Education Innovation

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Innovations in Open and Flexible Education

Springer

Education Innovation Series

Series Editor

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Aims and Scope – Springer Education Innovation Book Series

Education holds the key to unlock human resources that a society needs to survive and flourish. This is particularly salient in a borderless knowledge economy. For the past decades, the sterling performance of economies such as Hong Kong, Finland, Japan, Singapore and Taiwan in international studies (e.g., TIMSS, PIRLS and PISA) has attracted much attention internationally.

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The audience of the edited volumes and monographs published in this series includes researchers, policy makers, practitioners and students in the fields of education and teacher education, and public policies related to learning and human resources.

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Foreword

The Springer's Education Innovation Series was introduced in 2014, with an aim to capture the latest educational innovations that emerged alongside the changing scenarios and landscapes in education to address many of the emerging demands in the twenty-first century, a century characterized by the advent of knowledge economy, the need for lifelong learning to cope with all the uncertainties brought about the radical economic restructuring mainly because knowledge economy, as a post-modern and post-industrialization era phenomenon, is fundamentally different from the economic shapes of the past. What we can witness today is that the life cycle of a job can be as short as 3 years or even less. Knowledge and creativity is more powerful in earning income, as compared with the need of manufactured products in the old industrial era. Knowledge and creativity provide more abstract products, or more correctly services, that replace the tangible products in the old economies. In this context, an individual's ability of lifelong learning (continuously) is necessary to survive in the new economic scenarios. Today's learners are required to learn flexibly, adaptively, innovatively, collaboratively, informally, and ubiquitously, in order to meet the new demands and requirements in the new economies. The winners in the new economies are those who are smart enough to innovate and create new needs, new conceptual products, new frameworks that can attract real investments, purchases and consumptions. Today, we can see the power of Apps that has created new ways of doing business unconceivable 10 or 20 years ago, such as those taxi apps and hotel/hostel/bnb Apps. Today, you don't need to own vehicles to run taxi companies, and likewise, you don't need to build hotels to run hotel business. The design is conceptual (and abstract), but the service is real, and the payment is also real.

As mentioned, today's learners are expected to be learning flexibly, adaptively, innovatively, collaboratively, informally, and ubiquitously in a lifelong learning manner. What about the education providers? Are they offering simultaneous provisions to allow our students in the new era to learn in new ways? The excitement of this new book, the 12th volume in the Education Innovation Series, entitled *Innovations in Open and Flexible Education* is that it will say "Yes" to this question. It is

a collection of papers to share with readers that corresponding new pedagogies are also emerging in a similar manner. While the responsibilities of lifelong learning rests on the individuals, thus it seems that we have less concern about whether the learner is successful in picking up the new ways of learning – and after all, they will succeed if they can master the new learning, or they will fail, if they cannot. However, the issues are much more complex and complicated when we look at the provisions of new pedagogies from education institutions, as it is always known that schools, as an institution, are most difficult to change, and teachers are living in a 'protected' environment insulated from the latest market change and economic restructuring, and thus they are relatively less sensitive towards to need to change.

The good news that this book brings about is that this collection of papers shows that there is no short of forward-looking education institutions and educators that have spent tremendous efforts in providing learning resources, programmes and approaches that would facilitate open and flexible learning for students of today. This book provides many real cases deployed in various higher institutions that have offered open and flexible learning programmes, and open and flexible learning resources and facilities. The book will be very interesting to readers who are interested in this field, as it provides a range of different kinds of attempts from pedagogical experiments by individual teachers to programme planning at institutional levels. The cases can be as small as using Whatsapps and Instant Messaging, and as big as big data maneuvering. This book is also conceptually rich, as the book has offered various analyses on terminologies and concepts prevalent in the field of open and flexible learning, such as "open education", "flexible education", "m-learning" (mobile learning), "u-learning" (ubiquitous learning), "OER" (open educational resources), "MOOCs" (massive open online courses) and "flipped classrooms".

The concept of MOOCs has been widely welcomed by the public, but it is not unanimously welcomed by offering institutions, as the situation will be complicated if learners want to accumulate credits and obtain certain qualifications out of attending MOOCs. Moreover, it can be very costly to prepare a MOOC class. The book has a couple of chapters touching on these issues and offer some practical solutions. Readers interested in flipped classroom will find this book useful as well, as there are a couple of chapters sharing teachers' experience of conducting learning in flipped classroom, not in the setting of higher education, but in primary and secondary schools – and if flipped classroom learning can penetrate to the school sector and be widely adopted, this will lead to overhaul changes in the classroom landscapes and pedagogical practices in school.

