The impact of mobile technology
on the learning of management science,
and the development of problem-solving skills

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Learning is the construction of knowledge. E-learning is the application of information and communication technology (ICT) to make education accessible to learners who are physically not on-site. It is ubiquitous, enabling learners to study whenever they prefer and from wherever they are in the world. In the learning of problem solving skills through the subject of Management Science, the mobile technology plays an important role in enhancing students' understanding and learning. This paper presents part of research findings of a sample of 15 students who are undergraduates and four facilitators in the class of Management Science. With the introduction of wireless and mobile technologies, the respondents have mixed opinion about the efficacy of mobile learning whether it could enhance or retard their learning of MS. The implications of the study are suggested.

Key words: mobile technology, management science, e-learning, problem solving skills.

1.0   Introduction

The advent of new generation of smart phones has changed the lifestyles of people dramatically. The third-generation mobile networks, or 3G, was introduced in to the U.S. in 2003 which has a minimum consistent Internet speeds of 144Kbps. It was equipped with "mobile broadband", but the capacity of 3G connection now has improved by ten times to an Internet speed of more that 400Kps, with more network capacity for more data per used, and better voice quality. However with the emergence of 4G phones in 2015, it is considered a 'heaven' for users who like to surf the Web and especially stream video. If connected to a laptop to the mobile link, the 4G makes huge difference in transferring large amount of data (Cassavoy, 2015; Segan, 2014). Mobile technology, whether 3G or 4G, has dramatically changed the methods of learning, communication and information access among students via e-books, e-learning, Face book. You Tube, mobile blogging, MySpace, PLS, Moodle, and other digital tools. The mobile generation stays connected with their peers via SMS, WhatsApps, chat rooms, and emails messages, and expect the 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 savvy with 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. Problem solving is regarded by many educators as the most meaningful and important way of learning and thinking. It is also regarded as one of the educational objectives in the international education system (OECD, 2004). Moreover, most of MS problems are real world problems but complex in nature. Studies reported that MS methods have been increasingly used for tactical, operational and organizational decision making in Malaysia and many other Asian countries (Chang & Hsieh, 2008; Munisamy, 2012). However, in Malaysia, studies (Mahavera, 2014; HRDF, 2011, PISA, 2012; PISA, 2014) periodically reported that fresh graduates generally lacked problem solving skills when they started on their careers. Problem solving skill is one of the critical skills sought-after by the employers.

In the learning of problem solving skills through the subject of Management Science, it is envisaged that the mobile technology could play an important role in enhancing students' understanding and learning. Firstly, mobile technology enables students to learn anywhere and at any time (Ching, 2009; Watson & White, 2006; Attewell, 2005; Wentzel, Lammeren, Molendijk, Bruin, & Wagtendonik , 2005). Siraj and Nair (2008) reported that students from digital generation prefer self-accessed information, which allows self-paced learning and discovery of learning interesting topics. Ten years ago, Prensky (2005) envisioned that there was a need for education system to take heed of the pervasiveness of mobile technology, and to embrace it into the pedagogical practices.

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

2.0   Methodology

The main objective of the study was to investigate to what extent had the MS students adopted to use mobile-learning in solving problems in MS. In order to probe the 'real-world' issues on adoption of mobile-learning in solving problems in MS, a phenomenographic approach was used to gather detailed and rich qualitative data. Accordingly, a phenomenography such as this, has allowed the researcher to examine

students' learning experiences that had happened in their natural situation while solving the MS problems.

This case study was conducted on 15 MS students in a private education institution in Malaysia. It was considered important that students who participated in this study were matured enough to make informed judgments about the adoption of mobile learning. Furthermore, these MS students were chosen because they were in the second and third year of their bachelor degree, and were supposed to be familiar with mobile learning approaches. Before the interviews, the students were asked to fill a questionnaire to seek their perceptions on mobile learning. Individual face-to-face interviews were subsequently conducted and the interview questions were guided by the responses from the questionnaires. This was to allow the researcher to probe the 'real-world' issues and enrich the data on the adoption of mobile learning in solving MS problems.

3.0   Results and Discussions

In this study of 15 MS students, majority, (80.0%, 12) of them were females. They were the age-group of 20-22, and due the attendance requirement of the programme, attended the face-to-face lecture.

3.1   Perceptions of Respondents on M-learning

Table 1 presents the perceptions of participants on M-learning gathered through the questionnaires, indicate that they agreed to 'Relevancy' but were neutral on 'Helfulness'. But they disagreed on the fact that M-learning was able to substitute the instructor, and able to accelerate their problem solving skills in MS. They further lamented that M-learning was time consuming and therefore resorted to not making use of M-learning.

Table 1: Perceptions of Participants on M-Learning in Solving MS Problems

Rank	Details of Items	Mean	Std.dev.
1	Relevancy	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

Based on their perceptions, and as active participants in their own learning, it would be interesting to interview these students to listen to their 'voices' in adapting and adopting the M-learning in solving MS problems.

3.2 The Voices of the Participants on M-learning in Solving MS Problems

Individual interviews were conducted to fathom deeper, the reasons for using the M-learning approaches among the participants. Their voices are to enrich their responses to their perceptions in the survey. These responses 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 preferred paper notes. (P1, Female)

Yes, such as learning system on-line. (P2, Male);

It could be inferred that most of the participants had a 'rough' notion of mobile technology, but not the depth and importance of it.

