from student interview.

As for the case study of *ELEC 3542*, according to the pre-test and post-test results of Students' Learning Outcomes Survey conducted in the class, the mean score of the question related to developing students' programming and CT skill increases from 4.38 to 4.79. This result implies that students felt more confident in using advanced programming skill and CT skill in application development.

In the case study of *MATH1851*, the online learners considered the lecture videos and other online learning materials very effective: "*Lecture* v*ideos adequately covered core material … (and online learning materials) were very effective… in shedding additional light on problem-solving issues*" – from student interview.

10.4.2 Impact on Acquiring Subject Contents

Apart from developing students' CT skill, the student interview and student questionnaire results show that adopting blended learning can also help students with acquiring subject contents as well as their learning performances.

In the case study of CCST9003, students agree that the blended learning design helped them to acquire the subject contents by the activities during the F2F session. One student pointed out that *"we learn more ideas of the algorithms and the Internet from different activities.*" While another student highlighted that "*[s]ometimes the walk-throughs are very high level and you cannot get them. But if you review those videos, you can gain a basic picture of what the lecture talks about. So, you have a preparation, and also you can do some of those first, previously by yourself. So, you can check it out and learn more efficiently.*" By providing the background concepts prior to the F2F class, students were able to better appreciate the concepts learned during the activities.

And in the case study of *ELEC3542*, the pre-test and post-test results of Students' Learning Outcomes Survey showed that the mean score of the question related to basic technical concepts increases from 4.46 to 4.57, implying that students were more familiar with the concept of the Internet of Things (IoT) after taking the course. Students believed that the online lecture videos have a positive impact on the result above: "*I found the course videos very well structured. The illustrations were great, and the explanations were thorough. I think the course videos help us a lot*."

10.4.3 Impact on Students' Learning Engagement

Students' engagement level is an essential criterion in the learning performance. The student interview in *CCST 9003* showed that the adoption of the blended learning approach is effective in engaging the students in the learning process: "*(the blended learning approach) … not like a traditional lecture form. Students can have more time to participate in the activities. Yeah, so I think it (is) actually more engaging than the traditional lectures.*" "*Honestly, very different (from the traditional course). This gets you to engage with the tasks that are provided. It also makes you interact with your classmates… it's really effective.*"

10.4.4 Recommendation

In good blended learning design, the alignment among the learning activities is always essential, and such learning activities alignment should go across the online lecture videos, quizzes, in-class activities, post-class assignments, the final assignments, etc., in order to reinforce students' understanding of the concepts and messages being delivered. The alignment may take time to adjust, hence, fine-tuning the course across different cohorts based on students' comments and suggestions is crucial. The course team can use the ADDIE model or other instructional design models and check the learning contents, the alignment, and the entire course structure in every cohort as a routine.

It is also worth noting that using technologies for blended learning should be carefully considered in designing the process (Gonda et al., 2018; Luo, Hew, Lei, & Oh, 2017). For example, constant and timely feedback from the facilitators is important to the CT skill related learning activities, while it may be time-consuming for the teachers. The instructional designers should provide suitable technologies that allow the course team to give out timely feedback, such as Google Docs, Mentimeter, etc. Moreover, maximizing the use of technologies on blended learning design can help the teaching team to gain more feedback and to modify the course in the future. For example, in the case of *CCST 9003*, the team developed a course package based on its first year of improvement, which led the team to explore repackaging the same content, in terms of course design and content, to promote it to non-HKU students. Similarly, for *MATH 1851*, the course content moved from Khan Academy style videos to fully animated videos, and the course moved from teaching on-campus students to the global stage. After launching the course outside of HKU, the course team pulled back all the lessons learned from the online community back to the on-campus course, and revised it for the next semester teaching for HKU students. It is hoped that the recommendations in this chapter can provide insights for the teachers who wish to develop blended learning for developing students' CT skill in the future.

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Chapter 11
Blended Learning for Intercultural Competence: A Case Study in Engineering Education

Yun Dai

Abstract This chapter presents a case study on a global educational initiative titled iPodia Program that addresses the quality access to intercultural competency through blended learning. The iPodia Program was firstly initiated by the Viterbi School of Engineering at the University of Southern California, USA, and now has grown into an alliance with 14 universities across the world. Guided by a socio-technical framework of engineering education and Bloom's taxonomy, the program created a flipped learning approach with a novel integration of videoconferencing technology, a learning management system, and classroom teaching. The approach included a series of online and face-to-face activities that allowed students to interact across space and time and work collaboratively for meaning negotiation. With these activities, the approach strived to move students from surface to deep learning and nourished global perceptiveness. By examining the program design and student feedback, the study identified various levels and dimensions of intercultural competency development, as well as how the instructional design made the respective development possible. Based on the case analysis, it showed how a blended learning approach can be leveraged in engineering education for intercultural competency development. Limitations and implications of this approach are also discussed.

11.1 Introduction

The blended learning, by integrating online and face-to-face learning, is believed to be advantageous in extending the student engagement and fostering deep learning (Bonk & Graham, 2012; Lim & Wang, 2016). Inspired by its strength, postsecondary educators have been exploring its application in the global and intercultural education, especially when there are multiple cohorts of students who are physically dispersed (e.g., Guth & Helm, 2010; Hilliard, 2015; Liu, Morrison, & Lu, 2015).

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Traditionally, these student cohorts are oftentimes connected via videoconferencing or Internet for synchronous or asynchronous communication (Beldarrain, 2006; Çiftçi, 2016). These traditional approaches have been proven difficult in boosting interpersonal collaboration and fostering group attachment (Kreijns, Kirschner, & Jochems, 2003; Lawson, Comber, Gage, & Cullum-Hanshaw, 2010; So & Brush, 2008). From this perspective, the blended learning approach might help solve this problem by creating a "glocal" paradigm: the online tools allow globally distributed students to interact in a more flexible and collaboration-friendly way, while the face-to-face interaction among the co-located students helps create a sense of groupness and belonging.

Despite its potential, the blended learning has not been fully exploited in the global and intercultural education, where the instructional design yet to be specified and evaluated. Most of the former ICT-based intercultural programs were developed in the setting of language education and liberal arts subjects, with few situated in the STEM areas (Çiftçi, 2016). At the same time, considering the global outsourcing and multicultural workplace in the twenty-first century, there has been a call to prepare engineering students with relevant soft skills, such as the intercultural competency (National Academy of Engineering, 2004; Royal Academy of Engineering, 2007). Such a call seems to contradict with the technical nature of engineering subjects. To resolve this tension, more efforts are needed to explore how to integrate the intercultural competency development to the teaching and learning in the engineering education. To address the above issues, we present a case study of the iPodia Educational Program for intercultural competency in the field of engineering education. This iPodia Program was first developed in the Viterbi School of Engineering at the University of Southern California (USC), USA. The development of this program was guided by a socio-technical framework of engineering education and Bloom's taxonomy, which sought to foster meaningful, active, and deep learning among students. The program was designed with a special pedagogy, which was based on a novice integration of information and communication technology and a series of learning activities. Through this program, students were expected to engage in interactive and collaborative learning for enhanced understandings and deep knowledge about cultures.

11.2 Literature Review

For a long time, the postsecondary engineering programs are featured with a great amount of mathematics and technical courses, indicating an emphasis on the "hard," cognitive skills (Grasso & Burkins, 2010). In recent years, due to the globalization in the supply chain and distribution, engineers are expected to have a strong technical capability but also skills in communication and teamwork on a global scale (Colvin & Edwards, 2018; De Graaff & Ravesteijn, 2001). In response, the engineering education has been experiencing a paradigm shift from the technical-oriented to the socio-technical perspective that also addresses student understandings of social and cultural issues on a global scale. Such a shift is evident in the changing curriculum and accreditation criteria of postsecondary engineering programs. For instance, both the Accrediting Board for Engineering and Technology (ABET, 2018) and the European Network for Engineering Education (EURANEE, 2015) urge that engineering students need to "consider the impact of engineering solutions in global, economic, environmental, and societal contexts." One of the major goals for the socio-technical perspective of engineering education is to train globally and interculturally prepared students (Lohmann, Rollins, & Joseph Hoey, 2006), that is, the development of intercultural competency. Intercultural competency refers to the knowledge, skill, and attitude to appropriately interact in the intercultural encounters (Deardorff, 2006). It includes multiple components, such as the cultural-specific information, cultural self-awareness, sociolinguistic awareness, and deep cultural knowledge. As students gain more information about cultural facts, they are more likely to have a transformation in their awareness and attitudes, as well as more sophisticated and insightful understandings about cultures (Bennett, 2009; Deardorff, 2009). Nowadays intercultural competency is deemed as a competency required for engineers to succeed in the twenty-first century. It can provide engineers a reference framework to "make accurate predictions and attributions' in intercultural situations (Wiseman, 2002), and therefore, to "ensure cultural acceptance of proposed engineering solutions" (NAE, 2018). As indicated in the socio-technical perspective, intercultural competency, which is oftentimes seen as a domain-general skill, is not a stand-alone subject in the context of engineering education (Lohmann et al., 2006). Instead, the teaching of intercultural competency should be combined with the domain-specific knowledge, where the nature of the subject matter should be taken into account (Grandin & Hedderich, 2009). For example, in comparison with algebra and number theory that is abstract and based on "hard" science, subjects such as engineering design and production development that are closely tied to the end users or customers seem to be more suitable to contextualize the teaching of IC and socio-technical understandings (Jing & Lu, 2011; Lu & Cai, 2001; Lu & Liu, 2011). For example, the technical solutions in software engineer and production development greatly rely on customer's demand and preference and are eventually tested by the customers. As such, the teaching of IC should be aligned with the subject matters, and it is pertinent to consider the nature of domain-specific learning in the respective instructional design. The digital technology has long been deployed as a powerful tool for the intercultural competency development (e.g., Dai, 2019; Jin & Erben, 2007; Lee, 2007; O'Dowd, 2000; O'Dowd, 2006). Enabled by the technology, globally distributed students are brought together in virtual space for intercultural interaction, through which they are expected to develop understandings and knowledge about their own and other cultures (Deardorff, 2006). Nevertheless, Çiftçi (2016), in a systematic review of these efforts, found that the growth of student understandings centered on superficial information about similarities and differences across cultures, with limited deep cultural knowledge or insightful cross-cultural interpretations. He further argued that the development of intercultural knowledge was not only to learn about cultural similarities and differences but more importantly, to analyze, evaluate, and interpret cultures for deep understandings. That is, the current competency model that is oriented to the fact-based information should be transformed into a more constructive approach that eventually nourishes deep knowledge and insights about cultures (Dasli & Diaz, 2016; Nagata, 2006).

To support such transformation, we draw upon Bloom's taxonomy which classifies the cognitive activities and learning objectives into levels of complexity and mastery. According to Bloom's taxonomy, learning takes place in a continuum of cognitive activities including remembering, understanding, applying, analyzing, evaluating and creating, where learners move from surface to deep learning (cf. Anderson et al., 2001; Bloom, 1956). At the stage of surface learning, learners are most likely to only identify, absorb, and memorize new ideas. But the process of deep learning, in which students are more likely to integrate and construct new ideas and understandings, usually takes place via a highly collaborative, integrative, and reflective process (e.g., Beattie IV, Collins, & McInnes, 1997). It is noted, however, that the deep learning can't be simply seen as preferable or superior than the surface learning. The lower-level learning can build basic skills and lay a foundation for high-level cognitive skills, while learning at higher levels can reinforce and enhance the lower-level skills. From this perspective, student learning is not a one-way linear process but an iterative and recursive process where they go through various levels of cognitive activities, moving from the fact-based and content-oriented surface learning towards the analytical, critical, and reflective learning.

As educators search for practical tools to move students from surface to deep learning, the notion of flipped learning has gained prominence (Brame, 2013; O'Flaherty & Phillips, 2015; Zainuddin & Halili, 2016). The flipped learning, as an offshoot of blended learning, is a pedagogical model in which the typical lecture and coursework in a course are reversed. Students view short videos of lectures or other content materials asynchronously before the class session. Then instructors guide students by answering their questions and helping them apply and reflect on the contents for clarification and deep understandings. In this teaching model, students are supposed to take up the responsibility of mastering concepts on their own time and space, so they can come to the class session with a prepared mind. Then the in-class time is used for active and collaborative learning, where instructors can incorporate more interactive activities such as discussions, project-based or problem-based assignments, and others. In this way, the class session, which has been traditionally used to lecture facts and contents, is now devoted to orient students to step forward and engage in a higher level of cognitive activities.

The recent development in learning technologies has created great convenience for instructors to adopt and implement the flipped classroom in their courses (Beetham & Sharpe, 2013; Duhaney & Zemel, 2000). However, it is still challenging to realize the preferred learning outcomes among students, and there is no one best way to plan an active, collaborative learning experience in the flipped classroom. The question is how to design the instructional plan that works best for a particular group of students learning particular subject matters, specifically, how to align the pre-class and in-class activities and forge the focused and progressive process towards deep learning (Dai, 2019; Hertel, Geister, & Konradt, 2005). As most likely such a progressive learning process won't take place naturally, it needs proper scaffolding and purposeful intervention from the instructor or peers with expertise.

11.3 The Design and Development of iPodia Program

11.3.1 Historical Background

Guided by the socio-technical perspective and goal in intercultural competency development, the Viterbi School of Engineering at the University of Southern California (USC) in the USA initiated the iPodia Porgram in 2009. The first pilot iPodia course was launched in the same year between the USC and Peking University in China, which was also the first member university in the program. Till today, the iPodia Program has established a partnership with 14 universities on the four continents for the joint curriculum development and collaborative course offering. All the member universities are research universities, with a population ranging from 15,000 to 30,000 undergraduate students.

The technology-enabled course is the major output from the iPodia Program. The courses focus on socio-technical subjects within the engineering fields, such as engineering design thinking and product development, where sociocultural factors (e.g., customer preference, social trends, cultural value) play a significant role in engineering problem solving and decision making. Every course is participated by at least two universities from differentiated cultural contexts, with 15–25 students from each university. The class is usually led by a chief instructor from one university or co-taught by instructors from multiple universities. Most of these courses are conducted in English and exclusive to engineering undergraduates. In all the courses, students register in their home universities, and there is no exchange of tuition fees and credits across universities. Besides, a program officer at the USC facilitates the cross-site collaboration and manages the day-to-day operation, while the local administrative team in member universities manages the onsite logistics.

11.3.2 The Instructional Design

To fulfill the learning objectives, the iPodia Pedagogy has been designed to guide the teaching and learning process in the courses (Lu, 2018). The iPodia Pedagogy follows a weekly flipped learning cycle, as demonstrated in Fig. 11.1. The learning cycle includes the pre-class and the class sessions, in which there are respective learning environments and activities.

As shown in Fig. 11.1, the learning cycle starts with pre-class learning, which is supported by a specially developed learning management system, named the iPodia P2P Platform. In the platform, there are basic functions such as the administration,

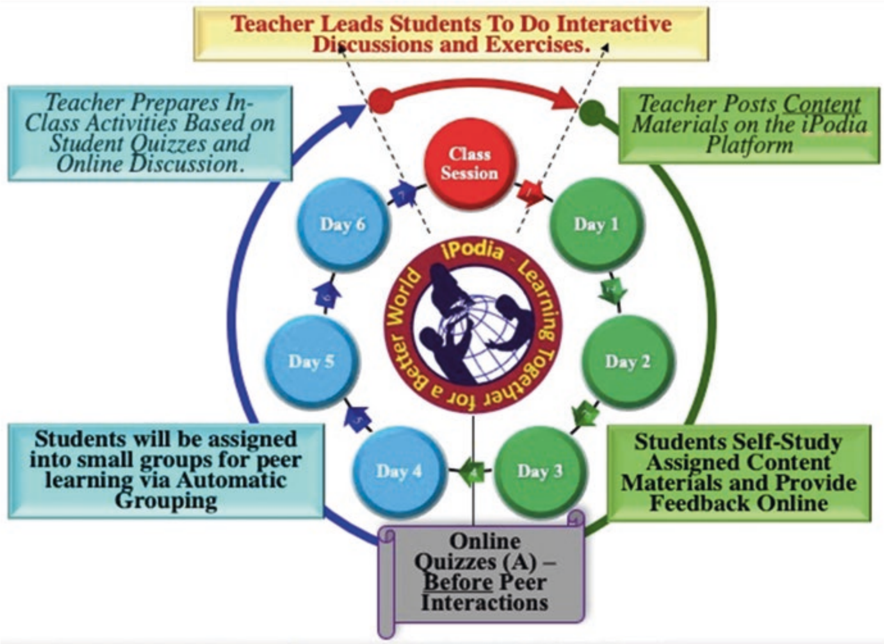

Fig. 11.1 The iPodia Pedagogy – a flipped learning cycle

material delivery, and communication, along with a peer-to-peer interaction zone. All the students in the iPodia courses are required to register an account in this platform and provide their demographic information, including gender, majors, university affiliation, and so on.

The pre-class session lasts for 6 days in total, during which students are required to participate in a series of activities:

- The pre-class learning starts when the instructor posts the self-study materials on the platform, usually in the format of PowerPoint slides, lecture videos, and readings. In making the materials, the instructor organizes the content into several key concepts, so students have a clear road map to follow. During the 3-day self-study, students need to do an online quiz to provide their feedback. The quiz includes two kinds of questions: first, the knowledge-based questions to examine students' learning outcome of the material content and second, the preference question in which students rank their interests to discuss these key concepts. The quiz is not graded, so students would feel more comfortable to provide honest feedback.
- Following the self-study is the 3-day team discussion. Based on the self-study feedback from quizzes, students are assigned into small teams for peer-to-peer discussion, usuaully in a group size of 4 to 5 students. The team formation is based on a unique algorithm developed by the iPodia Program that automatically computerizes students' understanding levels, preferences, and university

affiliation for optimized outputs: firstly, the team members' differences in the knowledge levels and university affiliation are maximized, so all the students are placed in a multicultural environment where the peer tutoring is possible; secondly, the members' difference in the discussion preference is minimized, so those with similar preference are placed in a team. In the platform, each team is provided with a private space for text-based and videoconferencing meeting, where the focal key concepts, along with a discussion prompt, are given. The prompt, which is programmed in the discussion space, guides students via a series of questions to connect the key concepts to their everyday lives and reflect on how the key concept is manifested in a particular culture. The guided discussion, by forging the peer learning, is to elicit the cultural diversity of students for collaboratively learning about the socio-cultural topics and growing their intercultural competency.

After the 6-day pre-class session, students attend the class session in their local classrooms which are connected via the videoconferencing technology. The local administrative team arranges their classroom space following the same design, as demonstrated in Fig. 11.2 (Dai, 2019; Lu, 2018). Figure 11.2 exemplifies the conceptual design of classroom layout when there are three participating universities. In each classroom, there are three screens of the equal size, to project the lecture slide, the instructor, and the combined live streams of two remote classrooms.[1]

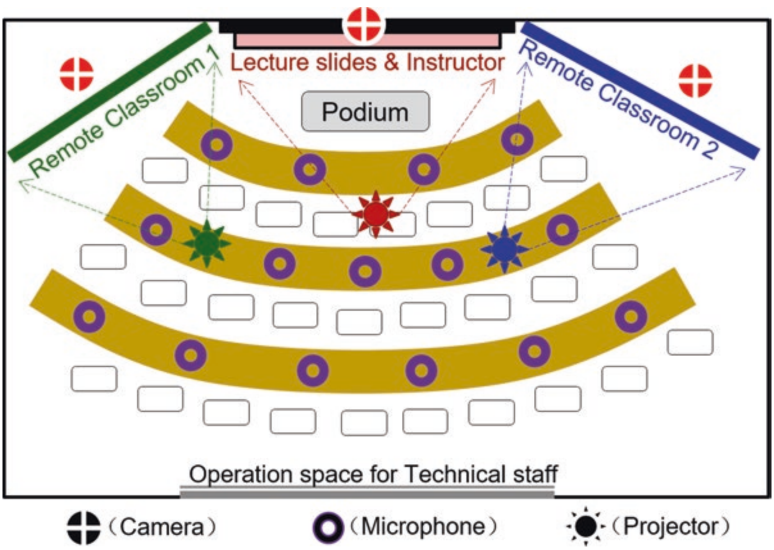

Fig. 11.2 The classroom layouts. (Reprinted from Dai, 2019, with permission from Elsevier)

[1] In the classroom where the instructor was collocated, the three screens would project the lecture slides and livestreams of the other two classrooms.

A number of cameras and microphones are installed to capture and transmit the live stream of audio and video. With the abundant table microphones, the class activities are made more accessible for students. Besides the videoconferencing facilities for classroom connection, students have personal desktops or tablets for in-class team interaction. Both the videoconferencing and computer connection are supported by the WebEx software.

The class session is dedicated to enhancing students' knowledge of key concepts as well as intercultural understandings. Before the class session, the teaching assistant analyzes students' pre-class input for the instructor's reference. The analyses include the following: first, students' pre-class quizzes are collected and analyzed to identify the learning gaps and student confusions; second, the team discussion is analyzed using the natural language processing techniques to identify the patterns of peer learning, such as the frequency of student participation, the popular topics, the most adored answers, and so on. The analyses are to facilitate the instructor' lesson preparation, so he or she can tailor the class activities accordingly.

Usually the instructor organizes the three kinds of in-class activities:

- The instructor usually starts with summarizing and commenting the pre-class session. Based on the analysis of student quizzes, he uses visual presentations of descriptive statistics to show the distribution of student responses and highlight the misconceptions. Departing from the pre-class progress, he orients the class to discuss these concepts and clarify the confusion.
- The instructor also selects and highlights some topics or posts from the team discussion for the class. There are two selection criteria: (1) the richness of student contribution, which indicates how much, if any, students find the topics relevant and meaningful, and (2) the heuristic value, referring to its potential in assisting students in making meaningful connection and discoveries. In extracting the team discussion for the classroom interaction, the instructor hopes to create a more inclusive and engaging space for in-depth interaction.
- Beyond mastering the concepts, the instructor seeks to engage students in applying, analyzing, and evaluating the key concepts and theories. To fulfill this purpose, the instructor designs some stand-alone or semester-long activities that require higher-order cognitive activities. Such activities are oftentimes highly collaborative and analytical, including the case study, debate, personal sharing and presentation, reflections, and so on. In doing these activities, students are no longer discussing *whats* of the key concepts but more about *hows* and *whys*.

11.3.3 Program Evaluation

Since the pilot course in 2009, the iPodia Program has been continually (re)designed and improved its technological envrironment and instructional practices under the overarching framework of iPodia Pedagogy. To trace its development and evaluate its effectiveness, the program office at the USC conducts the program evaluation research project every year. The research project was jointly conducted by an interdisciplinary team of engineering educators and educational researchers to examine and evaluate the teaching and learning in the iPodia courses. The major methods deployed in this project were classroom observation and teaching evaluation survey. While the classroom observation was primarily to examine how the instructional design was unfolded and enacted, the teaching evaluation was to directly elicit student opinions about their first-hand experiences.

All the participating students were invited to fill in the survey anonymously. It included both quantitative and qualitative questions. The quantitative part was five-point Likert scale questions, in which students indicated their degree of satisfaction with the courses in multiple dimensions, such as the overall course, learning contents, and evaluation scheme. The quantitative data was analyzed using descriptive statistics. In the qualitative part, students were asked to share the new understandings or transformation they had gained in terms of intercultural communication, subject matters, and other learning objectives. In answering these questions, students were also encouraged to point out the problems and issues, as well as suggesting possible solutions. The collected qualitative data was analyzed using thematic coding to identify and extracting themes from texts (Gibbs, 2007). Given the focus of this chapter, Deardorff's framework (2006) and Bloom's taxonomy (1956) were used as the initial code lists, to identify student development in various dimensions of intercultural competency at the surface or deep levels.

11.4 Findings on Student Satisfaction and Development

The analyses and findings of student experiences and development in the iPodia courses were demonstrated in the following two themes. The account of each theme was built upon the quantitative and qualitative data from the teaching evaluation survey, along with the analyses of respective instructional practices.

11.4.1 A General Development in Fact-Based Understandings and Cultural Awareness

Figure 11.3 shows the average ratings of students' overall satisfaction with the iPodia courses from 2009 to 2018. The average rating stayed above 4.39 out of 5. It indicated that most of the students had participated in the intercultural interaction with positive feelings, although there were some varying voices. As shown in the qualitative responses, students generally enjoyed the mediated intercultural commutation, through which they had obtained extensive facts and information about other cultures. Especially, such understandings were developed with the help from

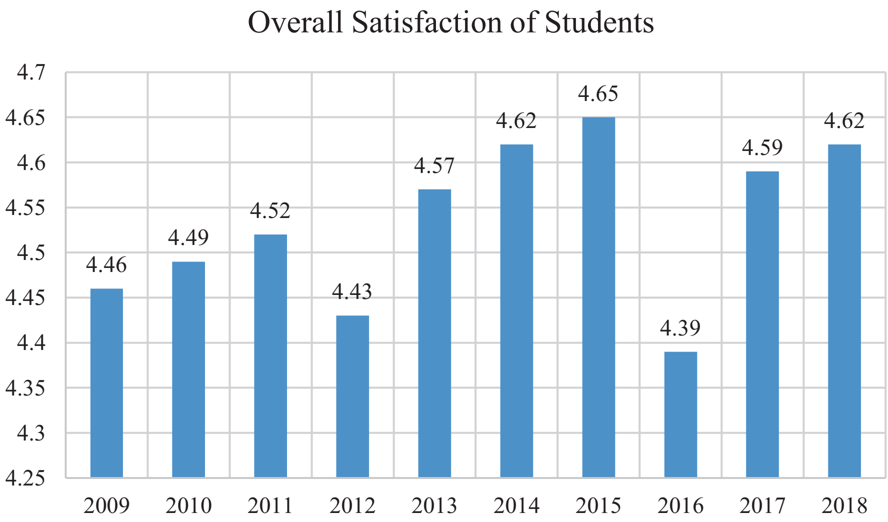

Fig. 11.3 The overall satisfaction of students during 2009 and 2018

peers, that is, the real insiders of the target cultures, which greatly enhanced the feeling of authenticity and closeness.