All in all, this is a timely book, which shows the efforts of many educators to provide *open and flexible education for all*, by offering open access, open educational resources, and sharing the experience of new attempts. By doing all this, the

new ideal for educational provision is indeed to create a favourable environment to achieve *lifelong learning for all* as well. I wish you would enjoy reading the efforts made by the authors of this collection of works on "Open and Flexible" education and learning.

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Introduction to the Book

Openness and flexibility are two major trends in contemporary education, particularly at the tertiary level, which influence the whole spectrum of education institutions across the globe. Open and distance learning universities embrace openness in terms of open admission, multiple exit points for studies, easy access to learning resources and flexible modes of learning. Conventional tertiary institutions are following suit by providing free course contents to learners as open courseware (the OCW movement); offering MOOCs as free online courses; and practising blended learning and 'flipped classrooms'. All these changes are made possible through technological advancement and breakthroughs in information and communication technologies. We see a worldwide trend away from seeing knowledge as a restrictive entity only accessible by the privileged towards regarding it as something that should be openly accessible, by means of designing open source software and open source publications (such as Wikipedia). Modes of learning and teaching are also becoming more open and flexible in terms of time, space, curriculum contents, organisation, pedagogical methods, infrastructure and requirements.

This book, *Innovations in Open and Flexible Education*, offers a wealth of practical experience and research in the area of open and flexible education. It includes a total of 23 papers from authors with unique experiences and perspectives from Asian countries (taking Australia to be a part of the Asian circle), most of which were papers presented in at the Second International Conference on Open and Flexible Education (ICOFE2015), organised by the Open University of Hong Kong (OUHK) in July 2015. The conference presented a Best Paper Award, and most papers in this book came from the shortlisted papers for the Award chosen by the Best Paper Award Selection Committee. In the process of assessing the papers for the Award, the committee found that many papers were of high quality and worthy of publication, thus recommending the publication of this book. Taking over the manuscripts, the editors further scrutinised the papers, and requested the authors

to further substantiate and improve their papers to ensure the collection is coherent and will adequately cover the themes of the book.

We believe that this book will shed light on new modes of learning and teaching in tertiary education.

The papers in the book are grouped into four themes, viz.

Part 1:
Open/flexible curriculum and pedagogy
Part 2:
Mobile and ubiquitous learning
Part 3:
Digitised media and open educational resources
Part 4:
Tracking and analysis of student learning.

Accelerating innovations and advances in technology are bringing about a paradigm shift in education that opens up education and improves learning effectiveness by enabling learning to be conducted at any time and from anywhere. In a flexible and personalised mode of education, the flipped classroom, the educational use of social media, mobile learning (m-learning), ubiquitous learning (u-learning), open educational resources (OERs) and massive open online courses (MOOCs) are examples of how educators are applying the latest technologies to cater for the diverse needs of different learning communities.

This book interprets and analyses a range of highly effective educational modes of learning. It allows professors, academics, researchers, students, education practitioners and administrators in international education corporations to keep abreast of the empirical research results and good practices in open and flexible education. For example, administrators in educational institutions can understand the latest developments in the field that can help them to make decisions and develop business plans; academics can relate their research interests closely to their choices of teaching modes; and students can identify learning modes which match their needs — including the means and the media to go through course contents, the learning resources available, and ways of engaging physically, cognitively and emotionally with their study programmes.

The papers selected for inclusion in this book cover a wide range of research methodologies, including qualitative and quantitative research studies, empirical and social case studies, experiments with statistical analyses, descriptive surveys, and interviews. As far as possible, we encouraged authors to provide illustrations such as figures and tables to present the data and findings. Overall, *Innovations in Open and Flexible Education* is a book that intends to provide readers with the latest academic thinking and research in the field of open and flexible education. The case studies and practical applications illustrate the effectiveness of new modes of education in which the latest technologies and innovations are widely used in the global context. The research results can develop readers' awareness of the related insights and

implications, thus advancing their understanding and stimulating critical thinking as to how new technologies will enhance and empower learning and teaching in different educational settings.

We very much hope that this book will provide a platform for sharing research, practices and views relevant to open and flexible education; for facilitating networking and cross-institutional collaboration among researchers and educators in both open and conventional universities; and for promoting open and flexible education to enhance educational access and quality.

