Chapter 8
Using Mobile and Flexible Technologies to Enhance Workplace Learning in Vocational Education and Training (VET)

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Abstract This paper discusses the possibilities of using mobile and flexible technologies to enhance workplace learning in vocational education and training (VET). It also proposes a number of innovative pedagogical practices enabled by technologies to facilitate better learning and teaching experiences for VET students and mentors in workplaces. While mobile and flexible technologies emphasise self-paced online and virtual learning experiences, VET stresses the mastery of hands-on skills and practices in authentic workplaces. The findings of this study show that, despite the need for innovative pedagogical practices, an increase in the effectiveness of mobile and flexible technologies relies on the instructional design of the trade-specific learning and teaching materials, as well as the readiness of students, teachers and workplace mentors.

Keywords Mobile and flexible technologies · Workplace learning · Vocational education and training

Introduction

Half a century ago, McLuhan (1964) advocated that 'the medium is the message' and asserted that any new technological invention is an extension of ourselves and contributes to changes in human interaction. For McLuhan, changes are multidimensional, addressing technological, societal and cultural aspects. In this vein, the rapid advances in information communication technology and the popularity of mobile devices (e.g. smartphones, iPads and tablets) and flexible technologies (e.g. Wi-Fi, online and web-based networking) ease access to information. These advances have sparked a phenomenon of technology hype and massive information exchanges. Robertson (2007) contends that there is a 'convergence of technologies into the single units and a shift from fixed to wireless and mobile

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systems' (p. 11). Rather than using station and laptop computers, there is an increasing preference for retrieving information by using mobile devices. Nowadays, mobility and flexibility are the priorities for technology consumers, especially the young generation. This development not only has an impact on technology and entertainment consumption but also implies that students may prefer using mobile and flexible technologies for learning. Therefore, it is not surprising that higher educational institutions have been experimenting with mobile and flexible technologies to enable students' self-paced online learning for academic subjects. Although promising results have been found in a number of studies (Jenkins, Klopfer, Squire, & Tan, 2003; Lee, Lam, & Liu, 2014; Tang, Pang, & Wong, 2014; Tsang, Yuen, & Cheung, 2014), while mobile and flexible technologies emphasise self-paced online and virtual learning experiences, vocational education and training (VET) stresses mastery of hands-on skills and practices in authentic workplaces. How could these two learning paradigms complement each other and benefit VET?

Current Issues in Vocational Education and Training (VET)

A Global Perspective

The global VET sector has undergone rapid changes in the past decade. The findings from the report *Global Trends in Vocational Education and Training* (Dandolopartners, 2011) showed that an increasing number of people are enrolling in vocational education at an earlier age or after years of work. This report found that, in the United Kingdom, the total number of vocational qualifications awarded increased by 11% from 2006 to 2009, mostly acquired by students who took vocational subjects at school (BBC News, 2009). The number of school students aged 15–19 who participated in Australian vocational education and training also increased by nearly 30% from 167,100 in 2006 to 216,700 in 2009 (NCVER, 2011). In Asia, Singapore, for instance, quadrupled its annual capacity in continuing education and training from 22,000 workers in 2007 to 80,000 in 2010 (Ministry of Manpower, Singapore Government, 2010). Also, to enhance the work readiness of its young people, China has introduced a 'dual certification' system that provides students with an academic diploma and a vocational work permit upon graduation from secondary vocational education schools (Australian Education International, 2010). VET aims to develop skills that help to engage people in useful endeavours and, at the same time, address the operational needs of society. VET also recognises that people have different talents – some geared more towards academic study and others towards hands-on dexterities – and offers them an education that suits their attributes. The above examples signify a growing anticipation of the possible contribution of VET to a number of societal and economic issues – such as the higher unemployment rate of youth, the large number of conventional school failures every year who are frustrated about where to go in employment or education and the shortage of suitably skilled human resources in various service and industry sectors

of society. To cater better for the increasing demand and diversification of trade-specific subjects in VET, governments and VET institutions in various countries have started to make significant efforts to enhance VET's positioning, curriculum design and delivery and learning and teaching strategies, as well as industrial and community collaboration.

