Chapter 12
The Impact of Mobile Technology on the Learning of Management Science and the Development of Problem-Solving Skills

Sheila Cheng and Heng Loke Siow

Abstract Learning is the construction of knowledge; and e-learning is the application of information and communication technology (ICT) to make education accessible to learners who are not physically on-site. E-learning is ubiquitous, enabling learners to study whenever they wish and wherever they are. In learning problem-solving skills in management science (MS), mobile technology plays an important role in enhancing students' understanding. This paper presents part of the research findings on a sample of 15 undergraduate students and 4 facilitators for a class in MS. The study found that the respondents had mixed opinions on whether mobile learning enhances or inhibits their learning of MS. Various implications of the study are suggested.

Keywords Mobile technology · Problem-solving skills · Management science

Introduction

The advent of the new generation of smartphones has changed people's lifestyles dramatically. The third generation of mobile networks, or 3G – which was introduced in the USA in 2003 – had a minimum consistent Internet speed of 144Kbps and was equipped with 'mobile broadband'. But 3G has now been greatly improved to an Internet speed of more than 400Kbps, with more network capacity for more data per use and better voice quality. The emergence of 4G phones in 2015 is a major advance for users who like to surf the Web and, especially, stream video. If a laptop is connected to a mobile link, 4G makes a huge difference to transferring large amounts of data (Cassavoy, 2015; Segan, 2014). Mobile technology, 3G or 4G, has

S. Cheng (✉)
School of Management, Asia e University, Kuala Lumpur, Malaysia
e-mail: sheila.cheng@aeu.edu.my

H. L. Siow
School of Graduate Studies, Asia e University, Kuala Lumpur, Malaysia
e-mail: hengloke.siow@aeu.edu.my

K. C. Li et al. (eds.), *Innovations in Open and Flexible Education*, Education Innovation Series, https://doi.org/10.1007/978-981-10-7995-5_12

radically changed the methods of learning, communication and information access among students via e-books, e-learning, Facebook, YouTube, mobile blogging, MySpace, PLS, Moodle and other digital tools. The mobile generation stays connected with their peers via SMS, WhatsApp, chat rooms and email messages and expects teachers or institutions to be connected in the same manner. This new wave of communication has created the need for educators to be more knowledgeable and understanding about the use of mobile technology such as virtual classroom learning experiences.

The discipline of management science (MS) came into existence due to the need to solve problems in the area. Problem-solving is regarded by many educators as the most meaningful and important way of learning and thinking and also as one of the educational objectives in the international education system (OECD, 2004). Most MS problems are real-world problems, but they are complex in nature. Various studies have reported that MS methods are being used increasingly for tactical, operational and organisational decision-making in Malaysia and many other Asian countries (Chang & Hsieh, 2008; Cheng & Siow, 2015; Munisamy, 2012). However, in Malaysia, other studies (HRDF, 2011; Mahavera, 2014; PISA, 2012) have periodically reported that fresh graduates generally lack problem-solving skills when they start in their careers. Problem-solving is one of the critical skills most sought after by employers.

In learning problem-solving skills in management science, it is envisaged that mobile technology could play an important role in enhancing students' understanding as it enables them to learn anywhere and at any time (Attewell, 2004; Ching, 2009; Watson & White, 2006; Wentzel, Lammeren, Molendijk, Bruin, & Wagtendonk, 2005). Siraj and Nair (2008) reported that students from the digital generation prefer self-accessed information, which allows self-paced learning and the discovery of interesting learning topics. Over 10 years ago, Prensky (2005) argued that there was a need for education systems to take heed of the pervasiveness of mobile technology and embrace it in their pedagogical practices.

In Malaysia, many higher education institutions, whether public or private, have invested in e-learning to enhance student's performance by incorporating mobile technology (Manimekalai, 2014). While several projects (Adkins, 2011; Ragus, 2006; Rosli, Ismail, Idrus, & Ziden, 2010) have shown that mobile learning offers convenience to students because of easy access to information, Abas, Chang and Mansor (2009) found that 44.09% of students in the Open University Malaysia were less willing to subscribe to mobile learning. The purpose of this research is to explore the behavioural intentions of MS students towards adopting mobile learning. The technology adoption model (Davis, Bagozzi, & Warshaw, 1989; Hassan, 2009) is used as the basis of the research.

Methodology

The main objective of this study is to investigate the extent to which MS students have adopted mobile learning for solving problems. In order to probe the 'real-world' issues in the adoption of mobile learning in this subject, a phenomenographic approach was adopted to gather detailed and rich qualitative data. This allowed the researcher to examine the students' learning experiences in their natural situation while solving MS problems.