Part I of the book is on open/flexible curriculum development and pedagogy.

The first paper by Li and Wong on revisiting flexible learning examines how the quality of education has been enhanced and addressed diverse student needs through such practices. The authors adopt a semantic approach by differentiating flexible learning from its associated terminologies which have been used interchangeably with the term flexible learning, such as open learning, technology-mediated learning, and distance learning. The authors also analyse flexible learning in terms of various dimensions, namely time, content, entry requirement, delivery, instructional approach, assessment, and research support, etc. Li and Wong's analysis show that the term flexible learning covers very broad meaning indeed, from entry requirement, to distance learning and technology-mediated learning. The term flexibly learning is being used really flexibly by people in the field. Notwithstanding its possible confusion, from a constructive perspective, this richness in meaning shows the development of the field, and how today's educational providers are trying to provide a more helpful learning environment, so that there are more opportunities for learners to get access to learning, and be engaged more meaningfully in learning.

Yoko Hirata's paper shares her experience in innovative curriculum planning through the organisation of student interviews, in order to understand students' perspectives of flexible learning. Their findings suggest the importance of providing students with the opportunities to express their honest opinions openly and directly to their teachers. It is only when teachers know whether their teaching is useful to students then they can improve their teaching methods and materials, and shape the curriculum and pedagogy to meet students' needs.

Lee's paper is the only paper in this book that analyses the significance of budget planning to provide flexible learning especially in self-financing institutions because they have a totally different set of criteria to follow in the planning process as compared with the government-funded institutions. Lee points out that the goals of flexible learning is to achieve equity, efficiency and effectiveness in educational provision, thus careful and responsible budget planning to achieve these goals is not only important, but these three goals can be competing and easily compromising if budget planning is not meticulous and forwarded looking.

Wong et al.'s paper is focused on needs assessment to support academic research in order to achieve flexible learning that would attain the above-mentioned goals of equity, efficiency and effectiveness. Even though most flexible learning providers, such as open and distance learning institutions are mainly teaching institutions,

research on pedagogies and technology-mediated learning are particularly important for these institutions if we want to serve the purpose. Thus, Wong et al's paper functions like an honest and blunt warning to these institutions that they do need to invest in academic research that can provide a timely reference for successful offering of open and flexible learning.

Yoshiro Hirata's paper compares different models of the 'flipped classroom' in Japanese educational settings and discusses the benefits and limitations of each. This paper provides refreshing information and perspectives in regard to how flipped classrooms have taken place in Asian classrooms for quite some time, even though they practise this with a very low profile. Particularly alarming from this paper is that it describes flipped classroom in primary and secondary schools – thus flipped classroom is not the monopoly of more advanced students. The flipped classroom can be applied to any classroom at any level of learning. It casts on the innovative teaching reform in Japanese education, and offers food for thought for readers who are planning to implement a 'flipped teaching approach'.

While most paper in this volume are reports from individual counties, Wong and Wong's paper provides an analysis of cross-country profiling in adopting open and flexible learning. Profiling the characteristics of a large number of open and flexible learning institutions in Asia, their paper addresses the strengths and opportunities of these institutions, with recommendations given for further development of open and flexible learning in the continent. In particular, they captured the exponential penetration of the Internet in Asian countries, which allows open and flexible learning institutions to reach a broader range of learners.

Lambert and Alony provides a positive answer to whether or not to include MOOCs as part of a programme's curriculum. Based on a small-scale pilot study, the authors describe how MOOCs have been used to address skills shortage among university students, and to engage staff in hybrid learning. Their findings are that once MOOCs is introduced, they witness the dynamism of curriculum transformation. The main element conducive to academics' engagement in adopting MOOCs is that the MOOC's delivery can be scaffolded for repeated use of the prototype to fit the learning needs of the students. Despite the initial *high* costs of developing the MOOCs prototype, its customised repeated use becomes minimal expenses. Thus, self-financing open learning institutions can budget MOOCs as an upfront investment for future adaptive use that can achieve various purposes – in the long run, the average costs of producing MOOCs will be decreased and affordable.

Part II of this book is devoted to studies on teaching and learning which involve the use of mobile devices.

Ng and Lam's paper is focused on the use of mobile technologies in vocational education and training (VET). 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. They specifically highlight the significance of Augmented Reality and Virtual Reality as a learning experience. Augmented reality and virtual reality (AR/VR) learning would arouse students' interest, according to their learning preferences. 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.

