Mobile School Conceptual Model for Secondary Schools in Malaysia

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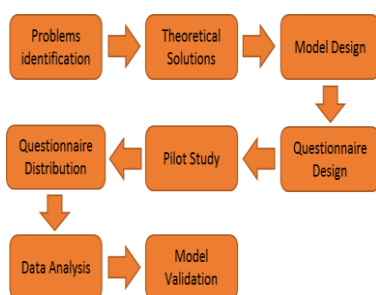
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Graphical abstract

Abstract

Incorporation of e-learning and mobile web technology in the education produces significant positive impacts to the students. These technologies are able to complement the weaknesses of current practices in teaching and learning. This paper presents Mobile School conceptual model that has been developed for secondary schools in Malaysia. This model is developed by integrating the potential concepts and theories to solve the problems related to teaching and learning in Malaysian secondary schools. Validation of this model has been conducted using questionnaire instrument where the questionnaire has been distributed to 407 respondents including school administrators, teachers, students and parents. The analysis showed that the variables that have been integrated in the model could solve the identified problems. The variables are also important to be implemented in mobile learning (m-learning) system development for secondary schools in Malaysia.

Keywords: secondary school;m-learning; e-learning; mobile web technology; distance learning.

Abstrak

Pemerbadanan e-pembelajaran dan teknologi web mudah alih dalam pendidikan menghasilkan kesan positif yang besar kepada pelajar. Teknologi ini dapat melengkapi kelemahan amalan semasa dalam pengajaran dan pembelajaran. Kertas kerja ini membentangkan model konsep Mobile School yang telah dibangunkan untuk sekolah-sekolah menengah di Malaysia. Model ini dibangunkan dengan menggabungkan konsep-konsep dan teori yang berpotensi menyelesaikan masalah-masalah yang berkaitan dengan pengajaran dan pembelajaran di sekolah-sekolah menengah di Malaysia. Pengesahan model ini telah dilakukan dengan menggunakan instrument soal selidik di mana soal selidik telah diedarkan kepada 407 responden termasuk pentadbir sekolah, guru, pelajar dan ibu bapa. Hasil analisis menunjukkan bahawa pembolehubah yang telahdi integrasikan dalam model dapat menyelesaikan masalah yang dikenalpasti. Pembolehubah ini juga penting untuk dilaksanakan dalam pembangunan system pembelajaran mudah alih (m-pembelajaran) untuk sekolah-sekolah menengah di Malaysia.

Kata kunci: sekolah menengah, m-pembelajaran, e-pembelajaran, teknologi web mudah alih, pembelajaran jarak jauh.

1.0 INTRODUCTION

Learning Management System (LMS) is one type of m-learning system which is used to manage the teaching, learning and administrative activities within an institution. The integration of mobile device technology with this system allows the system be accessed through mobile devices.

In general, model is a representation of concepts and relationship between them in solving the identified problems of a specific business process [1]. Usually, model is produced by incorporating relevant concepts to solve the

problems. Different models will be produced for the same domain due to different focus, demographic or other variables. In m-learning studies, there were various models that were produced in previous research. For example, basic m-learning model called FRAME [2], AEFIRIP model for mobile tutoring [3], Shih's m-learning model [4] and many more. However, these models were developed for different contexts and backgrounds. In this particular research, the incorporation of the variables focuses on mobile learning management system (MLMS) with the demography of secondary schools in Malaysia, thus different problems were identified including physical limitations of mobile devices, ineffective communication among school communities and usability issues of operating m-learning systems.

Most weaknesses of the developed mobile learning systems are due to the physical limitations of mobile devices [5, 6]. Physical limitations of mobile devices here refer to small screen size, low battery life, less capacity of storage and less processing power. As emphasized by [7], the usability of a system is not only determined based on the interface design of the system, but also closely influenced by other external factors including the device. In terms of communication, ineffective communication among parents and school administrators was found. It was due to less commitment and cooperation by parents towards their children's schooling [8].

Therefore, the objective of this study is to identify theoretically potential variables to solve the problems related to the focused demography and to develop a conceptual model by incorporating the identified variables.

2.0 LITERATURE REVIEW

In conducting this study, thorough literature review has been carried out on the existing models, frameworks, theories or concepts related to mobile learning that can be adapted to overcome the identified problems.

2.1 The Framework for the Rational Analysis of Mobile Education Model

The Framework for the Rational Analysis of Mobile Education (FRAME) model was developed by Koole[2] to describe m-learning as a learning process that has been produced from the integration of mobile technologies, human learning capabilities and social interaction. This model addresses existing and current pedagogical issues, mobile device issues, and communication and collaboration issues. FRAME model consists of 3 important components; device aspect (D), learner aspect (L) and social aspect (S).