The Hong Kong Experience

VET has received more attention in Hong Kong in recent years, due to a few significant factors. Firstly, VET is considered to be an alternative study pathway which benefits students who have achieved less academically. Secondly, there is a growing demand for skilled labour in some industries, especially for those manufacturing and production lines which have returned from mainland China. Thirdly, the Hong Kong SAR Government aims to produce graduates with knowledge and skills which match the labour qualities demanded by various industries. There are signs that the Government has started to step up the emphasis on VET. To enhance the image and quality of vocational education, the Government had set up a Task Force on Vocational Education to devise strategies for promoting it in the community. The year 2014 was particularly important for VET in Hong Kong, as a substantial portion of the 2014 Chief Executive's Policy Address was devoted to VET, in which the Chief Executive stated that 'mainstream education is not a straightjacket that fits all young people as everyone has his or her own interests and abilities. The Government should re-establish the positioning of vocational education in our education system and guide the younger generation in choosing their career' (Hong Kong SAR Policy Address, 2014, p. 102). He went on to announce a series of measures to strengthen VET and support its development alongside academic education. In particular, a pilot training and support scheme – 'The New Earn and Learn Pilot Scheme' achieved by 'integrating structured apprenticeship training programmes with clear career progression pathways' – was proposed to attract and retain talent for industries with a keen demand for labour (Hong Kong SAR Policy Address, 2014, p. 106). The 'New Earn and Learn Pilot Scheme' is an initiative that combines vocational education and on-the-job training with promising progression pathways to attract learners for a range of trade-specific industries. An allowance and a guaranteed salary will be given to the learners by the Government and participating industries to guarantee the learners a steady income while equipping themselves with knowledge and skills to pursue prosperous careers. Learners will study in the VET training programmes and be engaged in on-the-job training at the companies which employ them. Because of the academic qualification and recognition, graduates of the schemes are also eligible for further studies to obtain higher academic qualifications for pursuing their career development. This new Scheme was subsequently endorsed by the Legislative Council. During their study in the Scheme, students receive theoretical knowledge and practice in simulated work environments in school, while the learning and practices

of 'authentic' trade-specific and generic competences – such as communication, teamwork, problem-solving, transferability and work ethics – take place in real-life workplaces (Deissinger, 1997; Tremblay & Le Bot, 2003; van Merriënboer, 2001). For the above reasons, VET in Hong Kong has developed a heavy emphasis of workshop learning and industrial attachment. The salient issue is then the development of appropriate pedagogical approaches that enable the workplaces, in the settings of Hong Kong, to be used as authentic learning environments.

Workplace Learning and Situated Learning

Rauner and Maclean (2008) assert that 'vocational education and training is characterised by the crucial importance of learning in the work process as a dimension of intentional and informal competence development' (p. 15). Workplace learning is an important characteristic of VET as it provides 'a fertile opportunity for learners to appropriate knowledge that connects theory to practice in a realistic and efficient way' (cited in Smith, 2003, p. 53). Workplace learning is a manifestation of Lave and Wenger's (1991) view of learning as 'situated activity' (p. 29). In these authors' view, learning is a social process in which learners participate in the lived-in world and understand the world as they experience it. During workplace learning, students experience the real, factual consequences of their actions and the ultimate aim is 'learning transfer': students internalise the theories and skills and then export them to the field of enterprises and connect their learning experiences so that an earlier learning process can enhance a later one in a positive way (Bank, 2013). Research has shown that most VET learners prefer to learn in groups and from mentors in workplaces rather than learning on their own. A collegial context for learning is the essence of workplace learning where learners learn in social environments assisted by peers and instructors (Sangster, Maclaran, & Marshall, 2000; Smith, 2006). It is asserted that applying theories into practices through a competency-based training (CBT) approach in authentic work environment is exceptionally important in VET. However, given that many of the workplace mentors are trade specialists and do not have formal academic training, students' learning of subject theories in the workplace may not be provided. Instead of training, very often students spend most of their time doing practical and production work without a solid knowledge and theoretical background, and so the learning outcomes may not be achieved and students may not benefit as much as is desired from their workplace learning (Evans, 2001; Smith, 2003, 2006; Stehlik, 2003). Furthermore, as there are increasing changes in VET's programmes and delivery modes in Hong Kong and the scope of the new VET disciplines is being increased, it is necessary to review and propose innovative pedagogical strategies for VET in order to cope with the needs of students, mentors, institutions and industries in the workplaces.