The paper by Li et al. looks at the preference and readiness for nursing students for mobile learning in the context of the Open University of Hong Kong. Their study found that nursing students would like to access their learning materials anytime and anywhere. The nursing students considered 'ease of reading' and 'ease of note-taking and highlighting' as the most important factors that determined their use of electronic learning materials. They further considered 'level of comfort in reading', 'portability', and 'input and output capabilities' as the three most important factors in using a mobile device for learning. Among the different study topics, they highly preferred to have body systems and diseases as well as medical terminology to be provided in multimedia materials in the mobile device. These findings will help future design of the curriculum for mobile learning to ensure receptiveness by the students and effective use of the mobile learning resources.

The study of Singh et al. reports on a pilot project which investigates students' use of WhatsApp Messenger to communicate images, audio and videos, as well as texts, during the study of a course. Their paper outlines the Open University Malaysia (OUM)'s efforts and processes for implementing the WhatsApp as a tool for mobile learning support, and its effectiveness. They found that although WhatsApp Messenger is primarily used for chatting with friends and accepted as a medium for social networking, it has great potential for use as a tool to facilitate learning or provide support for it. The findings of Singh et al 's study are that the mobile learning support via WhatsApp Messenger helped the majority of the learners. They considered the messages to be useful and worthy of their time and attention. The ubiquitous nature of WhatsApp with appropriate mobile learning instructional strategies can help to further advance the support for course-specific content.

After a survey of students' needs, Zhang et al. specifically designed a mobile 'App' to assist students' learning. Their paper describes the use and benefits of the App and learners' satisfaction is reported. Their paper points out the major contribution of introducing ubiquitous learning (u-learning) and mobile learning (m-learning) in the digital age. In sum, under the u-learning and m-learning environment, students can get access to rich media and information relevant to learning; they can share information with each other to achieve peer and collaborative learning; they can take control of their lives. Students may encounter uncertainty

about the truthfulness of the information obtained from the Internet, but this is part of the training of mediate education that can help them to identify truth (and fact) from opinion.

Cheng and Siow's paper focuses on the impact of mobile technology on learning management science and the development of problem-solving skills. Their study found that mobile technology plays an important role in enhancing students' understanding. On the other hand, they have mixed findings about whether a learning management system was useful in enhancing their learning, as sometimes the students expressed that the process even retarded their learning. The students' reactions to m-learning described here need to be addressed for their sake; and m-learning should be implemented in MS subjects, as well as across the undergraduate curriculum.

Part III of the book shares the innovative use and analysis of digitised media and open educational resources.

To explore the benefits of digital game-based learning for younger learners, Tso and Lau report on how a free, open-for-all digital game package was designed and integrated into regular primary school mathematics education. They found that digital game-based learning can increase learners' motivation, develop learners' autonomy, and improve their academic performance. It is not only useful in eliciting learners' motivation and enhancing learner's self-directed learning skills, but also significant in improving learners' academic performance. As digital experience has come to play a central role in modern life, educators should reflect upon what they can do to help students train up their digital literacy, problem-solving, self-directed learning, and readiness for lifelong learning, so as to become competitive and well-equipped for their future.

Chen and Wu's paper introduces the concept of 'flipped' MOOC classes teaching college physics. This paper provides detailed statistical analysis, comparing the teaching and learning effects in conventional didactic classes and the 'flipped' MOOC classes. The statistical analysis showed that the average exam score in the 'flipped' MOOC class was better than the average exam score in the conventional class, and the *t*-test suggested significant differences in score between them. However, there was not a significant difference in procedure scores. Nonetheless the 'flipped' MOOC class did not just enhance students' knowledge. The students also learned cooperative, self-management, communicative and organisational skills, and so the 'flipped' MOOC class has good prospects.

Yuen and Li's paper evaluates Hong Kong's First Open Textbooks project. This is actually a draft report of the project, which introduces open textbooks for primary and secondary schools in Hong Kong, as a form of introducing Open Educational Resources (OER) in Hong Kong. It is encouraging to note that most teachers who used the open textbooks have developed a sense of ownership of the books because of the possibility of customisation as part of the design of the open textbooks. Ownership is the first step for teachers' involvement in future modification of the

open textbooks. Their findings are in line with those of open textbooks projects in other countries, suggesting that apart from the investment at the beginning of the project, further customisation for school-based and student-centre teaching and learning does not require further substantial financial resources, and thus OER is a sustainable textbook for ongoing customisation according to the needs of the students. In addition, the good news to parents is that they no longer need to worry about annual increase in the price of textbooks. An additional benefit is that online textbooks can lessen the students' burden of carrying heavy copies of the books to and from school (Petrides et al. 2011).