The reported growth in the fact-based understandings about specific cultures responded to the surface learning that students had gone through. Students claimed that they had exchanged and learned intensively about what people did in cultural contexts, such as their everyday lives, mentalities, high- and low-brow cultures, and other cultural-specific information. Such exchange had stimulated them to compare the similarity and difference across cultures, leading to their increasing awareness of cultural diversity. Some students even reported an emerging interest to study or work abroad after graduation. It is noted that this general growth in cultural facts was somehow superficial, as the majority of exchanges were information about what people did. But these surface-level understandings had proven helpful, not only in increasing their intercultural understandings but also triggering an attitude change or forging a positive attitude towards other cultures to a certain extent.

Meanwhile, students agreed that the blended learning approach in the iPodia courses had greatly contributed to their overall development of intercultural knowledge. While the grouping algorithm ensured the multicultural composition of all the teams, it opened a window for students to different cultures. The team-based interactive space created a sense of privacy and closeness among members, where students felt safe to exchange ideas and build up interpersonal connections. Through the discussion, students were engaged in a purposeful, structured, and focused process of applying the key concepts in their own cultural contexts, sharing cultural-specific examples with peers, comparing and evaluating various interpretations. Such an exchange might look trivial and fragmentary but provided concrete images about a cultural phenomenon. Especially, guided by the discussion prompt, what students learned were not general traits or stereotypes of cultures but meaningful and understandable experiences that they could relate themselves to. As for the class session, the videoconferencing connection created a public and inclusive space accessible for all the students. While students attended the lectures in their local classrooms, they stayed in their own cultural groups and were less likely to feel isolated. Many of them felt more comfortable and confident and were willing to speak out and shared their personal experiences and thoughts.

11.4.2 Enhanced Intercultural Understandings and Deep Cultural Knowledge

Beyond the fact-based understandings, students demonstrated varying degrees of development in deep cultural knowledge. Departing from the fact-based understandings about cultural similarity and difference, many students continued to reflect and investigate the underlying logics and reasons. In this way, the fact-based understandings were turned into learning resources that triggered their active and deep learning. Such enhanced learning was evident in many dimensions, such as the sociolinguistic awareness and deep knowledge of culture. For example, several American students reportedly had learned that Chinese and Koreans peers expressed disagreement in a more implicit way and tended to avoid the confrontation, which was due to the value of being humble and modest in the East Asian culture. The identified patterns of behavior, along with the impact of cultural values, were based on students' interpretation of cultural differences. This understanding went beyond the *whats* of cultural facts and indicated a step forward to the *hows* and *whys*, which can be seen as deep cultural knowledge.

At the same time, more in-depth changes in attitudes and behaviors were identified. The following quote from the student survey exemplified such a change:

> My most rewarding experience was discovering and overcoming cultural differences. I learned a lot about the difference between American culture with the Chinese and Korean cultures. Initially, I made many cultural assumptions that were later challenged and overturned by my teammates.

The mediated intercultural interaction exposed students to cultural differences and triggered them to identify what led to such differences. To fully understand the differences, students had to give up their assumptions and shifted their viewpoints of others (Dai, Lu, & Liu, 2019). In taking up others' viewpoints, they broke down their cultural stereotypes and transited from ethnocentrism and ethnorelativisim. This transition can shed a profound impact on student attitude towards their own and other cultures or even led to fundamental changes to their everyday lives (Dai, 2019).

The enhanced, deep knowledge was made possible by the flipped learning in the iPodia courses. Thanks to the pre-class sessions, the in-class time was used for collaborative learning, such as group discussion and team projects. Especially, considering that students in different universities were quite likely to have different schedules and lifestyles, it could be difficult for them to find a meeting time that worked for all. Under this constraint, the in-class activities resolved the schedule conflicts and made sure that all the students were provided opportunities for intensive, immediate interaction. The in-class teamwork was greatly appreciated by students, as shown in the following quote:

> It challenged students to work with people in different countries in a virtual environment. It's not like you were having a language partner to practice English nor working on a course project with students on the same campus. It's the whole package, need to manage the challenge from all aspects.

In addition, the learning of subject matters (i.e., the socio-technical topics) and intercultural learning had constituted a double-loop learning for students. On the one hand, learning the socio-technical subjects enhanced students' intercultural understandings. For example, when students shared relevant examples and cases in explaining and applying the concepts, they were also sharing the cultural-specific information and engaged in a co-construction process to identify the cultural diversity and difference. Especially, in learning about how the technical solutions would interact with social and cultural dimensions, students gained knowledge about the processes and practices related to special social groups and individuals, along with their insider perspectives (Czerwionka, Artamonova, & Barbosa, 2015). On the other hand, the intercultural interaction prompted the deep learning about engineering subjects. This positive effect was evident in their team and classroom discussion. The peer interaction had catalyzed the active and creative exploration of key concepts and supported their collaborative negotiation for deep understandings. This negotiation oftentimes involved careful observation and analytical reasoning, where students took up a series of higher-level cognitive activities, leading to a deeper understanding of the content knowledge.

11.5 Limitations and Discussion

This chapter presented a case study of the iPodia Program to demonstrate how the blended learning approach can be adopted to promote the intercultural competency in the engineering education. By integrating the Internet, videoconferencing, and face-to-face interaction, the program designed a flipped learning cycle where students were engaged in a sequence of immersive and interactive activities to develop both an understanding of subject contents as well as intercultural competency. Especially, benefited from the sequential learning, students were oriented to move from remembering and mastering the concepts to more comprehensive and critical understandings. Through this process, the learning of socio-technical engineering subjects and intercultural competency enhanced and reinforced each other, together promoting the growth of deep understandings.

Despite its effectiveness, there are several limitations with the iPodia Pedagogy, implying directions for future improvement. A major complaint from the students was the workload in the weekly learning cycle, along with the technical issues. As there are multiple tasks imposed on students throughout the 7 days in a week, students had to frequently check up the learning platform to keep up with the activity flow; otherwise they would be lagged behind or feel out of the loop. Many students viewed it as intensive and stressful, even felt challenging to commit the expected input. One possible solution proposed by students was to develop a mobile application of iPodia Platform, so they can access it via smartphones in a more flexible and convenient way. They also suggested the reminder or alarm function for the application development, which can help users keep track of dues and tasks.

The complaint about the workload was not only from students but also from instructors. As all the iPodia courses were expected to follow the iPodia Pedagogy, instructors needed to devote a large amount of time to prepare learning materials and activities, such as recording the video lectures, making the PowerPoint slides, and design in-class projects and activities. In comparison with traditional teaching, the workload was much heavier in teaching the iPodia courses, which would hinder the participation and contribution of instructors. To resolve this issue, we suggest developing institutional policy and incentive, to recognize and reward the instructor's inputs. Besides, the heavy workload implies the complexity of this program. When multiple globally distributed classrooms were connected online for such intensive interaction, the joint course delivery could be difficult to coordinate and organize. For instance, as shown in the two drops of student satisfaction in Fig. 11.3, when they were due to personnel changes and the program manager position was not filled, students criticized the ill-organization of the classes and felt little supports from the teaching team. The student reaction not only showed the importance of course management and coordination but also implied that a more sophisticated mechanism of cross-institutional collaboration is needed, to ensure a stable program operation and maintenance in a long run.

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Chapter 12
Closing the Urban-Rural Higher Education Quality Gap with Blended Learning in a STEM Course at Three Cambodian Universities

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Abstract Governments have identified higher education as a major driver of economic competitiveness and have invested substantially on improving the access of their population to higher education. While the improvement of access through the expansion of universities has helped to build a foundation for the development of the higher education sector in developing countries, there are quality gaps between universities, especially between urban and rural ones. This chapter presents a case study of how blended learning has been adopted to close the urban-rural quality gap of a Science, Technology, Engineering and Mathematics (STEM) course at three universities in the Kingdom of Cambodia. The country's flagship university in the city worked collaboratively with two provincial universities to design and develop a STEM course with online resources and activities that were then implemented at all three universities using a blended learning approach. This chapter examines how the blended learning approach is adopted in the rural university contexts to address the existing quality and access challenges of teaching and learning in the STEM course. It documents the impact of the blended learning approach through interviews and focus-group discussions with the key stakeholders. Based on the enabling and hindering factors identified in the study, the chapter discusses and suggests the blended learning strategies to close the urban-rural quality gap of STEM teaching and learning in the Cambodian higher education context.

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12.1 Introduction and Background

In a world that is becoming increasingly complex and knowledge-based, where demands of the job market are ever changing, there has been a growing consensus among economists and educators that human capital of “know-how” and “know-why” plays a key role in a nation’s socio-economic development. Countries around the world have given high priorities to develop and transform their higher education sector to prepare such qualified human capital. The Kingdom of Cambodia is of no exception. Cambodia is an emerging economy located in the southern region of the Indochina Peninsula in Southeast Asia. Over the last two decades, Cambodia has achieved remarkable economic progress towards middle-income countries (MICs) status, with Gross domestic product (GDP) growth at an annualised rate of approximately 7% (ADB, 2018). As the country works its way towards the transition from a labour-intensive economy to a knowledge-oriented one, human resource development through higher education is among the driving forces to move away from an over-reliance on low-skilled, low-wage, and low value-added industries (MoEYS, 2015).

The Royal Government of Cambodia has committed to improve access to quality higher education. For example, with financial support from donor agencies, it has enhanced access to higher education by establishing new provincial based universities. The number of public universities grew from fewer than 10 in the 1990s to 39 in 2014 (MoEYS, 2015). With better understanding of the labour market and better coordination and links with the industries, the government has been seeking to enhance the quality of higher education and its relevance to emerging industries. For example, Science, Technology, Engineering and Mathematics (STEM) courses and programmes that develop problem-solving and critical thinking competencies have become one of the focal points of The Ministry of Education, Youth and Sport (MoEYS)’s Education Strategic Plan (ESP) (MoEYS, 2014a), and large-scale projects such as the Higher Education Improvement Project (HEIP) (MoEYS, 2017). A number of STEM related undergraduate and postgraduate degree programmes have been implemented in universities across the country to develop the competencies of Cambodia’s young population to meet emerging needs of the labour market.

Cambodia’s higher education, however, faces several challenges and issues. One of them is the quality gap between urban and rural universities (MoEYS, 2014a, b). For example, there is a lack of qualified teachers in rural universities; the majority of them possess only a master’s or bachelor’s degree as compared to those teachers in urban universities who have at least a master’s degree and increasingly a PhD (MoEYS, 2015). Many of these teachers adopt teacher-centred “chalk and talk” approaches due to large class sizes in small classrooms. There are no professional development opportunities available for these teachers to enhance their capacity for quality teaching and learning. Such constraints are likely to compromise the effectiveness of higher education teaching and learning where students do not have opportunities to learn in different modes and learn at their own pace. The quality of teaching and learning resources is also questionable due to an over-reliance on outdated textbooks.

Blended learning, the deliberate fusion of online and face-to-face contact time between teachers and students and/or among students in a course (Graham, Woodfield, & Harrison, 2013), provides universities with opportunities to enhance access to quality teaching and learning. For example, blended learning may positively affect quality where teachers use up-to-date and high-quality online learning resources to meet the diverse needs of their students. Appropriate use of blended learning may create a 'learner-centric' learning environment where students are provided with opportunities to learn at their own pace, chart their own learning paths and interact with their teacher, fellow students and online resources (Boelens, Voet, & De Wever, 2018; Broadbent, 2017).

While the potential of blended learning to enhance quality higher education is well documented in the literature, how effective blended learning is in enhancing quality teaching and learning depends on the context it is implemented and supported (Garrison & Kanuka, 2004). In a developing country context where blended learning is a relatively new teaching and learning approach, it is worth exploring how blended learning may close the urban-rural quality gap in higher education teaching and learning. Based on a case study of a STEM course in three universities in Cambodia, this chapter examines how a partnership-based approach to blended learning adoption, implementation and support could close the urban-rural higher education quality gap in a developing country.

12.2 Literature Review

This section first identifies and explains the challenges facing Cambodia's higher education system with a focus on the unequal access to quality education between urban and rural areas. It then discusses how these challenges could be addressed through the blended learning approach to teaching and learning and urban-rural educational partnerships as a means to co-design quality courses.

12.2.1 Urban-Rural Divide in Cambodia and the Access to Quality Higher Education Teaching and Learning

Reports on the quality of Cambodian higher education (Chet, 2009; Un & Sok, 2014; Vann, 2012) have highlighted significant urban-rural disparities in terms of financing, infrastructure and human resources. Despite the strong commitment to improve the country's education system as a whole, demonstrated by the various initiatives by the MoEYS, and the establishment of Accreditation Committee of Cambodia (ACC) as a national independent higher education quality and assessment body, a considerable gap still exists in terms of higher education quality between universities (Rany, Zain, & Jamil, 2012). First, over-crowded classrooms with poorly equipped facilities in under-funded universities may not support learner-centred activities. Second, the regular salaries of teachers, as low as 6 USD per teaching hour (especially in the rural universities), are not based on performance and may not encourage improvements in teaching and learning (Sothy, Madhur, & Rethy, 2015). The resulting poor quality of teaching and learning in these universities could lead to learning disengagement and high repeat and dropout rates among students. These repeating students in the freshman and sophomore years may further contribute to the problem of overcrowded classrooms.

Third, access to quality higher education may also be caused by the unequal distribution of qualified teachers between urban and rural areas. Many rural universities experience a lack of qualified teachers (Chet, 2009; UNESCO, 2011). Although teachers in the rural universities may be compensated by the MoEYS in terms of hardship and housing allowances, qualified teachers who have graduated with a PhD often choose to stay in the city (Tandon & Fukao, 2015). These teachers are reluctant to work in rural and remote areas due to the prevalence of larger class sizes, double-shifting or multi-grade teaching, poor living conditions, transportation challenges, and a general lack of support (UNESCO, 2011). As a result, many universities have to employ ‘contract teachers’ - locally recruited and sometimes with questionable teaching qualifications – as an interim strategy (Nith, Wright, Hor, Bredenburg, & Singh, 2010). While the frequency of such arrangements has significantly been reduced, and the MoEYS has developed specific goals towards eliminating ‘contract teachers’, their services are sometimes still in need where there is an acute shortage of qualified teachers. This is particularly the case in STEM courses. After receiving poor quality instruction from less-qualified staff, students may lack the competencies required to succeed in the labour market.

Beyond issues caused by resource-related inequities, the gaps in the quality of Cambodia’s higher education follow deeply entrenched socio-economic divisions within the country, particularly those between poor and rich, and male and female. Poverty pushes many students out of higher education because many parents, especially in rural areas, cannot afford direct costs such as tuition fees and indirect costs such as food and transportation, as well as the opportunity costs of not having an extra pair of hands on the farm. Full-time students generally have no income, and many families need their children to help at home with domestic chores and field work. Traditional gender roles further limit their children’s options for entering higher education (UNESCO, 2013). This issue is particularly marked in STEM disciplines. Another issue is attracting students to higher education. Many public universities offer programmes at a relatively low fee and sometimes provide scholarships or subsidies, but there is still an obvious lack of interest among young people from poor, rural villages. One reason that young people are unmotivated to attend any STEM programme is because they believe it still will not help them find a job, given the high rate of unemployment among university graduates (Un & Sok, 2018). This perception may be due to the mixed quality of universities in Cambodia, where some programmes have failed to develop a relevant set of competencies for the fast-changing labour market and economy (CDRI, 2013). These setbacks form part of a cycle in which the quality of teaching and learning results in low enrolment, which in turn affects the financing of the universities.

12.2.2 Blended Learning for Access to Quality Higher Education

Blended learning has been responsive to new developments in higher education and has evolved over time (Dziuban, Graham, Moskal, Norberg, & Sicilia, 2018). Research studies suggest that the optimal adoption of blended learning may enhance student learning engagement and outcomes (Al-Qahtani & Higgins, 2013; Kiviniemi, 2014; Lim & Morris, 2009; López-Pérez, Pérez-López, & Rodríguez-Ariza, 2011; McKenzie, Perini, Rohlf, Toukhsati, Conduit, & Sanson, 2013; Vo, Zhu, & Diep, 2017). Studies also show that well-implemented blended learning encourages active learning by engaging students in online discussion and reflective journals, along with more active participation in face-to-face lessons (Aspden & Helm, 2004; Bower, Dalgarno, Kennedy, Lee, & Kenney, 2015; McKenzie et al., 2013; Snodin, 2013; So & Brush, 2008). Blended learning may also stimulate student deep learning through communities of learners engaged in peer coaching, sharing and support (Castaño-Muñoz, M. Duart and Sancho-Vinuesa, 2013; Ginns & Ellis, 2007; McKenzie et al., 2013; Owston, York, & Murtha, 2013). Blended learning through synchronous and asynchronous activities supports personalisation and learner autonomy as it provides students control over and management of the learning process (Spring, Graham, & Ikahihifo, 2018; Yoon, 2016).

12.2.3 Bridging Quality Gap Through Partnerships and Co-design of Courses for Blended Learning

While the potential for access to quality higher education of blended learning is well established, its adoption in unconducive environment can pose enormous challenges for its effectiveness, not to mention its sustainability and scalability (Lim & Wang, 2016). Meanwhile, modern-day constructivist approaches to learning have challenged the traditional understanding of the role of the teacher, the students' learning processes, and learning environments in general (Jonassen, 2011). Such gradual shifts, together with emerging technological landscape within education, have resulted in new and more demanding requirements that repositioning of teaching as a design science (Laurillard, 2013), and teachers as facilitators who create effective conditions for learners to learn (Mor et al., 2013). These challenges can be further amplified in developing countries such as Cambodia, where there is a considerable access and quality gap in higher education. Case studies in developing countries have shown that when there are urban-rural partnerships and co-design strategies, these challenges could be overcome (Draxler, 2008; Verger, 2012).

Urban-rural partnership is based on shared interests. It is a tool to achieve goals that would otherwise be difficult to achieve. Co-design, in the context of pedagogical innovation, is a highly-facilitated, team-based process in which teachers, researchers, and developers work together in defined roles to design an educational innovation, realise the design in one or more prototypes, and evaluate each prototype's significance for addressing a concrete educational need (Law, Yuen, & Lee, 2014).

In this study, the project team examines how blended learning closes the urban-rural higher education quality gap in Cambodia. The research questions are:

1. How do universities collaborate to co-design and develop a course with blended learning to address the urban-rural higher education quality gap in Cambodia?
2. What are the impacts of blended learning on student learning in the course at the rural universities?
3. What are the enabling and hindering factors of blended learning in the course at the rural universities?

12.3 Research Design and Methods

To address the research questions, we employed a qualitative case study method (Creswell, 2013) that focuses on a contextual process of "how something happens" (Merriam, 1998, p. 94). Taking a naturalistic approach, the research enquiry followed emergent design, which allowed changes to take place as the study unfolded (Hatch, 2002; Rossman & Rallis, 1998). The project team researcher served as an integral part in the study by acting as the data-gathering instrument and data analysis device (Hatch, 2002). The cases were selected in consultation with the Department of Higher Education (DHE) of MoEYS in Cambodia to ensure that our investigation was aligned to the strategic mission of the DHE. The DHE's key strategic missions include enhancing access to quality higher education in both rural and urban universities, and focusing on STEM. Three universities, one urban and two rural, were selected for the study. The Royal University of Phnom Penh (RUPP), established in the Cambodian capital in 1960, is the country's oldest and largest public university. The rural counterpart, Svay Rieng University (SRU), established in 2005, is a public university located in Svay Rieng province in the southeast part of Cambodia. The University of Battambang (UBB) was founded in Battambang province in 2007 under the jurisdiction of MoEYS with the vision of providing opportunities to students living in rural areas, especially in northwest Cambodia.

There were three phases to the research study:

12.3.1 Phase I – Needs and Situation Analysis

A needs and situation analysis (Altschuld & Kumar, 2010) was conducted in the three universities through semi-structured interviews with institutional leaders and programme leaders and teachers. The needs and situation analysis aligned the actions of the project team with the critical needs of the institutions. The interviews aimed to understand the challenges the rural universities had been facing, especially in the teaching and learning of STEM courses. Readiness for adopting blended learning was examined by going through the dimensions in Lim & Wang (2016)'s self-assessment tool for institutional blended learning adoption. Follow-up questions were asked to understand the unique local context of the rural universities. All the data collected in this phase guided the project team to identify possible courses that could be co-designed and developed by the three universities. One of the STEM courses that was offered across faculties (Faculty of Engineering and Faculty of Science) at all three universities, *C Programming Language* was chosen for this project. This course equips first year students with an understanding of the concepts and structures of programming language, and simple source codes in C, and provides them with opportunities to use C programming language to solve mathematical problems.

After the course has been selected, interviews were then conducted with the course teachers to build rapport and develop a better understanding of the course and its context. Questions were asked to elicit the learning needs of students, understand what they hope to achieve through our project, and understand their perceptions of blended learning and the possible partnership between the three universities. This process was supported by collecting and analysing documents related to the course that were used in previous semesters, including course outlines (syllabi), course materials, handouts, assignments, and administrative documents.

Phase I allowed the project team to develop an understanding of the needs and situations at the institutional and programme levels. It also contributed to better strategy formulation for the next two phases, and better informed research methodology.

12.3.2 Phase II – Blended Learning Resource Development and Induction Training

The online learning resource development started with meetings, a document analysis of the previous syllabus, and a review of handouts, worksheets, assignments, and administrative documents related to the C Programming Language course across the three universities. The Faculty of Engineering at RUPP took the lead with the online learning resource development, receiving constant input and feedback from UBB and SRU teachers as they reviewed the online resources (video-based lectures, screen recordings of technical demonstrations, lecture slides, and sample exercises) that were being developed. This process catered to the needs of the two rural universities by ensuring the development of appropriate and quality digital resources for use in the course.

While the online learning resources were being developed, three professional development workshops were organised for all teachers involved in the project. The first two workshops focused on blended learning practices. A cloud-based, free-version of a learning management system (LMS) was adopted for the online learning activities and resources to support face-to-face learning activities. The last workshop for supporting SRU and UBB teachers was led by the online learning resource development team from the Faculty of Engineering at RUPP that focused on the use of the online learning resources in the course. These workshops built the capacity of the teachers, and encouraged ongoing dialogues between the online learning resource developers and the course teachers across the three universities.

12.3.3 Phase III – Implementation and Evaluation

Throughout the 2017 Fall Semester (October 2017–April 2018), the teachers at SRU and UBB adopted a blended learning approach to integrate the online learning resources in their course. The developers and teachers provided technical and pedagogical content support from RUPP.

Three lesson observations by the project team took place over the period of the course in each of the two rural universities to document the blended learning practices of each case. This method was supplemented by document analyses through the researcher's non-participation role on the LMS using a functional account. The researcher of the project team went through the learning resources and activities online on the LMS. The analyses included (i) the nature of the activities/tasks; (ii) the learning resources used; (iii) the teacher communication and teacher-student interactions that occurred, and (iv) the participation of students. These complementary methods allowed the project team with a more comprehensive understanding of how blended learning enhance the access to quality teaching and learning in the two cases.

Three semi-structured interviews were conducted with the teachers of the course for them to share the key blended learning activities and the context of these activities. These interviews provided the teachers to explain the rationale behind the blended learning activities, how these learning activities take place, how online and face-to-face learning are being blended, and the effectiveness of the blended learning activities. The interviews also included the opportunities and challenges, and enabling and hindering factors of blended learning that the teachers have experienced in the course.

A semi-structured focus-group meeting was also conducted at the end of the semester with students who had taken the course in each of the two cases. The questions were aimed at determining the impact of blended learning on student learning in the course, to what extent the course was different from other courses in the programme, what the most and least effective aspects of the blended learning activities were, what the challenges they have encountered were, and what the overall satisfaction of their blended learning experiences was. (Table 12.1).

The medium of communication and documentation during the data collection was in English; the interviews, discussions and observations were simultaneously translated from Khmer (the official language of Cambodia) to English and vice

Table 12.1 Data collection schedule

Phase	Period	Activities	Collected data
Phase I	April 2017	Needs and situation analysis	Semi-structured interviews
Phase II	May 2017 – October 2017	Blended learning resource development Induction training	Focus-group meetings
Phase III	October 2017 – April 2018	Blended learning implementation Lesson evaluations	Onsite observations Document analysis Semi-structured interviews Focus-group meetings

versa by a local translator. Although teachers in the study had professional working proficiency in English that would have allowed them to express themselves clearly and effectively, the translation addressed the possible confusions and misunderstandings.

The data collected was first transcribed and organised for further coding. This process was done by the researcher himself as it allowed the researcher to add context, nonverbal information and bracketed notations from notes and memory. The transcribed and organised data were subsequently processed using Creswell's (2008) thematic development technique of theme layering and theme interrelating to inductively form understandings and explanations toward the research questions. More specifically, at first, every document, note and transcript was reviewed until the researcher had a close familiarity with the participants, the context, and the themes. In the second step, the researcher annotated the text with descriptive, linguistic, and conceptual comments to extract key information and create preliminary interpretative notes. As there was no pre-determined coding scheme, the initial coding applied an open coding technique (Miles, Huberman, & Saldaäna, 2014) first, and included a comment for further analysis. During the third step, the researcher analysed each comment, reviewing the original text as needed, and developed a concise, meaningful statement, or code, that represented each comment. Once all of the comments had been carefully analysed and codes are developed, the fourth step was to explore relationships between these newly created themes and cluster them into higher-order themes. In the final analytical step, the higher-order themes were checked with the original data to ensure they were accounted for in the data. The process of triangulation (data source triangulation, methodological triangulation, investigator triangulation, and theory triangulation) and member checking (Creswell, 2008) were integrated throughout the data collection methods to validate the findings.

Employing this research design and methods, the findings were expected to help the project team gain an in-depth understanding regarding how blended learning may close the urban-rural quality gap in higher education teaching and learning in the context of Cambodia.

12.4 Key Findings and Discussions

All teachers involved in this study spoke positively about the adoption of blended learning in their course, especially their recognition of the pedagogical value of blended learning for enhancing student learning engagement and outcomes. There were three key impacts of our project: Ownership of quality learning and teaching, formation of community of practice, and paradigm shifts in learning and teaching.

12.4.1 Fostering Ownership of Quality Learning and Teaching

The teachers reported that their adoption of the online learning resources encouraged them to take up the ownership of quality learning and teaching. The teachers of the rural universities had access to these online learning resources and how they could be used in the course. Through modelling instead of imitation templates, our approach also left the rural teachers ample opportunity to make the quality teaching their own. In other words, to move toward such ownership, changes in their own teaching approaches had taken place. A teacher from SRU detailed his approach:

> "The exercise in RUPP's material (resources) is helpful for me as examples when I design the exercise…I go through the material developed by RUPP and see if my understanding of the topic is coherent with theirs…I followed the course outline produced by RUPP. But I have made some changes…I rearranged the lessons based on the situation of my class."

