M-Learning Curriculum Design for Secondary School: A Needs Analysis

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Abstract—The learning society has currently transformed from 'wired society' to become 'mobile society' which is facilitated by wireless network. To suit to this new paradigm, m-learning was given birth and rapidly building its prospect to be included in the future curriculum. Research and studies on m-learning spruced up in numerous aspects but there is still scarcity in studies on curriculum design of m-learning. This study is a part of an ongoing bigger study probing into the m-learning curriculum for secondary schools. The paper reports on the first phase of the study which aims to probe into the needs of curriculum design for m-learning at the secondary school level and the researcher adopted the needs analysis method. Data accrued from responses on survey questionnaires based on Lickert-point scale were analyzed statistically. The findings from this preliminary study serve as a basis for m-learning curriculum development for secondary schools.

Keywords—curriculum design, e-learning, future curriculum, m-learning

I. INTRODUCTION

THE rapid development in technology has altered our lives and on how we learn. The learning process has expanded beyond the physical classroom walls [1], becoming increasingly globalize and life-long in nature [2]. Technology intervention has always been the interest of academic researchers specifically on how technology could be incorporated into teaching and learning; however studies and researches could barely catch up with the rapid technology advancement. It was in the midst of academicians and researchers that were still grappling with electronic learning (e-learning) when the world is almost instantly hit by the mobile technology which gave rise to a new emerging learning concept - mobile learning or m-learning. Albert Einstein (born 1879) did warn us when he said that: "We live in a world of problems which can no longer be solved by the level of thinking that created them" [3]. This saying indicates that human creativity and imaginative powers evolve faster than our learning process to find solution for problems, that is, we need to know more, since our generation power is faster than our knowledge generating and learning abilities. Fortunately, researchers were quick to respond to the emerging mobile society which led to the buildup of literature in mobile technology in education ranging from studies which

focuses on impact of mobile devices, mobile applications, learning environment, learning theories and models, learning modules to course designs, and etc. For example, past researches reveals that mobile technology has significant impact in supporting teaching and learning [4], improving students' learning achievement and motivation in subjects like Science and Mathematics [5] while Wierzbicki [6] stressed a pertinent point that wireless technology in education offers solution to the widening digital gap which inflicts most developing countries as mobile phones and PDA are significantly cheaper than desktop computers. Wireless mobile devices coupled with wind or solar powered cell towers which create significant infrastructure advantage compared to wired technology, heighten m-learning prospect in future curriculum for all [7].

The development in mobile technology has also resulted in the launching of m-learning projects both in small and large scales. Among worth noted would be 'Leonardo da Vinci Project' and 'IST FP5 in Europe [8], and UniWap Project [9]. Besides this, course and module designs were initiated to be compatible with mobile applications and devices [10][11].

Although m-learning is still at its infancy stage, there is a massive bulk of research studies in m-learning. However literature reveals that most of the studies concentrated largely on mobile devices either on digital functions of mobile devices [12][13][14] which are mostly conducted by telecommunication giants like Ericsson, Apple, Intel & Sun for trade and commercial competition; the effectiveness of mobile devices on preparation of learning activities [15][16][17]and professional learning [18]; or focused research study on a type of mobile device based project such as mobile computer based project [19][20][21].

However there is a large vacuum in the literature on research studies with regards to m-learning curriculum design although curriculum design is one of the major issues which hinders implementation of any new technology based initiatives in education. Among the earlier studies conducted in Malaysia is an assessment on a m-learning program set up for the fifth graders in a primary school in Kuala Lumpur [22]. Besides identifying the strength and weaknesses of the m-learning programme, the study reported that the implementation of the program achieve its predetermined desired results.