Banerjee's paper lists the various ways in which OER can be incorporated into the infrastructure and pedagogy for promoting ubiquitous learning. The author examines how teachers, learner profiles, assessment tools, social platforms and Internet connectivity play a role in promoting ubiquitous learning and remove the boundaries of education. To involve the teachers in this approach is a challenge which can be met by providing them with the required technical knowhow, and also training them professionally in the newer paradigms of instructional design and pedagogy which are required for ubiquitous learning. As a result of this change in instructional design, the learners shift from being knowledge receptors to knowledge actors.

Wong and Wong's paper discusses how videos could be used in blended learning. They have provided a comprehensive discussion on the concept of blended learning, especially how different stakeholders can see blended learning in quite different ways, both in terms of its function and application, and how blended learning can be integrated into the main curriculum. In addition to identifying how blending learning can help to make learning more effective, their paper also explores the pitfalls and success factors that will affect the successful design and implementation of blended learning. One major contribution of this chapter is the provision of evaluation of blended learning from a dimensional perspective. The authors provide a framework that helps to clarify the role and functions of using videos in blended learning, namely the narrative role, the communicative role, the adaptive role and productive role. The list of success factors is also useful for educational stakeholders to take into consideration to enhance the successful opportunities of adopting blended learning in their course delivery.

He's paper identifies the factors which contribute to media literacy in young students, through the implementation of a questionnaire survey and statistical analysis, and correlational analysis in particular. The author found that students from various schools in Beijing were significantly different in terms of the cognitive dimension of media literacy. Secondly, age and gender were important factors affecting the level of media literacy of young students, and the students' age was inversely proportional to their cognitive level. Thirdly, the results showed that the higher the frequencies of the students' use of computers and networks, the better their performance at the technical level. The use of computers and networks thus had a positive impact on students' cognitive abilities. By increasing the use of computers and networks, both within and outside the school environment, students are expected to enhance their media literacy at the cognitive level.

Part IV of this book is on tracking and analysing student learning. With innovations in open and flexible teaching and the use of new educational technologies, their influence on student learning has to be tracked and analysed to reveal their effectiveness.

Learning analytics (LA) and the use of big data in education are gaining attention in academic research. It has been found that big data analysis and learning analytics are not only useful at the institutional level in terms of providing information on students' learning outcomes and learning preference. They are also useful for teaching improvement in classroom learning and teaching, as the information is also useful for the design of learning tasks and classroom activities.

The paper by Lv et al. focuses on the use of big data in the context of teaching, learning and evaluating college physics experiments. This paper analyses research results on mobile learning (m-learning), ubiquitous learning (u-learning) and educational big data mining. Their analyses deal with the promotion of personalised adaptive learning, where educational data mining and learning analytics can be used to help students find the best learning methods and resources for physics experiments. Their study also looks at the digitising of a university physics experiment course for recording resource usage and the experimental operation process. It casts light on how teachers provide rich e-learning resources and a useful communication platform for recording the data produced by students, and adjust their teaching methods and strategies for different students. The paper discusses the possibility of adopting blended learning that combines informal after-class learning and formal classroom experiment learning, and uses the prediction function of big data to change students' learning method for different experiments. Finally, the paper looks at the reform of the evaluation method for physics experiments to reflect more objectively students' actual levels of performance by analysing the whole process.

Yue's paper studies the use of instant messaging (IM) for tutoring undergraduate students. The paper analyses how the instant messages are used among students and their tutor to explain their assessment results, and examines factors influencing the message exchange. Yue's study found that the students who exchanged instant messages (all related to the completion of their written assignment) with their tutor are likely to understand the requirements of the assignment better. Their completed assignments were of a better quality and therefore obtained higher marks than the students who had not contacted their tutor using IM. Those students who were involved in IM with their tutor under a tutor-centred teaching method scored higher in their assignments than those under a student-centred method. This could be due to the fact that, under the tutor-centred method, more explanations were given by the tutor in the tutorial classes. Under the student-centred method, the students' oral presentations took up some class time, leaving less time for the tutor to elaborate on the answers to the tutorial exercise questions and discuss the final written assignment the students have to complete.