Applying Mobile and Flexible Technologies to Enhance VET Workplace Learning

In addition to learning management platforms (e.g. Moodle, Blackboard), technology-enhanced learning (TEL) – such as MOOC, flipped classroom and lecture capture, particularly enabled by mobile and flexible technologies – has become the common means to facilitate learning and teaching in education. These kinds of technologies provide 'just-in-time contemporary learning and can be accessed from any site' (Choy, 2006, p. 2). Other than supplementary activities, TEL, when combined with flexible delivery and situated workplace learning, promotes students' cognitive and transferable skills, including problem-solving, analysis, reflection and learning to learn. Studies have found that mobile and flexible learning best connects theories and practices to enrich workplace learning experiences in VET (Liu, Han, & Li, 2010; Smith, 2003, 2006; Stehlik, 2003). As early as 2000, Mitchell observed the emerging of a network-based model of workplace training and realised that there is an increasing use of flexible learning methods involving technology-mediated forms of delivery. Liu et al. (2010) point out that 'mobile learning is increasingly used in workplaces, museums, schools, enabling a wide spectrum of possibilities' (p. 210). For instance, if students are to spend much of their time in the workplace, having a certain number of learning sessions that do not require them to go back to school, allowing them to be in different workplaces to co-learn together at the same time slot becomes desirable. Billett (cited in Smith, 2003) suggested the development of learning strategies based on students' everyday practice and human interactions in connection with mentoring, direct instruction, observation and listening, other workers and the work environment, subsequently found that 'everyday practice and engagement with authentic activities were consistently viewed as more effective than print-based instructional materials' (p. 53). Effective pedagogies that take advantage of mobile and flexible technologies need to be introduced to facilitate better quality workplace learning.

Taking this opportunity to promote better learning in different trade disciplines (i.e. nursing, catering, language) in diverse workplaces, a number of studies have been carried out on the effectiveness of using mobile technologies (Tsang et al., 2014), social media and instant messaging (Ng & Leung, 2014), and real-time augmented reality (Lee et al., 2014; Tang et al., 2014). These studies have been conducted by Hong Kong academics to enhance students' motivation, learning interest and collaborative learning, as well as their cognitive, psychomotor and communication skills, with promising results. Such kinds of flexible, mobile, web-based and blended learning tools would allow VET students to review recorded lectures or participate in live-broadcasting learning sessions (i.e. lectures and seminars in schools or conferences) and share their views collaboratively in their own workplaces. It is believed that an appropriate technology-enhanced pedagogical approach utilising mobile and flexible technologies would promote learning and teaching in workplaces and generate mutual benefits for workplace mentors and

students. Interestingly, Liu et al. (2010) found that, although students are enthusiastic about using mobile devices, flexible technologies and all sorts of online activities, they regarded themselves as technology users and consumers rather than learners. Similarly, Robertson (2007) found that students prefer using mobile devices and flexible technologies for entertainment, acquiring information and communicating with others, but they seldom use them for educational purposes. Given that mobile and flexible learning provides learners with a large degree of learning autonomy, it requires learners to have a higher degree of self-directness, self-management, persistence and independence. Teachers have also expressed the view that they are more likely to use technologies in teaching practices if they are user-friendly and compatible with their existing practices and teaching needs (Errington, 2001, 2004; John, 2002, 2005; Robertson, 2005a, 2005b, cited in Robertson, 2007). Also, while mobile and flexible technologies are well adapted for higher educational institutions' academic subjects and theory classes, their applicability for VET's trade-specific subjects is still in question because generally teachers and mentors consider that there is no substitution for practical and hands-on lessons, such as mechanical engineering and printing. Therefore, the consideration of what should be taught in schools and workplaces, and what should be covered by mobile and flexible technologies, is crucial. It is assumed that mixed modes or blended learning delivery with appropriate instructional design enabled by mobile and flexible technologies could be the solution. In sum, the application of TEL in VET is a dichotomy with a number of problematic issues yet to be resolved.