Device aspect refers to the characteristics of mobile devices including physical characteristics, input and output capabilities, file storage and retrieval, processor speed and error rates. Previously, mobile devices such as mobile phones, smartphones and tablets have their limitations in all mentioned characteristics. However, these limitations have been reduced from day to day due to thorough research and development in mobile device technology field [9]. Due to the advancement of latest technologies, m-learning can offer more useful functions to the users.

The second component which is learner's perspective highlights the aspects of individual's prior knowledge, memory, context and transfer, discovery learning, and emotion and motivation. Observing learner's current cognitive structures is very important in the development of any m-learning tools so that the tools are effective to the learner's learning process. Moreover, m-learning tool developers need to find suitable approaches to optimize learner's short-term and long-term memory.

The third main component is the social aspect which emphasizes more on conversation and cooperation, and social interaction. Both criteria of social aspect should be included in any m-learning tools so that the social approaches in classroom settings can be provided to the learners while using the tools

There are 4 intersections where two or all three important components overlap with each other. The intersections contain the attributes that belong to both or all components including device usability (DL), interaction learning (LS), social technology (DS) and mobile learning (DLS). Generally, device usability (DL) and social technology (DS) intersections refer to the capabilities of mobile technology while interaction learning (LS) describes the implementation of suitable instructional design or learning theories that support social constructivism of the learners.

Theoretically, this FRAME model is very useful to guide the development of learning contents, LMSs, content management systems or other educational systems that involve the utilization of mobile devices as the medium of teaching and learning activities.

2.2 Transactional Distance Theory

Transactional distance theory (TDT) was first invented by Moore [10]. It is a learning theory for distance education practices where distance here refers to separation of learners and instructors either by location or time. Meanwhile, transaction obviously refers to the interaction between environment, individual and behaviours' patterns in a specific situation. In TDT, transaction occurs when instructors and learners are having learning activities in an environment where instructors and learners are separated through time and location. This separation leads to the change of pattern of behaviours of learners and instructors as compared to usual learning processes.

In TDT, Moore [10] highlights 3 important elements which are dialogue, structure and learner autonomy. These elements have been further explained by Starr-Glass [11]. Dialogue refers to the positive constructive interactions occur between two parties where both parties will get benefits from

the interactions. Usually, every party in a dialogue is an active listener, effective contributor and develop the contributions to other parties. Meanwhile, structure refers to the instructional elements in delivering a specific course or subject. The examples of structure include learning objectives, thematic content, presentations, case studies, animations, exercises, projects or examinations. Different communication media will implement different level of teaching structure. Therefore, best structure has to be determined to ensure the effectiveness of teaching delivery. At the first place, distance education should implement less structured teaching and instructional design so that constructive discussions can take place among learners and educators [10, 12]. However, suitability of structuring the teaching is also very much dependant to the learners' level of education [13]. Less teaching structure is suitable to be delivered to tertiary education students whereas semi-structured teaching is suitable for secondary education. Finally, learner autonomy refers to the control given to the learners to setup their learning goals, learning experiences and efforts, and handling pace of learning activities and processes. In general, the implementation of this theory is said to be effective when the dialogues and learner autonomy are increased, and less structured teaching being practiced [14].

2.3 Computer Mediated Communication

In the normal state, face-to-face communication is assumed as the most effective communication where the communicators are not separated by either time or location [15]. The messages can be delivered very quickly. Furthermore, this communication also allows communicator to observe and sense other communicator's facial expression and feelings on the subject of the conversation. In conventional teaching and learning process, teacher (instructor) will communicate to the student (learner) face-to-face (directly) [16]. Teacher can observe the level of acceptance of teaching delivery very fast either by asking the student or by observing student's facial expression. Therefore, in implementing computer mediated communication(CMC) in education processes, the selection of medium is very vital to ensure the delivery of teaching and learning contents (messages) can be accepted at the same or higher level than face-to-face communication in the classroom settings [17].

A comparative study has been conducted by Bordia [18] between face-to-face communication and CMC. This study synthesizes the findings that have been carried out from 18 published experimental studies that compared both types of communication. As a result, it was found that the respondents in CMC group took longer time to complete the given tasks and produced fewer comments during the given period of time. However, the quality of outputs from the given tasks by both groups was similar. Longer time taken by CMC group occurs due to the exposure of new CMC technologies and lack of information

and communication technology (ICT) literacy among the respondents. In relation to that, there is evidence that these weaknesses are only temporary as the CMC technologies are improving from day to day and the exposure of new CMC technologies are more comprehensive.

2.4 Mobile Web Technology

Mobile web refers to the use of Internet-connected applications or browse-based access through the Internet from mobile devices [19, 20]. Mobile web technology has been developed due to rapid growth and improvement of mobile devices capabilities. When it comes to the development of m-learning system, two types of platforms are involved to provide the best service to the teachers and learners; mobile web and native platforms.