Another teacher from UBB said:

> "The introduction of blended learning has allowed me to rethink what is possible and how the use of it can benefit my students."

12.4.2 Forming Community of Practice

The teachers expressed their desire to "improve their teaching" and student learning. The teachers from the three universities formed a community of practice (Wenger, 2015) to co-develop the online learning resources and implement them in their course. One of the teachers from SRU explained:

> "…I'm less experienced than the RUPP lecturers. The learning materials (resources) they developed are more updated and more authentic on the subject. So for me it is also a process of learning when I prepare for the lessons…I have contacted the RUPP teacher in the course material design team when I have questions in the materials and the online system. I have also talked to the teacher from UBB a few times to exchange experiences."

12.4.3 Shifting Paradigm in Learning and Teaching

The teachers shared that blended learning had changed their students' perceptions of learning; from the "spoon-feeding" learning paradigm towards a more active, self-directed, and personalised learning paradigm. To accommodate such a change, teachers also made adjustments to their teaching practices. One teacher from UBB explained:

> "I found students now have some level of self-motivation for learning the materials. Also, students can send messages to their classmates or teachers. I have been working very hard to reply the questions online… for one session, sometimes it could be up to 50 questions to be answered… Among these 50 questions, I usually respond selectively as many (questions) are similar issues."

The shift in students' paradigm of learning was observed by another teacher from SRU:

> "I found some students be able to come to me asking more valid questions. I don't have to explain to my students from A to Z that are already in the materials they have used. It will then help them to move forward and go straight to the practices."

The focus group discussions with students confirmed the teachers' observations. One student from UBB explained his blended learning experience:

> "A day before the class, I spend 2-3 hours on the things teachers posted each week. There are reading materials, videos of the lesson, and some useful links. I send my instructor questions sometimes using Facebook Messenger on my phone."

Some students indicated that blended learning helped them understand the topics better because the teacher-student interactions were extended beyond the classroom. A student from UBB added:

> "When I cannot follow my instructor during the class, I can check the learning materials my instructor posted on Schoology and study again…I think many of my classmates also do it this way."

12.5 Issues and Challenges

However, feedback from the teachers highlighted issues and challenges faced by the teachers during the implementation of blended learning at the rural universities: (1) Gap of student capacity between rural and urban universities; (2) English language issues and teachers' dilemma of the medium of instruction; (3) technical and infrastructure challenges; and (4) policy contradictions.

12.5.1 Gap of Student Capacity Between Rural and Urban Universities

Although teachers in rural universities were provided with quality online learning resources for their adoption, they were doubtful about their students' capability without their facilitation and further adaptation. Both teachers from SRU expressed their concerns after they went through and trailed the online learning resources:

> "The learning materials (from RUPP) are more difficult and I have to make evaluations on what to use and what not to use so that my students can learn from them…… when one exercise is good enough for RUPP students in those materials, I will need to prepare 3-4 more exercises in order to make my students master the topic…I try to look for more and easy-to-understand examples that are related to the topic and can be applied to the level of my students."

> "There is still a big gap between the theory and practice. By learning the videos lessons from RUPP are not enough for my students to be able apply the theory into practice. They would need more examples and exercises. So I need to make sure they understand the lesson before they go into practice. As a teacher I cannot read line by line of whatever RUPP gave me, but find solutions of linking the theory into practices. In some case I have to skip the parts that are too difficult based on situation of my students, and reinforce the parts that they are able to master and apply. In some case I just use my own materials that are informed by RUPP's materials."

One teacher from UBB shared how he provided additional resources for his students to complement the online learning resources:

> "I found out my students were not up to this level …I would also make supplementary handouts and other materials based on students' performance during the class, and make them public together with RUPP's materials. I think such a change would help my students to further develop the understanding when they study RUPP's materials, rather than viewing them without having any clue."

Students' feedback validated the teachers' comments of the importance of supporting the RUPP's resources with supplementary handouts and explanations. One student from UBB said:

> "When I study them before the class, they are difficult. But when the teacher explains to me during the class, I can then easily understand and be clearer on the topic. … sometimes, the teacher also give us more notes to understand the materials."

Another student from SRU shared how her teacher's support addressed the challenge:

> "It (the material) is quite difficult. I need to ask my instructor questions and sometimes it is getting better after he explained them to me… if not I can probably understand about 50% percent of the content in the video lecture."

This suggests that teacher's facilitation and adaptation are necessary in a blended learning environment. The teachers play a critical role in designing and implementing the blended learning activities.

12.5.2 English Language Issues and Teacher's Dilemma in Medium of Instruction

It was highlighted by all the teachers that using English in the online learning resources might be a challenge for students. However, professional proficiency in English is necessary due to the nature of the subject matter. Access in quality learning and teaching requires students to understand the medium of instruction. A teacher from UBB shared his dilemma of whether to use English or Khmer as the medium of instruction:

> "All the information in the materials are presented in English language and explained through voiceover in Khmer language. This is good for the course nature because not only our textbook but also the command, syntax and algorism in C programming are in English. However, on the other hand this is also an issue because most of the students in my class have very limited English proficiency. Many terms and expressions in the subject do not have direct translations in Khmer language. The voiceover in the materials is not enough to address the language challenges and my students would need lots of explanations from me. This might not be a problem for RUPP students as they have better English proficiencies. But language is a big challenge for our students here."

The students confirmed their teachers' observations, and highlighted that the teachers' explanation was necessary in this context.

> "It is difficult because there are many terms from English that I cannot understand. Those the Khmer symbol do not have any meaning (Note: transliteration). Sometimes the examples are useful but I still need teachers to explain more."

12.5.3 Technical and Infrastructure Challenges

Technical and infrastructure challenges such as the lack of computers and the internet at students' homes were the main factors affecting online learning by the students both in and outside the classroom. The teachers expressed their concerns that implementing the online learning activities might cause unequal learning opportunities for the students without access to technologies:

> "Doing online sessions, especially for the practicing aspect of our programming lessons, would need students to have good access to personal computers and good internet connections – I cannot guarantee that… This slows down what I can do with blended learning."

Meanwhile, the access to blended learning appeared to be manageable with the students using their mobile devices, although the slow speed and technical issues still existed. As students from UBB said:

> "I don't have a computer at home…I can still use my phone to do the online studying. I don't feel that is a problem. But I often need to check with the Schoology App with my phone because sometimes I don't get notifications that the instructor posted something. Sometimes I have to go to my classmate place to use their computers to check the posts when I have issues with my phone."

> "My mobile phone and the network are very slow. The materials often cannot load. Sometimes I have to wait to the late night for checking the materials because the speed is better at night."

12.5.4 Policy Contradictions

All the teachers mentioned that some policies at the institutional/system level were contradictory to their adoption of blended learning. The hierarchical university culture might not be conducive for the teachers to make autonomous decisions about their blended learning practices. This hindered their adoption of new technologies and pedagogical approaches.

The teachers particularly pointed out that the current teaching hour did not support blended learning.

> "This blended learning project made me think about different forms of teaching practices but at the moment it has been constrained by our university policies and the reality of students when they are not at the university. In an ideal situation I would wish to replace some face-to-face session to online that my student not necessarily come to class because I know many of them have other studies or work. However, our university policy does not allow students to stay at home for the sessions. They have to attend the class, otherwise they will be counted as absent. If they have many absent records, they will not be allowed to attend the final exam and would fail the course. This policy also applies to me. I cannot teach at home. I must come to the class."

> "The academic office monitors teacher's record for attending the class. According to our current Internal Quality Assurance, IQA, students have to do 45-hour learning… the 45-hour learning is now only taking account in-classroom learning. The IQA is followed the government guideline, and the change of that could be difficult and complicated issues even if I wish to include more online lessons. I'm not sure if our university can have our own institution policy that can work this out."

12.6 Conclusion and Implications for Practice

This chapter has explained the potential of adopting blended learning in addressing the quality gap between rural and urban universities in teaching STEM disciplines. The key findings suggest that there are paradigm shifts of learning and teaching among the students. The findings also highlight the teacher's role of facilitation and adaptation in making the blended learning work. With the growing use of mobile devices among students, and the employment of a cloud-based rather than institutional-hosted Learning Management System (LMS), blended learning is more likely to provide access to quality learning and teaching. That is, access to the quality digital resources may reduce the digital divide that blended learning initiatives in similar contexts often face. Contextual variables such as goal alignment, teacher readiness, and student capacities were identified as critical factors for successful blended learning towards quality higher education. It was also recognized that blended learning could improve access to quality higher education, but could be still largely constrained by the capacity required for supporting its adoption at the institutional/system level. Therefore, it is necessary for institutional capacity-building.

There are two implications for practice. First, our experience demonstrated that if teachers have a better understanding of the merits of the blended learning approach, they are more likely to transform their learning and teaching. The rural universities continue to address their technical and infrastructure issues, and teacher's community of practice could become a regular practice. At the same time, professional development programmes (PDP) that address the teacher's challenges and issues need to be put in place. PDP must be more than episodic events but a long-durational process of progression. Peer mentorship mechanisms that pair leading teachers at the partner institutions with the ones who are less experienced about the blended learning approach can be established. For reducing the student capacity between rural and urban universities, supporting mechanisms such as immersive blended learning camp and learning tutorials should be established.

Secondly, successful blended learning with the partnership approach requires a nurturing environment in which teachers can have the autonomy to try out new methods and reflect on their own practices. This means removing the contradictions at the university policy levels. Autonomy must be given for teachers so that they could engage in the new modality of teaching and the reflective dialogue for shaping their improved practices. Through policy advocacies, the sharing of ideas among teachers may result in a positive peer impact, and ultimately effective practices in blended learning partnerships to close the urban-rural higher education quality gap.

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Chapter 13
Finding the Right Blend: Bringing Learning Back to Blended Learning

Seng Chee Tan, Helen Bound, and Xinghua Wang

Abstract The central theme for this chapter is to highlight the importance of learning design for blended learning. This means anchoring blended learning on established learning approaches substantiated by theories, principles, and empirical data. Also important is the *blending* of various components related to learning, and how to achieve effective blending. Thus, we propose a blended learning design involving three major components: (1) design considerations from a learning perspective, (2) considerations of different dimensions of blended learning and (3) integrating different components for effective learning. A case example of blended knowledge building strategy was provided as an illustration of this design approach. We further suggest that this approach is transferable to other learning approaches, such as flipped classroom approach.

13.1 Bringing Learning Back to Blended Learning

This chapter has a seemingly simple yet complex mission: foregrounding *learning* in the design of blended learning. Blended learning has become a widely adopted learning approach in higher education (Lim & Wang, 2016). Nevertheless, Sharpe, Benfield, Roberts, and Francis (2006) highlighted the issue of different interpretations of blended learning and lamented the lack of consensus on how blended learning is defined. The most common definitions, according to Graham (2013), are "(1) blending online and face-to-face instructions, (2) blending instructional modalities (or delivery media), and (3) blending instructional methods" (p. 334).

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There could be good reasons for the wide range of definitions for blended learning. Norberg, Dziuban, and Moskal (2011) suggested that blended learning can be treated as a boundary object that is shared across various communities, each adapting it for local contexts and needs, yet maintaining a common identity. This could explain for the wide adoption of blended learning. Yet, there are a few related issues with the lack of consensus and clarity of the meaning of blended learning. First, the wide range of the definitions of *blended learning* means that it refers to a broad variety of approaches of learning that encompass various interpretations and implementation methods. When we say we use a *blended learning* approach, it probably conjures different images in different people. How is this helpful to learning designers and educators? In addition, if the instructional method is working or not working, we can't really tell what makes it work or what leads to the failure. This leads to the second issue: what are the affordances of blended learning environments that could lead to effective learning? To say that we use a mix of online and face-to-face delivery methods does not help much; we need a more granular description of the conditions of the learning environment. For example, in the Community of Inquiry model (Garrison, Anderson, & Archer, 2000), successful learning occurs through effective interactions between the instructor and the learner, learner and other learners, and learner and the learning resources. That means a more detailed description of the learning conditions based on an established learning theory, model, or principle is needed. Third, all definitions highlighted by Sharpe et al. (2006) focus on how instructions are delivered or implemented, rather than designing for effective learning interactions. Graham (2013), in a comprehensive review of blended learning, suggested that while empirical studies show the effectiveness of blended learning, there are "still needs to uncover the root causes for improved learning outcomes in blended learning contexts." (pp. 345–346). He further proposed some productive areas of research, such as exploring quality of interactions, cognitive engagement, and learner characteristics. These areas of research are, in fact, all related to learners and learning. In other words, to explain for how and why blended learning works, there is a critical need to bring the perspective of *learning* back to blended learning.

Critically, we need to be cognizant that the term blended learning is constituted of two words: blended and learning. Specifying how it is blended is not sufficient, we need to describe the conditions for effective learning. Thus, blended learning has to be anchored by learning design for effective learning.

13.2 Learning Designs for Blended Learning

Focusing on learners and learning means prioritizing thinking about how to create a holistic learning environment for more effective learning. Without considering how to design for effective learning, other aspects of blending may not be productive. Learners will not learn better simply because we change the modes or modality of delivery. Graham, Henrie, and Gibbons (2014) made a similar argument after reviewing empirical studies of blended learning. They found that much of the design research of blended learning focused on surface features or physical attributes such as the modes of delivery, which did not help to explain why and how blended learning worked pedagogically. To have greater explanatory power, they suggested identifying the core attributes of the design and highlighted the importance of the pedagogical layer of design.

Putting learners at the centre of our design consideration, we can consider learner's experiences in a learning context. We propose a blended learning design involving three major components: starting with (1) design considerations from learning perspectives, followed by (2) considerations of different dimensions of blended learning and finally (3) how to achieve effective *blending*.

1. Designs underpinned by learning approaches and principles. In general, successful learning occurs through effective interactions between the instructor and the learner, learner and other learners, and learner and the learning resources (see Anderson, 2008). Ultimately, a learner has to be engaged in thinking about the content, and relating to prior knowledge, or dialoguing with others about the content, and engage in meaning making. The integrative effect of cognitive, social, and emotional engagement provides the favourable conditions for learning to take place. Thus, one fundamental design consideration could be providing the appropriate blend of cognitive, social, and emotional engagement for holistic learning. The instructor could choose to adopt a more specific learning approach or model that integrates holistic engagement with students, for example, a dialogic approach to learning.
2. Building on this basic unit of effective learning interactions and engagement, we can begin to extend the design considerations to other dimensions of blending (Sharpe et al., 2006), such as face-to-face and online, or synchronous and asynchronous learning. Different aspects of blending could be considered. Sharpe et al. (2006) proposed eight dimensions of blending: delivery modes, technologies supporting blended learning, synchronous or asynchronous modes, practice-based or classroom-based learning contexts, different grouping strategies, pedagogical approaches, acknowledging different learning goals, and self-directed or teacher-directed. Some of these, such as pedagogical approaches, are related to learning.
3. For each dimension of blending, it is important to consider the alignment across different modalities or modes of instruction. For instance, there could be weaving between face-to-face and online learning to achieve strong coherence between the two modes of instruction, rather than as independent instances of instruction and learning. For example, if an online forum is used to engage students in the online discussion, the content of discussion could be weaved into the face-to-face discussion, and vice versa. Otherwise, the learners may feel that the learning is compartmentalized. Similarly, if an instructor chooses to use dialogic approach to learning, then the same approach could be applied across the modes of instruction. If the online mode is only used for delivering content via computers didactically but the face-to-face instructions is reserved for problem solving (which is practised in some flipped classrooms), the learners might form the impression of one mode of instruction being more important or more engaging or more interesting than the other. Critically, there is a lack of opportunity to deepen understanding of knowledge learnt.

In the next section, a case example will be used to illustrate what the proposed learning design looks like in a case example.

13.3 Case Example – Blended Learning through Knowledge Building Approach

This case example was a graduate level course that was offered to Master's and doctoral students, focusing on computer-supported collaborative building (CSCL) and knowledge building (KB) approach. Two instructors co-taught this course and both have more than 15 years of experience working with CSCL and KB. This chapter is based on the findings of part of the case study; it highlights on the blended learning *course design* and the *rationales* underpinning the design.

There were 15 participants in this course, out of which 14 participants consented to a case study research. The 14 participants, aged between 31 years to 60 years, had obtained a Bachelor's degree and 4 participants had completed a Master's degree. In addition to the tertiary education qualifications, 9 participants had completed professional training in adult and continuing education. All participants are educators working in schools, institutes of higher education, or other adult education contexts.

The main learning goal of this course was to help participants gain deep understanding of the theories and practice of CSCL with deeper exploration into knowledge building as one specific CSCL approach. This is aligned to the ideal of educating learners in the knowledge age (Tan, Hung, & Scardamalia, 2006). The instructional approach was to engage the participants in knowledge building so as to learn about CSCL and knowledge building. This is also an approach that instructors *walk the talk* (Divaharan, Lim, & Tan, 2011) by modeling the pedagogical approach. More explanations on the learning design will be elaborated below. There were 13 face-to-face sessions, each lasting for about 3 hours. During and in between face to face meetings, the participants also engaged in online discussion using a CSCL platform known as Knowledge Forum.

13.3.1 Learning Design – Blending of Cognitive, Social, and Emotional Aspects of Learning

Underpinning the blended learning for the course is the knowledge building approach (Scardamalia & Bereiter, 2014), which essentially involves collaborative inquiry among participants towards the shared goal of problem solving or problem of understanding. A critical part of the process is the construction and improvement of shared knowledge artefacts (e.g., notes, concept maps) that represent deepening of understanding of knowledge achieved by the community. Knowledge building is an integrative approach of learning that involves interactions between the instructor and the learner, learner and other learners, and learner and the learning resources (see Community of Inquiry model by Garrison, Anderson, & Archer, 2000).

Unlike approaches that focus solely on individual cognitive changes and approaches that emphasize individual acquisition of knowledge, knowledge building is aligned to the socio-cultural perspective of learning where knowing is achieved through participation in cultural practices (Sfard, 1998). In addition, it has the added element of learning through knowledge creation (Paavola & Hakkarainen, 2005) that highlights the critical role of co-creating and improving knowledge artefacts that capture the group learning. It is also a dialogic approach where productive dialogues among participants are critical to bring about meaning making. By productive dialogues, we mean productive talks that are not simply agreeing, or are confrontational, but exploratory talks (Dawes, Mercer, & Wegerif, 2003) that require active listening, being critical and constructive to others' ideas, treating ideas as tentative and open to improvement, and aiming to collaborate rather than to compete (Walton & Macagno, 2007). Through exploratory talks, participants build on and improve one another's ideas. In addition to cognitive gain in individual learners, social aspects of learning are critical in knowledge building.

In more concrete terms, knowledge building is triggered by problems authentic to the participants that are raised by the participants (e.g., is collaborative learning different from cooperative learning? How do we foster productive discussion?) Such authentic issues act as a trigger for the participants to put forth their ideas, and seek to improve their ideas. To create a space for exploration, the questions are "open or divergent…in terms of allowing a broader degree of uncertainty in what would constitute an adequate answer" (Burbules, 1993, p. 97). In other words, open-ended questions are solicited to trigger inquiry rather than for assessing students. By idea, we mean a unit of thought that can be a question, an explanation, an observation, or an opinion. It is represented in some ways using the semiotic resources (e.g., a text written by a participant). These ideas are thus captured as knowledge artefacts in a shared platform (e.g., an online forum). Once in the shared platform, the participants can read the ideas, compare ideas, identify the strengths and weaknesses, identify gaps, suggest ways to improve the ideas, or propose new ideas. Since these texts are representations of students' ideas, improving the idea representation could mean improving their understanding of the topic or issues being discussed. Overall, it leads to collaborative idea improvement through productive discourse. This process could be cyclical in that the process of collaborative inquiry usually triggers other new ideas and new questions that lead to further inquiry.

Focusing on authentic inquiry suggested by the participants has the advantage of developing their epistemic agency, that is, participants taking ownership of their knowledge creation effort. When the participants are engaged in inquiry of an authentic problem they raised, they are naturally more motivated and are likely to invest a lot of effort to pursue the answer. In other words, knowledge building entails emotional aspect of learning.

Scardamalia and Bereiter (2010) proposed 12 principles of designing for knowledge building. Table 13.1 shows how these 12 principles were applied for the design of this course.

Table 13.1 Application of 12 principles of knowledge building for the course design

Principles	Examples of initial approaches to guide the students
An idea-centric approach	
Real ideas, authentic problems Engage students in inquiry related to problems that arise from their effort in understanding the world.	Trigger students' curiosity and interest in a topic and help them to generate inquiry questions. For example, "Dillenbourg (1999) distinguished between cooperative learning and collaborative learning. Why? Are these two concepts different? Are there similarities?"
Improvable ideas Treat all ideas as improvable.	From the students' discourse, show the students a few examples of good ideas and to think of ways to improve the ideas further. Explicitly talk about respecting one another's ideas.
Idea diversity It is good to identify ideas that are related and to have a variety of ideas that approach the same problem from different perspectives.	Highlight examples of ideas that are different because of different perspectives or different ways of approaching the same inquiry problem. Identify the values of how these differences enrich the way we think about an issue or approach a problem.
Rise above The aim is for students to be able to integrate ideas, to synthesize new ideas, or to use higher level principles or theory in explanation.	Demonstrate to students how different ideas can be integrated to become a better idea; how to go beyond listing discrete facts and pieces of information to understanding a topic or a problem from a higher level principle or theory. For example, relating the seemingly different concepts of "constraints" and "affordances" as ways of facilitating learning.
Knowledge building practices	
Authoritative sources of knowledge Students should make meaning of authoritative sources of knowledge, not just acquiring the knowledge, but also to use them for the inquiry.	Provide students with selected articles for meaning making. Highlight how to assess the information critically for accuracy, how to interpret the meaning of the information, and how to use relevant information towards the goal of the inquiry.
Knowledge-building discourse Students should engage in productive talks that focus on active listening and building on one another's ideas, rather than competing to win an argument.	Show examples of good and productive talks and get students to apply them mindfully. Teach students how to negotiate differences. Contrast productive talks with talks that are competitive, disputation in nature, or those that are of simple agreement or disagreement without providing reasons.
Transformative embedded assessment Assessment is not a separate activity. We can integrate assessment *for* learning and assessment *as* learning seamlessly in the process of knowledge building; encourage self-assessment.	Use students' notes as evidence of learning. Use analytics (e.g., analytics in the Knowledge Forum®) to provide quick feedback to the students. Engage students in discussing the criteria for assessment and the criteria to assess the quality of notes in the discussion. Get students to assess their own notes. In this way, assessment is part of the learning process.
Symmetric knowledge advancement Recognize different expertise among students; having them take turns to lead and contribute will eventually benefit everyone.	Help students to identify different expertise and strengths among them and encourage them to take turns to help one another. Increase students' awareness that we benefit and learn in the process of teaching others. Teach the students about collaborative strategies.

(continued)

Table 13.1 (continued)

Principles	Examples of initial approaches to guide the students
Develop knowledge-building capacity	
Pervasive knowledge building Develop knowledge-building practice as a habit of mind to be applied across various learning contexts and subjects, not just an ad hoc application.	Use knowledge-building approach consistently, regularly and frequently throughout the course.
Democratizing knowledge All students have the rights to contribute in knowledge building, not just the privileged.	Emphasize that every student has the rights (and responsibility) to participate and contribute. Set class rules about respecting every participant. Provide opportunities (online and face-to-face) for students who are less confident to contribute in class.
Collective cognitive responsibility Develop in students the attitude that everyone has the responsibility in advancing the collective knowledge to the benefit of the community.	Allocate some points for positive group behaviours. Provide opportunities for students to create something as a whole group or class (e.g., group portfolio and group taking turns to lead discussion).
Epistemic agency Help students develop the ownership of learning and autonomy in doing knowledge building.	Let the students know that their ideas matter; find opportunities to highlight good ideas contributed by the students. Provide opportunities to show autonomy in their learning. Encourage students to show autonomy by sharing relevant resources or initiating new inquiry.

In short, the course design was underpinned by knowledge building principles. The following sections explicate various dimensions of blending, and for each, the design considerations for effective blending.

13.3.2 Blending the Synchronous/Face-to-Face and Asynchronous/Online Modes

This course consisted of both face-to-face instructions complemented by online discussion supported by Knowledge Forum (a CSCL platform) (see Fig. 13.1). In essence, Knowledge Forum provides a platform for the participants to put forth their ideas and collaboratively improve their ideas. It has customizable scaffolds to help shape productive discourse and it is equipped with various analytics (e.g., social network, level of participation) available to the instructor and learners.

The notes on the Knowledge Forum act as the knowledge artefacts that represent the students' ideas. Once posted, they serve as a historical record of the development of ideas and mediate the collaborative idea improvement process. These textual records of the online discourse is critical in linking the online asynchronous discussion and the face-to-face synchronous discussion, which is achieved with intentional design that weaves the two modes of instruction, illustrated below with a specific topic of discussion on the affordances of technology.

