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Introducing Computer Aided Learning in Teaching Basic Electronics for Technical-Vocational Students

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Abstract
The use of technology in the delivery of teaching and learning is vital nowadays especially in education. Computer Aided Learning Software (CALS) is basically the use of computer in the delivery of instruction with a tailored fit program intended for a specific lesson or a set of topics.
The CALS software developed in this study is intended to supplement the traditional teaching methods in technical-vocational (TECH-VOC) instruction specifically the Consumer Electronics Servicing course.
There are three specific objectives of this study. First is to create a learning enhancement and review materials on the selected lessons. Second, is to computerize the end-of-chapter quizzes. Third, is to generate a computerized mock exam and summative assessment. In order to obtain the objectives of the study the researcher adopted the Agile Model where the development of the study undergoes iterative and incremental process of the Software Development Life Cycle.
The study conducted an acceptance testing using a survey questionnaire to evaluate the CALS. The results showed that CALS was generally interpreted as very satisfactory. To further improve the CALS it is recommended that the program be updated, enhanced and lastly, be converted from stand-alone to a client/server architecture.

Keywords: Computer Aided Learning Software, Computerized Mock Exam, Consumer Electronics Servicing

Introduction

Around the world, there is growing consensus among education leaders, researchers and educators that teaching and learning must change to help students develop the skills they will need to succeed in the 21st century [1]. The educational technology era has arrived accompanied by major changes in both education and technology [2]. Educational technology is the study and practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources [3].

Attention is now moving towards a more integrated approach in Computer literacy education which focuses on three main aspects. These are: (i) training of teachers and students in Information Technology (IT); (ii) integration of IT into all teaching and learning and the delivery of hardware and software, and (iii) research and development of IT in education [4]. According to administrators' and faculty members' opinion, computers and instructional educational technology have a positive impact on the quality of teaching and research. Likewise, students indicate that the availability of electronic information has been helpful in their work [2]. Thus, there is an agreement among faculty and students that technology can be a useful tool for a successful teaching and learning environment.

Future education and training need proper tools that are able to overcome space, time and performance demands. Such demands are highlighted by the increasing geographical distribution of education and training centers, the need for a continuous updating in technology-related information and the learning effectiveness provided by the integrated use of multiple forms of information. Such tools can be developed by the use of multimedia communication systems for educational and training purposes [2]. With the use of Computer Aided Learning Software (CALS), these will somehow answer the demands.

Computer Aided Instruction (CAI) can provide tailored instruction to an unlimited number of students on an individual basis. Given the move by many universities towards larger classes with integrated technology, multimedia instruction and interactive tutorials provide a convenient means to augment classroom instruction [2]. Specifically with interactive multimedia tutorials, a single faculty member could teach multiple, large sections of a course while providing convenient and tailored instruction for individual students.

Literature Reviews

Innovative Teaching and Learning Research

Use of Information and Communications Technology (ICT) by teachers and students is significantly associated with innovative teaching practices more generally. This association is stronger when ICT is used in higher-level ways that promote deeper student engagement with content. More commonly among teachers in the Innovative Teaching and Learning (ITL) Research sample, ICT is used in more basic ways, to access content (for students) and as a presentation tool (for teachers and students). In some countries, these uses may represent important steps toward innovation.

Nevertheless, models and tools for using ICT in ways that powerfully promote deep student learning can help prepare teachers for taking the next step [1].

Software Development Life Cycle and Agile Method

Software Development Life Cycle (SDLC) is a process followed for a software project, within a software organization. The life cycle defines a methodology for improving the quality of software and the overall development process [5]. Since SDLC model is a traditional and predictive approach, an adaptive software development method is needed for integration which is the Agile Method. The Agile Method implements an iterative approach in which each build of the iteration is incremental in terms of features; the final build holds all the features required by the system.

Computer Aided Instruction

Student learning is the focus of teaching learning process. Theorists and practitioners have always been made concerted efforts to facilitate students learning by enhancing the quality of learning experiences. Emergence of learning theories over time reflects the concern of educators to explore process, factors and conditions involved in human learning. Application of predominant learning theories have always been changing and modifying the methods of teaching and learning [8].