Mobile web app is web-formatted for mobile devices including smartphones and tablets, and the web is accessed using mobile device's web browser [21]. Similar to web version, usually mobile websites are developed using 3 core technologies including Hyper Text Markup Language (HTML), Cascading Style Sheet (CSS) and JavaScript. Mobile web app is a browser-based, thus the apps or systems can be accessed via any mobile devices that are equipped with wireless network connection and web browsers. Normally, there is a server that acts as the host to store the data that will be accessed by mobile users.

The key advantage of mobile web apps is cross-platform compatibility and allowing them to reach the broadest audience for the least effort [22]. They are relatively cheap, easy, and fast to build, although some device-specific customization is usually required. Mobile web browsers are fairly standardized, making it much easier to create a universal mobile web app than a native one. Web apps are also cheaper and easier to maintain than native apps for the same reasons, using cross-platform applets rather than keeping up with changes across different devices. Mobile web apps are also simple and support ubiquitous access where users do not have to download any application, but simply access the URL via their mobile browser which instantly delivers the most up-to-date application to their device. They can then bookmark the URL for repetitive use.

2.5 Cloud Computing

Software as a Service (SaaS) is one of the cloud computing components where it refers to the use of software in cloud (virtual server). In the easiest word, SaaS is also the implementation of online applications to access resources either formatted or Web documents [23]. Similar definition was given by PSC [24], where SaaS allows consumers to utilize the online applications and removes the needs of installing and running the applications from users' machines. Badger, Grance [25] discuss the architecture of SaaS where it involves two processes. The first process takes place in cloud (virtual machine) where all users' requests are processed and stored. For example, a user requests

to search for a specific file using Web browser. The file will be searched in the cloud. Once the file is found, it is presented in the same Web browser using the suitable application that was programmed in the cloud. Meanwhile, the second process takes place in end users' machines where users can view the file from their machines. Similarly, in cloud computing integration with mobile devices, the processing task of resources and storage are moved from users' mobile devices to the clouds. Then, online application can be accessed using mobile Web browsers via wireless network connection [26].

2.6 Mobile Web Usability

Ebner, Stickel [7] classify mobile web usability into three main categories; device usability, browser usability and website usability. In general, the device usability category involves hardware and system implementation aspects while browser usability category refers to the web technologies that support mobile devices and website usability category gives focus to the navigation, content and layout of the system interfaces. In practical, all categories influence each other and are integrated to produce the best usability for mobile web. In mobile web practices, usually the user experiences the usability designs that have been implemented without focusing on detailed implementations. However, from the developer's point of view, the details of each implementation are sparingly taken into consideration in producing mobile web-based systems[7].

As mentioned earlier, the device usability deals with hardware and operating system (OS) of mobile device. Therefore, usability level is very much dependant to the manufacturer's mobile device design. Overall mobile web browsing user experience will be positive as the device's primary focus of the design is to support mobile web browsing. In addition, user interaction can still be focused even though the device manufacturer does not set browsing as the main concern of the system. For example, user interaction with mobile web can be enhanced by giving more concerns to the input and interaction mechanisms of mobile device, list style and narrow layout and minimizing contents to only important points.

3.0 METHODOLOGY

Figure 1 illustrates the procedures for producing MobileSchool conceptual model. MobileSchool conceptual model formalization involved 3 main procedures including background identification, integration of theoretical solutions and validation of the model.

3.1 Input of Conceptual Model Formulation

The input of this study is categorized into 3 categories; background identification, theoretical solution and validation of variable.

3.1.1 Background Identification

Problems, technological requirements, target users and perceptions of MLMS implementation were used as the raw inputs for this stage. Based on this background, literature studies were conducted thoroughly to determine potential theoretical solutions that could solve the identified problems and fulfil other aspects of background including technological requirements, target users and perceptions of MLMS implementation.

Generally, the findings from the preliminary study revealed three 3 major problems:

1. Physical limitation of mobile devices including small screen size, limited storage and limited processing power.
2. Ineffective communication among school communities including school administrators, teachers, students and parents.
3. Usability issues of operating m-learning systems.

3.1.2 Theoretical Solution

Based on literature studies that have been conducted, 6 possible concepts were determined to solve the problems that were identified. These concepts involved pedagogical theory, technological adoption and usability principles. The concepts were Framework for Rational Analysis of Mobile Education (FRAME) model, transactional distance theory (TDT), social information processing theory (SIPT), mobile web technology, Software as a Service (SaaS) of cloud computing and mobile web usability principles. Finally, these concepts were decomposed into eight important variables that had been incorporated in MobileSchool conceptual model. The variables are communication, learning structure, user autonomy, SaaS of cloud computing, mobile web technology, content, layout and navigation.