Contributing to leverage the scarcity of studies in m-learning curriculum design specifically on curriculum objectives, subject and learning content, implementation approaches, and form of assessment; this study partakes the responsibility of developing one. However this paper is the first of three parts of a bigger study in m-learning curriculum design. The paper will explore the needs of m-learning in

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secondary school which will act as scaffolding for the m-learning curriculum design. The present and future education stakeholders, policy makers, teachers, researchers and private sectors could benefit from this study especially in gaining some insights into the needs of m-learning curriculum in schools and other learning institutions as a guide to set up relevant infrastructures, selection of mobile devices and learning content, management of learning system, or skills and form of training needed for instructors. Based on the aim of the whole study that is to develop a curriculum design for m-learning at the secondary level, the researcher will discuss the methodology adopted, and through the result generated, the researchers attempt to explore the needs of m-learning in secondary school based on teachers' views.

M-learning Concept

Quinn [23] and O'Malley et. al [24] defined m-learning as learning via mobile devices such as Palms, PDA and mobile phones while Nyiri [25] stated that m-learning is learning which occurred when individuals communicate wirelessly. To conclude, m-learning is any learning or training via mobile devices such as personal laptops, PDA and mobile phones anywhere and anytime [26][27]. Conceptually, Brown [28] stated that m-learning is subset of e-learning which is subset of distance learning. E-learning is the macro concept which involves online learning environment and m-learning (refer to Fig. 1).
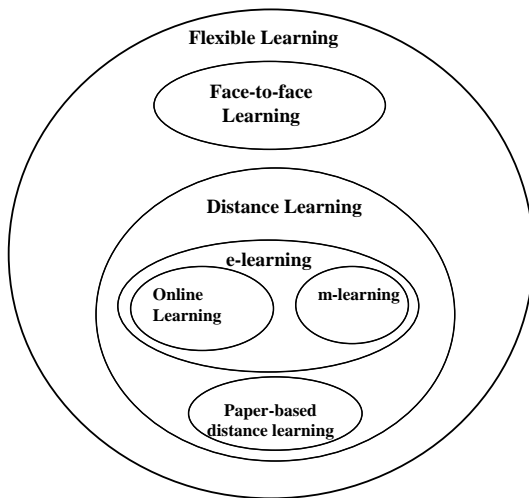

Fig.1. M-learning model
Source: T. H. Brown (2005). Towards a model for m-learning in Africa. International Journal on E-Learning, 4(3), 299-315.

II. THEORETICAL FRAMEWORK

The study as a whole adopted two models as a framework for curriculum design and development. The first model is TABA Curriculum Development Model [29] which is used to develop the m-learning curriculum and the second model, Instructional System Design Model [30] is chosen to be used as a base for specific design of m-learning curriculum for

secondary school level. TABA Model outlines seven steps in curriculum design: 1) Needs diagnosis 2) Identifying objectives 3) Selection of content 4) Arrangement of content 5) Determine learning experiences 6) Arrangement of learning experiences 7) Determine what and how to assess the curriculum. Since its development in 1962, TABA model has been the major model adopted by curriculum designers, policy makers, educationists, and researchers worldwide. Fraenkel [31]asserted that the model is an ideal model to lean on as it innovatively emphasized the acquisition, understanding, and the use of ideas and concepts rather than facts alone; it carefully defines the terminal behaviors expected of students; it includes a number of carefully designed teaching strategies which encourage the development an acquisition of certain specified intellectual skills; it encourages student examination of the attitudes and values which they possess; it includes sequentially designed learning activities in order to encourage cumulative learning; and it provides for continual teacher and evaluation student of student progress.

Instructional System Design Model [30] on the other hand was developed based on ADDIE [32] and ASSURE [33] while developing their instructional design (refer to Fig. 2). This model consists of six steps : 1) Needs analysis of students and mobile environment 2) Integration of instructions based on mobile technology 3) Design of m-learning strategies 4) Design and development of m-learning content 5) Implementation of learning activity 6) Assess effect of m-learning. This model will be the theoretical framework for the specific strategies adopted in the design of the intended m-learning curriculum in this study.