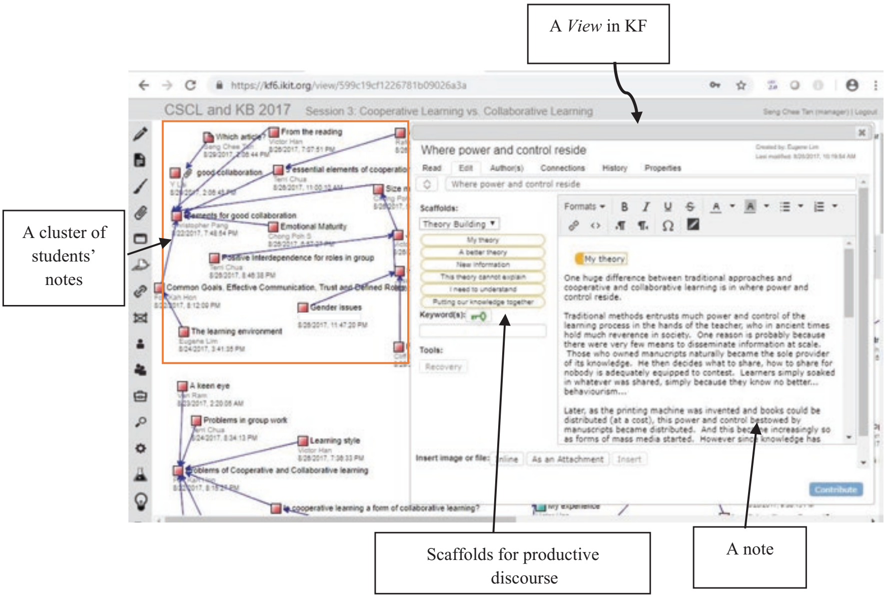

Fig. 13.1 Knowledge Forum interface

In one of the face-to-face sessions, the topic of discussion was on collaborative learning and cooperative learning. Following that, an academic paper that discussed the affordances of computer-supported collaborative learning (Jeong & Hmelo-Silver, 2016) was posted in the Knowledge Forum. This was to start linking "computer-supported" (the roles of computers) with the concept of "collaborative learning". Through the asynchronous online discussion mode, the students had an extended discussion on the meaning of "affordances", which involved related concepts such as "perceived affordances", "intended affordances", "affordances and context", and "affordances and constraints". This was led by a group of students who was responsible for facilitating the discussion. In the subsequent face-to-face meeting, the students summarized the key concepts discussed and highlighted a few insights generated through the discussion. The instructor then came in to address one of the concepts, *constraints*, which was misinterpreted by the students. Following this, the instructor led the students to concepts of knowledge building, which involve the principles of facilitating collaborative learning supported by networked computers.

In summary, the strategy of integrating synchronous/face-to-face discussion with asynchronous online discussion involves (1) the design consideration of how concepts are linked to one another in a logical manner, (2) how to engage the students to gain deep understanding of these concepts, (3) how to bring the discussion of the concepts from the online mode to the face-to-face mode and vice versa. Knowledge artefacts play a key role in this process, both as a record of the development of ideas, as well as mediator for collaborative idea improvement across different modes of learning.

13.3.3 Blending Instructor's and Students' Voices and Choices

Blending of instructor's and students' voices is reflected in the dialogues among students and with the instructors. Knowledge building is a dialogic approach in that productive dialogues among participants is a critical element to collaborative idea improvement. Students are taught to focus their talks on epistemic quality of ideas, for example, providing elaborate and justified explanations and support ideas with examples, reasons, and evidence. There should also be meta-level reflection by examining the process of the discussion and the epistemic criteria for reasoning, thus creating opportunities for self-correction (Burbules, 1993; Splitter & Sharp, 1996). Meta-level discourse moves include seeking clarification, connecting ideas across contexts and participants, and reflecting on levels of understanding. Through the dialogic process, the students engage in collaborative co-construction of knowledge by building on one another's positions and justifications, integrating the preceding contribution to advance the group's reasoning. Correspondingly, the instructor focuses on providing epistemic feedback. That is, rather than dichotomizing students' answers as right or wrong, the feedback could help to advance the inquiry by paying attention to the process and quality of ideas, seeking elaboration for the epistemic basis of the answers, such as justification, asking for evidence, and challenges students with alternative perspectives (Gregory, 2007).

Reznitskaya and Gregory (2013) described dialogic teaching as "a pedagogical approach that involves students in the collaborative construction of meaning and is characterized by shared control over the key aspects of classroom discourse" (p. 114). Thus, another aspect of dialogic teaching, as compared to monologic teaching such as didactic instruction, is the shared control given to students. In other words, dialogic teaching also caters to autonomous adults by encouraging shared control among the educator and adult learners in the teaching and learning process. In concrete terms, there is a democratic power relationship among participants over the content and form of discourse. Students are encouraged to take responsibilities for pursuing their inquiry questions, managing talks, offering new ideas, seeking clarification, evaluating one another's ideas, and suggesting changes. In knowledge building, the democratic power relationships are reflected in several design principles: developing students' epistemic agency, assuming shared cognitive responsibilities, and democratic participation.

In the course, blending of instructors' and students' choices are reflected in the flexible course implementation. The instructors provided the course outline detailing the intended learning objectives, course schedule, and delivery methods, thus setting the initial exploration space for the topics in the course. The students, however, had the choice of raising their inquiry questions, exploring deeper into related issues (e.g., explore deeper into the concept of affordances) and providing additional resources (e.g., additional readings). The students also took turn to assume instructional leadership by leading and facilitating online discussion, and presenting the summary of discussion or additional learning activities in the subsequent face-to-face meeting.

13.3.4 Blending Individual and Group Learning

By now, it could be apparent to some that knowledge building is concerned with collaborative idea improvement, which features strongly the interactions among the learners. Personal and group learning, however, are actually intertwined. This is explained in Stahl's (2006) model of collaborative knowledge building. Adapting from this model, we can view knowledge building as involving two intertwined spheres of learning. A personal space and the social knowledge building space (Fig. 13.2).

Explained from the perspective of Vygotsky's theory of human development (Vygotsky, 1978), learning is social in nature as it first takes place in an intermental plane (between individuals) before moving into an intramental plane involving individual thought processes. When we interact with others in a shared space, we share our thoughts and experiences with others, and in the process, interpret and codify our experiences (Varela, Thompson, & Rosch, 1991). In other words, we co-construct meanings and develop coherent understanding of the world through social interactions. The knowledge building process (e.g., posting notes on Knowledge Forum, engaging in idea improvement) reflects this social interaction and learning. The shared understanding is captured in the co-constructed knowledge artefacts (e.g., notes).

Expanding this concept of shared knowledge artefacts to our everyday life, we are living in an environment surrounded by cultural artefacts (e.g., books) and practices (e.g., how to do something). These are resources that we use as we engage in knowledge building. As we learn to use these artefacts and develop the practices, we assimilate the experiences of others (Leont'ev, 1981). In the process, we are set on

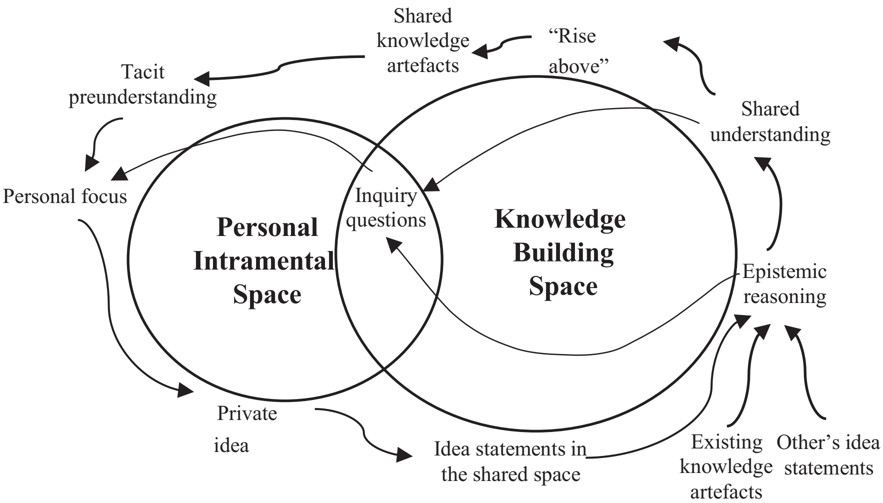

Fig. 13.2 Intertwined personal and group learning in knowledge building

a trajectory of mastering the cultural tools and developing the accepted practices. Seen from this perspective, human beings possess not only biological inheritance, but cultural inheritance; and the participation in communities of practice brings about continuity of the society. Learning, from this broader perspective, is the result of continuous participation in social activities that leads to transformation of the identity of an individual who develops expertise in using cultural tools and engaging in practices. Through joint activities with others, different people contribute to developing solutions for new situations, complementing and supporting one another in the interest of achieving the shared goal. Teaching, the intentional act of providing instructions to another towards a predetermined objective, is but one way of helping another person to develop. From this perspective, learning through knowledge building, in itself, is a blended personal and group learning process.

In the course, to recognize and encourage both individual and group learning, course assessment consists of both individual assignments (e.g., maintaining personal portfolio, concept maps, reflection), as well as group assignments (e.g., leading a discussion).

13.3.5 Blending Assessment of, Assessment for, and Assessment as Learning

Assessment is an integral part of learning. There are, however, different approaches of assessment for different purposes. In essence, assessment of learning is to place judgement on students' learning (e.g., end of course assessment) for the purposes such as awarding credits. Assessment for learning emphasizes the use of information of learning to improve students' learning (e.g., providing feedback, identifying areas for improvement). Assessment as learning engages students in the process of self-assessment for self-monitoring or self-directed learning.

In this course, all modes of assessment are employed. Assessment of learning is needed as this is a course offered for credit. Criteria for the course assessment are communicated to the students at the beginning of the course, comprising both individual and group components. For the group assessment, the groups are tasked to facilitate an online discussion followed by face-to-face "rise above", as mentioned earlier. The individual assignment is based on personal portfolio and a summative reflection. By asking the students to build their portfolio as the course progresses, assessment for learning is linked to assessment as learning. For example, the students were asked to construct concept maps as they explored different topics. In this way, newer concepts can be linked back to the earlier concepts learnt, and amendments can be made to the earlier maps, which is, in a way, a reflection of own learning.

Analytics are used in this course to provide feedback to the students. Knowledge Forum is equipped with a suite of analytics tools, including level of contribution over time (Fig. 13.3), social network analysis (Fig. 13.4), and time machine (recording online behaviours over time).

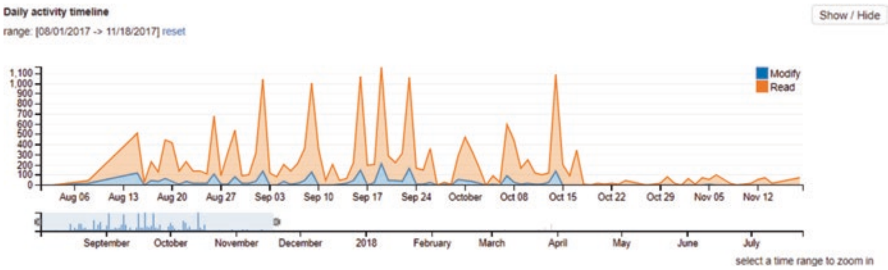

Fig. 13.3 Activity levels of reading and modifying notes over time

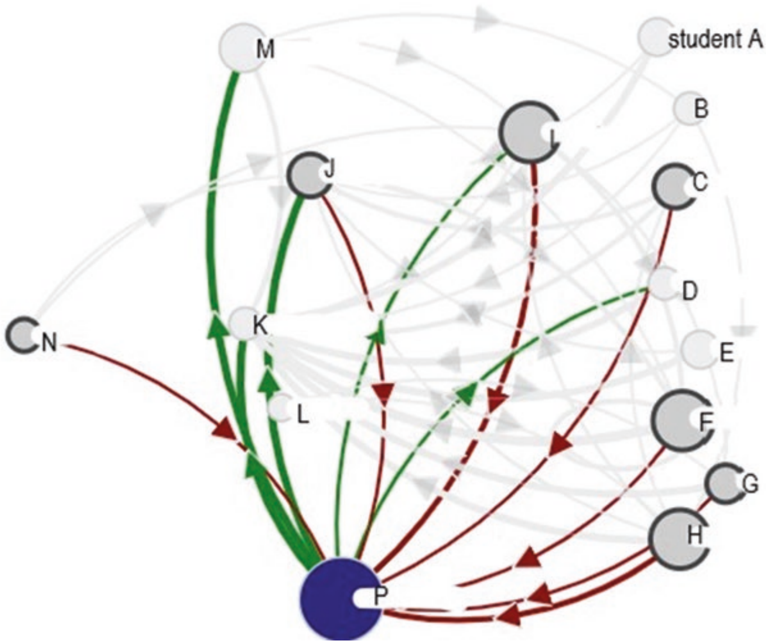

Fig. 13.4 In- and out-notes built on network visualization of a selected author

For example, Fig. 13.3 shows the level of activities over time. The instructor first showed the analytics to the students, highlighting the fact that most online activities happened the day before the class. Figure 13.4 shows a selected student (dark shaded circle), the extent other authors built onto the notes (thickness of the line) contributed by this student (in arrow), and the number of times this student built onto notes of other participants.

These analytics are also available to the students, who were keen to use the tools to monitor their own activities and behaviours. As reflected in the post-course interview, the students were particularly mindful of whether other people responded to the notes contributed by them and they wanted to post high quality notes that could lead to active discussion.

These analytics, first used by the instructor to provide feedback to the class (assessment for learning), become tools for students to monitor their own performance and behaviours (assessment as learning).

13.4 Discussions

The above case example on the design of blended knowledge building is used to illustrate the key considerations for the blended learning design that we proposed. These are guidelines that we suggest are applicable if other learning approaches are adopted.

To iterate, the main message we intend to bring across in this chapter is that blended learning comprises two parts: blended and learning. We should not lose sight of learning design. Suppose an instructional designer decides to use a blended learning approach considering various conditions such as the learners' preference, the instructor's preference, the infrastructural provision and support, and the availability of computing devices, at some point in time, the designer needs to consider what learning activities should be assigned to the online mode and what to be implemented in the face-to-face instruction. This cannot be a random decision. We have illustrated how the design decisions were made following knowledge building principles (Table 13.1). Consider another example, if the designer decides to use a flipped classroom approach, then principles of flipped learning need to be applied. Consequently, what learning activities to be assigned before, during, and after classroom instruction phases will follow depending on which models of flipped learning is adopted. The decision to adopt a flipped learning approach means that there are some underlying assumptions about what constitutes effective learning and what the roles of technologies are in supporting learning. In other words, we cannot escape from the learning design. Since learning designs are closely related to our beliefs about learning, it is critical to anchor the design on learning theories, principles, and approaches, before considering to blend different components and methods.

Second, once a learning approach is selected, it is important to understand the key principles of the anchoring learning approach to minimize the risk of a "lethal mutation" (Brown & Campione, 1996, p. 292). In the knowledge building example presented through the case example, we need to keep the key essence of collaboration and idea improvement through dialogic inquiry. Consider another example regarding a flipped classroom approach, then the focus cannot be merely on creating video to deliver content. It requires a careful consideration of the distribution of learning activities across different phases of the instruction. If an instructor decides to use video to deliver part of the content to the students so as to free up more time for the face-to-face instruction (a very common rationale for flipped classroom), it is critical that learning activities that deepen the understanding of the core concepts or that engage the learners in applying the concepts should be designed for the face-to-face meeting. If the face-to-face interactions are limited to lectures and common text-book based exercises, the key values of flipped classroom will be lost.

Finally, we should not neglect the integration of different components in the blending phase. Learners might feel that the learning activities are compartmentalized and learning effectiveness may be sacrificed. For example, in the case of knowledge building, if there is no connection between discussion on the Knowledge Forum and the face-to-face meetings, we will lose the opportunities to deepen understanding of key concepts or to have more nuanced insights on related issues. Likewise, for flipped classroom approach, the concepts learnt in the pre-classroom phase should be employed in the classroom activities (e.g., problem solving); otherwise, they are just distinct instructional phases with different modalities, rather than a blended learning.

13.5 Conclusions

This chapter started with a declaration of the mission of bringing *learning* back to blended learning, in other words, to give due attention to learning design focusing on designing conditions for effective learning, before considering other issues such as delivery methods and modes. We propose a learning design for blended learning involving three major components:

1. design considerations from learning perspectives by anchoring it on established learning approach or model,
2. design considerations of different pedagogical dimensions of blended learning, such as delivery modes, delivery methods, individual and group learning, assessment, and voices and choices of learners, and finally,
3. design considerations for achieving effective *blending*, that is, to weave different components together to provide a coherent learning experience towards the learning goals.

As a case example, we presented a blended knowledge building approach (Fig. 13.5), which is an approach that has evolved with decades of research and stood the test of numerous classroom implementations. As explained in the earlier section, essentially, knowledge building engages learners in collaborative idea improvement and involves cognitive, social, and emotional aspects of learning. Knowledge building is an integrative approach of learning that involves interactions between the instructor and the learner, learner and other learners, and learner and the learning resources (see Community of Inquiry model by Garrison et al., 2000). This learning approach, backed by a wealth of empirical research data, provides confidence that the suggested design principles could lead to effective learning.

Four types of blending are featured in this design, each with a suggested blending strategy.

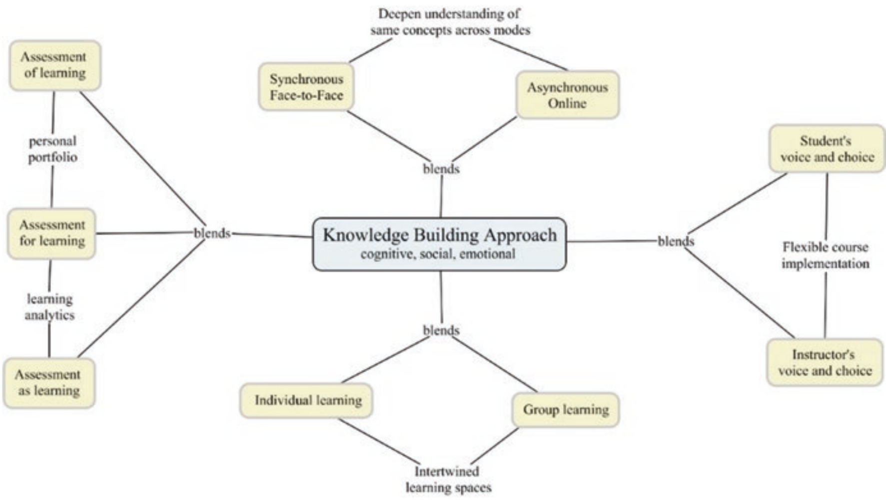

Fig. 13.5 Summary of blended knowledge building strategy

1. Blending of synchronous/face-to-face with asynchronous/online learning. The design could consider how discussions could be weaved in the two modes of instructions to deepen learners' understanding of the concepts or key ideas. Knowledge artefacts created by the learners can mediate this process.
2. Blending of instructors' and students' voices and choices. This involves consideration of the initial boundary or scope or rules set by the instructors and the flexibility to encourage learners' choice of inquiry questions. It also empowers the learners by highlighting the importance of dialogues among learners in the learning process.
3. Blending of individual and group learning. This can be achieved through the exploration space as a naturally intertwined personal intramental space and social knowledge building space. The instructors can further strengthen the conditions by including as assessment components of both individual's and group's performance.
4. Blending modes of assessment. This is achieved through the building of personal portfolio incrementally throughout the course and the use of learning analytics to encourage reflection as part of learning.

We further suggest that the above components of learning design can serve as a general guideline, even if other learning approaches are adopted. Regardless, it is critical to understand the key elements of a learning approach and avoid mutation of the methods that might compromise the effectiveness of the blended learning. It is also important to pay attention to the integration (or blending) of different aspects of instruction.

Finally, we like to iterate the key message: blended learning is made up of two terms, *blended* and *learning*. Anchoring design of blended learning on established learning approaches is critical.

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Chapter 14
Empowering Blended Learning via MOOCs for Teacher Education in Malaysian Higher Education

Norazah Nordin, Helmi Norman, and Yasmin Zakaria

Abstract Previous years have seen emerging learning environments such as massive open online courses (MOOCs) that alter the higher education landscape. MOOCs provide a platform to conduct globalized online learning with various approaches, learners and contexts – further expanding the possibilities of its applications in the context of teacher education in blended learning at higher education level. Malaysia too has begun to adopt MOOCs via its nationwide initiative, called Malaysia MOOCs, in which all public universities produce and implement MOOCs in blended learning settings. To date, the initiative has produced around 570 MOOCs with enrolments of over 380,000 learners. Nevertheless, with regard to MOOCs in teacher education, limited research has been carried out in this field; hence, we have yet to fully understand its potentials, benefits and drawbacks in higher education. As such, this chapter will discuss these aspects in the context of Asian higher education where a case study in Malaysia is presented. The discussion revolves around whether MOOCs in blended learning enhance or disrupt learning. This chapter ends with a discussion on issues, challenges and future directions of MOOCs in blended learning for higher education in Malaysian, Asian and global contexts.

Keywords Blended learning · Massive open online courses · Malaysian higher education · Asian higher education · Teacher education

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14.1 Introduction

Massive open online courses (MOOCs) have emerged in previous years, shifting the higher education landscape (Ally, Embi, & Norman, 2019; Spring & Graham, 2017). MOOCs provide the avenue for implementation of globalized online learning across diverse learning approaches and contexts as well as accommodate a wide variety of learners (Kizilcec, Pérez-Sanagustín, & Maldonado, 2017; Lim, Tinio, Smith, & Bhowmik, 2018). In the context of teacher education, MOOCs show much promise in blended learning contexts at higher education level (Yousef, Chatti & Schroeder, 2015; Andersen, Na-songkhla, Hasse, Nordin, & Norman, 2018). In line with the global phenomenon, Malaysia too has begun to adopt MOOCs on a nationwide scale, called Malaysia MOOCs. The birth of the initiative was based on the Malaysia Education Blueprint, 2015–2025 (Higher Education) in which one of the aspects in the blueprint aspires globalized online learning via MOOCs (Embi, 2011; Nordin, Embi, & Norman, 2015). This is also in line with the Malaysia e-Learning policy, where 70% of the courses conducted in public universities are required to be in blended learning settings by year 2025 (Nordin, Norman, Embi, Mansor, & Idris, 2016). The aim of MOOCs is to provide an efficient course delivery system, enhancing universities' performance and expertise and making Malaysia a global education hub. MOOCs in Malaysia emphasize flexible learning with a comprehensive integration on competency-based learning, where the focus is on student achievement and learning outcomes (Nordin, Embi, Norman, & Panah, 2017).

To date, the initiative has produced around 570 MOOCs with enrolments of over 380,000 learners. Nevertheless, with regard to MOOCs in teacher education, limited research has been carried out in this field; hence, we have yet to fully understand its potentials, benefits and drawbacks. As such, this chapter will discuss these aspects in the context of Asian Higher Education where a case study in Malaysia is presented. The discussion revolves around whether MOOCs in blended learning enhance or disrupt learning. This chapter ends with a discussion on issues, challenges and future directions of MOOCs in blended learning for higher education in Malaysian, Asian and global contexts.

14.2 E-Learning Policy in Malaysian Higher Education

The National e-Learning Policy was launched by the Ministry of Higher Education in 2011 to support the National Higher Education Strategic Plan (PSPTN). It serves as the guidance for the implementation of e-Learning among tertiary institutions (Higher Education Institutions (HEIs)) in Malaysia. The ultimate goal of e-learning policy is to optimize the use information technology and communication as a tool to improve the quality of teaching and learning with the aim of developing world-class human capital. Generally, the e-learning policy is underpinned with five main aspects, namely (a) infrastructure, (b) organizational structure, (c) curriculum and e-content, (d) professional development and (e) culture. This new policy has shifted its focus to highlighting innovation in education, rebranding the Malaysian education and reducing cost of delivery and bringing Malaysian expertise and skills to global context while promoting lifelong learning in education (Malaysia Education Blueprint, 2015).

Analysis of e-Learning policies has been conducted to obtain responses from e-Learning administrators and lecturers in Malaysia. Findings related to the status, trends, effectiveness and challenges of e-learning policy in Malaysian HEIs revealed that 38.5% of HEIs have e-learning policy while 61.5% of HEIs do not have e-Learning policies yet. The study also revealed that development for e-Learning policies only includes the top management and representatives of faculties/centres/departments and disregards the involvement of the students and external stakeholders. In addition, the dissemination of information on e-Learning policies includes formal training programmes (80%), university web sites (70%), circulars (60%), pamphlets (60%) and induction programmes (40%). The majority of HEIs also possess low awareness of e-learning policy whereby eight HEIs are at a low level of awareness regarding e-Learning policies and six HEIs were reported to have high awareness on e-Learning policies (Malaysia Education Blueprint, 2015).

Despite high awareness of e-Learning policies among lecturers in HEIs, support from the lecturers is still very low (25–50%), while 76–100% of the contribution was from management, faculty/school/department and students at HEIs. The lecturers in HEIs have also confirmed that information about the policy was obtained mainly from institutional websites (58%), circulars (57.4%) and formal training programmes conducted by their respective HEIs. Despite of the training and dissemination of information about e-Learning policies, majority of the lecturers (64.4%) in HEIs stated that they did not fully comply with the e-Learning policies in their respective HEIs, while only 30.6% of the lecturers have fully complied with the e-learning policy in their respective HEIs (Malaysia Education Blueprint, 2015).

14.3 Globalized Online Learning and the Malaysia Education Blueprint, 2015–2025 (Higher Education)

In the Malaysia Education Blueprint, 2015–2025, Globalized Online Learning refers to the shift in learning environment towards a wider context, particularly the global context. This initiative is in line with the national agenda of the Ministry of Education to ensure holistic and relevant graduates from all HEIs. According to the Malaysia Education Blueprint, 2015–2025, Malaysia's Internet penetration has increased to 67%, making it seventh place among Asian countries. The remarkable position of Malaysia to be among the top users of Internet uncovers a new potential for the current learning environment. There are significant opportunities to achieve the desired outcomes first set forth in the National e-Learning Policy (Dasar e-Pembelajaran Negara or DePAN). Malaysia needs to move from a mass production delivery model to one where technology-enabled innovations are harnessed to democratize access to education and offer more personalized learning experiences to all students (Malaysia Education Blueprint, 2015).

Blended learning models have become a staple pedagogical approach in all HEIs. Students will benefit from robust cyber infrastructure that can support the use of technologies like videoconferencing, live streaming and massive open online courses (MOOCs). Malaysian HEIs will also develop MOOCs in their niche areas of expertise while participating in international MOOC consortiums and building the Malaysian education brand globally (Malaysia Education Blueprint, 2015).

To achieve these outcomes, the Ministry of Education is working with Higher Education Institution (HEI) to build the capabilities of the academic community and explore the establishment of a national e-learning platform to coordinate and spearhead content development. Key initiatives include:

- Launching MOOCs in subjects of distinction for Malaysia such as Islamic banking and finance, in partnership with high profile international MOOC consortiums like EdX and Coursera, so as to build Malaysia's global brand
- Making online learning an integral component of higher education and lifelong learning, starting with the conversion of common undergraduate courses into MOOCs, and requiring up to 70% of programmes to use blended learning models by year 2025
- Establishing the required cyber infrastructure (physical network infrastructure, info structure, platform, devices and equipment) and strengthening the capabilities of the academic community to deliver online learning at scale

In Malaysia, MOOCs were developed by respective HEIs according to the course offered by the institutions. The development of the course may vary according to the existing academic programmes, and other customized courses below consideration of each HEI MOOC Malaysia can be divided into three types of courses, namely (i) general course, (ii) niche courses and (iii) lifelong learning courses. HEIs can develop and offer in-depth courses from any of the above categories and simultaneously coordinate with the Malaysia MOOC committees in terms of topics and types of courses to be developed by HEIs before it is developed and then offered on MOOC Malaysia platform (Malaysia Education Blueprint, 2015).