3.1.3 Validation of Variables

The final stage of MobileSchool conceptual model formulation is validation. The purpose of validation is to proof the importance of variables that have been included in MobileSchool model to solve the problems and their relevancy to be implemented in any development of m-learning management system. This validation process involved the use of the questionnaire instrument. The questionnaire contains 12 sections including demographic information, communication, learning structure, user autonomy, mobile web technology, Software as a Service (SaaS), content, layout, navigation, perceived system usability, perceived pedagogical effectiveness and perceived effectiveness of MLMS. For demographic information section, the questions on gender, type of user, form, stream, age group, experience of using mobile web and school name were asked. For the remaining sections, respondents were asked to answer the questions by rating the Likert scale of 1 (strongly disagree) to 5 (strongly agree).
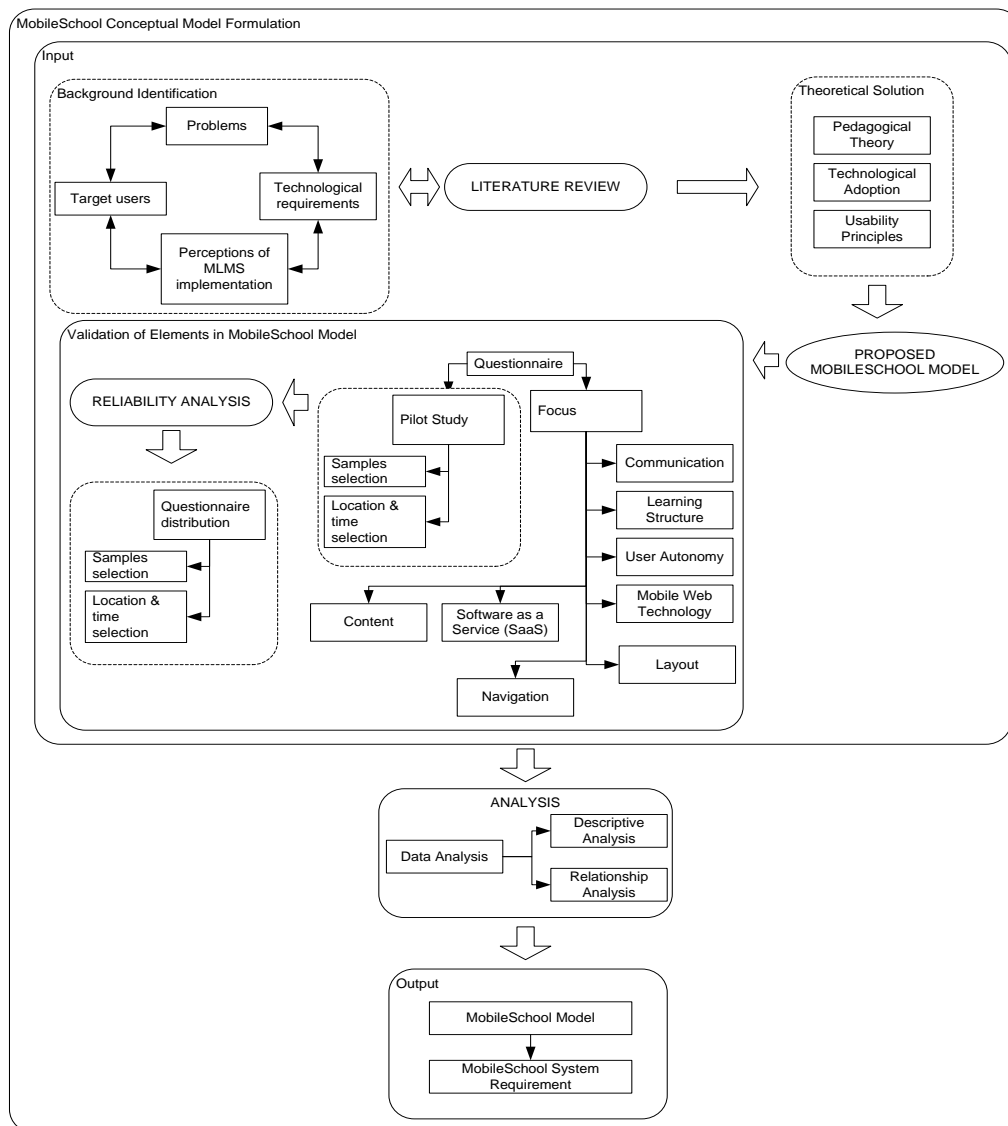
Figure 1 Conceptual Model Formulation Phase

Before disseminating the questionnaire to the larger number of respondents, a pilot test was conducted to 42 random respondents involving 30 secondary school students, 6 teachers, 5 parents and 1 school administrator. The main purpose of conducting pilot test was to assess the reliability of the questionnaire where the questions were adopted from Kismihók [27], Motiwalla [28] and Fetaji, Ebibi [29]. The reliability of questionnaire was analyzed using Statistical Package for the Social Sciences (SPSS).