Do you find it useful in helping your learning (the subject MSM)?

It helps you learn. Easier to find info, quicker & more efficient if only to search for one piece of info. No need to open the computer, it is very distracting. (P15, Female)

A bit, not so much, for accessing notes directly. I still preferred paper notes. (P13, Male).

The results seem to suggest mixed-feeling of the efficacy of M-learning in helping the participants in their learning. Their responses indicated that M-learning is time-consuming.

Do you find M-technology change your learning style?

Yes, go to library less often. Even go to library, will borrow lesser books.(P13, Female)

No, I still like to read hard copy. Reading on the screen has a lot of radiation and make my eyes very tired, can't read long, still prefer print out. (P11, Female).

Whilst the participants acknowledged that M-learning reduced their time to visit the library, they were not acceptable to read the on-screen notes, and preferred hard copy materials.

Do you find e-learning useful in your learning?

Yes, go to Library less often. However, I still like traditional printed materials. I preferred class. (P10, Male)

Depends on the subject. For MSM, I can study by myself, not necessary to attend class, preferred to learn it by my own pace. I focus on areas which are different from the lectures. I can't focus on 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, being reinforced by their friends and printed materials.

Is the e-learning enough to replace the face-to-face class?

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

No substitution. I found I can learn better in the classroom environment. (P8, Female).

Practically all participants preferred to attend the 'traditional' classroom environment in learning the MS subjects.

These interviews had fathomed an in-depth knowledge on the reasons participants adopted or reluctant to adopt M-learning in solving the MS problems.

Based on the survey and interviews, it could be summarized that whilst M-learning is an innovative change to learning, the participants in this study were not prepared for these changes. They preferred to the traditional face-to-face teaching and interaction in delivering the lessons. Similar findings were also reported by Zainab (2003) and Manimekalai (2014) in that new technologies for learning and teaching need time to be accepted by the users.

4.0   Conclusion

The findings presented in this paper are from the 'voice' of participants studying the MS programme. The findings provided in this study could help educators the need to educate the learners and instructors on the efficacy of M-learning in the modern classroom. It is important to note that the efficacy of M-learning described here needs to be addressed not only for the sake of current situation and students, but also in the light of implementing M-learning in MS subjects as well as across the undergraduate curriculum as well. After all, problem solving is seen as most meaningful and important way of learning and thinking. The ability to aptly apply cognitive skills in problem solving is considered as the fundamental and crucial aspect in a human life

It is hoped that the findings will stimulate further development and improvements in advocating the successful implementation of M-learning in advocating problem solving skills amongst Malaysian students, especially in MS.

References

Abas, Z. W., Chang, L. P., & Mansor, N. (2006). A study on learner readiness for moble learning at Open University Malaysia. Proceedings of IADIS International Conference on Mobile Learning, 151-157.

Adkins, S. (2011). *We put research into practice*. Retrieve on 8 February 2015, from www.ambientinsight.com

Atwekk, J. (2005). Mobile technologies and learning: A technology update and learning project summary. Learning and Skills Development Agency. Retrieved on 8 February 2015, from http:www.mlearn.org.za/CD/papers/Atwell.pdf.

Cassavoy, L. (2015). Today's 4G phones. Retrieved on 8 May 2015, 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.

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

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, USA.

Human Resources Development Fund (HRDF).(2011). *1Malaysia Training Programme*, Ministry of Human Resources, Malaysia.

Manimekalai, J. (2014). Determinants that influence adoption of mobile technology in learning environment. Unpublished PhD thesis, Asia e University, Malaysia.

Mahavera, S. (2014, March 25). *Low quality Malaysian education more alarming than household debt, says World Bank economist.* Retrieved on 8 February 2015 from http://www.themalaysianinsider.com/malaysia/article/low-quality-of-malaysian-education-more-alarming-than-household-debt-says-w#sthash.D99uKqE7.dpuf

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

Prensky, M. (2005). Adopt and adapt school technology in the 21st century. Retrieved on 8 February 2015 from http://www.marcpresnky.com/writing/default.asp.

Ragus, M. (2006). MLearning: a future of learning. Retrieved on 8 February 2015 from http://citeseer.nj.nec.com/pretschner99personalization.html

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).

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

Segan, Sarcha. (June 2014). Which carrier is the best for fast mobile data where you live? Fastest Mobile Networks2014, Retrieved on 8 February 2015 from http://www.pcmag.com/article2/0,2817,2459185,00.asp.

Watson, H., & White, G. (2006). mLearning in education. Retrieved 8 February 2015 from http://www.educationau.edu.au/jahia/webdav/site/myjahiasite/shared/site/mLearning.pdf.

Wentzel, P., Lammeren, R., Molendjik, M., Bruin, S., & Wagendonk, A. (2005). Using mobile technology to enhance student's educational experiences. Case study from the EDUCAUSE Centre for Applied Research. Retrieved on 8 February 2015 from http://www.educause.edu/ir/library/pdf/ers0502/cs/ecs0502.pdf.

Zaiab, Hussin. (2003). Factors affecting distance learning student's use of the Internet as a student support system. Unpublished PhD thesis, University of Malaya.