Potential Tools for Blended Learning in Mathematics Courses

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The development of smartphone innovations has shifted users' dependency on bulky computers to a smaller pocket-size computing device that ease their daily tasks. In the first quarter of year 2014, Lenovo reported that the sales of their smartphones began to exceed the sales of personal computers globally (Anatol, 2014). In Malaysia, it is visible that there is a rapid shift in the manner in which things are done conventionally. Many daily tasks can now be accomplished through a smartphone application without the need to visit the corresponding physical stores. Besides being able to initiate or receive phone calls and text messages, e-commerce activities such as reservation of flight ticket, purchasing a dress via online store, and reselling used items on auction sites could be done with just a few taps on smartphone. Internet banking or bill payment could also be carried out through smartphone applications. In terms of learning, students use smartphones to search for information via Google search to clear their doubts on a specific mathematical concept. They could also post their questions in an online forum to get help from other experts overseas. They may use Automath application accessible from smartphones to obtain a step-by-step solution simply by taking a snapshot of the mathematical expressions used in a mathematical problem.

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The Ministry of Education had launched the Malaysian Education Blueprint 2015-2025 (Higher Education) where Shift 9 in the blueprint highlighted the need for institutions of higher learning in Malaysia to gradually gearing towards the full implementation of blended learning (Malaysia, 2012). Blended learning integrates both the traditional face-to-face learning environment and e-learning approach by employing suitable learning models (Horn et al., 2011; Kaur, 2013). In a blended learning environment, students would spend less time face-to-face with their lecturers and spend more time doing self-learning online. The students are given the authority to choose their pace of study. In general, blended learning combines the best features of classroom interaction and online interaction in such a way that it allows personalise learning and provides thoughtful reflection (Güzer & Caner, 2014). Some academicians struggle to shift to blended learning approaches as reported by researchers in the Asia region including Malaysia (Haron et al., 2012; Jong et al., 2014; Tham & Tham, 2011) while there were some who are positive with the shift (Embi & Panah, 2014). Those who struggle found the shift was too drastic to be accepted as there were too many instructional design considerations and planning that have to be put in place first. A good implementation of blended learning requires a comprehensive instructional design that employs the six blended learning models (Embi et al., 2014). This includes the work of identifying potential educational tools that could enhance students' learning. This article aims to share two online tools that could potentially enhance students learning experience when undertaking Mathematics courses.

At the moment, the course management system (CMS), social media, and instant feedback platform are widely known to possess suitable features for the implementation of blended learning (Embi & Panah, 2014). Moodle platform is an example of CMS and it is usually used to post announcement, to store lecture notes and tutorial questions, and to store the grades of students' continuous assessments. Some lecturers may use it to create formative assessments that provide instant feedback about students' level of understanding individually. However, such a practice is not common as the designing tool is not sufficiently versatile to the design of assessment (Jong et al., 2015). This is especially true for mathematics courses because assessing a mathematical solution and providing feedback are usually done by lecturers themselves using the paper and pen approach. Formative assessment is too time-consuming for the mathematics courses that are taught in large classes. MathDIP could be one of the solutions in providing formative assessments that give instant feedback to students (Pacheco-Venegas et al., 2015). It is a web-platform service (http://www.mathdip.org/) designed by researchers in Mexico. It was used by students taking introductory university mathematics course there. The system employs an open source computer algebra system (CAS) that is capable of evaluating mathematical expressions for calculus, algebra and statistics. Students could easily check their level of understanding by integrating their solution into this system. Lecturers could capture the progress of students through the system as it records every mathematical expression input by the students as they solved a mathematical problem. The immediate response would motivate students during their self-learning time. Even though the functionality of the application is promising, such ecosystem is not publicly available to be used by other institutions as it is just newly established. Unless Pacheco-Venegas's team made further progress in extending the accessibility, other institutions which are interested with such an

ecosystem will need to develop the system on their own.

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As for face-to-face sessions, game-based tools could be a good choice to check students' progress in their level of understanding. Enjoyable learning experiences in class will mostly promote students to adopt deep learning (Nisbet & Luther, 2014). Kahoot! is one of the game-based digital learning platform that was recently being introduced in my centre to enhance classroom learning. It has been used in The Norwegian University of Science and Technology in Norway to improve students' engagement in learning (Hussein, 2015). Based on the responses provided by their students, the tool was very helpful in building useful learning experiences. Basically, it only requires students to have a device with a browser application and Internet connection. Smartphones would be the most convenient device as it is an always-on device. Lecturers need to prepare several multiple-choice questions and answers before entering the class. During the face-to-face sessions, students will need to login to Kahoot! Web page via a pin number that is provided by their lecturer. Once they enter, the lecturer is notified and may begin the game. The students only need to choose the options that appear on their screen. The correct answer is provided according to the timing decided by the lecturer. The wear-off effect of the tool was being studied as well. It was evident that the students continue to stay motivated after the tool was being used continuously for five months (Wang, 2014). Thus, it is worthy to explore the method of incorporating this tool to enhance learning experiences in mathematics courses.

The search for suitable tools and teaching pedagogy to empower blended learning is a continuous effort (Embi et al., 2014). Hopefully, the tools introduced here are able to encourage academicians to adopt blended learning in their teaching especially in the case of Mathematics teaching.

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