As analyzed, the overall reliability score denoted as Cronbach's alpha was 0.942. As mentioned by Sekaran and Bougie [30], Cronbach's alpha value must be higher than 0.7 to pass the level of reliability. Based on the obtained Cronbach's alpha score, the questionnaire was reliable and internally consistent, thus, the questionnaire is ready to be distributed to the larger number of respondents.

Subsequent to that, the same questionnaire was distributed to 407 respondents using cluster random sampling. It involved 15 school administrators, 52 teachers, 62 parents and 278 secondary school students from three schools in Perak namely SMK Gunung Rapat, SMK Raja Perempuan Kelsom and Maktab Rendah Sains MARA (MRSM) Lenggong. The selection of these schools was done based on their experience in having e-learning programme called KPerak E-Learning Cluster (KPEC).

3.2 Data Analysis

In the final step of validating the importance of variables in the model, descriptive and relationship analyses of statistical analysis have been used. Descriptive analysis could produce descriptive information including frequencies, mode, median, mean, standard deviation and others. However, the relationship analysis is more relevant to validate the relationship between two continuous variables. Therefore, Pearson's product-moment correlation was used to analyze the relationships of the variables.

4.0 RESULTS& DISCUSSION

4.1 MobileSchool Conceptual Model

Mobile School conceptual model is a model that covers elements related to administrative, teaching and learning works via mobile platform. It was developed based on problems that had been identified from preliminary study. 6 potential concepts that can solve the identified problems had been incorporated to produce the model. The concepts include the Framework for the Rational Analysis of Mobile Education (FRAME) model, transactional distance theory (TDT), social information processing theory (SIPT), Software as a Service (SaaS) of cloud computing, mobile web technology and mobile web usability principles. Figure 2 illustrates the conceptual model of Mobile School.
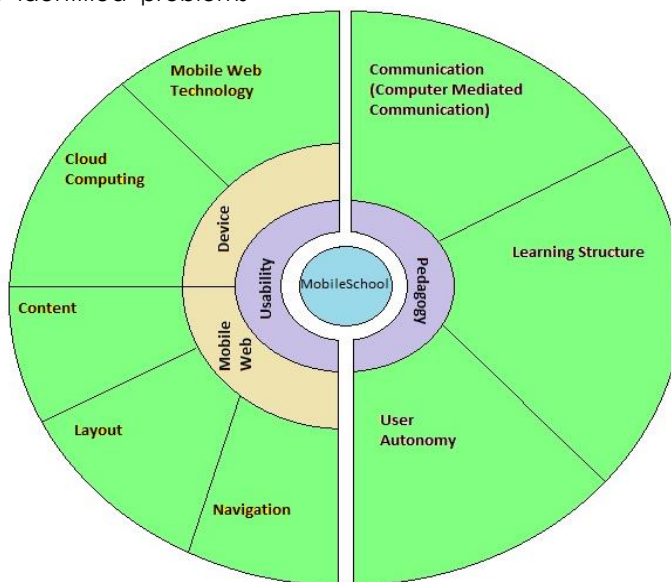

Figure 2 MobileSchool Conceptual Model

The model was divided into 2 main components; pedagogical and usability components as advised by Wang [31] where any computer-based learning tool should consider these two important aspects to ensure the developed system being effective to the learners and educators. In pedagogical component, 3 variables were incorporated; communication, learning structure and user autonomy. The inclusion of these variables was derived from the incorporation of TDT and SIPT of computer mediated communication (CMC). In communication variable, text-based CMC would be implemented for all conversation among the users through MLMS. Besides, this model also practiced semi structured of learning where lesser guidance will be given by the teachers but all activities that occur through the system have to be monitored. Finally, user autonomy refers to the authority and control given to the users in conducting education related activities in the system. School administrators and teachers could access web version in doing private and confidential tasks such as managing user accounts and preparing students' academic reports. Meanwhile, mobile web version could be accessed by all four users since this version was purposely developed more to viewing purposes.

For usability component of the model, this component was divided into 2 sub-components which are device usability and mobile web usability. In the device usability sub-component, mobile web (variable) had been chosen as the platform for operating Mobile School system. It was due to the benefit of this platform where the system can be accessed from any smartphones that equipped with mobile web browser; hence the system could be compatible with any smartphones [32]. In addition to that, Software as a Service (SaaS) of cloud computing was chosen to be operated together with mobile web technology where this concept allows any formatted documents including PDF to be viewed from mobile web browser without downloading and requires any specific software to run the document. This concept also gave more support towards compatibility of the developed system with any smartphones.

The basis of Mobile School conceptual model formulation was the Framework for the Rational Analysis of Mobile Education (FRAME) model [2]. Originally, Koole's FRAME model consists of 3 main components for developing a mobile learning system; learner, device and social aspects. There were also 4 intersection components identified in this model including device usability, social technology, interaction learning and mobile learning. These main and intersection components were expanded according to the different specific use, context and implementation.