14.4 Teacher Education and MOOCs in Malaysia

Teacher education involves the general aspects of education involving schooling, teaching, teachers and their education that introduces pre-service and in-service teachers to specific forms of practice in teaching. Initially, the term "teacher training" was used to refer to trainings for pre-service and in-service teachers for professional development. In 1981, the term was replaced with "teacher education" aiming to make these teachers more proficient and pedagogically skilled. The training was aimed to fulfil the aspiration of developing proficient and skilful teachers (Zeichner, 1983). The implementation of MOOCs for teacher education has revealed various consensuses around online learning. Implementation of MOOC provides high-quality education that functions as a means to enhance online learning experience at a larger scale. In other words, an MOOC enables learners to improve their skills and professionalism efficiently with greater cost savings. In teacher education, particularly in the Universiti Kebangsaan Malaysia (UKM) context, this platform has evolved to be an accessible and flexible means for learning in higher education institutions. As an assessable and practical tool for learning, UKM MOOC also provides completion assessment and award certification for students who successfully completed the course. Introducing MOOCs for teacher education has also improved the development of pre-service and in-service teachers' skills related to pedagogy in the twenty-first century. Aspects related to teaching, digital literacy and academic writing are increasingly demanding. Therefore, the introduction of MOOCs as a part of teacher education and skills development becomes a stepping stone in producing relevant, skilled and well-trained teachers. Elements of "massiveness" in MOOCs provide larger opportunities for all learners to participate in learning the subject matter regardless of their background knowledge and expertise. Knowledge sharing on a large scale enables an increasing number of enrolments for professional development which has resulted in high production of skilled and knowledgeable students who are also trainee teachers (Malaysia Education Blueprint, 2015).

14.5 A Case Study of Blended Learning and MOOCs for Teacher Training at Universiti Kebangsaan Malaysia

In line with global and local aspiration of MOOCs for globalizing online learning, Universiti Kebangsaan Malaysia (UKM) has also developed its own MOOC initiative called UKM MOOC. As of November 2018, UKM MOOC has produced a total of 189 MOOCs with enrolments of over 19,5000 students across the MOOCs that is conducted in blended learning format. The UKM MOOC can be accessed via https://www.openlearning.com/ukmmooc. In illustrating teacher training and blended learning using MOOCs, we describe a case study of educational technology course at postgraduate level in Faculty of Education. The course is an educational technology course that focuses on instructional design and development of educational technology products.

For the blended learning environment, a course MOOC was provided to the students as the online learning environment. The MOOC was positioned as a centralized platform for access of learning materials and tasks, as well as a platform for discussions among students enrolled in the MOOC. The MOOC has been developed since 2015 and has been conducted for six cohorts – each cohort has a period of 4 months. Although the MOOC is used for the educational technology course, the enrolment in the MOOC is not restricted to students from UKM or those currently taking the course. Anyone from anywhere could enrol the course anytime they wanted to. Currently, the course has a total enrolment of over 700 students from 26 countries:

- Asia: Malaysia, Thailand, Indonesia, Oman, Kuwait, Saudi Arabia, Pakistan, Bangladesh, Hong Kong, Iran
- Europe: France, Belgium, Germany, the Netherlands, Greece, Finland, Portugal, United Kingdom, Switzerland, Norway, Georgia
- North America: Canada, USA
- South America: Peru
- Africa: South Africa and Australia

This was conducted to ensure learners not only blended with their coursemates but also with coursemates from the global learning community.

The instructional design of the course MOOC has roots in the H-MOOC framework of Pérez-Sanagustín, Hilliger, Alario-Hoyos, Kloos, and Rayyan (2017), problem-based learning and the ADDIE framework (analysis, design, development, implementation and evaluation). The H-MOOC framework posits that hybrid MOOC initiatives be framed on two factors, which are (i) institutional support to reuse an existing MOOC and (ii) curricular alignment between a MOOC and the programme, or the blended/hybrid course. As the UKM MOOC is part of the nationwide initiative of Malaysia MOOCs, the typical development of MOOCs at the university has full institutional support at university and faculty levels. The curriculum of the developed MOOC would be aligned based on the programme or course offered by the faculty. However, in the education technology course, we reversed or "flipped" the typical development mode of MOOCs to involve our postgraduates in MOOC development. The postgraduates consisted of in-service teachers, education minister officers as well as full-time postgraduates enrolled in the field of education. Here the postgraduates took the roles of subject matter experts, instructional designers and learning content developers. With regard to subject matter experts and instructional designers, they designed the learning that was reviewed by lecturers. As learning content developers, their role was to develop content based on the developed learning designs. As for learning tools and materials, a course MOOC was provided as a learning platform to access learning materials and tasks and to engage with their coursemates.

As stated before, the instructional design also integrated problem-based learning using the generic ADDIE framework. The instructional design of blended learning was conducted in five phases of ADDIE. In the first phase (analysis phase), the instructors met with students in face-to-face sessions to provide the learning task which was to produce a MOOC in collaboration with instructors on the subject area. The task was loosely provided to students in order to shift the autonomy level of problem creation to students. In other words, this was done to provide a sense of belonging or sense of control over problem formulation, as discussed by Ryberg et al. (2010). In the second phase (design phase), online collaborative mind mapping (Norman et al., 2017) was carried out to achieve mutual consensus of brainstorming

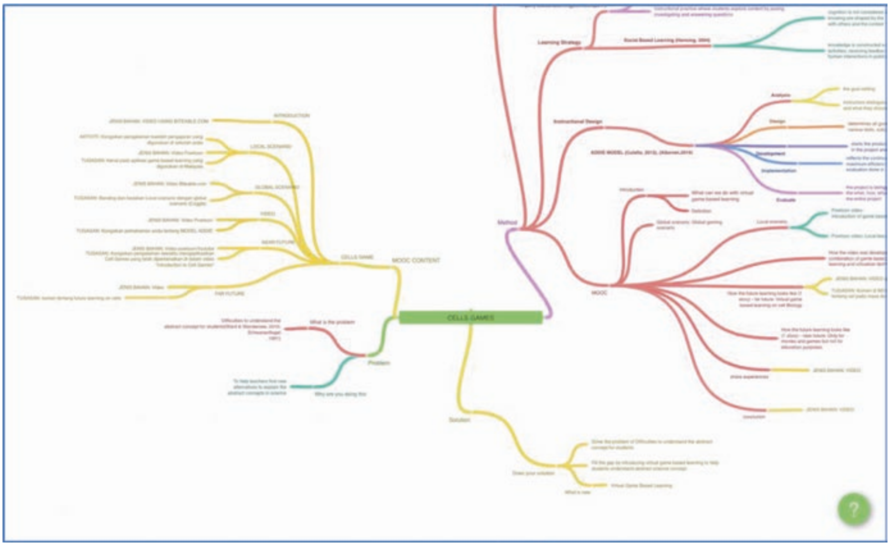

Fig. 14.1 Online collaborative mind map produced for problem formulation and planning of instructional design

over formulation of their learning problem as well as identification of gaps in literature, learning theories and strategies. Online mind mapping also assisted in planning of instructional design in MOOC that they were developing. An example of a mind map is illustrated in Fig. 14.1.

In the third phase (development phase), the students developed their MOOCs based on the mind maps developed in the previous phase. This was conducted in blended learning settings where both online and face-to-face settings were applied. Figure 14.2 shows the interface of the MOOC and learning materials developed. Table 14.1 summarizes the 19 MOOCs developed by the students. With regard to the field of study, four MOOCs were in mathematics, three in general science, three for language learning, two in biology and two in educational approaches, while the remaining were for ICT and risk management. As for the mode of learning material delivery, most of the materials were developed in English (13 MOOCs), while the remaining ones were developed in Malay language.

In the fourth phase (implementation phase), the developed MOOCs were presented in face-to-face sessions and shared online (via instant messaging) for review. In the final phase (evaluation), the MOOCs were reviewed by the instructors and peers in terms of instruction design, subject matter and language in blended learning settings. The MOOCs were then improved based on the feedback given.

Fig. 14.2 User interface and learning materials for one of the developed MOOCs

14.5.1 Average Active Learning Time and Daily Active Students on the Course MOOC

In assessing learning patterns in online learning settings, measures such as active learning time and daily active students were used for the assessment of the course MOOC. The average active time spent on each page is recorded as it varies according to the topics and module presented in the MOOC. Interestingly, "the share your video tutorials" page and "resources on blended learning" page recorded the highest average active learning time on the course MOOC with average times of 1 hour and 38 minutes, respectively. This can be related to a study conducted by Hone and Said (Hone & El Said, 2016), where they studied on retention rates of MOOCs with 379 participants. The study revealed that learning materials on MOOC have a significant effect on retention. Meanwhile, Kolås, Nordseth, and Hoem (2016) reported that the use of interactive videos increased retention levels in MOOCs. The study revealed that quizzes that were embedded in the videos increased engagement in MOOC and avoided passive video watching.

Coming back to this study, the highest active time was on "the share your video tutorials" page that consisted of learning products developed by students in the form of 3D animations. "The resources on blended learning" page had the second highest

Table 14.1 Summary of MOOCs developed

Topic	Details	Field	Material delivery language	URL
Fun with Math	Exposure for primary school students to the foundations of mathematics	Mathematics	English	https://www.openlearning.com/courses/funwithmath/
Pengenalan Web 2.0 (Introduction to Web 2.0)	Introduction to web 2.0 and software for digital educational materials	ICT	Malay language	https://www.openlearning.com/courses/web-2-0-exploration/pengenalan_web_2_0
Risk Management	Risk management introduction and process, as well as risk tolerance and roles of risk manager within organizational settings	Risk management	English	https://www.openlearning.com/courses/risk-management-my/
Theorem Pythagoras (Pythagoras theorem)	Introduction to the basics of Pythagoras theorem	Mathematics	Malay language	https://www.openlearning.com/courses/theorem-phytagoras/
Digestive system	Exposure to human's digestive system, function of the associated organs and relevant processes	Biology	Malay language	https://www.openlearning.com/courses/digestive-system/
Writing skills for beginners	Introduction to academic writing, its features, reviewing process, reference access and writing process of an academic paper	Language	English	https://www.openlearning.com/courses/writing-skills-for-beginners/
Teknologi Maklumat Komunikasi (information technology and communication)	Exposure to basic digital literacy for primary school students which includes usage of software for word processing, presentations and spreadsheets	ICT	Malay language	https://www.openlearning.com/courses/teknologi-maklumat-komunikasi
Bilik Darjah Pintar (smart classrooms)	Introduction to setting up smart classrooms for learning	Education	Malay language	https://www.openlearning.com/courses/bilik-darjah-pintar/HomePage
Augmented Reality Geometri Sekolah Rendah (augmented reality for primary school)	Introduction to geometry for primary school level using augmented reality	Mathematics	Malay language	https://www.openlearning.com/courses/augmented-reality-geometri-sekolah-rendah/

(continued)

Table 14.1 (continued)

Topic	Details	Field	Material delivery language	URL
Cell games	Learning in the field of biology focusing on cells using game-based learning approaches	Biology	English	https://www.openlearning.com/courses/cells-games/
First touch learning	Introduction to learning via touch-based learning tools	Education	English	https://www.openlearning.com/courses/first-touch-learning/
Future classroom for ESL learners	Introduction to the future of learning and technologies that can assist in learning of English	Language	English	https://www.openlearning.com/courses/future-class-for-esl-learners/
Virtual science lab	Exposure to physics via a virtual science lab	Physics	English	https://www.openlearning.com/courses/physics-virtual-lab/
Science smart learning	Introduction to teaching and learning approaches of science with the support of ICT	Science	English	https://www.openlearning.com/courses/science-smart-learning/
Fun in English learning	Introduction to English language learning via digital posters	Language	English	https://www.openlearning.com/courses/fun-in-learning-english-language/homepage
Mobile learning for science	Exposure to science via mobile learning	Science	English	https://www.openlearning.com/courses/mobile-learning-for-science
Revolution of science learning	Introduction to science via learning apps and game-based learning	Science	English	https://www.openlearning.com/courses/revolution-of-science-learning
School of tomorrow	Exposure to the concepts of future schools and its impacts on education	Education	English	https://www.openlearning.com/courses/school-of-tomorrow
Smart learning in geometry	Introduction to mathematics focusing on measurements using ICT	Mathematics	English	https://www.openlearning.com/courses/smart-learning-in-geometry/homepage

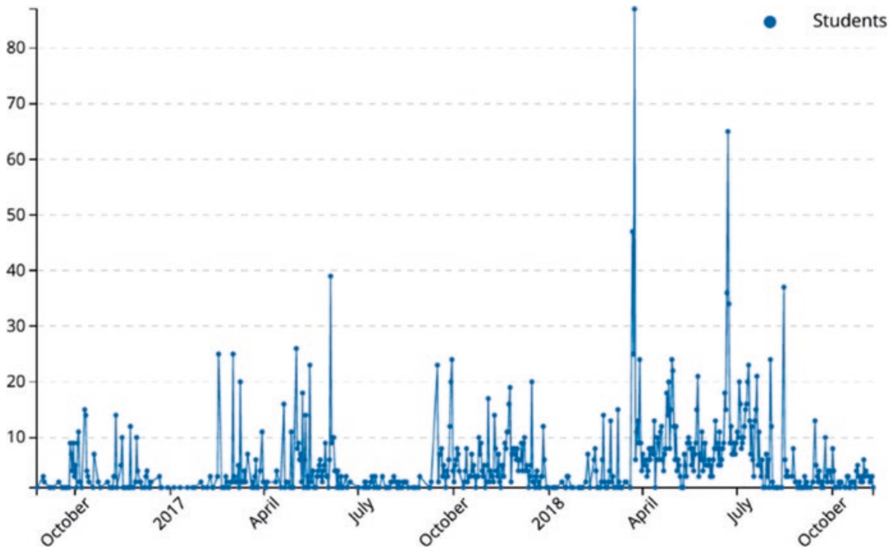

Fig. 14.3 Daily active students

active time, which had videos and presentation slides from the International Association for Blended Learning 2017: 2nd World Conference on Blended Learning. The high average time was probably due to the learning resources available on the page from an international conference. In relation, reviewing active learning time in an online context is crucial as it provides an insight to visualizations of learning analytics and patterns. These visualizations assist instructors to identify active learners and contributors in MOOC learning and help instructors gain in-depth information for the design of effective blended teaching and learning (Martin & Ndoye, 2016). In other words, data analytics on active learning time on MOOCs is useful to provide more information in designing effective online programmes and courses. Daily active students were also assessed, as shown in Fig. 14.3. From the figure, we can observe that there are several peaks of active time. It can be seen that the highest peaks were between the months of April and June, where the semester ends. The high number of daily active students was probably due to the fact that learning task deadline was assigned near the end of the course period (Nordin, Embi & Norman, 2016). In a related study, Nawrot and Doucet (2014) found out that integration of submission time of learning assignments increased task submission and active learning time.

14.6 Concluding Remarks: Issues, Challenges and Future Directions of Blended Learning for Teacher Training in Malaysian and Asian Higher Education

This chapter has illustrated the Malaysian scenario of blended learning via its e-learning policy and blueprint as well as the Malaysia MOOC initiative that has influenced blended learning for teacher training in Malaysia. This chapter also presents a case study in a local university, UKM, in which the Education Faculty reversed the typical MOOC development model (institutional and faculty level) to students creating MOOCs for their peers. The instructional process was described via five phases, where the initiative produced 19 MOOCs by students in collaboration with instructors. There are several issues, challenges and implications for the overall Asian higher education with regard to blended learning for teacher education.

First, although blended learning is typically conducted throughout the Asian continent in teacher education, without proper frameworks for implementation such as the H-framework by Pérez-Sanagustín et al. (2017), implementation of blended learning would be ineffective, and learning would be enhanced by blended learning. Second, the emergence of MOOCs from Asian countries and also global MOOCs could be used to mould blended learning for teacher education to suit the localities of a nation or a learning context. Whether MOOCs are driven by local or global learning content, each brings certain values that could be useful for cultivating globalized online learning in the region or locality (Margaryan, Bianco, & Littlejohn, 2015). Third, although the ideal learner-centric mode is typically preferred over teacher-centric mode, careful measures should be taken to ensure learning is enhanced rather than disrupted. The level of learner autonomy is quite diverse among learners as different types of learners have different needs of intervention levels. There is always the possibility that learning would diverge from the intended aim if certain measures and interventions are not properly put in place.

Fourth, there is still lack of research in blended learning for teacher education in terms of instructional design framework, especially for the Asian region. These studies would be beneficial in becoming foundations of resolving issues and challenges faced in implementing blended learning (Spring, Graham, & Hadlock, 2016). Fifth, there is also limited research that addresses the issue of blended learning assessment for teacher education (Ally et al., 2019; Spring & Graham, 2016). While measures such as MOOC learning analytics and social network analysis (refer to Norman, Nordin, Din, Ally, & Dogan, 2015) could be beneficial in understanding learning patterns of online learning, there are yet proper measures and tools to assess blended learning settings which could quantify both online and face-to-face learning. Such assessment solutions would truly be beneficial in assisting an educator understand more about effective design of blended learning.

Finally, as this research area is quite promising, there is an urgent need for more longitudinal and rigorous studies that could further enhance and cultivate the field of blended learning in Malaysia. It is hoped that this chapter could be beneficial for future educators and researchers interested in the field of blended learning in teacher education and its impact on Asian higher education.

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Chapter 15
Enhancing Learning Engagement Through Formative E-Assessment in General Education Foundation Course Tutorials

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Abstract Prior studies have highlighted the importance of General Education (GE) in reinvigorating higher education. In spite of the significant contribution of GE, students' engagement in the course is also frequently negative. Formative e-assessment (FEA) is supposed to enhance undergraduates' learning engagement due to the nature of formative assessment and the relative affordability of technology. An FEA intervention was included in GE foundation course tutorials which used Kahoot!, Mentimeter, and Google+. This study adopted a quasi-experimental design to demonstrate the effectiveness of FEA intervention on student tutorial engagement. At the end of one-term tutorial, two experimental groups and one control group completed a survey on course engagement, and eight students from experimental groups attended two focus group interviews. The findings reveal that students in experimental groups were more engaged than those in the control group although the difference was not significant. Kahoot! was perceived the most useful to engage students, and Google+ was believed the least effective to engage students due to their unfamiliarity with it, examination-oriented learning attitudes, low course learning motivation, and time constraints.

15.1 Introduction

Prior studies have highlighted the importance of General Education (GE) in reinvigorating higher education (Bok, 2013; Roth, 2014; Wells, 2016). Wells (2016, p. 2) explains that GE "is expected to expose students to a diverse array of ideas, incorporate curricular and co-curricular experiences, provide a space of connection, offer intellectual challenge, and be exciting to boot." In spite of the significant contribution of GE, there are challenges to its implementation in universities. Boyer

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(1988, p. 2) described GE as "neglected stepchild of the undergraduate experience." Students' engagement in GE courses is frequently insufficient (Keeling & Hersh, 2012; Kirk-Kuwaye & Sano-Franchini, 2015; Most & Wellmon, 2015). Therefore, it is important to find ways to engage students in GE courses.

This study designed formative e-assessment (FEA) as an intervention to enhance student course engagement. Formative assessment has been identified as an integral component of good teaching, active student engagement, and a higher level of achievement (Ecclestone, 2010; Johnson et al., 2016; Spector, 2015). The development of new learning technologies provides opportunities for teachers to strengthen the effects of formative assessment on learning as it can encourage student engagement because of its temporal and spatial flexibility. It is also a low-cost tool for creating interesting assessment tasks while enhancing meaningful interactions with content, peers, and self (Gikandi, Morrow, & Davis, 2011; Laborda, Sampson, Hambleton, & Guzman, 2015).

15.2 Literature Review

Student engagement is always believed as an important factor which affects students' learning outcomes and learning achievements (Carini, Kuh, & Klein, 2006; Coates, 2005; Park, 2005). According to Gunuc and Kuzu (2015, p. 588), student engagement refers to

> The quality and quantity of students' psychological, cognitive, emotional and behavioral reactions to the learning process, as well as to in-class/out-of-class academic and social activities, to achieve successful learning outcomes.

Gunuc and Kuzu (2015) believe that student engagement includes campus engagement and class engagement. Since this study only focused on student engagement in a GE foundation course tutorial, class engagement is the focus of the literature review. In the GE field, student engagement in courses is always regarded as the biggest challenge (Keeling & Hersh, 2012; Kirk-Kuwaye & Sano-Franchini, 2015; Most & Wellmon, 2015). However, there is lack of studies that explore how to enhance student engagement in GE courses. To the best of the authors' knowledge, only Kirk-Kuwaye and Sano-Franchini (2015) proposed academic advisers should help students to find out their personal purposes of taking the course. It suggests that students' learning motivation is closely related to their engagement in the course. However, Kirk-Kuwaye and Sano-Franchini have not collected empirical data to demonstrate their proposal. Therefore, it is meaningful to empirically explore the methods which could enhance student engagement in GE courses.

Formative assessment has been identified as an integral component of good teaching, active student engagement, and a higher level of achievement (Ecclestone, 2010; Johnson et al., 2016; Spector, 2015). Formative assessment is "the process of seeking and interpreting evidence for use by learners and their teachers to decide where the learners are in their learning, where they need to go and how best to get there" (Assessment Reform Group, 2002, p. 2). The claim made by Black and William (1998, p. 2) that "Formative assessment does improve learning" has inspired many researchers and practitioners in higher education. The development of learning technologies provides opportunities for teachers to conduct formative assessment in their classrooms.

The existing literature has shown the positive role of FEA in engaging students in meaningful learning experiences. In their literature review on the functionality of FEA, Gikandi et al. (2011) illustrated why FEA could enhance student engagement. They believe that FEA could promote deep learning and student motivation through three forms of interaction (i.e., learner-content/activities, learner-others, and learner-self). A number of studies provided empirical evidence to demonstrate the power of FEA in engaging students in the learning process. Herrington, Reeves, and Oliver (2006) demonstrated learner engagement could be enhanced through the students' participation in an authentic learning context where assessment tasks were supported by technological resources in three different disciplines. Sorensen and Takle (2005) designed threaded discussion forums which provided collaborative assessment for educational technology majors, and they found that this FEA enhanced participation, motivation, and ownership of learning. Chung, Shel, and Kaiser (2006) also found that an interactive online discussion in a circuitry course could engage learners cognitively and affectively. Armellini and Aiyegbayo (2010) found that a collection of Web 2.0 tools enhancing students' interaction with peers and teachers increases student engagement in three courses of media studies, psychology, and interprofessional education. Jiao (2015) reported that an e-tutor used in engineering courses encouraged students to correct errors through multiple submission to receive award marks for assessment, which contributed to students' active engagement in learning. Lin (2008) demonstrated that participation in e-portfolio processes allowed preservice teachers to self-assess their own work in a reflective way, which promoted later learning. The above literature review shows that the existing experiences are mostly related to the use of FEA in disciplinary courses and the use of FEA tasks in engaging students in GE courses is seldom reported.

However, FEA does not always bring about positive effects on students' learning processes. Gikandi et al. (2011) believed that the design of FEA could affect its effectiveness. They argue that only a valid and reliable FEA could enhance engagement and learning. A valid FEA should be authentic, provide effective feedback, use multidimensional approaches, and give learners support. A reliable FEA needs to document learning progress, collect multiple sources of evidence, and share rubrics with students.

There are still some challenges in implementing FEA. Lin (2008) found that using e-portfolio was time-consuming and might stress students because its purpose is unclear. It also could not fit the variety of learning styles. Hamid, Waycott, Chang, and Kurnia (2011) found that students' lack of ICT skills prevented them from actively participating in e-activities and also there were time management issues and limited technical infrastructure in some universities. Bennett, Bishop, Dalgarno, Waycott, and Kennedy (2012) also found that students' unfamiliarity with the technologies and limited technical infrastructure might be obstacles for using Web 2.0

technology in learning but they could be relatively easy to overcome. They were more concerned about constructive alignment between assessment and intended learning outcomes (Biggs, 1999) which echoes Lin's (2008) finding. They also worried about a clash of "practice logic" which illustrated the conflict between participation and collaboration valued by Web 2.0 and an individual's contribution toward qualification emphasized by higher educational practice. The clash of "practice logic" was also demonstrated in Waycott, Sheard, Thompson, and Clerehan's (2013) study. Students were reported to show concern about the copyright of their work since it was visible to others for comments online.

Most of the existing experiences of using FEA are accumulated in the West. Assessment is a social activity, and we can interpret it only by considering the social, cultural, economic, and political contexts where it takes place (Gipps 1999). It is meaningful to explore the effectiveness of FEA in Eastern universities and challenges that learners may encounter in their use of FEA. As stated by Carless (2012), the cultural values of Confucianism such as collectivism, hierarchical relations, a pragmatic approach to learning, and effort may influence the development of formative assessment in the Chinese context. In the previous studies on FEA, cultural factors are seldom mentioned. The concern is whether Chinese cultural values play roles in mediating the effectiveness of FEA on student engagement in this study.

15.3 FEA Intervention

The GE foundation course is a compulsory 3-credit point course for all first-year students in the second semester at the Education University of Hong Kong. This course introduces students to a selection of major themes and topics in GE. Students are expected to think critically about a broad range of issues, construct and attain knowledge, and apply what they have learned to their own lives after completing the course. Therefore, the GE foundation course is a large-scale program that is seen as meaningful for developing undergraduates' generic skills for their lives and future work. Classes of the GE foundation course comprise weekly lectures and tutorials, both of which last 2 hours per week. The lectures are delivered face to face or via video by leading scholars or practitioners. A small class environment is used for tutorials where students participate in the activities arranged by instructors to develop their understanding and thinking about course content. GE foundation course assessment consists of multiple tasks which contribute to a final grade. Table 15.1 summarizes the assessment requirements.