III. METHODOLOGY

The researchers aim to develop a curriculum design for m-learning at the secondary school level which would be mainly based on experts' collective opinions. The whole study consists of three (3) phases: phase one- needs analysis study for m-learning curriculum based on selected experts among secondary school teachers; phase two- design of m-learning curriculum for secondary schools based on Delphi technique; phase three-evaluation of m-learning curriculum designed from phase two.

However as this is the first part of the study, the researcher describes the method used in phase one of the study. Phase one as stated earlier involves needs analysis of m-learning curriculum for secondary school level based on teachers' opinion which was conducted via survey technique. Needs analysis is not new and has been an important methodology used in education planning. Witkin [34] similarly defined needs analysis as a method to identify the gap between the current situation and targeted situation. While McKillip [35] stated that needs is a judgment value that a specific group has a problem which needed to be solved. Forty-eight teachers (n=48) who have expertise in Information Technology (IT) were involved as samples in this phase. They were teachers of the IT subjects (Form 4 & 5) in schools; coordinators of school computer lab (EPU labs); and coordinators of smart school computer labs in Malaysia. They were chosen as they would be able to respond to survey questionnaire relating to

technology based education owing to their qualification background and expertise in IT. The questionnaire contains 29 structured items combined with open ended questions which were developed by the researcher based on literature study. The questionnaire was then validated by three (3) curriculum experts to determine the construct validity of the questionnaire. A pilot study was conducted among 10 secondary school teachers in Ipoh, Perak, Malaysia to improve the questionnaire. Findings from the analysis of survey will serve as a base for m-learning curriculum design for secondary schools.

IV. FINDINGS

As discussed in the methodology section, findings of this study are a result of needs analysis to identify needs of m-learning curriculum for secondary schools. Through survey technique, 48 teachers were asked to identify elements which are needed to implement m-learning curriculum in secondary schools. The elements drawn from this study are needs of m-learning curriculum objectives, m-learning curriculum tools and services, m-learning curriculum implementation, m-learning curriculum contents, teaching and learning strategies, form of assessment, and teachers' and students' skills. The results are as shown in Table 1.

Based on Table 1, m-learning curriculum objectives should include 'students would be able to explore new learning activities through innovative approaches in m-learning(95.8%),'to encourage more self learning opportunities anywhere and anytime(95.8%), to overcome shortage and overcrowded classes(85.4%), to conduct dinamic and quick assessment on students' learning progress(70.8%), and to save time, energy and cost(70.8%). However, objectives like being able to overcome shortage of teachers (45.8%); to overcome transfers of teachers(45.8%); and to rectify illiteracy, inability to count and low learning participation among children, adolescents and adults(39.6%), receive low acceptance to be included in m-learning curriculum objectives especially the objective to overcome truancy/dropouts receives a minority vote of 33.3%.

In terms of needs for electronic tools and services, high percentage of confidence to be included in m-learning curriculum are given to laptops(100%) and interestingly desktops(93.8%) while electronic devices like web camera, digital camera and pen drive only receive three votes each. In terms of softwares, websites(97.9%) and e-mail(89.6%) are favoured more to be included in m-learning compared to SMS(52.1%), MMS(22.9%) and WAP(16.7%), while GPRS and Bluetooth only received three votes of acceptance each.

On the implementation needs, majority of the teachers believe m-learning should start as early as in Form 1(75.0%) where the m-learning curriculum is more preferred to be integrated with the present national KBSM curriculum (89.6%). In probing into subjects preferably to be included in m-learning curriculum, Table 1 reveals that science and technical subjects are more preferred to be taught through m-learning such as Information technology which accrued the highest percentage of acceptance of 95.8%, followed by Mathematics(89.6%), Science(87.5%), Biology(85.4%),