In comparison with original FRAME model, Mobile School conceptual model expanded the learner aspect to 3 more number of related parties including school administrator, teacher and parent. Based on the preliminary study that was

conducted, it was believed that all these 3 parties play a big role in ensuring the success of the students in academic. Besides, some of the aspects of FRAME model were expanded and filled with the well-established theories and concepts in producing an effective teaching and learning tool to the users. For example, Software as a Service (SaaS) of cloud computing and mobile web technology were improvise the device usability (DL) aspect, social information processing theory (SIPT) in social technology (DS) aspect and transactional distance theory (TDT) in interaction learning (LS) aspect. In previous studies such as [33] and [34], the aspects of FRAME model were only expanded based on the requirements of the learning system that will be developed. Different with Mobile School conceptual model where the aspects were expanded based on the requirements and thorough literature studies on well-established concepts and theories where the effectiveness of the theories and concepts were proven from the studies that had been conducted by previous researchers.

There were various models of mobile learning systems that had been developed by previous researchers. However, there was no fair comparison that can be made in discussing the effectiveness of the variables incorporated in Mobile School conceptual model with other similar models. The model was developed for the scope of secondary schools in Malaysia while most of mobile learning models that were developed for the scope of tertiary level [33, 35-38].

Pedagogical aspect here refers to the implementation of learning theories such as behaviourism, cognitivism and constructivism in mobile learning tool while technology aspect refers to the device components including accessibility and usability. The integration of pedagogical aspect with technology aspect (usability) is more effective as compared to implement only single pedagogical or technological aspect. Both aspects fulfil each other in producing the effective mobile learning tools or systems to the users.

Wang [31] mentioned that teaching and learning should be delivered in such a way that it can give benefits to the learners. Therefore, two important elements should be emphasized in mobile learning system which are pedagogical approach and usability of system [31, 39]. In having more detail discussions on formulation of the model, these two elements functioned as the basis.

For pedagogical approach, the model adopted transactional distance theory (TDT). As discussed in literature review section, TDT is a learning theory for distance education practices where distance here refers to the separation of learners and instructors either by location or time. Based on the original theory, it involved 3 main elements including dialogue, structure and learner autonomy [40]. In this model, these three elements had been modified to communication, learning structure and user autonomy. Communication refers to social interaction among school communities pertaining teaching, learning and administrative whereas learning structure refers to

the level of openness by the teachers in conducting the teaching and learning activities. Meanwhile, user autonomy refers to the level of controls given to all users in handling the system either for the purposes of teaching, learning or administrative.

One of the problems that had been identified was ineffective and limited communication space among school administrators, teachers, students and parents. Therefore, social information processing theory (SIPT) theories had been applied into the communication variable of conceptual model's pedagogical approach. In SIPT studies such as the comparative study that had been conducted by Antheunis, Valkenburg [41], text-only computer mediated communication was the most effective method of CMC as compared to visual CMC and face-to-face communication. Two factors that had been identified prior to this findings; the communicators were more honest when communicating through text-based CMC as compared to two other mediums and the communicators felt more comfortable to communicate through text-based CMC.

As a result, online and offline chat was integrated in the model. Statistically, about 74% of youth and 48% of people at age range of 45-60 years old in the developed countries were very familiar with social communication network such as Facebook and Twitter [42]. This trend was growing in the developing countries such as Malaysia nowadays. Therefore, this method of communication theoretically provided a wider space of formal and informal communication among school communities. On top of that, Mobile School system also provided other functions to support the active communication including feedback submission, online course discussion and the posting of school and course announcements.

For second aspect of TDT, the best approach for mobile learning system is to allow more dialogues, make learning structure more open and give more autonomy to the user [14]. However, for secondary school usage, slight modifications were made to suit the involvement of this target group. Therefore, the best approach of TDT was practiced with full monitoring by school administrators, teachers and parents.

Secondary school institution usually involves 4 important stakeholders including school administrators, teachers, students and parents. Thus, learners' autonomy aspect of TDT had been expanded to user autonomy. In secondary schools, students were not the only one who is responsible to achieve good academic results for themselves or the school. School administrators, teachers and parents should also play their roles in helping them. Effective communication among them is very important to ensure the success of the students' and school's academic achievements.

Ebner, Stickel [7] divided mobile web usability into 3 categories; device; browser; and mobile website. In the model, there were only two categories that had been applied which are device usability and mobile web usability. As defined by Ebner, Stickel [7], device usability refers

to mobile device capabilities that influence usability of mobile website. In ISO/IEC [43], compatibility of hardware was one of the elements that ensure the operability of mobile system usability. Thus, cloud computing approach and mobile web technology had been integrated in the model. Based on the readings, cloud computing is able to solve the limited storage problem of mobile devices. By implementing cloud computing, all system operations and files would take place and stored in the cloud without burdening mobile device's storage and processing power. For Mobile School cloud implementation, online Crodoc API (Application Programming Interface) for Portable Document Format (PDF) viewer was utilized. Crodoc, Software as a Service (SaaS) of cloud computing, is an online service that allows conversion and sharing of the documents on the web. Firstly, teacher will upload learning materials in PDF format. The PDF will be stored on the server of Mobile School. Then, the system will check the existence of the uploaded PDF from Crodoc's server. If PDF does not exist on Crodoc's server, it will be uploaded there and converted to a web page. The document can be viewed on the browser without downloading it. Another component of device usability, mobile web technology theoretically could increase the compatibility of MLMS system. As discussed by Cotfas [32] and Tandon [44], mobile website can be accessed by most wireless-supported mobile devices especially smartphones and tablets. Compatibility of the system would increase when it can be run by more mobile devices.