Lim's paper investigates the use of an experience application programming interface (xAPI) to track learning in a mobile and flexible learning environment, and discusses the advantages of using it. One major contribution of this paper is Lim's observation and findings that the development of learning technology has been found difficult mainly because of the confinement of content-based approach to learning, which has strongly influenced by the emphasis on cognitive learning, and has dominated the education ecology for centuries. The breakthrough of this paper is the attempt to switch to xAPI by educational technologists. xAPI no longer relies on content-based learning to track the learning progress. Interaction and engagement in the process of learning can be taken into account, and Lim's observation is that with xAPI, educators can monitor students' learning progress by means of interaction and process, without necessary referring to how much content a learner has grasped. Thus the switch xAPI has groundbreaking potential of discovering a new way of tracking and defining learning.

The paper by Choi and Lam explores how reinforcement learning (RL) can be employed to address the sequential decision problem involved in the LA process, and proposes an RL framework integrated with LA stages. So far, research efforts have focused mostly on studying independent research questions involved in individual stages. In this paper, the authors attempt to look at the whole LA progress instead. They discuss how RL, a sub-field of machine learning, can be employed to address the sequential decision problem involved in the LA process. In particular, they integrate the LA stages with an RL framework consisting of state space, action space, transition function and reward function, and illustrate this with examples of how the three most studied optimality criteria in RL – finite horizon, discounted infinite horizon and the average reward model – can be applied to the LA process. Overall, the authors argue that RL provides a rigorous and yet flexible model for formulating the learning analytics process.

This book is concluded by Wong et al's paper, which is their report on how smartphones and low-cost modern electronics can be used to design data logging devices and a modelling tool for high school students doing physics experiments. The authors tried to design data-logging devices and a modelling tool for high school physics labs with low-cost modern electronics, including smartphones, Lego Mindstorms NXT and Arduino, equipped with an ultrasonic sensor. For NXT and smartphones, experimental data were first logged in the devices and then manually copied to a personal computer for data analysis. For Arduino, experimental data were transmitted to a PC via Bluetooth in real time. With the data in a PC, each student used a modelling tool on a Web browser to try to find an equation that fitted the data with a small error. The equation was a function that related one variable to another. Based on the visual plot and the error information, the students can then try to reduce the error by revising the equation. The results indicated that both students and the instructor enjoyed using the modern data loggers and the acquired data to find equations that fitted the data well.

The four themes of papers in this book enable readers to become familiar with the latest academic thinking and research on how to make open and flexible education with proper educational technologies and big data analysis. We hope that the research, practices and views shared in this book will provide useful insights and guidance for advancement in this field.

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Part I
Open/Flexible Curriculum and Pedagogy

Chapter 1
Revisiting the Definitions and Implementation of Flexible Learning

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Abstract For decades, flexibility has been a focus of attention and efforts in the field of education. Flexibility in learning, which emphasises student choice, has been considered one key to enhancing education quality and satisfying highly diverse student needs. It is often associated with the terms 'open learning', 'distance learning', and 'e-learning'. With the increasing application of information and communication technologies in the field of education, flexible learning has been especially closely associated with e-learning and sometimes is considered to be the essence of the term. Since the ambiguity of the term could be counterproductive in discussions of flexible learning, a systematic review of the relevant literature is badly needed to put the meanings of the term in perspective. This paper provides a critical review of the literature relevant to flexible learning. The development of the use of 'flexible learning' and the implementation of the term are summarised. In this paper, the term 'flexible learning' is redefined with an aim to clarify its relationship with relevant terms and a proposed system of its dimensions. Suggestions for future research are also provided.

Keywords Flexible learning · Flexible education · Open learning · Distance learning · E-learning

Development of the Use of Flexible Learning

In the early 1970s, when Britain and other advanced economies went into a post-Fordist era, the economic paradigm was often referred to as 'flexible production'. It was then when the education systems were required to become more flexible responding to the new economic paradigm (Chalkley, 1997). The term 'flexible

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learning' originated in the United States during the 1970s, and the term started to appear in the literature in Britain during the early 1980s (Bell, Bowden, & Trott, 1997). In the late twentieth century, the word 'flexible' became highly frequently used (Nunan, 1999). The twenty-first century witnesses a more rapid increase in the interest in flexible learning. This is reflected in the number of papers on the topic. From a search done in June 2015 on the topic of 'flexible learning' in the Web of Science, results show that there were 431 papers on flexible learning in 1980–2000. During the following 5 years, another 409 papers on flexible learning were published. The number of papers in 2006–2010 increased to 1301 and then 1943 in 2011–2015.