TABLE I
CURRICULUM NEEDS FOR M-LEARNING IN SECONDARY SCHOOLS

CURRICULUM NEEDS	Mode	%
Curriculum Objectives		
1) Students would be able to explore new learning activities through innovative approaches	46	95.8
2) To encourage more self learning opportunities anywhere and anytime	46	95.8
3) To overcome shortage and overcrowded classes	41	85.4
4) To conduct dinamic and quick assessment on students' learning progress	34	70.8
5) To save time, energy and cost	34	70.8
6)To sustain interest of students towards learning	32	66.7
7) To solidify collaborative process among students	29	60.4
8) To be able to overcome shortage of teachers	22	45.8
9) To overcome transfers of teachers	22	45.8
10) To overcome illiteracy, inability to count and low learning participation among children, adolescents and adults.	19	39.6
11) To overcome truancy/dropouts	16	33.3
Electronic Tools And Services		
Laptops	48	100
Desktops	45	93.8
Personal Digital Assistant (PDA);	11	22.9
Mobile phones	12	25.0
Tablet PCs	11	22.9
3G Mobile phones;	24	50.0
Web camera	3	6.3
Digital camera	3	6.3
Pen drive	3	6.3
Technology softwares		
Websites	47	97.9
e-mail	43	89.6
SMS	25	52.1
MMS	11	22.9
WAP	8	16.7
GPRS	3	6.3
Bluetooth	3	6.3
Level of Implementation		
School Level		
Form 1	36	75.0
Form 4	22	45.8
Form 5	22	45.8
Form 6	22	45.8
Form 3	18	37.5
Form 2	15	31.3
Method of Implementation		
Integrated with KBSM	43	89.6
Separate from KBSM	6	12.5
Curriculum content		
Subjects		
Information Technology	46	95.8
Mathematics	43	89.6
Science	42	87.5
Biology	41	85.4
Chemistry	40	83.3
Physics	40	83.3
Geography	32	66.7
English Language	29	60.4
History	29	60.4
Islam Studies.	27	56.3
Bahasa Melayu	27	56.3
Literature	20	41.7

Chemistry(83.3%) and Physics(83.3%). Non-technical subjects obtained lower percentage of preference though still accrued considerable high percentage except for literature which obtained a low 41.7% of preference. This shows that non-technical subjects like English Language and History could still be included in m-learning curriculum.

Next, on m-learning curriculum needs for teaching and learning strategies, Table 2 shows that the percentage majority is below 80% for all teaching techniques with inquiry-discovery technique and on-line teaching voted most favoured techniques for m-learning which indicated 77.1% acceptance each. Other selected techniques are project technique(72.9%), small-group discussion(72.9%), problem-solving technique(72.9%), questioning technique(62.5%), drilling technique(62.5%), and case-study technique(60.4%). However lecturing technique indicated significantly low acceptance of 16 out of 48 votes. On suitable learning activities for m-learning, quizzes tops other learning activities acquiring 97.9% acceptance. Other favored activities are internet information search(95.8%), video conferencing(93.8%), group discussion(93.8%), giving responses(85.4%), collecting field data(85.4%), sending SMS(81.3%), sending MMS(81.3%), and receiving instruction from teachers(81.3%). However forum activity is not favoured to be included in m-learning learning activity needs as it yielded only 8.3% acceptance.

Another curriculum needs which is vital to be included would be assessment. Proper assessment tools are important to evaluate the curriculum as they identify whether the output of instructions and learning meet the the set curriculum objectives or not which finally determine the success of the curriculum. Table 2 shows that group work(95.8%), e-folio(89.6%) and produce a product(87.5%) are the more important form of test to be included in m-learning compared to in-class pencil/paper test(56.3%) and paperwork(52.1%) which are more widely use as form of test in conventional in-class curriculum. Pencil/paper test(33.3%) is also not favored to be included as form of examination compared to online objective questions(90.0%) and observation(80.0%). This can be understood as the nature of m-learning involves instant learning through small chunks of inputs at a time detached from the boundaries of space and time. Online objective questions would be a more practical form of examination compared to pencil/paper test as it allows quick and easy response from learners.