Table 2: Theoretical Effectiveness of Mobile School Conceptual Model

Theories/Principles	Problem(s) Solved
Transactional Distance Theory	Current learning practice where students are very much dependent to the teaching and learning process in classroom settings.
Social Information Processing Theory	Lack of communication among school communities.
Mobile Web Technology	Compatibility of the system access where it can influence the usability of the system.
Cloud Computing	Physical limitations including mobile device storage, processing power and battery. It can also improve usability of the system.
Usability Principles	Usability issues especially screen design.

For mobile web usability, the model considered 3 main usability variables; content; layout; and navigation. The design of MLMS would avoid unneeded or unnecessary information to be put in the content which was suggested by Parsons, Ryu [45]. Unnecessary information would make novice users confuse in finding the important points of the contents. Furthermore, it would also slow down the experts' learning pace [46]. Hence, it was advised to the developer to implement less is more rule in ensuring the contents accuracy and solidity [46-48].

In terms of layout, MLMS interface is recommended to be divided into 3 compartments; title; navigation and content. This design had been recommended and practiced by many developers and researchers [49-52]. The design of this layout would be consistent in all pages as it can help users to easily understand how the system operates [53, 54].

Finally, simple and consistent navigation would ensure the usability of MLMS [55]. Navigation mechanism also plays a big role in retaining the user's mood while interacting with the system. The system was best accessed using touch screen mobile devices. Touch screen would give better navigation control to the system. It was much easier for the users to scroll the page. Users could also simply zoom in the page without clicking to any specific button. Consistent navigation mechanism would be ensured in helping the users to learn the system operation faster.

Theoretically, all concepts that had been integrated in Mobile School conceptual model potentially could solve all identified problems. Table 2 summarizes the concepts included in the model and the problems that can theoretically be solved.

4.2 Validation of Variables in MobileSchool Conceptual Model

Expert validation was conducted among 5 teachers who had at least ten years' experience in teaching. Besides, the teachers had also at least 3 years' experience in utilizing computer-based learning tools and e-learning system. Mobile School conceptual model had been presented to them where each variable was explained in details on the advantages and significances of the variables included in the model for MLMS development for secondary schools in Malaysia. Qualitative reviews and comments were obtained from this validation.

The teachers believed that all incorporated variables are able to solve the mentioned problems on the existing teaching and learning practices in secondary schools, and the implementation of MLMS in the schools. The teachers also agreed to retain all variables to be incorporated as one single model. The implementation of the variables in the development of Mobile School system would produce a useful and effective MLMS to the school communities in enhancing the quality of the activities and processes related to teaching, learning, administering and communication. Nonetheless, the teachers worried with the access quality to the system since the system required good Internet connection. This issue was also occurred to many existing systems that were currently utilized in Malaysian schools including Frog Virtual Learning Environment (VLE) and school-based assessment system (PBS). This issue could only

be solved with the huge spending of funds to upgrade the Internet connection in the schools around Malaysia. However, the teachers still believed with the usefulness and effectiveness of MLMS that incorporates this conceptual model in the future as the conceptual model took into account the system compatibility and accessibility issues.

After the conceptual model was validated by the experts, the variables incorporated in the model were retained. Then, the same model was going to be validated by the end users of to-be developed Mobile School system where the end users were the secondary school communities including school administrators, teachers, students and parents.

Descriptive statistics and hypothesis evaluation had been applied to validate the importance of the variables included in Mobile School conceptual model. This study involved 15 school administrators, 52 teachers, 62 parents and 278 secondary school students from 3 schools in Perak namely SMK GunungRapat, SMK Raja Perempuan Kelsom and Maktab Rendah Sains MARA (MRSM) Lenggong. Out of 420 questionnaires, 373 questionnaires had been returned and completely answered by the respondents. This represented 88.81% of response rate. 30.2% of the respondents are male and the remaining 69.8% are female. Besides, 47.2% of total respondents had the experiences in using mobile web browser between 6 months to 2 years and 42% had the experiences between 2 years to 4 years. Remaining 9.3% of total respondents did not have experiences using mobile web browser. Therefore, total respondents who had at least 6 months experiences in using mobile web browser was 89.2% which was sufficient to represent the right group of respondents in evaluating the importance

of the variables included in MobileSchool conceptual model.