This study used FEA tasks as intervention to facilitate student engagement in tutorials. The FEA tasks were designed considering their links to lecture content and summative assessment tasks (i.e., e-journals, group presentation, and essay) in GE foundation course. There is an alignment between FEA tasks and the intended learning outcomes. Three tools (i.e., Kahoot!, Mentimeter, and Google+) were used to conduct various FEA tasks such as quizzes, peer assessment, and project inquiry so as to enhance their understanding and critical thinking of the topics in lectures

Table 15.1 Assessment requirements of GE foundation course

Assessment task		Weight
E-journals	1st E-journal	30%
	2nd E-journal	
	3rd E-journal	
Essay		30%
Group presentation		20%
E-portfolio		10%
Video lectures (3 times)	Online quizzes	6%
	Online discussion forum	
Class participation		4%

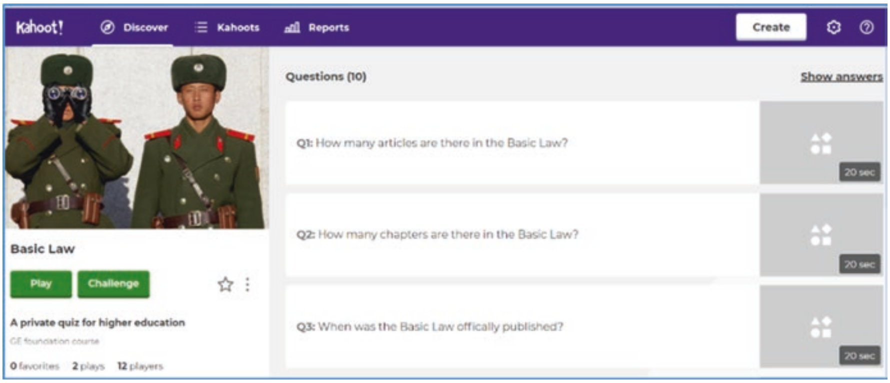

Fig. 15.1 Interface of a group competition on Hong Kong's basic law

and apply what they have learned to their own lives. In this way, the validity of FEA tasks was guaranteed. Since a variety of FEA tasks were conducted through tutorials, the collected multiple sources of evidence from students demonstrated their learning progress over a period of time. This ensured the reliability of FEA tasks.

Kahoot! is a user-friendly interactive game-based student response system used in educational settings (Dellos, 2015; Graham, 2015; Siegle, 2015). In this study, Kahoot was used to create quizzes and surveys. For example, a group competition on Hong Kong's basic law (see Fig. 15.1) and voting on freedom and security were integrated in the instructional process to clarify and deepen student understanding of the topics in lectures and assignments. Mentimeter is another open-source interactive student response system (Rudolph, 2018). In this study, an online peer assessment using Mentimeter was used to evaluate samples of the assignments (i.e., e-journals, group presentation, and essay). The students anonymously rated sample work based on their interpretation of the provided criteria of the assignments. After online voting, a Q&A session was conducted to inquire about the reasons behind students' rating and seek their advice on the refinement of the chosen sample. With the help of Mentimeter, it was expected that the instructor would share the criteria

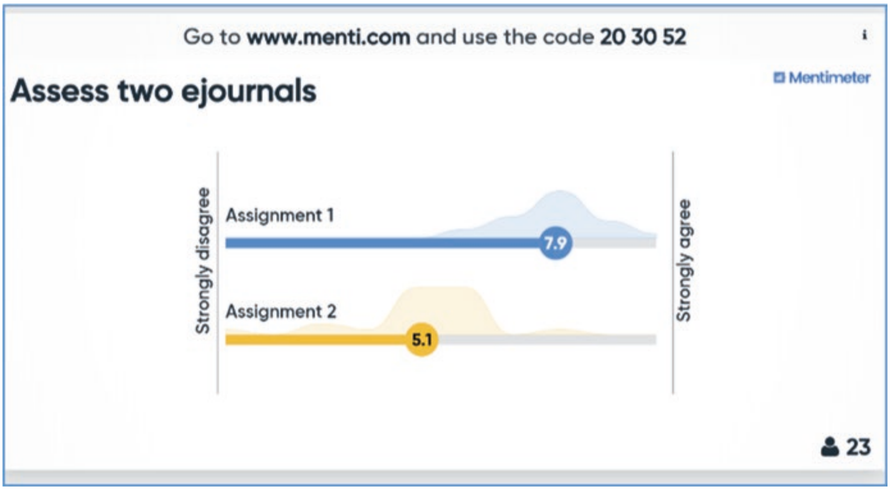

Fig. 15.2 Interface of peer assessment using Mentimeter

of the major assignments in GE course with the students in an effective way (Fig. 15.2).

Google+ is an online social network which is supposed to enhance the interaction between students and others (Gonzalez, Cuevas, Motamedi, Rejaie, & Cuevas, 2013). In this study, Google+ was introduced in the first tutorial with the purpose of establishing online communities to do a group project which would be presented at the end of the course. The students were randomly grouped with two or three peers in the first tutorial. They were required to share their inquiry questions with other groups and solicit comments online or in class. They also needed to submit a proposal (see the Appendix) following a proposal template on Google+ before they proceeded with their project inquiry. They could edit the proposal together using Google Docs. In this way, the students could see other group's proposals and give feedback for refinement. The instructor reviewed the submitted proposal in a face-to-face consultation. Figure 15.3 captures an interface of one group work.

15.4 The Study

This study adopted a quasi-experimental design to demonstrate the effectiveness of FEA intervention on student course engagement. At the end of the tutorials in one term, two experimental groups and one control group were required to do a survey on course engagement, and eight students from experimental groups attended two focus group interviews. This mixed-method approach provided broader evidence on the effectiveness of FEA intervention than by a single approach, thereby increasing the usefulness and credibility of the results found (Creswell & Plano Clark, 2011).

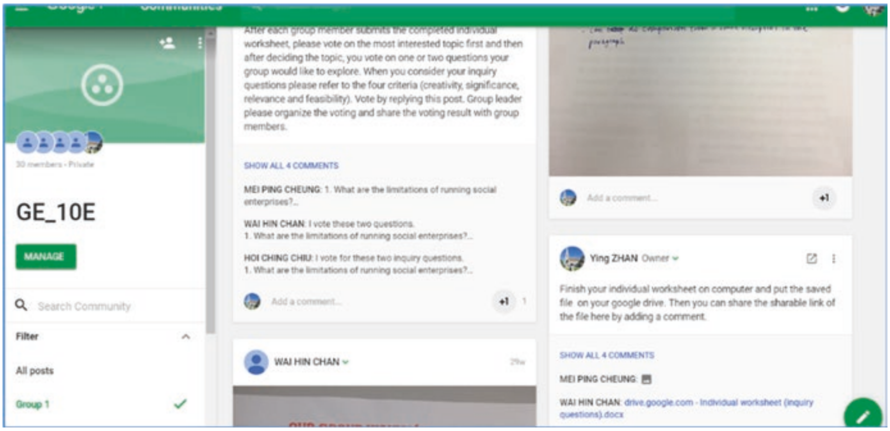

Fig. 15.3 Interface of one group work on Google+

15.4.1 Research Questions

This quasi-experimental study attempted to answer the following two research questions.

- Do the designed FEA tasks enhance students' participation in tutorials in a General Education Foundation course?
- What do the students think of the designed FEA tasks and their effectiveness in course engagement? And why?

15.4.2 Participants

Convenience sampling (Cohen, Manion & Morrison, 2018) was adopted to find participants in this study. Three classes comprising instructors and their students participated in this study on a voluntary basis. Both instructors were female and ranked as senior lecturers. One of them taught a control group, and the other taught two experimental groups. Seventy students were involved in the study, but 17 students declined to take part. In total, control group had 20 students, Experimental Group 1 had 18 students, and Experimental Group 2 had 15 students. The participants exhibited variations in age, gender, and major. The participants' age ranged from 18 to 24 years old. The average age was 19. Forty-three percent were male, while 57% were female. Table 15.2 summarizes the distribution of participants' majors.

Table 15.2 The distribution of participants' majors

Major	Frequency	Percentage (%)
Math	1	1.89
Science	1	1.89
Chinese	6	11.32
English	2	3.77
Visual Arts	3	5.66
Physical Education	2	3.77
Music	2	3.77
Sociology	4	7.55
Psychology	1	1.89
Environment Education	1	1.89
IT	2	3.77
Liberal Studies Education	3	5.66
General Studies Education	1	1.89
Special Education	1	1.89
Others (e.g., Chinese History, History Education, Greater China Studies, etc.)	10	18.87
Missing	13	24.53
Total	53	100

15.4.2.1 Data Collection

This study used a survey and focus group interviews to collect the evidence on the effectiveness of FEA intervention on student engagement. The survey was adopted from the classroom engagement part in a student engagement scale (Gunuc & Kuzu, 2015). In the scale of class engagement, there are three subscales, namely, cognitive, emotional, and behavioral. In total, 12 items were involved and adapted to the GE foundation course context under study. The items were rated on a six-point Likert scale ranging from "strongly disagree" (=1) to "strongly agree" (=6). Cognitive engagement refers to students' investment on learning, learning motivation, and effort. A sample item for cognitive engagement is "I am willing to take tutorials of a GE foundation course." Emotional engagement refers to students' emotional reaction in class and relationship with teachers and peers. A sample item for emotional engagement is "My instructor respects our opinions in discussions." Behavior engagement refers to students' attendance and participation in educational activities in class. A sample item for behavioral engagement is "I actively participate in class activities." Table 15.3 presents Cronbach's alpha internal consistency reliability coefficients and the item-total correlation of the specific subscales, based on the data collected from the participants of the study.

Focus-group interviews were adopted to elicit student attitudes and evaluation on the effectiveness of FEA intervention, which complemented and enriched the quantitative evaluation through the survey. Four students from each experimental group

Table 15.3 Student engagement: Cronbach's alpha coefficients and item-to-scale correlation

Student engagement (α = 0.88)					
Cognitive engagement (α = 0.72)		Emotional engagement (α = 0.83)		Behavioral engagement (α = 0.79)	
Item	Corr.	Item	Corr.	Item	Corr.
1	.472	5	.699	9	.554
2	.572	6	.668	10	.591
3	.396	7	.684	11	.614
4	.665	8	.603	12	.617
Mean	.526	Mean	.664	Mean	.594

voluntarily attended a focus group interview. The focus group interviews were semi-structured to ensure the moderator was able to maintain a topic focus. The interview protocol addressed three major aspects, namely, students' attitudes toward FEA tasks, evaluation on the effectiveness of FEA intervention on tutorial engagement, as well as the underlying reasons behind their attitudes and evaluation. On average, the interview lasted 1 h and 20 min. The interview was conducted in Cantonese and audio recorded for later analysis.

15.4.2.2 Data Analysis

The survey data were analyzed using SPSS 21.0. Descriptive analysis was used to reveal the status of students' tutorial engagement in terms of cognition, emotion, and behavior. An independent t-test was used to compare the students' tutorial engagement of experimental groups with that of control group. The transcribed focus group interview data were analyzed in an inductive way (Thomas, 2006). The coding process began with open coding which generated a great number of codes such as user-friendliness, easy access, positive emotional reaction, and examination-oriented learning attitudes. These initial codes were further combined into larger categories. For example, the codes such as learning motivation, time-consuming, difficulty of tasks, examination-oriented learning attitudes, and low course learning motivation were combined into the category of factors influencing the effectiveness of Google+.

15.5 Findings

15.5.1 Survey Results

Table 15.4 shows that the participants' behavioral engagement is lowest among all groups. It also reveals that the mean scores of experimental groups' cognitive engagement (M = 4.42), emotional engagement (M = 4.93), and behavioral engagement (M = 4.36) are higher than control group's cognitive engagement (M = 4.29),

Table 15.4 The independent T-test results for the comparison between experimental groups and control group in each item

Dependent variable/items	Experimental groups		Control group		Mean difference	*t*	*P*
	Mean	SD	Mean	SD			
Cognitive engagement	4.42	.65	4.29	.54	.13	.79	.43
1. I am willing to take tutorials of a GE foundation course	4.15	1.03	4.50	.76	−.35	−1.31	.20
2. I try to do my assignments in the best way	4.73	.72	4.75	.79	−.02	−.11	.92
3. I spend enough time and make enough effort to finish every assignment in the course	4.33	.89	3.65	.93	.68	2.66	.01**
4. I try to do my best during tutorials	4.48	.67	4.25	.55	.23	1.32	.19
Emotional engagement	4.94	.64	4.71	.60	.23	1.28	.21
5. My instructor always offers help when I need it	4.82	.73	4.85	.67	−.03	−.16	.87
6. My instructor respects our opinions in discussion	5.03	.77	5.05	.76	−.02	−.09	.93
7. The tutorial is entertaining	4.94	.90	4.50	.83	.44	1.78	.08
8. I feel myself as a part/member of a student group	4.97	.73	4.45	.61	.52	2.68	.01**
Behavioral engagement	4.36	.57	4.16	.41	.20	1.38	.17
9. I carefully listen to my instructor in class	4.58	.61	4.25	.64	.33	1.84	.07
10. I carefully listen to other students in class	4.24	.71	4.25	.55	−.01	−.04	.97
11. I actively participate in class activities	4.30	.73	4.00	.56	.30	1.70	.10
12. I actively think and respond to the questions proposed by the instructor	4.33	.78	4.15	.49	.18	1.05	.30

Note: **: p<.001

emotional engagement (M = 4.71), and behavioral engagement (M = 4.16). However, there is no significant difference between them.

Table 15.4 also indicates the independent t-test results for the comparison between the experimental groups and control group concerning their report on each item of the survey. It reveals that only Item 3 of the dimension of cognitive engagement ($P < 0.01$) and Item 8 of the dimension of emotional engagement ($P < 0.01$) show significant difference between the experimental and control groups. The participants in the experimental groups would like to invest more time and energy to finish every assignment and have a stronger sense of belonging to their group. However, since the mean differences of other items in the dimensions of cognitive engagement and emotional engagement are very small, no significant difference is found in the two dimensions.

15.5.2 Interview Results

15.5.2.1 Necessity and Effectiveness of FEA Intervention

Eight participants from the two experimental groups talked about their attitudes toward FEA intervention and qualitatively evaluated its effectiveness on their tutorial engagement. Most of the participants showed their positive attitudes toward the online quiz and poll using Kahoot or Mentimeter. Some of them believed that Kahoot was an eye-catching platform, which made them more active, entertained, and better informed in class. The following extract shows this point of view.

> Student 1: *Kahoot! could catch our attention easily because of its vivid setting and exciting music background. So, I like it very much and feel more willing to participate in class.*

> Student 3: *I have the same feeling. Kahoot is entertaining and interesting. We burst into laughter when we found an unexpected answer provided by the app and have a deep impression of that question. (Focus group interview 1)*

Some of the participants also believed that Kahoot enhanced their sense of belonging to a group, which triangulates the finding of the survey. For instance, student 2 mentioned:

> The instructor asked us to use group mode in the Kahoot test and we wanted to gain the highest mark, so we needed to cooperate and discuss with each other in a short time period. This experience made me realize that I am one of my group who needs to contribute.

Most of participants also indicated their fondness of Mentimeter which was used for peer assessment of the sample assignment. They thought the online poll could instantly show what fellow students thought about the quality of a sample assignment and were able to compare it with their own judgment. The follow-up justification on the grade provided through a Q&A session could also enhance their understanding of the criteria of assignments, which made them more carefully listen to the instructor and peers in Q&A session. For example, student 6 valued her instructor's input:

> The online poll using Mentimeter gave me a visual representation of the whole class's evaluation on the sample assignment. I don't always give a similar judgment, so when the inconsistency appeared, I would listen to my instructor more carefully and find out why and would pay more attention to the criteria which I had misunderstood or ignored in the process of writing the assignment.

The participants thought clarification of the criteria of assignments made them ensure the time and energy they needed to invest on each assignment, which qualitatively explained the significant difference in this aspect reported by the survey. The following extract reveals this point of view.

> Student 7: *After I clarified the criteria of the e-journal through the online poll and conversation with my instructor, I got to know how much time and energy I needed to spend to write a decent journal. This expected investment made me handle the assignment confidently.*
>
> Student 6: *I agree. We need to plan before we start our assignments. The activity conducted in class made me aware of this. (Focus group interview 2)*

However, compared with the Kahoot! test and Mentimeter poll, the participants appeared not to welcome group project inquiry through Google+ and doubted its effectiveness on tutorial engagement. The following extract is the typical reaction and evaluation of Google+.

> Student 4: *I don't like Google+ and don't think using Google+ could engage us more in tutorials. Compared with Google+, I would like to use WhatsApp to communicate with my peers about the project proposal and data collection or just have a face-to-face discussion in the library.*

15.5.2.2 Inhibiting Factors

Several inhibiting factors in the process of implementing FEA intervention were reported by the participants, namely, unfamiliarity with Google+, learning attitudes and motivation, and time commitment. All the participants claimed that they used Google+ for the first time in this study and were not familiar with its function, and some of them even had difficulty in registering into Google+ groups. For example, student 4 said:

> I remembered that I could not use my iPhone to register in Google+ groups in the first class and figured out how to do that. The unfamiliarity with the Google+ made me reluctant to use it to communicate with my group members. We privately set up a discussion group in WhatsApp and discussed our project there.

Participants' examination-oriented learning attitudes appeared to prevent them from actively participating in the activities organized through Google+. Five of them mentioned that since the participation in Google+ would not count in the group presentation, they did not want to spend time reviewing others' work and making comments. For example, student 8 mentioned:

> My participation in Google+ was not active, and I have not read proposals from other groups, nor made comments. It will not count for anything if I do this. I need to invest my time on the project itself instead of reviewing others' work.

Two of them mentioned that they wanted to give the impression that they were more knowledgeable and competent than they were in case revealing weaknesses may count against them in the group presentation; therefore, they did not want to discuss on Google+. For example, student 5 mentioned:

> I don't want the teacher to know about the process of our inquiry in case we made stupid mistakes which would give a bad impression to the instructor. This bad impression will affect her judgment on our group presentation. This is what we want to see.

Three participants also mentioned their low course learning motivation prevented them from actively engaging in the activities. For example, student 7 said:

> The GE foundation course is compulsory for us. A variety of topics were selected for us to learn. I don't like some topics, such as basic law, social enterprise. The lectures are boring and difficult to understand without Power Point slides sometimes. I don't think it is worth spending much time and energy on this course. I just focus on how to finish my assignments in tutorials.

Two participants complained about the time needed to finish tasks in Google+. They did not think the time spent on these activities was worth the weight of group presentation in final course grade. For example, student 4 said:

> We needed to propose individual questions online and then vote which question was the best and then figure out the group proposal. This requires us to spend more time negotiating with others online. Quite time consuming. And the group presentation only accounts for 20% of the final grade. What we did online did not deserve this.

Three participants believed that it might be better to skip the Google+ activities and directly consult the instructor face to face in order to save time and gain more personalized help. For example, student 8 said:

> It might be more efficient to ask the instructor about our concern in the project preparation. I like the face-to-face consultation since the tutor replied quickly and we can ask her on the spot if we don't get the meaning. In Google+, the instructor just offered several sentences of nonspecific feedback. And if we did not understand, we would not follow it up online.

15.6 Discussion

FEA has been regarded as a powerful weapon to enhance students' course engagement through bringing about meaningful interactions with content, others, and self (Gikandi et al., 2011). A number of empirical studies have provided convincing evidence in the Western context (e.g., Armellini & Aiyegbayo, 2010; Chung et al., 2006; Herrington et al., 2006; Lin, 2008; Jiao, 2015; Sorensen & Takle, 2005). This

Eastern study provides some evidence to demonstrate that FEA really matters in student engagement even though the difference between the experimental and control groups was not statistically significant in general.

It is noteworthy that experimental group participants developed a stronger sense of group belongingness than those in the control group because of their participation in the group competition on Kahoot!. Kahoot! is known as a student response system which is supposed to motivate students in a fun environment (McLaughlin & Yan, 2017), and little research has reported its role in creating a learning community. This finding is understandable considering that collectivism is closely aligned with Confucianism in the Hong Kong context. Levine (2011) suggests that shared purposes, codependency, and collective responsibility can promote learning in learning communities. Such a suggestion is in agreement with the principles of collectivism, which value the contributions of group members and highlight codependency on one another (Wei & Li, 2013).

It is also significant to find that the participants in experimental groups would like to spend enough time and make enough effort to finish every assignment in the course. According to focus group interview data, the participants believed that online peer assessment using Mentimeter made them better understand the criteria of assignments which enabled them to guarantee sufficient time and effort for each assignment. This finding supports the claim made by Gikandi et al. (2011) that reliable FEA should share rubrics with students in order to increase students' learning motivation and engagement.

The participants appeared to like Kahoot! and Mentimeter more than Google+. The participants were not attracted to or connected with Google+ which echoes the finding of Gonzalez et al. (2013). Although Kahoot and Google+ both engaged students in group activities in either synchronous or asynchronous ways, Google+ was less friendly to the participants than Kahoot. The unfamiliarity with the system seemed to prevent student active participation. The unfamiliarity with technology has been also reported as an obstacle in other studies (e.g., Bennett et al., 2012; Hamid et al., 2011). In addition to unfamiliarity with Google+, the participants also complained about excessive time being spent on group inquiry on Google+ after class which increased their workload. Some of them believed that face-to-face discussion and consultation would save time rather than discussing and giving feedback online. The time management issue has also been reported by other researchers such as Lin (2008) and Hamid et al. (2011). It seems that a main concern for the participants' acceptance of Google + was not the value behind the group activities, but whether the tool was familiar and comfortable for them to use.

The concerns about constructive alignment and clashes of practice logics in the study of Bennett et al. (2012) were not raised by the participants in this study due to two reasons. In this study, the designers paid more attention to constructive alignments between FEA and intended learning outcomes assessed by the assignments. The group members were given the same mark as a result of project inquiry. The other reason could be explained as cultural differences. Group activity is more appreciated by Hong Kong students due to collectivism in Confucianism than their Western counterparts who are strongly affected by individualism.

In this study, two other inhibiting factors such as low course learning motivation and examination-oriented learning attitudes were also reported which are seldom mentioned in Western literature on FEA. It is not unexpected to find that students have low learning motivation in GE courses, which has been mentioned by other researchers (e.g., Keeling & Hersh, 2012; Kirk-Kuwaye & Sano-Franchini, 2015; Most & Wellmon, 2015). Kirk-Kuways and Sano-Franchini (2015) suggest that learning motivation is closely related to student engagement in class. Therefore, it makes sense that when students' course learning motivation was low, their participation would be inactive even with FEA intervention.

There is a strong examination culture in Chinese society (Berry, 2011; Kennedy, 2016; Zhan & Wan, 2010). As Berry (2011, p. 200) explains, "For thousands of years, Chinese people have been very used to examinations and have culturally accepted high-stakes examinations as a means of determining their future prospects." In this study, the participants judged the value of project inquiry according to its weight in the final course grade and questioned the worthiness of time spent on it. They did not want to review and give comments on other groups' proposals because this activity did not contribute to group presentation grade. This contrasts with the finding by Armellini and Aiyegbayo (2010) that students at the University of Leicester would actively participate in purposeful, effectively moderated e-activities which were not assessed for marks. Another interesting finding is that they wanted to discuss on WhatsApp instead of Google+ since they did not want to give a bad impression to their instructor in case they made mistakes. Some students may be wary of seeking advice from instructors due to the power role of their teachers (Price, Handley, & Millar, 2011). This could cause "faking good" (Gibbs, 2006), when the participants tried to make a good impression that they were more knowledgeable and competent than they were through avoding the disclosure of their shortcomings that might count against them in the group presentation at the end.

15.7 Conclusions

This study examined the effectiveness of FEA on students' course engagement in terms of cognition, emotion, and behavior. The findings reveal that in general, FEA increased students' course engagement but not in a significant way. The significant change in course engagement only exists in students' sense of belonging to their group and their effort in assignments. The participants preferred Kahoot! and Mentimeter to Google+ and reported some inhibiting factors in using Google+ including their unfamiliarity with it, examination-oriented learning attitudes, low course learning motivation, and time constraints.

The findings of the study have implications for practitioners to implement FEA in their course teaching in Eastern universities. First, instructors can make good use of Kahoot! and Mentimeter to engage students in group activity and peer assessment, which will enhance their sense of group belongingness and guarantee the completion of course assignments. Second, it would be better for students to choose their familiar apps to do online group activity. Google drive and WhatsApp were mentioned by the participants in this study as their familiar apps to communicate and share materials with group members. In addition, online group activity could be blended with instructors' consultation and face-to-face discussion among group members to improve the efficiency of group work. Third, the course learning motivation was found as an inhibiting factor which affected the efficiency of FEA in this study. Therefore, it is necessary to find a way to attract students to spend more time and effort in doing FEA. The students in Eastern contexts are more likely to be affected by examination culture. Therefore, giving a weight of scores to FEA tasks may motivate them to participate in those tasks. The scores could be given considering students' participation and contribution. Meanwhile, in order to avoid "faking good" (Gibbs, 2006), instructors should create a safe discussion atmosphere online by sharing intentions of online group work with students and giving constructive suggestions online to help them to perform better in their work.

In spite of the interesting findings mentioned above, the study has some limitations which need to be cautiously considered when generalizing its findings to other contexts. First, convenience sampling was used to select participants, which might underrepresent the whole population of Hong Kong university students. Second, two different instructors respectively taught experimental groups and control groups. Although both of them were senior lecturers, their different teaching styles may affect students' engagement. Third, because students' course learning motivation would greatly influence GE course engagement (Kirk-Kuways & Sano-Franchini, 2015), it would be better to issue a motivation survey to both experimental and control groups to ensure that they are equivalent groups so that the robustness of quasi-experimental design should be increased and more generalizable and convincing evidence can be generated in future exploration. Meanwhile, higher engagement can enable students to be creative and critical and self-regulated (Garrison & Akyol, 2009; Gikandi et al., 2011). Therefore, in future studies, it would be meaningful to explore if students can advance their high-order thinking skills by using FEA, which would deepen students' learning outcomes.

This study contributes to our understanding of the use of FEA at tertiary level in the Eastern world which has been ignored in the literature. It shows possible cultural mediating effects when using FEA in a Hong Kong university such as collectivism in Confucianism and examination culture. It also has implications on the design and implementation of FEA by considering these non-assessment and non-technology issues.