Proposed Strategies for Technology-Enhanced Learning

TEL in different forms is being adopted as supplementary and complementary learning activities to better support VET students with records of performance and timely feedback. Learning and teaching resources in the forms of video, augmented reality/virtual reality (AR/VR) and instant messaging have been developed for students and teachers' ease of access. The major direction in developing the learning and teaching resources is on the resources' mobility and flexibility.

Video Capture System, MOOC and Wearable Technology

To cope with VET's increasingly flexible delivery mode, a video capture system provides opportunities for students to review lectures in workplaces or after work at their own pace. Employing the concept of 'Bring Your Own Device' (BYOD), it is recommended that students bring in their own mobile and hand-held devices such as smartphones and iPads to access the learning materials. An example to illustrate mobile learning in the workplace would be that, as there are hundreds of recipes in culinary studies, students may have difficulty in memorising the exact ingredients

for particular dishes. In such a case, with the use of mobile devices, they can retrieve recipes or short video clips of demonstrations for immediate reference without flipping through cookbooks or print-based materials that are not convenient to carry around in the kitchen. The merits of mobile learning in workplaces are subject to having a well-planned curriculum, with instructional design, together with teachers' and mentors' facilitation skills. For instance, students who engage in learning in workplaces which are not normally equipped with computer facilities – such as kitchens and flight cabins – can use their own mobile devices to retrieve recorded lectures or watch live broadcasting of prescheduled lectures and seminars simultaneously in different work locations without the restriction of viewing them in classroom settings. Together with the group chat and instant messaging functions, students can conduct real-time questions and answers with their teachers and peers. Taking advantage of these mobile technologies and apps, teachers can further generate discussions on particular issues raised from the lectures, followed by group or individual tutorials.

Similar learning and teaching activities can be applied on MOOC to promote workplace learning. The key issues for MOOC rest on the contents, instructional design and online assessment. Despite well-developed learning and teaching resources, the readiness of VET students is another matter because VET stresses trade-specific skills, and currently most MOOC topics are related to theories and humanities. In addition, the attention span and self-learning skills of VET students are usually shorter than those of students studying academic subjects. Therefore, mini-MOOCs with short videos were developed and pilot-tested to cater for VET students' learning preferences and acceptance by the teachers and mentors. The results showed that mini-MOOCs are best aligned with the concept of a 'flipped classroom' to enable pre-class theory study. Similarly, wearable technology, such as Google Glass and GoPro camera, allows workplace mentors to record or conduct live broadcasting of their demonstrations of specific trade skills for students' instant viewing or playback. For example, with strapped-on wearable recording devices, mentors in hair salons can videorecord the procedures, processes and skills during washing, cutting or perming on hair models or even real clients from the hairdresser's viewing angle. Despite the different locations of students, they can watch the mentors' demonstration projected on a screen together or on their mobile devices. It is also helpful for the students to review the demonstrations step by step from the recorded videos for a better understanding of the procedures at an available time. The demonstrations from real-life work tasks also apply to other trade-specific disciplines (e.g. mechanical engineering, printing, hospitality and servicing industries).

Augmented Reality/Virtual Reality (AR/VR)

Augmented reality and virtual reality (AR/VR) learning would arouse students' interest, according to their learning preferences. AR integrates digital information

in the existing environment and allows animation to tie in with the real world. AR provides learning experiences in immersive environments for a live direct or indirect view to generate physical, real-world experiences augmented by sound, videos, graphics or animation. VR uses virtual or simulated environments produced by computer to enable students' presence in the virtual environments. In VR environments, students can feel the sensory experiences that may involve taste, sight, smell, sound and touch, as well as use equipment to practise tasks. It is much easier to change the virtual environments than having different physical venues and scenarios; and it gives the student a faster knowledge transfer because AR/VR allows repeated practices for a large number of students simultaneously in a virtual environment before practice in real-life locations. An example of using AR/VR in the VET context is the AR/VR retail laboratory on one of the VTC campuses. The retail laboratory is equipped with a changeable non-immersive VR environment (projected on one side of the wall) to cater for different contexts and scenarios for students' practice on the operation of a supermarket or a retail store. AR technology is also applied to the real goods and commodities on display on the shelves; and, using mobile devices, students can learn about the origins, history, characteristics, ingredients and details of the goods and commodities in the form of three-dimensional (3D) animation and graphics. Another AR/VR) training facility for practical training in electrical and mechanical services provides students with immersive simulated VR environments (projected on the whole room from wall to wall and floor to ceiling) that simulate real-life locations. This facility is now equipped with a simulated 3D engine plant room with the scenario of safety enhancement as the context tailored for training on safety procedures. Based on the experience of the pilot tests, a series of learning resources on arboriculture, aircraft and lift maintenance and engineering and automotive engineering will be developed to enrich students' learning experiences. AR/VR suits the purpose for learning and practising trade-specific methodical skills in safe simulated virtual workplace environments.