4.2.1 Descriptive Statistics

As mentioned in methodology section, the questionnaire applied the Likert scale of 1 to 5. In analysing the mode of respondents' rated scales, the scales were combined to produce more meaningful results. Scale 1 and 2 had been combined as disagree whereas score 4 and 5 had been combined as agree. Meanwhile, score 3 remained neutral. Table 3 shows the average percentage of agree, neutral and disagree, and the average mean score of each variable of MobileSchool conceptual model.

4.2.2 Relationship Evaluation

Relationship evaluation had been conducted to determine the importance of the variables that influence the effectiveness of Mobile School conceptual model implementation. In conducting this evaluation, Pearson's product-moment correlation had been applied to analyze the relationship between the variables with the perceived effectiveness of Mobile School conceptual model. Here, the analysis was conducted based on the respondents' perceptions toward the included variables. The results of this analysis also supported the analysis that was obtained from descriptive statistics in previous section. At the end of this analysis, the important variables that need to be included to ensure the effectiveness of Mobile School conceptual model had been determined.

Table 3 Percentage of Agree, Neutral, Disagree and the Mean of Variables

No	Variable of Mobile School Conceptual Model	Percentage (%)			Mean (out of 5)
		Agree	Neutral	Disagree	
1	Communication	67.20	24.72	7.71	3.88
2	Learning Structure	72.63	24.10	3.28	4.03
3	User Autonomy	62.20	30.52	7.28	3.78
4	Mobile Web	63.98	29.60	6.43	3.88
5	Software as a Service	57.75	35.03	7.23	3.74
6	Content	70.63	25.38	4.00	3.96
7	Layout	67.80	27.90	4.30	3.87
8	Navigation	62.96	31.56	5.48	3.83

Based on Figure 3, the correlation value denoted as r between variable communication, learning structure and user autonomy with perceived pedagogical effectiveness was 0.660, 0.666 and 0.744 respectively. Meanwhile, the correlation (r) value between variable mobile web technology, Software as a Service (SaaS), content, layout and navigation with perceived system usability was 0.680, 0.651, 0.686, 0.739 and 0.657 respectively. Finally, the correlation (r) value between variable

perceived pedagogical effectiveness and perceived system usability with perceived MLMS effectiveness was 0.881 and 0.833 respectively. According to [30], if the value of r is bigger than +0.60, it indicates the strong positive relationship between those two variables. Therefore, the result portrayed strong positive relationship between all ten (10) tested associations.
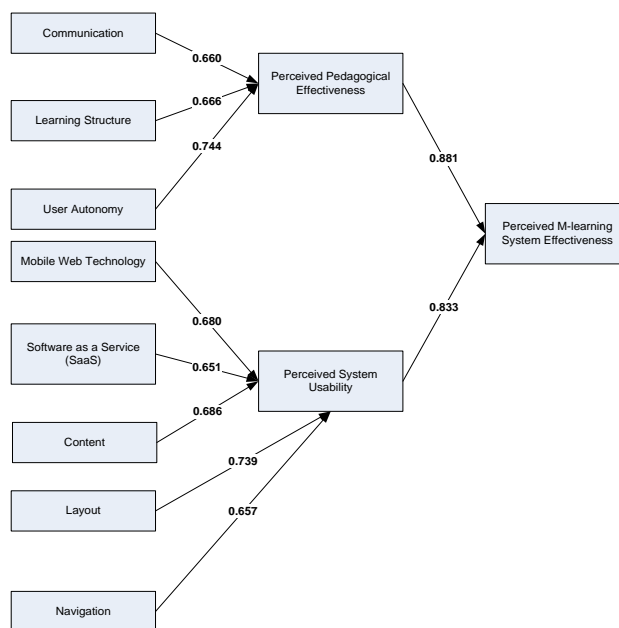
Figure 3 Summary of Correlation on Variables

All variables that had been incorporated in Mobile School conceptual model were validated their importance to the effectiveness of MLMS. In conclusion, the Pearson's product-moment correlation (*r*) for all relationships displayed strong positive correlations. Therefore, there were statistically proven that communication, learning structure, user autonomy, mobile web technology, Software as a Service (SaaS), content, layout and navigation variables should be applied in the development of MLMS.

5.0 CONCLUSION& FUTURE WORK

Mobile School conceptual model was developed as the guidelines for the development of MLMS. This model was aimed to solve all problems include the problems with currently practiced teaching, learning and administrative tasks in Malaysian secondary schools and usability problems with existing m-learning systems. MobileSchool conceptual model had been developed by integrating the potential variables from theories and concepts that were identified to solve the problems into one single model called Mobile School conceptual model.

This study can be expanded by integrating different concepts and theories to solve the identified problems. By integrating different concepts and theories, different functions of MLMS might be produced.

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