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Appendix

Group project proposal template which was completed by the group members on Google Docs

OUR INQUIRY PROPOSAL

This proposal is submitted by Group: _______

We plan to investigate: ____ (Inquiry topic)

The specific inquiry questions are:

____

____

____

____

The background of the selected topic (what is the basic information of the topic and why it is important for us to explore this topic)

____

____

____

____

Please figure out a plan to collect and analyse data/ information to answer the question(s).

- **What data do you plan to collect to answer your inquiry questions?**
- **How do you plan to get these data? (From the documents, online resources or collecting data by yourselves. If you want to collect your own data, what method you plan to use, survey or interview. You need to think about the details of survey design or interview question design)**
- **How do you plan to analyse your data? (i, e., categorization of the data - how many aspects do you plan to report to answer the target questions and what are they?)**

We plan to divide the work amongst ourselves *(E.g. John and Jane– find the literature and design the PPT)*

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Chapter 16
Current and Future Directions of Blended Learning and Teaching in Asia

Holt Zaugg, Charles R. Graham, Cher Ping Lim, and Tianchong Wang

Abstract In this chapter, we discuss the current state of blended learning (BL) and its impacts on inclusive and quality higher education in Asia through the lens of seven strategic dimensions that have been outlined by (Lim CP, Wang T, Graham C, Innov Educ 1:1–12, 2019) for implementing BL in higher education. The seven dimensions include (1) curriculum; (2) vision and policy alignment; (3) infrastructure, facilities, resources, hardware, and support; (4) professional development; (5) student learning support; (6) partnerships; and (7) research and evaluation. We then present insights gleaned from each chapter as they relate to the dimensions of the framework for the strategic planning of BL. As we synthesize the insights and identify the missing links, we discuss six key recommendations and directions for Asian universities as they continue to develop their capacity for BL into the future. First, while Asia can learn from the research done as BL becomes the new normal globally, many issues may be unique to the learning culture and issues in Asia. Second, there needs to be a better alignment between BL and current theories of learning, including how those theories may be modified or creating new theories. Third, congruence building between an institutional shared vision and individual practices of BL needs to be a concerted effort between higher education institution (HEI) leadership and BL practitioners. Fourth, pedagogy and teacher professional development should be prioritized areas for HEIs' BL capacity building. Fifth, HEIs need to re-envision the role of libraries and be more explicit in how BL can be supported by library services offered. And finally, HEIs need to respond to the rise of K–12 BL to achieve greater inclusive and quality higher education agenda.

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16.1 Introduction

The advantage of sharing individual experiences is that it enables one to identify the commonalities and unique perspectives among those stories. The blended learning (BL) experiences shared in this book focus on efforts within Asia to use and develop BL opportunities. Each BL experience is implemented in different contexts but has commonalities across these experiences expressed through the framework discussed in this chapter. We seek to synthesize these experiences to provide a better understanding of the current state of BL in Asia, namely, how it is implemented and evolving within Asia. It will end with a glance to the future that we hope will guide BL initiatives both within Asia and beyond.

This chapter briefly reviews the framework for the strategic planning of BL and the relationship of each chapter's content to this framework. We will then present insights gleaned from each chapter as they relate to the dimensions of the framework for the strategic planning of BL. Finally, we will discuss potential future directions for BL in Asia. We hope this view will offer perspectives and insights that are helpful both to those currently using BL and those wishing to begin implementing BL.

16.1.1 Framework for Strategic Planning of HEIs for BL

As illustrated in Fig. 16.1, there are seven dimensions to the strategic planning framework used to develop and assess higher educational institutions (HEIs) for BL. This framework is often referred to in the preceding chapters and used by multiple institutions to develop and evaluate how well BL is working. We offer a brief review of each dimension.

16.1.1.1 Curriculum Issues

Curriculum is the central piece of the model because it touches and influences all other dimensions. It includes a thoughtful, systematic, and deliberate packaging of competencies to be learned. It answers the questions of what is to be learned, why it needs to be learned, and how learning may be facilitated. It incorporates twenty-first century competencies that may occur across all BL opportunities, including assessment for learning instead of just assessment of learning.

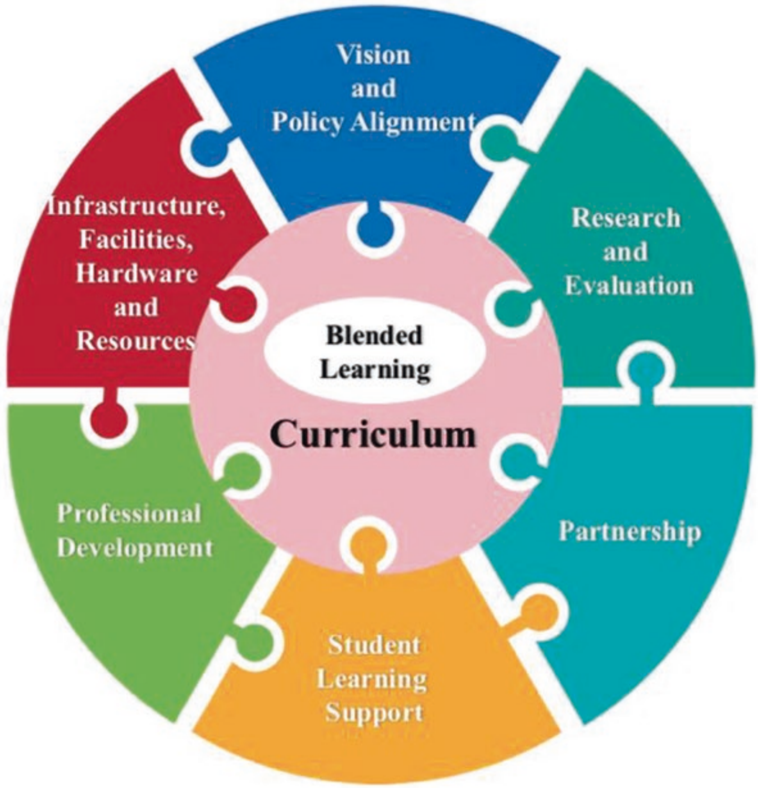

Fig. 16.1 Framework for strategic planning of HEIs used for evaluating the current state of BL at Asian universities. (Adopted from Lim, Wang, & Graham, 2019)

16.1.1.2 Vision and Policy Alignment

This section is a descriptive picture of the future framed by the policies and practices of the institution. It provides a clear image of BL environments that are grounded in the teaching practices of academic and teaching staff and the learning of students. It articulates an institutional-wide plan with policies, guidelines, and mechanisms that support those engaged in developing and using BL courses. The vision helps to promote BL in a way that results in instructor buy-in, motivation, and support.

16.1.1.3 Infrastructure, Facilities, Resources, Hardware, and Support

This dimension is the crucial behind-the-scenes part of BL. It includes the access to a wireless network with sufficient bandwidth for online activities, tech-rich learning commons with adequate support, and classrooms that are redesigned and scheduled in ways that support BL. It has archival and technical systems that provide easy access to BL materials for individual or group work.

16.1.1.4 Professional Development

Professional development (PD) provides additional expertise and training to help academic and teaching staff who are designing BL instruction from scratch or re-tooling face-to-face (F2F) instruction into BL. It provides compelling reasons for academic and teaching staff to engage in BL and creates a community of practice that allows academic and teaching staff to network with others in helpful and trusting ways. It allows personal relationships to form where academic and teaching staff willingly share promising practices, lessons learned, challenges, and the desire to have a peer mentor and be a peer mentor to others. It promotes an attitude of lifelong learning.

16.1.1.5 Student Learning Support

While some students may have digital devices and expertise, others do not. Student learning support offers the opportunity to use digital equipment (i.e., laptops, tablets) and the technical and educational support to use them. Even students with expertise using digital devices may not have the experience needed to engage with BL fully. It assists students to learn self-regulation and pacing in their learning tasks. This learning may take the form of workshops, online learning strategies, navigation of scaffolding courses, and how to transcend cultural boundaries that may not be suited to BL.

16.1.1.6 Partnerships

Partnerships are the team effort to build mutually beneficial collaborations. Partnerships can be established both internally and externally. Internal partnerships may include collaborating with faculty (as a student or other faculty), IT support, and teaching and learning support. These partnerships allow for the sharing of resources and best practices that help to avoid duplication and expedite learning. External partnerships unite stakeholders across borders in institutions. They include business collaborations as well as consultations and dialogues with government agencies and non-governmental organizations (NGOs). The intent is to develop robust partnerships at a personal and institutional level that facilitate learning practices.

16.1.1.7 Research and Evaluation

Built into every BL opportunity is the desire to understand how well a BL experience worked and how it might be improved. In some instances, this is just an evaluation of what happened during a BL course. In other instances, it involves research experiments that pilot new procedures and practices. It is driven by the desire to revise and refine teaching and learning in ways that provide quality enhancements and provide value indicators to justify the investment of time, expertise, and money. It often serves to inform decisions in the other dimensions of BL.

16.1.2 Dimensions of BL Implementation in Asian Universities

The chapters within this book represent a broad spectrum of BL implementations across many institutions in different Asian countries. In order to prepare this concluding summary chapter, each of the preceding chapters was revisited and coded for statements related to the seven dimensions of BL implementation. The resulting codes (about 700) were organized to identify patterns across different cases. Table 16.1 summarizes how the seven strategic dimensions are represented within the chapters. High discussion chapters, represented by a star in the table, had ten or more coded instances related to the dimension. Most chapters had a strong emphasis

Table 16.1 Cases of BL represented in this volume (rows) and which strategic dimensions (columns) of the BL framework they address

	Cur	V&P	IFHR	PD	SLS	P	R&E
Ch1	●	★	★	★	●	●	★
Ch2	●	●	●	★	●	●	●
Ch3	●	★	●	★	●	★	●
Ch4	●	●	●		●		●
Ch5	●	●	★	●	●	●	●
Ch6	★	●	●		●	●	●
Ch7	●	●	★	●	★	●	★
Ch8	★	●	●	●	●	●	★
Ch9	★	★	●	●	●	●	●
Ch10	★	●	●	●	●		●
Ch11	●	●	●		●		●
Ch12	●	●	●	●	●		★
Ch13	★		●				●
Ch14	●	★		●	●	●	●
Ch15	●	★	★	★	●	●	★

● indicates low discussion in chapter**.** ★ indicates high discussion in chapter
Cur curriculum, *V&P* vison and policy alignment, *IFHR* infrastructure, facilities, hardware, and resources, *PD* professional development, *SLS* student learning support, *P* partnership, and *R&E* research and evaluation

in at least one of the dimensions, and all chapters addressed three or more of the strategic dimensions. Only two dimensions (curriculum, research and evaluation) were discussed in all chapters. While the table indicates the strength of the dimensions by their presence within each chapter, to some extent, in these shared BL experiences, it also lends some support to the need to further explore professional development and partnerships in BL situations, as these two dimensions were discussed the least of all dimensions.

16.2 Current State of BL in Asia

In this section, we have used the coding from Table 16.1 to identify several themes across chapters for each of the strategic dimensions. Because these themes are drawn from data in the chapters, they represent themes of the current state of BL in Asia. Figure 16.2 provides a visual representation of the themes which are subsequently described in the following sections.

16.2.1 Curriculum Issues

It is imperative to understand the key elements of a BL approach and how they fit together. BL should be considered as a mosaic, where F2F and online elements are clearly distinguishable but fit together to form a BL mosaic. Understanding these key elements allows those creating and those using BL to see the large mosaic, as they zoom from the large picture of a BL course to a specific learning activity within a BL course. Having these perspectives enables those using BL as an instructor or student to proceed in a successful manner. In this section, we discuss three key elements – course format, pedagogical approaches, and student considerations – as their pieces fit together to make the BL mosaic.

16.2.1.1 Course Format

Course format focuses on the reasons why someone wants to use a BL format for instructing a course. It combines the elements that are best taught in an F2F format with online learning methods. Development of an online course typically has two starting points, adapting an existing F2F course or developing a BL course from scratch. However, both processes for creating a BL course quickly merge together. In Chap. 1, Han and Wang suggest using a flowchart that lists all F2F and online dimensions of a course and how they intersect with each other.

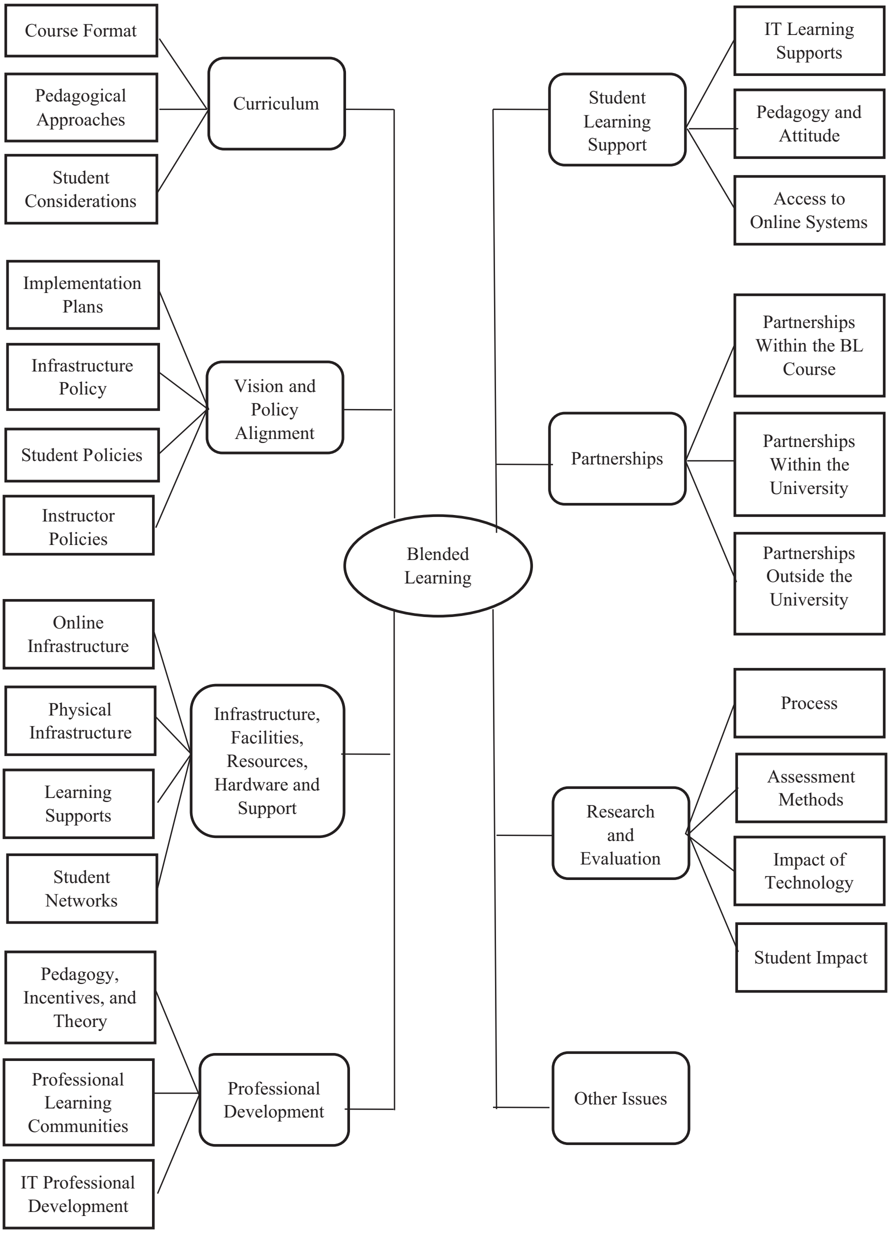

Fig. 16.2 Visual representation of themes drawn from the chapters in the book for each dimension of the framework for the strategic implementation of BL

The instructor makes deliberate, thoughtful decisions on how the online elements integrate with the F2F elements. Some of the key decisions include whether the course will:

- Include synchronous or asynchronous elements.
- Provide opportunities for deep understanding or cover key course content.
- Be more theoretical or more practical.
- Be more individual or have a social group component.
- Provide opportunities for direct creation or adaption.
- Contain other learning activities best suited to F2F or online instruction that broaden students' horizons.

In Chap. 13, Tan, Bound, and Wang examine the processes that bring learning back to BL. They emphasize the importance of anchoring BL instruction and course development in substantiated theories, principles, and empirical data. They propose three dimensions for developing a BL curriculum, including designing course materials from a learner perspective, considering the dimensions of BL, and integrating all instructional components in a proper way to produce effective learning. It becomes a process of seeing how all of the pieces fit together to facilitate student learning and success.

A final key element, discussed in six of the 15 chapters, is that of assessing student learning. Assessment may be used in a formative or summative manner to determine if the BL method used is accurately and effectively helping students learn what they need to learn from the BL course. This assessment may involve a simple evaluation of student learning via short online quizzes. It may combine several BL activities into a final project that demonstrates deep learning, collaboration, and the ability to solve problems. It may involve examining online chats or comments in discussion rooms to determine the degree of student learning and if additional instruction needs to occur.

16.2.1.2 Pedagogical Approaches

The pedagogical approaches are typically viewed as a significant transformation of how instruction and learning occur. The activities are geared specifically to course content and student ability. The methods deliver the course content in a way that benefits student learning and allows the instructor to try different pedagogical approaches (see Chaps. 9, 10, and 13).

BL focuses on using pedagogy to transform how instruction is delivered and how students learn. The BL course seeks to pair the course requirements and student abilities with the methods of delivery so that there is a diversity of methods used. It creates links between different modes of teaching and learning. Some examples provided from the previous chapters include:

- Using a mixture of multimedia including voice, video, and text to present course content in an appealing package.
- Providing key questions at the beginning of each learning activity that serves as the focus of instruction.

- Using a narrated PowerPoint (PPT) presentation followed by activities that consolidate and assess student learning.
- Connecting course content to MOOCs. The MOOCs may be part of other courses or created specifically for the course of instruction. This connection provides students with opportunities to experience things that are difficult, if not impossible, to bring into class.
- Using a flipped classroom with short, 5- to 6-minute videos to instruct and prepare students for more in-depth and practical F2F instruction.
- The integration of course material, including videos, to a quiz assessing learning, prior to F2F instruction.
- Using response-based activities such as discussion rooms and online posts to spur student learning and demonstrate understanding of course content.

16.2.1.3 Student Considerations

In Chap. 9, So, Lee, and Lee indicate that BL provides the opportunity to increase student satisfaction with course learning. It allows students to control, to some extent, when the course material is presented, the pace of delivery, the communication between the instructor and students, and where the learning will take place. BL places the responsibility for learning into the control and purview of the student.

In creating the BL course, consideration needs to be given to the students' literacy of online technologies and the language of instruction. The course may require students to learn how to use new technologies to be able to learn course content. It also includes considering student time management skills and how these may be supported and developed. It considers student motivation and desire to participate in collaborative online activities and the rules for engagement. For example, if chatrooms are used asynchronously, it means that students would not only need to make an initial post but also periodically check back in a timely manner to respond to comments made to their post. It also includes developing online norms of etiquette and conduct so that when students meet F2F, there is more of a collaborative spirit than a confrontational attitude.

The intent with BL is to consider the student as the prime element in BL design and instruction. In some instances, it may mean more work for the instructor, but greater benefit, learning, and satisfaction of the students.

16.2.2 Vision and Policy Alignment

If vision is the road map to achieving BL, then policies become the vehicle that moves academic and teaching staff and students further down the road. Each trip has its share of pitfalls and snags ranging from road construction, unexpected but required stops or side trips, to vehicle maintenance. However, knowing the route, alternate pathways, and helpful stops smooths the journey. In this section, we outline some pathways and side stops that are helpful to know as one proceeds along the route to BL at their institution. These pathways and stops include implementation plans, infrastructure policies, student policies, and instructor policies.

16.2.2.1 Implementation Plans

There are two distinct paths towards BL, namely, top-down and bottom-up approaches. The top-down approach is when a governing organization views BL as the means to deliver education to people who may not otherwise be able to receive an education. These plans typically include several steps or aspects designed to provide guidance to those delivering the instruction. They examine what is currently used in BL and adapt it to their specific circumstances and goals. This top-down approach has BL mandated at a world (UNESCO), country, or university level to achieve specific goals. For example, in Chap. 3, Suraweera et al. describe national government efforts to provide all Ski Lankans with basic Information and Communication Technology (ICT) skills through e-learning and BL. In Chap. 14, Nordin, Norman, and Zakaria discuss Malaysia's goal to have 70% of programmes use BL by 2025. This effort includes converting F2F courses into MOOCs and providing infrastructure to support such learning efforts. In these and other instances, the directive of the leadership helps to drive the BL initiatives forward, even when supporting policy and infrastructure may not be in place or is lacking.

The bottom-up approach begins with the front-line academic and teaching staff who have learned or experienced BL and see its advantages in teaching students. In this instance, academic and teaching staff begin to use BL in designing or converting F2F courses to BL instruction. They access vertical services to help understand how technology, course content, and pedagogical delivery may be used to improve and benefit student learning. The academic and teaching staff have the vision of how BL may be used, and they seek to gain the attention of leaders at higher levels so that BL may become more mainstream and supported by policies acknowledging instructor efforts as they implement BL.

16.2.2.2 Infrastructure Policy

Infrastructure policy refers to what is needed to run a BL course successfully. It ranges from building infrastructure from the ground up, borrowing infrastructure – such as MOOCs – to use in BL instruction, or upgrading existing infrastructure to meet the needs of BL. This last point becomes an ongoing policy issue as improvements and upgrades to technology occur. The infrastructure policy helps to determine a pathway to achieve a successful approach to supply the network, the technology, and the support needed to fully implement BL instruction. The intent is that academic and teaching staff and students are not left on their own to implement and use whatever infrastructure is present when they implement BL instruction.

Academic and teaching staff and students have the support they need to succeed in BL (see Chaps. 5, 7, and 10).

16.2.2.3 Student Policies

One of the key goals of BL is to level the playing field for all those who wish to learn. It becomes a mechanism to provide lifelong learning for students who are in isolated areas of the country where access to advanced education is limited or non-existent. It serves as a mechanism for those who are employed to upgrade and improve their skill set to advance into a profession of their choosing (see Chap. 1). Policies should support these self-actualizing efforts of the students as they seek to empower themselves and advance in learning and understanding (see Chap. 3). The policies should seek to make BL inclusive and equitable, especially in terms of equating credits earned whether the instruction is F2F, e-learning, or BL. The policies that support BL should allow students to decide, to some extent, where they learn, the pace at which they learn, and how they learn. Policies should recognize BL as another option, in which the institution can provide BL-based education that fits into the life of students instead of the other way around.

16.2.2.4 Instructor Policies

University and government policies need to recognize all efforts of academic and teaching staff who implement BL. Initially, they should acknowledge the extra efforts needed to teach a BL course. Teaching BL does not make the life of a teacher easier, but it does make it better. Policies should support teachers who implement and use BL (see Chap. 12). Some policies may include financial support for academic and teaching staff who develop BL courses or who assist other BL academic and teaching staff (see Chap. 5). Policies acknowledge and support BL as part of an instructor's tenure and promotion. All policies should be examined and, where needed, modified to support those engaged in BL. The policies do not become an impediment, but the support for those teaching a BL course. They should support a culture of sharing and lifelong learning among academic and teaching staff.

16.2.3 Infrastructure, Facilities, Resources, Hardware, and Support

If BL were a play, the instructor and students would be the actors on the stage. The infrastructure, facilities, resources, hardware, and support would be all of the things and people backstage that make the show run seamlessly. They are the physical and organizational structures that are seldom seen or noticed but are essential to conducting a successful BL course. This topic alone could fill a volume regarding options and best practices. However, our discussion only focuses on four aspects of this topic – online and physical infrastructure, learning supports, and student networks – and how they assist BL.

16.2.3.1 Online Infrastructure

Online infrastructure refers to how academic and teaching staff and students access BL materials. It adjusts instruction and course material delivery in ways that accommodate for different bandwidths and Wi-Fi access on campus and in remote areas. Part of the online infrastructure includes developing or using open-access materials. In some instances, academic and teaching staff may find and use portions of MOOCs in the delivery of their BL course. They may develop their own online materials. Whichever method is used, care needs to be taken that the online portion of BL matches the abilities, needs, and infrastructure a student can access. For example, in Chap. 8, Tam discusses how an instructor created a voice recorded PPT presentation for online instruction in a BL course. While this instruction was sound, the PPT file was so large that it took students a long time to download the file when away from campus. After suggestions from students, the file was exported as a video file making it smaller in size and easier to download.

The online infrastructure also refers to the learning management systems (LMS) that enable students and teachers to interact with one another. The LMS may be locally developed or part of a generic LMS used by several institutions in multiple countries. The LMS should have a user-friendly interface that is easy to learn and access. Access may include live streaming when course content is taught synchronously. It should allow and facilitate students accessing course documents and turning in assignments whether they are on or off-campus. A challenge with this is when some aspect of online infrastructure is updated and other infrastructure is not. In these instances, the discrepancy between online infrastructures becomes an impediment to learning instead of a means to success.

16.2.3.2 Physical Infrastructure

Physical infrastructure refers to all of the tangible objects used in BL. It includes the brick-and-mortar buildings where the F2F portions of BL are held, the cameras and recording devices used to record and transmit the online portion of the course, the computers and Wi-Fi antennas used to access course materials, and everything in between (see Chaps. 1 and 11). In some instances, universities create and support on- and off- campus labs that allow students to used physical infrastructure that would be otherwise unaffordable. In other instances, it requires universities and institutions to upgrade their hardware on a continuing basis, including shifts in what online infrastructure can now be accessed and used on accessible hardware. This upgrading and modifying of course materials can easily become a “black hole” of educational funding as the rate of hardware changes increases.

16.2.3.3 Learning Supports

Current young students are often thought of and referred to as digital natives because of their constant use of digital tools to access and use online applications. For this reason, these students are often thought of as a perfect match for using BL and e-learning to meet their educational needs. However, this is not the case. Just as there are different categories of drivers’ licences that indicate a level of training and experience in driving cars, ambulances, freight trucks, and construction equipment, so it goes with accessing online materials. All people, including students, have their few devices and access tools they prefer to work with and use. While they may be proficient or experts in using these tools and applications, they may not have expertise using tools and applications needed for accessing online content. There may also be instances where learning to use online technologies is totally new to BL students.