Finally on m-learning curriculum needs for teacher and students'skills, both internet access and information search, and use of e-mail for communication skills seemed to be more vital to be included in m-learning compared to other skills, judging from the high 96.7% acceptance for teachers' skills and 100% for students skills. Other skills which yielded significantly high acceptance are electronic spreadsheets for information process(95.8%), use of presentation application(93.8%), word processing to design printed materials(91.7%), planning for computer organizational needs(87.5%), and maintenance of computer system and network(87.5%) which deemed needed to be included for teachers' skills. Other students' skills which are selected to be relevant are use of technology devices such as digital camera,

TABLE II
CURRICULUM NEEDS FOR M-LEARNING IN SECONDARY
SCHOOLS (continuation)

CURRICULUM NEEDS	Mode	%
Teaching And Learning Strategies		
Teaching Techniques		
Inquiry-discovery technique	37	77.1
On-line training	37	77.1
Project technique	35	72.9
Small group discussion	35	72.9
Problem-solving technique	35	72.9
Questioning technique	30	62.5
Drilling technique	30	62.5
Case study technique	29	60.4
Lecturing	16	33.3
Activities		
Quizzes	47	97.9
Internet Information search	46	95.8
Video conferencing	45	93.8
Group discussion	45	93.8
Giving responses	41	85.4
Collecting field data	41	85.4
Sending SMS	39	81.3
Sending MMS	39	81.3
Receiving instruction from teachers	39	81.3
Reading teachers' notes	33	68.8
Chat	33	68.8
Forum	4	8.3
Assessment		
Form Of Test		
Group work	46	95.8
E-folio	43	89.6
Produce a product	42	87.5
Online test	39	81.3
Quizzes through SMS	37	77.1
Forum	27	56.3
In class Pencil/paper test	27	56.3
Paper work	25	52.1
Form Of Examination		
Online Objective questions		
Observation	45	93.8
Practical test	42	87.5
Online essay test	36	75.0
Pencil/paper test	32	66.7
	16	33.3
Teacher And Students' Skills		
Teachers' Skill		
Internet access and information search	47	97.9
Use of e-mail for communication	47	97.9
Electronic spreadsheets for information process	46	95.8
Use of presentation application	45	93.8
Word processing to design printed materials	44	91.7
Planning for computer organizational needs	42	87.5
Maintenance of computer system and network	42	87.5
Management of data and tools security	41	85.4
Use of Learning Management System(LMS)	33	68.8
Coordinate and analyze data and information	31	64.6
Students' Skills		
Internet access and information search;	48	100
Use of e-mail for communication;	48	100
Use of technology devices such as digital camera, scanner and pen drives	46	95.8
Electronic spreadsheets for information process	44	91.7
Word processing to design printed materials	44	91.7
Use of presentation application	43	89.6

scanner and pen drives (95.8%), electronic spreadsheets for information process (91.7%), word processing to design printed materials (91.7%), and use of presentation application (89.6%).

V. CONCLUSION

Based on the theoretical framework outlined here, the findings from the study serve to fulfill the preliminary stage in developing the intended m-learning curriculum. As highlighted in both curriculum development models, TABA model and Instructional System Design Model, needs analysis is required as a basis for curriculum development. In this preliminary study, the needs analysis revealed m-learning curriculum needs on the elements: 1) M-learning curriculum objectives for secondary level; 2) M-learning electronic tools and services; 3) M-learning level of implementation; 4) M-learning curriculum content; 5) M-learning teaching and learning strategies; 6) M-elarning assessment; and 7) M-learning teacher's and students' skills. The findings will be used to form questionnaires for survey purpose in phase two of the bigger study to gather experts' opinions via Delphi technique. M-learning curriculum for secondary level would then be developed based on results from phase two. The developed curriculum would then enter phase three of the study for evaluation.

Education stakeholders, policy makers, teachers, researchers and private sectors could benefit from this study especially in gaining some insights into the needs of m-learning curriculum in schools and other learning institutions as a guide to set up relevant infrastructures, selection of mobile devices and learning content, management of learning system, or skills and form of training needed for instructors.

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