

Chapter 1

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



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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 life-long 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 vacations, 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 flow-chart 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 grassroots 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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