This case study was conducted on 15 MS students in a private education institution in Malaysia. It was considered important that the students who participated in this study were matured enough to make informed judgements about the adoption of mobile learning. Furthermore, these students were chosen because they were in the second and third years of their bachelor's degree and were supposed to be familiar with mobile learning approaches. Before the interviews, the students were asked to fill in a questionnaire to seek their perceptions of mobile learning. Individual face-to-face interviews were subsequently conducted, and the interview questions were guided by the questionnaire responses, thus providing rich data on the topic.

Results and Discussions

In this study of 15 MS students, the majority (80.0%) were female. They were in the age group 20–22, and due to the attendance requirement of the programme, they attended the face-to-face lectures.

Perceptions of Mobile Learning

Table 12.1 presents the participants' perceptions of m-learning gathered through the questionnaire, which indicated that they agreed to its 'relevance' for solving MS problems but were less positive about its 'helpfulness'. Also, they disagreed that m-learning was able to act as a substitute for the instructor and accelerate their problem-solving skills in MS. In addition, they considered that m-learning was time-consuming and they therefore resorted to not making use of it.

Based on their perceptions, they were then interviewed to hear their views on adapting and adopting m-learning to solve MS problems.

Table 12.1 Perceptions of participants on m-learning for solving MS problems

Rank	Details of items	Mean	Standard deviation
1	Relevance	3.57	0.54
2	Helpful	3.43	0.79
3	Substitution	2.57	0.79
4	Slowness	2.14	1.06
5	Time-consuming	1.29	0.49
6	Frequency of use of m-learning	1.14	0.38

The Voice of the Participants on M-Learning for Solving MS Problems

Individual interviews were conducted with participants to examine more deeply their reasons for using/not using the m-learning approach. The responses below were typical answers to specific questions.

- Do you understand what is meant by 'mobile technology'?

  A bit – not so much – for accessing notes directly. I still prefer paper notes (P1, female).
  Yes, such as the learning system online (P2, male).

  It could be inferred that most of the participants had a 'rough' notion of the meaning of mobile technology, but were not aware of its depth and importance.
- Do you find it useful in helping your learning (of MS)?

  It helps you learn. It is easier to find information, quicker and more efficient if only to search for one piece of info (P5, male).
  There is no need to open the computer, [as] it is very distracting (P15, female).
  A bit, [but] not so much, for accessing notes directly. I still prefer paper notes (P13, male).

  The results seem to suggest mixed feelings about the efficacy of m-learning in helping the participants in their learning. Their responses also indicated that m-learning is time-consuming.
- Do you find m-technology changes your learning style?

  Yes, I go to the library less often. Even if I go to the library, I will borrow fewer books (P13, female).
  No, I still like to read hard copy. Reading on the screen has a lot of radiation and makes my eyes very tired; I can't read for long, [and] still prefer print outs (P11, female).

  While the participants acknowledged that m-learning reduced their visits to the library, they did not accept reading the on-screen notes and preferred hard copy materials.

- Do you find e-learning useful in your learning?

  Yes, I go to the library less often. However, I still like conventional printed materials. I prefer going to the class (P10, male).

  It depends on the subject. For MS, I can study by myself – it's not necessary to attend class. I prefer to learn it at my own pace. I focus on areas which are different from the lectures. I cannot focus in the class. Usually I will chat with my friends in the class (P8, female).

  Being exposed to other subjects, the participants preferred to study on their own, reinforced by their friends and printed materials.
- Is the e-learning enough to replace the face-to-face classes?

  I still need a table, chair and printed books. E-learning is just a supplement (P2, male).

  There is no substitute. I can learn better in the classroom environment (P8, female).

  Practically all the participants preferred to attend the 'conventional' classroom environment for learning the MS subjects.

These interviews provided in-depth knowledge on why the participants adopted or were reluctant to adopt m-learning in solving MS problems.

Based on the survey and interviews, it can be concluded that, while m-learning is an innovative change in learning, the participants in this study were not prepared for the changes involved. They preferred conventional face-to-face teaching and interaction in delivering the lessons. Similar findings have also been reported by Zainab (2003) and Manimekalai (2014) who argue that new technologies for learning and teaching need time to be accepted by the users.