The growing use of 'flexible learning' has raised such questions as 'What does "flexible learning" mean' (Roebuck, 1987) and 'what does flexible learning look like in practice' (e.g. Hudson, Maslin-Prothero, & Oates, 1997; Lindberg & Olofsson, 2006; Sadler-Smith & Smith, 2004; Wade, Hodgkinson, Smith, & Arfield, 1994). Analysing the way the term 'flexible learning' is used, it is found that learners are often put in the centre (Collis & Moonen, 2002a, 2002b; Li, 2014; Moran & Myringer, 1999). For example, flexible learning is defined as a teaching and learning approach which is learner-centred (Moran & Myringer, 1999) or as an approach revolving around the provision of learning options based on students' specific needs and preferences (Demetriadis & Pombortsis, 2007).

Since its conception, flexible learning was used as a term which was closely associated with 'open learning' and 'distance learning'. It was also associated with information technology with its boom at the end of the twentieth century. As Ellington (1997) noted, flexible learning was interpreted very loosely at that time, but Ellington suggested that we should not aim to overly define the term but should let practitioners interpret and develop its meanings when they adopt and implement flexible learning. Despite various attempts to define the term during the last few decades, up to now, defining flexible learning is still a highly perplexing task. There is still no universally accepted definition for the term (Casey & Wilson, 2005; Tucker & Morris, 2011). In addition to its association with open learning and distance learning, flexible learning is now also closely associated with e-learning or technology-mediated learning.

Despite its haziness and indistinctness in meaning, flexible learning has been pursued by many educators and researchers. As Collis and Mooner (2002a, 2002b) point out, 'Flexible learning is becoming somewhat a buzzword: everyone is for it, but often people have not thought further about it' (p. 218). However, the ambiguity of the term is sometimes counterproductive, as this may lead to confusion among teaching staff in regard to what flexible learning refers to technically (Kirkpatrick, 1997). Thus, there are ongoing efforts to clarify the definition of flexible learning and its semantic dimensions.

Meaning and Semantic Dimensions

Flexible Learning and Open Learning

One way to clarify the meaning of flexible learning is to distinguish it from the terms that it is often associated and used interchangeably with. Although both open learning and flexible learning try to minimise constraints of access, time and place, pace, and methods of study (Kember, 2007; Khan, 2005), open learning targets at democratisation of access to education by not requiring entry qualifications (Olakulehin & Singh, 2013), while flexible learning targets at providing learning flexibility to satisfy diverse student needs. According to Demetriadis and Pombortsis (2007), flexible learning refers to the learning where 'learners are offered a variety of options for personalising the learning experience based on their specific needs and preferences' (p. 148).

Learning equity, or having equal opportunities to receive education, is the core concern of open learning (Perraton, 2007), while learners' choice of the learning approach that suit them is the crux of flexible learning (Collis & Moonen, 2002a, 2002b). As Collis and Moonen (2001) suggested, to increase flexibility, students should be allowed to choose what is best for them as the key dimensions of learning. Entry requirements could be one aspect of flexibility (Collis & Moonen, 2002a, 2002b; Li, 2014; Tucker & Morris, 2011), but flexible learning should cover many more aspects in the learning process (Collis & van der Wende, 2002).

Flexible Learning and Distance Learning

Besides 'open learning', 'distance learning' is often associated with flexible learning. From this perspective, flexible learning 'has replaced distance education as a means of servicing the needs of geographically distant or remote students' (Kirkpatrick, 1997, p. 160). However, flexibility does not necessarily refer to distance, and there is a lot more than distance that flexible learning refers to. As Collis and Moonen (2002a, 2002b) note:

> There are many ways to make education more flexible that can benefit students who are in full-time residence on a campus and even benefit those who are in the same room together. Flexibility can involve options in course resources, in types of learning activities, in media to support learning, and many other possibilities. There is more than distance that can vary. (p. 218)

Although many efforts in flexible learning focused on allowing and facilitating students to learn at a place which is at a distance from the teacher or teaching