In a nutshell, content development for mobile and flexible learning requires three types of specialists: a programmer, an instructional designer and a trade-specific expert. In addition, to effectively implement mobile blended learning or AR/VR learning in workplaces, collaboration between lecturers and workplace mentors is also essential. There is a need for them to negotiate the distribution of teaching and mentoring workloads and plan thoroughly on who, when, how and what to do to facilitate lessons in workplaces.

Implications and Conclusion

Learning and teaching with new technologies raise a number of issues and implications that need to be examined. The first issue concerns investment. The investment in hardware and software is high, with most of the expenses being spent on the upgrading and maintenance of equipment and newer versions of software. The first-generation iPad is now regarded as a dinosaur when compared to the latest iPad mini

or iPad Air, and smartphones are constantly upgraded with advanced technologies. Secondly, with the rapid changes in trade skills, the contents of VET learning resources have to be renewed to meet industry standards. Thirdly, there is a shortage of professionals for content development (e.g. programmers, instructional designers and animators), as well as teachers and mentors in specific subjects and trades. Fourthly, the acceptance, willingness, readiness and mindset change of teachers, workplace mentors and students are hurdles to using mobile and flexible technologies for learning. Teachers and workplace mentors may find the new technologies inapplicable to VET because of its heavy emphasis on hands-on skills. For example, a teacher once asked the authors how students could practise a simple task like tightening and loosening nuts and bolts on a simulator. In real life, you need to use a certain degree of strength to tighten and loosen nuts and bolts, but, with today's technology, you may not be able to achieve it unless you invest a fortune to develop the hardware and software. Another teacher said that people only live once – you will not hurt in simulated environments if you make mistakes but will surely be injured in real life. In addition, to implement mobile and flexible learning, teachers and mentors need a closer work relationship and better instructional design; but, in reality, the collaboration between them is very limited. Very often, workplace mentors learned from doing their jobs and are not likely to have received formal training in mentoring skills, learning and teaching pedagogies and the principles of assessment. A noteworthy point, derived from the students' perspective, suggested that, although students are followers of technologies, they may prefer not to use their mobile devices for learning as most of them are technology users and consumers rather than learners. Moreover, as indicated by earlier studies, VET students prefer working in groups rather than self-learning and so need a lot of guidance and supervision from workplace mentors. Therefore, the distribution of blended learning activities between schools and workplaces is another issue to be examined. The authors of this paper suggest that the application of mobile and flexible learning in workplaces should not be a substitution for real-life practices. On the contrary, it should be regarded as a supplementary or complementary activity. Last but not least, effective mobile and flexible learning depends largely on the instructional design of the learning materials and the support from workplace mentors to raise students' motivation and sustain their engagement so as to enrich their learning experiences.

This paper has provided views for further study on the effectiveness of using mobile and flexible technologies to enhance learning in VET. Future studies may focus on the motivation, acceptance and readiness of the key players: teachers, workplace mentors and students. The strategies proposed for the development of innovative pedagogies to facilitate mobile and flexible learning in workplaces are yet to be explored and refined. Given the variety of trade-specific modules, it is suggested that the learning resources for core and foundation modules should be developed for the most popular trades – for example, engineering disciplines, culinary and catering services and the hospitality and retailing industries – which can then be easily adapted for enrichment. To conclude, this paper has addressed the increasing need for mobile and flexible learning technologies to be applied in the fast-changing VET sector. The article also discussed the importance of applying new

technologies to enhance students' learning experiences in workplaces. With examples of innovative learning and teaching pedagogies, the paper proposes using mobile and flexible technologies to complement and supplement learning and teaching strategies to enable self-paced learning and practice in hands-on skills in authentic workplaces.

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