Conclusion

The findings presented in this paper illustrate the 'voices' of the participants studying the MS programme. These results could help educators to recognise the need to educate the learners and instructors on the effectiveness of m-learning in the modern classroom. 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. After all, as mentioned earlier, problem-solving is seen as the most meaningful and important way of learning and thinking – and the ability to apply cognitive skills appropriately in problem-solving is considered to be a fundamental and crucial aspect of human life.

It is hoped that these findings will stimulate improvements in the implementation of m-learning for problem-solving skills among Malaysian students, especially in MS.

References

Abas, Z. W., Chang, L. P., & Mansor, N. (2009). A study on learner readiness for mobile learning at Open University Malaysia. *IADIS international conference mobile learning* (pp. 151–157), Malaysia. Retrieved from http://library.oum.edu.my/repository/569/1/a_study_on_learner_readiness_for_mobile_learning_at_OUM.pdf

Adkins, S. (2011). *We put research into practice*. Online Research paper.

Attewell, J. (2004). Mobile technologies and learning. *A technology update and m-learning project summary*, 25. Retrieved from http://www.hostdrome.com/technical/The%20m-learning%20project%20-%20technology%20update%20and%20project%20summary.pdf

Cassavoy, L. (2015). *Today's 4G phones*. Retrieved from http://cellphones.about.com/od/cellphonereviews/tp/4G-phones.htm

Chang, P., & Hsieh, P. (2008). Bibliometric overview of operations research/management science research in Asia. *Asia Pacific Journal of Operational Research, 25*(2), 217–241.

Cheng, S., & Siow, H. L. (2015). Enhancing problem solving skills in operational research: The well-structured problem case study. In *World Journal of Management*. Sydney, Australia: World Business Institute.

Ching, Y. H. (2009). *The effects of computer-based video strategy training for problem representation and self-explanation on undergraduate students representing and solving ill-structured problems*. Unpublished doctoral dissertation, Pennsylvania State University, PA, USA.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science, 35*(8), 982–1003.

Hassan, A. (2009). *Determinants of mobile learning acceptance: An empirical investigation in higher education*. Unpublished doctoral dissertation, Oklahoma State University, Stillwater, OK.

Human Resources Development Fund (HRDF). (2011). *Malaysia training programme*. Putrajaya, Malaysia: Ministry of Human Resources.

Mahavera, S. (2014). *Low quality Malaysian education more alarming than household debt, says World Bank economist*. Retrieved from http://www.etawau.com/edu/Department/EducationSystem.htm

Manimekalai, J. (2014). *Determinants that influence adoption of mobile technology in learning environment*. Unpublished Ph. D. thesis, Asia e University, Kuala Lumpur, Malaysia.

Munisamy, S. (2012). Corporate operations research practice: Evidence from Malaysia. *Interdisciplinary Journal of Contemporary Research in Business, 4*(3), 342–352.

OECD (Organisation for Economic Co-operation and Development). (2004). Retrieved from http://www.oecd.org/

PISA. (2012). *Technical report*. OECD. Retrieved from https://www.oecd.org/pisa/pisaproducts/PISA-2012-technical-report-final.pdf

Prensky, M. (2005). *Adopt and adapt school technology in the 21st century*. Retrieved from http://www.edutopia.org/adopt-and-adapt-shaping-tech-for-classroom

Ragus, M. (2006). M-learning: A future of learning. *Knowledge Tree eJournal, Edition, 9*.

Rosli, M., Ismail, I., Idrus, R. M., & Ziden, A. A. (2010). Adoption of mobile learning among distance education students in Universiti Sains Malaysia. *International Journal of Interactive Mobile Technologies, 4*(2), 24–28.

Segan, S. (2014). *Which carrier is the best for fast mobile data where you live? Fastest mobile networks 2014*. Retrieved from http://www.pcmag.com/article2/0,2817,2459185,00.asp

Siraj, S., & Nair, V. K. (2008). *Mlearning modules design for futuristic secondary curriculum implementation Malaysia*. Konvensyen Teknologi Pendidikan (Educational Technology Convention), 654.

Watson, H., & White, G. K. (2006). mLearning in education: A summary.

Wentzel, P., Lammeren, R., Molendijk, M., Bruin, S., & Wagtendonk, A. (2005). *Using mobile technology to enhance student's educational experiences*. Case study from the EDUCAUSE Centre for Applied Research. Retrieved from http://www.educause.edu/ir/library/pdf/ers0502/cs/ecs0502.pdf

Zainab, H. (2003). *Factors affecting distance learning student's use of the Internet as a student support system*. Unpublished Ph.D. thesis, University of Malaya, Kuala Lumpur, Malaysia.