In the worst-case scenarios, academic and teaching staff and students are left to themselves to decide which technologies to use and how to use them when problems occur. The best-case scenarios include a multitude of support services such as IT and pedagogical supports for those looking to develop or use BL courses or to take a BL course. This support includes the instruction to students and academic and teaching staff on how to use the materials. It also includes ongoing, just-in-time support when needed. This support may also include the limiting factors of using free, open-access technology instead of the pay-for-use technologies that have better access and features. It may also include instances where an instructor uses a delivery technology that students are unfamiliar with and unwilling to learn because a parallel technology exists that they use and are familiar with.

Most institutions lie somewhere between these two extremes, but the point is that expertise needs to be accessible so that both academic and teaching staff and students can access and learn how to use it. The learning supports may take the form of IT centres to help with any technical or access issues. They may include centres for teaching and learning to help academic and teaching staff learn new pedagogical approaches (see Chaps. 4 and 5). There needs to be flexibility in how these learning supports are integrated and used in the BL course and how academic and teaching staff are informed of best practices and options and how they can inform students of these options.

16.2.3.4 Student Networks

It is no surprise to any instructor at any level of education that students talk to and support one another. This support ranges from how to best access materials, approaches to use in learning course materials and taking tests, and workarounds when things do not work the way they should. Such networks are increasingly important to students in a BL situation. The online connections with other students enable them to learn how to best proceed in their BL course. They also offer a support network when assignments and the work-school-life balance are offset. BL student networks become a critical aspect of BL. Academic and teaching staff should support and facilitate such efforts to help reduce the frustration student may experience (see Chap. 4).

16.2.4 Professional Development

PD in this section refers to the processes, policies, and units that are in place to support academic and teaching staff who are engaged in BL or who wish to start using BL. The PD support ranges from very personal and specific to broad and general. We briefly discuss how academic and teaching staff receive PD on pedagogy, incentives and theory, their involvement in professional learning communities, and IT professional development.

16.2.4.1 Pedagogy, Incentives, and Theory

BL academic and teaching staff are continually looking for ways to improve their instruction and student learning. The PD comes in several forms. Academic and teaching staff may form communities of learning where experts welcome novices to share what did and did not work well for them in a BL course. In other instances, it is PD offered by government or entities within an institution that teaches academic and teaching staff how to use different learning theories (e.g., constructivist theory) to design and scaffold courses. This PD helps academic and teaching staff to expand their teaching skills and repertoire of teaching strategies. In this way, teachers are able to cater instruction to the specific needs of students in specific BL courses.

The support for teachers using BL instruction becomes critical and takes several forms. In Chap. 1, Han and Wang indicate that these incentives may include grants to support efforts to change F2F courses into BL courses, salary/payment increases, and awards for teaching excellence and use of technology in BL courses. In addition to this support, BL academic and teaching staff are also eligible for additional PD opportunities and support to access external funds to assist in the development and understanding of BL practices. This support also extends to times when BL academic and teaching staff are struggling with teaching a BL course and need support so they do not quit.

16.2.4.2 Professional Learning Communities

PD is often delivered as a one-and-done format where academic and teaching staff come together at conferences, workshops, or seminars. While these efforts are important and helpful, PD with BL instruction needs to be ongoing and supportive. There need to be networks developed that allow BL academic and teaching staff to ask for help when needed. Professional learning communities provide a network for such assistance.

In Chap. 2, Lim, Yang, and Gao describe a PD method that identifies and uses BL ambassadors. The BL ambassadors have experience and training in using BL in their instruction. They are open to sharing with other academic and teaching staff things that have worked well and things that did not go well. This openness promotes honest and clear dialogues with academic and teaching staff who are new to BL. It creates networks that may be accessed. For example, if an ambassador is asked a question she or he does not know, they may be aware of another ambassador within their network who does have experience and to whom the new instructor may be referred. This open sharing creates comradery and trust among academic and teaching staff that supports the learning and teaching of BL academic and teaching staff.

In Chap. 12, Lim, Wang, Nith, and Mak discuss how an urban university and two rural universities joined together to learn about and deliver a STEM course via BL. In this instance, they began with three workshops to introduce BL practices and online tools. The combined effort not only helped with learning BL practices, but it also helped to establish professional learning communities.

In some instances, the professional learning communities are at a national level. In Sri Lanka, a national e-learning resource centre served as a clearinghouse to provide professional development to those involved with BL. It not only trained academic and teaching staff but also prepared them to share their knowledge with other academic and teaching staff. In this way, a learning network was developed among BL academic and teaching staff.

In other instances, professional learning communities centred around a university-level centre for teaching and learning (CTL). The CTL may offer workshops for BL academic and teaching staff and their support staff. Some CTLs produce LMS user manuals and videos to help academic and teaching staff learn the full capacity of the LMS. Additionally, a CTL will have consultants who can work one on one with academic and teaching staff on an as-needed basis and using methods that are familiar and suited to the instructor.

16.2.4.3 IT Professional Development

When developing a BL course or modifying an F2F course, the instructor must consider the background and experience of students attending their class in the context of the material being delivered. This process is even more important in a BL class as it involves the use of technology to engage students in the learning process.

IT PD introduces academic and teaching staff to IT options for delivering and assessing course content and seeks to improve their skill set. It is akin to adding more tools to the instructor's teaching toolbox.

The IT PD is an ongoing process as online tools for assessment, student online forums and chat rooms, wikis, and content delivery methods are discovered, explored, and used in a BL course. As these online tools change, additional IT PD is needed to upgrade instructor skills. If the instructor is aware of the technology, there is the increased option of using it in a way that is helpful to student learning. This PD for academic and teaching staff not only helps them to learn about and use the technologies but also helps to troubleshoot technical problems students are having as they move through their course.

Additionally, collaborations between units within the university become quite important. In Chap. 11, Dai describes a situation where a programme manager position was not filled. The result was a disconnect in the teaching team and led students to describe the course as poorly organized. This example illustrated the need for strong collaboration between all those involved in the design and presentation of the BL course, whether just on campus or across multiple universities.

16.2.5 Student Learning Support

Regardless of the type of instruction and learning modalities, students need support. This support typically comes from the instructor and others enrolled in the course. In a BL course, additional supports are needed for students to experience the full potential learning offered in a BL course. This section discusses the IT learning supports, changes to pedagogy and students' attitudes towards those changes, and access to online systems.

16.2.5.1 IT Learning Supports

As mentioned earlier, students are often assumed to be digital natives who are fluent in several applications and willing to learn more. However, this is not the case. Academic and teaching staff need to determine the online fluency of their students and their willingness to try and learn new applications (see Chap. 2). Workshops for students are also mentioned in several chapters as a means to deliver content. It seems that some of these workshops could take the form of a lab that is integrated into the BL course, as in other courses. The workshops mentioned across several chapters appear to have a similar role, as they prepare students to use new but needed online technologies (see Chap. 7).

In addition to these workshops, it is also critical for students to have access to an IT support centre for "just-in-time" assistance. This day-to-day assistance supports academic and teaching staff who are focused on teaching the BL course, while IT supports students in using the online applications to complete assignments, participate in chat room conversations, or complete online tests. The IT support assumes this burden in the BL courses. This support may also take the form of a FAQ section, online tutorials, chat lines, or telephone contact (see Chap. 3).

16.2.5.2 Pedagogy and Attitude

This part of BL refers to a shift from a teacher-centric to a student-centric approach. Students become more responsible for their learning activities and course assignments. For example, if a student misses a class in an F2F lecture, she or he must try to recover learning from others' notes or lecture notes the professor is willing to share. In BL, the lessons are recorded online, and the student can "attend" the lecture at a convenient time (see Chap. 7).

Additionally, class assignments have built-in flexibility. Online tests that randomize questions and responses enable students to take a test within a specific window instead of having to show up at a specific location and time. Depending on the type of questions, quizzes may be automatically scored so students can see how well they did at the same time the professor receives their test score.

Platforms for student comment are also helpful to foster classroom discussion and learning. In Chap. 6, Wang described a cultural benefit to these online forums. In this instance, students made classroom presentations and then critiqued other student presentations. Culturally, students disliked making oral critiques of presentations but were more at ease providing feedback online. Thus, the online comments provided feedback and demonstrated student learning in a way that fits into the lives of students.

In a flipped classroom situation, students must view materials online to be prepared for F2F classroom activities (see Chap. 9). All of these online activities change the nature of traditional education. Students must make a more conscious effort to know what has to be done and to do it within a specified period of time. An instructor is not there to ask for the assignment by the end of class, and the student must have an attitude shift where they take ownership of their learning. Additionally, students may review the online material multiple times so that they can better understand and master it.

When F2F sessions occurred, students would often be involved in small group work. This required a change in attitude for students as they not only learned the course material but also learned collaboration and cooperation skills within their assigned group. While not formally part of students' course materials, these skills (collaboration, cooperation, self-regulation) become critical as students move into the working world.

16.2.5.3 Access to Online Systems

While the online dimension of BL provides for greater flexibility and autonomy, it brings with it additional responsibilities. Students must learn the systems used for online learning. In some instances, students may be more familiar with one parallel system than another. In these instances, academic and teaching staff need to prepare students and help them to learn how to access and use the online formats. Students must be willing to learn and use new online platforms, even if they prefer other parallel platforms.

Greater discipline is also needed by students. As mentioned earlier, this includes self-regulation in planning when to do assignments and managing their learning activities. However, the self-regulation goes beyond this. Some students are accustomed to multi-tasking, having several open platforms for work, school, social, and recreation. In this instance, access refers to students learning to limit or restrict their access so they are not distracted from the task at hand (see Chap. 7). Again, strategies from other students and academic and teaching staff may be helpful in them learning these skills. The self-regulation also includes students participating in learning tasks that may not be graded or of much value but add to the learning.

16.2.6 Partnerships

Much could be written on the different partnerships and networks that facilitate BL instruction and learning. We limit our discussion to three partnerships within a BL course – partnerships with those participating in the course, partnerships within the university community, and partnerships beyond the university both in academia and the private sector.

16.2.6.1 Partnerships Within the BL Course

In each learning situation, trust must be built for learning to occur. Trust building occurs between the instructor and students and among the students themselves. This trust is one dimension that supports strong learning. Within a BL course, trust is filtered through technology in ways that hinder and promote trust building.

In Chap. 2, Lim, Yang, and Gao describe how students had difficulty building trust because of the interplay between technical support staff (TEL-Hub) and students and between TEL-Hub staff and academic and teaching staff. Students did not feel that they could discuss their ideas with TEL-Hub staff because of their insufficient subject knowledge. TEL-Hub staff found it difficult to start conversations with academic and teaching staff who are less comfortable using technology to communicate.

In this instance, protocols and professional development needed to occur to help each of these groups speak and listen to each other. The protocols might include TEL-Hub staff acknowledging when a question is beyond their expertise and have a mechanism to forward discussions to the instructor. They also need to develop protocols to review and help academic and teaching staff who are weak in using technology to engage in the process with them. Such interactions may need to include overcoming cultural norms. Increased emphasis needs to be given on instances when there are F2F interactions. These become critical to developing trust and establishing protocols for BL courses.

An example of this was discussed in Chap. 15 by Zhan et al. In their first F2F tutorial, students were randomly divided into groups of three or four. From here, students shared inquiry questions and solicited comments either online or in the F2F class. Students were able to rate, discuss, and refine their choices for the final product of the class. F2F and technology, with proper instruction, helped students build trust and learn how to communicate through technologies in ways that facilitated their learning.

Another partnership occurred through technology when a student was absent. In a traditional course, the student must get notes from the instructor or fellow students. In Chap. 7, Khan et al. discuss how a BL course and its associated technologies facilitate a situation where a student misses class instruction. In a BL course, instruction is posted online so the student may access it after the lecture. If they miss the instruction, they can access the online lessons. In this instance, students were able to use a discussion forum platform to seek answers and clarify issues arising from the online lecture that they missed. The BL technology facilitated trust building and learning that otherwise may have been lost or compromised.

16.2.6.2 Partnerships Within the University

Within the university, partnerships may occur by drawing upon the expertise found within that community. These efforts may engage those with technical expertise to identify and teach academic and teaching staff how to use helpful and relevant technology. It may engage subject content experts to help with the course content, including assessments of course learning (see Chap. 6). It may involve pedagogical experts who can help academic and teaching staff understand the differences and nuances of pedagogical approaches in BL courses. Each of these resources helps to form a local network of support for BL (see Chap. 2).

In some instances, these collaborative experiences occur in local or regional university conferences. Workshops may promote a forum for discussing how BL currently occurs within the university and how it may develop. Participants may range from those with extensive BL experience to those who are just exploring BL to see if it would be something they wish to engage in. It also affords the opportunity for BL academic and teaching staff to be exposed to different strategies and technologies through demonstrations and hands-on learning. It may also bring in academic leadership to better understand how BL works and how university policies help and hinder the process. The point is that BL, as a pedagogical approach, brings a multitude of stakeholders together to share, discuss, and learn from one another.

16.2.6.3 Partnerships Outside the University

Partnerships outside the university take one of two forms – collaborations with other institutions and collaborations with non-profit and for-profit organizations.

Collaborations with other institutions often come about as institutions share common goals and build relationships with one another. In these instances, the resources and experience at each institution are pooled to create situations where the sum of the parts is greater than the whole. These partnerships become critical to the success of a BL experience. In these instances, there needs to be open communication and cooperation among partners so there is a united presentation of course materials and required assignments to demonstrate learning. This partnership often takes the form of an online professional learning community. Academic and teaching staff can discuss issues and concerns with the entire course or unique to their students. For example, if the BL course spans several countries, there needs to be coordination of national holidays, semester start and end dates, institutional deadlines, or other situations that may require adjustments in the BL course instruction.

These online professional learning communities may also assist academic and teaching staff in sharing personal instructional experiences and learning with others in a way that supports and strengthens the learning community. In Chap. 5, Lim, Cho, and Kim discuss how a partnership was formed with other universities so they could share their personal experiences with BL learning. These open discussions focused on technologies and teaching experiences that resulted in successful learning experiences and those that were less optimal. The willingness to discuss both positive and negative experiences enabled others in this professional learning community to learn what to try and replicate and what to avoid or adjust.

Partnerships with non-profit and for-profit, non-university organizations typically centre on the use of technologies and learning materials. In some instances, it includes the use of already developed MOOCs, using parts of developed MOOCs, or creating MOOCs specific to the BL situation. It may also include partnerships with businesses who are developing and using online communication tools. The partnership benefits both as the BL class becomes a lab for the business to determine how well their technology works and how it should be developed. For the university, it provides the means for another support for BL instruction. The concern arises with BL becoming commercialized or dependent on a single technology.

16.2.7 Research and Evaluation

Like the section on curriculum, every chapter in this book discusses research and evaluation, even if only minimally. Evaluation in this context refers to both evaluation of the students' learning and success and evaluation of BL courses, instruction, and programmes. This type of evaluation folds well into research on BL as an attempt to discover best practices and define the value and place of BL in an academic setting. In this section, we discuss the process of research and evaluation, assessment methods used in evaluating student learning, research on the impact of technology, and research on the impact of BL on students.

16.2.7.1 Processes

The focus of research and evaluation of BL processes is to determine if theories on BL can be translated into practical solutions and activities. Research also examined how BL fits into the life and processes of universities. Given the time and expense of personnel that may be involved in BL experiences, institutions and academic and teaching staff want to examine what was done throughout the life cycle of a BL course.

In Chap. 8, Tam indicates the potential scope of researching BL focuses on the development, implementation, and revision of courses and course materials. This examination includes student perceptions of BL course strengths and weaknesses, preferred activities, and suggestions for improvements. It also includes instructor reflection on BL instruction and recommendations for future practice.

Research and evaluation processes have a heavy slant on practicality in all of the processes surrounding BL. This examination of what worked and what did not informs future changes and adaptations of the BL course and programme.

16.2.7.2 Assessment Methods

Researchers used a variety of research methods to examine and compare BL methods and learning to more traditional courses and to itself. The research methods included surveys and questionnaires, interviews, student and instructor journaling, peer reviews, e-portfolios, examinations of writing assignments, video recording, and focus groups. There are also instances of online analytics examining BL activities such as student grades, log data, student course evaluations, course browsing, posts on discussion boards, submitted and completed homework, dropout and course completion rates, oral expression, self-learning skills, logical thinking, team spirit, and students' sense of responsibility. Often these methods are used in concert with each other to triangulate findings and provide a stronger picture of what is happening in the BL experience, with the intent on assisting both students and academic and teaching staff to have a more successful BL experience (see Chaps. 14 and 15).

16.2.7.3 Impact of Technology

A great deal of effort has been and continues to be focused on how technology is used in a BL course, including the impact of technology on BL. In course development, academic and teaching staff must decide which technologies they will use in the course and how those technologies assist in the delivery of course material.

In Chap. 7, Khan, Chenda, Heng, and Coniam used several research methods with students and academic and teaching staff to determine the impact and efficacy of technologies used in a BL course. As the concept and use of BL were new to both students and academic and teaching staff in this instance, it provided a key opportunity to examine the BL experience from the perspective of novices. It provided vital insights where students first saw no purpose in the off-campus sessions and felt that these would only be more work. However, after just two sessions, they had reversed their perspectives. This type of research not only helped examine how students and academic and teaching staff moved from the role of novices towards being experts and how perceptions of BL and the associated technologies can impact the delivery of course instruction and student learning.

In some instances, the technology examined has broad applications for all BL courses. This may include applications such as moodle-based learning management systems, technologies used to create and use MOOCs, message boards, and other communication technology. However, in other instances, the technology is course specific. One example is the BL course discussed in Chap. 4. In this instance, augmented reality was used to present case scenarios to help students learn to identify and correctly act towards actions of academic integrity and ethics. The real-life situations were shared via computer and portable technologies, and students were able to respond via these same technologies. The study examined student satisfaction with the use of this technology to teach this content. It found this unique technology enhanced student learning and satisfaction.

16.2.7.4 Student Impact

One of the central focuses of research and evaluation of BL is on how BL impacts student learning. It answers the question: is BL just different or is it better? If it is better, in what ways and circumstances is it better? When examining how BL impacts student learning, researchers, academic and teaching staff, and institutions, we must take an open, honest approach that identifies and examines both positive and negative effects of BL on student learning. If positive effects are found, researchers and academic and teaching staff should seek to replicate and maintain these procedures. If negative effects are found, researchers and academic and teaching staff should try to avoid these practices or determine ways to change them to positive influences.

In Chap. 10, Gonda, Luo, Lei, and Leung adopted this design-learning approach using an ADDIE model and three engineering courses. They used an iterative approach wherein they developed course materials, prototyped or implemented them, evaluated the approaches' effect on student learning, and then made adjustments to the BL courses. In using this approach, they were able to develop a framework to improve students' conceptual thinking and facilitate the development of other BL courses.

In Chap. 8, Tam described a process where student feedback fuelled changes to the BL course. As BL was a new experience for students, they were able to discuss things that would assist their learning, such as an online forum where they could discuss and ask questions about the course instruction. In response to this feedback, a discussion forum was added in subsequent iterations. In this instance, course evaluation led to improvements in ways students could use technologies to assist one another. The point with research and evaluation is that it is continuous and ongoing. It should be built into every BL course and programme so that academic and teaching staff also become students and all students are learning and improving.

16.2.8 Other Issues

There are several issues that need to be considered with BL, especially considering its potential scope and impact. While these issues are not directly discussed in the chapters, there is a strong implication towards them.

There are two approaches to a successful BL program: a top-down approach and a bottom-up approach. Instead of dictating (top-down) or cajoling (bottom-up) to move BL forward, each approach needs to see the perspective of the other approach and adopt the attitude of "What can I do to help you succeed?" When both approaches have the same vision and work together, BL has the potential to grow, develop, and change advanced education. BL policy should support and enable both students and academic and teaching staff to further their academic and career pursuits as lifelong learners.

BL students become lifelong learners. While it is successfully used with students in universities, it also offers the potential for mature learners to gain a degree, advance in degree level, or keep current with practices within their chosen profession. Workers who wish to upgrade their education or skills can use a BL experience to do so without leaving their employment. Students who have left or completed university and who want to return have a chance to return and become lifelong learners. In this sense, BL seeks to fit into the life of the student instead of the student fitting into the life of BL.

Current BL practice allows for F2F and online instruction and learning. The F2F instruction typically happens at the instructor's university. The question arises if this is the only or best configuration for BL. It begs the questions: what other configurations are possible with BL and when should these other configurations be used?

Additionally, there are questions about the impact of unique factors. One of these factors is culture, especially for BL partnerships that cross national borders or include unique populations. Other factors may include differences between genders and the efficacy of BL when used in different levels of education.

Additional instruction, typically with issues of time management and technology, is often provided to students and academic and teaching staff of BL courses. The intent of this instruction is to assist both students and academic and teaching staff on how to effectively use technology and their time. However, an issue becomes how well and long this learning lasts. An issue that needs to be resolved is the integration of this additional instruction into a BL learning course.

16.3 Future Directions of BL in Asia

As we discuss the current state of BL practices and its impacts on inclusive and quality higher education in Asia, the following future directions emerge.

16.3.1 Giving Attention to the Contextual Uniqueness While BL Is Becoming the New Normal

It is clear that BL is becoming the new normal in universities around the world (Dziuban, Graham, Moskal, Norberg, & Sicilia, 2018). A growing number of case studies of BL at universities across Asia in this book and others (e.g., Lim & Wang, 2016a) are evidence that BL is also rapidly advancing in Asia. Recent analyses of worldwide research related to BL provide a current view into the blended practices being shared through research in Asia (Spring & Graham, 2016, 2017; Spring, Graham, & Hadlock, 2016). While Asia can learn from the research done in other countries around the world, there are many issues that may be unique to the learning culture and issues in Asia. Asia has much to offer the worldwide research community with its cases of adoption and implementation.

16.3.2 The Need for More Comprehensive Understandings of BL from Theoretical Perspectives

While there have been many studies of BL that have put emphasis on data-driven, evidence-based research as well as empiricism, the theoretical scholarship of BL still seems to be lacking. With researchers of BL drawing insights from learning theories, human development models, cognitive psychology, computer science, and other related theoretical scholarship to generate BL-specific knowledge for practice, there is also a need to understand how this knowledge may alter existing theories or develop new theoretical scholarship. Such understanding can drive the research and practice of BL to the next level. But in order to achieve this, we need to first chart a clear road map showing what research needs to occur, what research has been conducted, and what research is yet to be done on BL. Subsequently, more comprehensive understandings of BL from theoretical perspectives can be developed. One example of this in recent years is the development of the Academic Communities of Engagement framework developed specifically to look at support systems within blended and online environments that enable affective, behavioural, and cognitive engagement (Borup, Graham, West, Archambault, & Spring, 2020).

16.3.3 The Search for Congruence Between Shared Vision and Individual Practices of BL

Although HEIs in Asia are recognizing the need for shared vision of BL, the alignment process is challenging in many cases. Sharing a vision does not simply mean adopting someone else's vision (Fullan, 1993), and institutional attempts that impose false consensus that suppresses rather than enables personal beliefs are likely to fail.

Congruence building between an institutional shared vision and individual practices of BL needs to be a concerted effort between HEI leadership and BL practitioners, an effort that requires both a reinforcing and communicative process (Fullan, 1993). The reinforcing process requires HEIs to help BL practitioners take collective ownership of the shared vision, particularly in terms of BL's role in achieving inclusive and quality higher education. The communicative process helps HEIs gain a deeper understanding of both what individual practitioners believe and how their practices could be adapted in order to be congruent with the HEI's vision. Both processes will eventually lead to agreement about why BL adoption is necessary and what is expected from adoption, while at the same time fostering respect for the unique ways that practitioners blend.

16.3.4 A Focus on Pedagogy and Teacher PD

A critical issue faced at all institutions of higher education in Asia is developing the capacity of the academic and teaching staff (Lim & Wang, 2016b). Universities can invest in technical infrastructure, create a new vision, and even change institutional policies, but if the faculty have not learned how to teach effectively in BL contexts, then the implementation will not be effective for students. Quality blended teaching is largely a pedagogical decision. While blended teaching can adopt the best of both the online and face-to-face worlds, we often forget that it can also be made up of the worst of these two teaching worlds. The best of blended teaching pedagogies moves the learning experience to be more student centred and focused on greater active learning in both in-person and online modalities. So, professional development for faculty should be at the forefront of Asian university priorities for successful adoption and implementation of BL (Graham, Woodfield, & Harrison, 2013; Lim & Wang, 2016c; Porter, Graham, Spring, & Welch, 2014).

16.3.5 Re-envisioning the Role of Libraries as a BL Resource and Support Hub

Libraries in HEIs serve two complementary purposes: to support the curriculum and to support the research of the university faculty and students (Curzon & Quiñónez-Skinner, 2009). Although the purposes of libraries do not reflect a specific concentration on BL, there are many synergies between the services that a library can provide and the practices of BL, particularly in terms of curated online learning resources, collaborative physical spaces, state-of-the-art facilities, and the information literacy necessitated for BL. While some chapters in this book mentioned about the use of online resources, none of them thoroughly discussed the role of libraries in supporting BL. For HEIs to thrive in BL for inclusive and quality higher education, the role of libraries needs to be re-envisioned.

16.3.6 The Rise of K–12 BL and Its Implications for BL in Higher Education

BL research communities have recognized that BL is slowly taking off in recent years in K–12 education (Digital Learning Collaborative, 2019; Halverson, Spring, Huyett, Henrie, & Graham, 2017; Picciano, Dziuban, & Graham, 2013). However, none of the chapters in this book has investigated the implications of this trend for HEIs. For HEIs to further move towards the inclusive and quality higher education agenda, there needs to be research and discussion on how HEIs can better learn from the expansion of BL in K–12. For example, there is currently work in the K–12 sector to identify the unique teaching competencies needed for blended vs fully online teaching (Pulham & Graham, 2018; Pulham, Graham, & Short, 2018) as well as efforts to create and validate instruments for measuring blended teaching competencies and assessing blended teaching readiness (Graham, Borup, Short, & Archambault, 2019b; Graham, Borup, Pulham, & Larsen, 2019a). Additionally, HEIs can take advantage of BL trends in the K–12 sector (and the flexibility BL enables) to provide opportunities and support for students to earn advanced university credit or to take apprenticeship instruction while still in high school.

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