Computer-Aided Instruction (CAI), diverse and rapidly expanding spectrum of computer technologies that assist the teaching and learning process. CAI can dramatically increase a student's access to information. The program can adapt to the abilities and preferences of the individual student and increase the amount of personalized instruction a student receives. Many students benefit from the immediate responsiveness of computer interactions and appreciate the self-paced and private learning environment. Moreover, computer-learning experiences often engage the interest of students, motivating them to learn and increasing independence and personal responsibility for education [9].

Methodology

The design for the Computer Aided Learning Software (CALS) was specifically for the Consumer Electronics Servicing Course. Chapter Lessons were identified namely: Tools & Testing Instruments, Electronic Components, Occupational Health & Safety (OHS) Procedures, Assembly/Disassembly Techniques and Inspection & Testing Procedures. Moreover, the user has the option to take the End- of-Chapter Quiz, Mock Exam or to Exit the program.

A selected number of students were chosen to test and evaluate the CALS for validation. Validated survey questionnaire forms are used to substantiate the overall features of the CALS. The questionnaires evaluated specifically the layout & user interface, software content & operations, general functionality, end-of-chapter quiz and computerized mock exam. A survey response were conducted through the user acceptance testing tool. The data gathered from the survey questionnaire were analyzed by calculating the percentage from the total number of respondents.

Figure 1 shows the main menu which has five chapter lessons intended for the Consumer Electronics Servicing course.

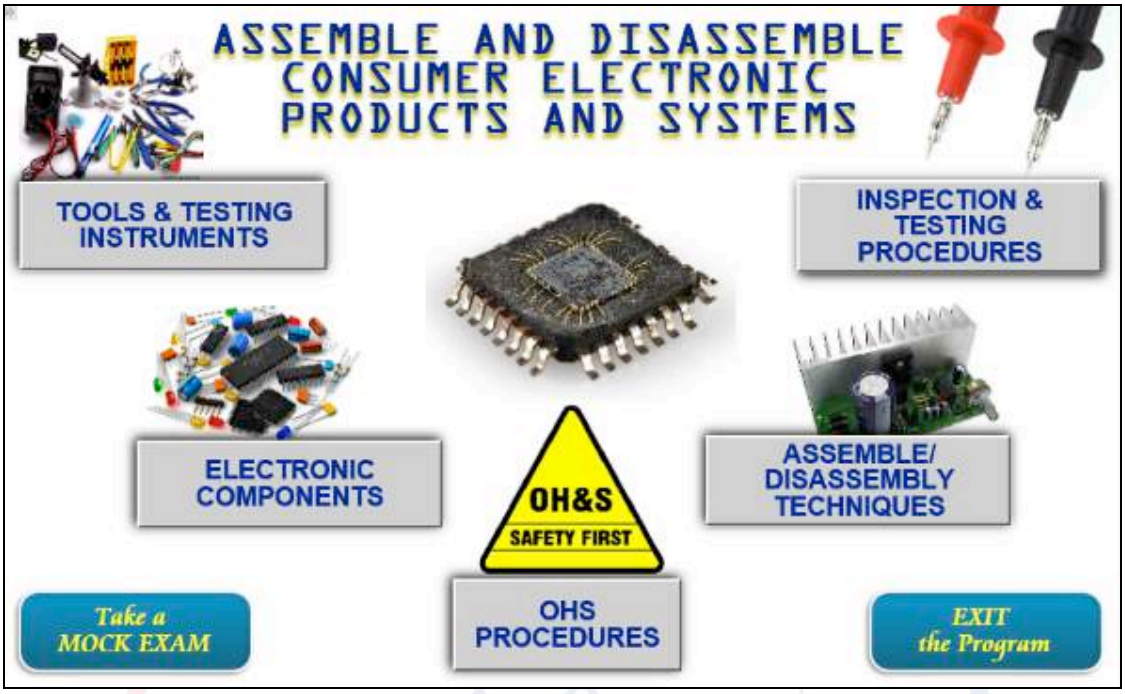

Fig. 1. CALS for Consumer Electronics Servicing - Main Menu

Figure 2 shows the Mock Exam Window which provides the exam assessment compose only of multiple choice exam similar to the electronics competency written exam category. This serves also as a reviewer for the users/students before they take the actual competency exam.

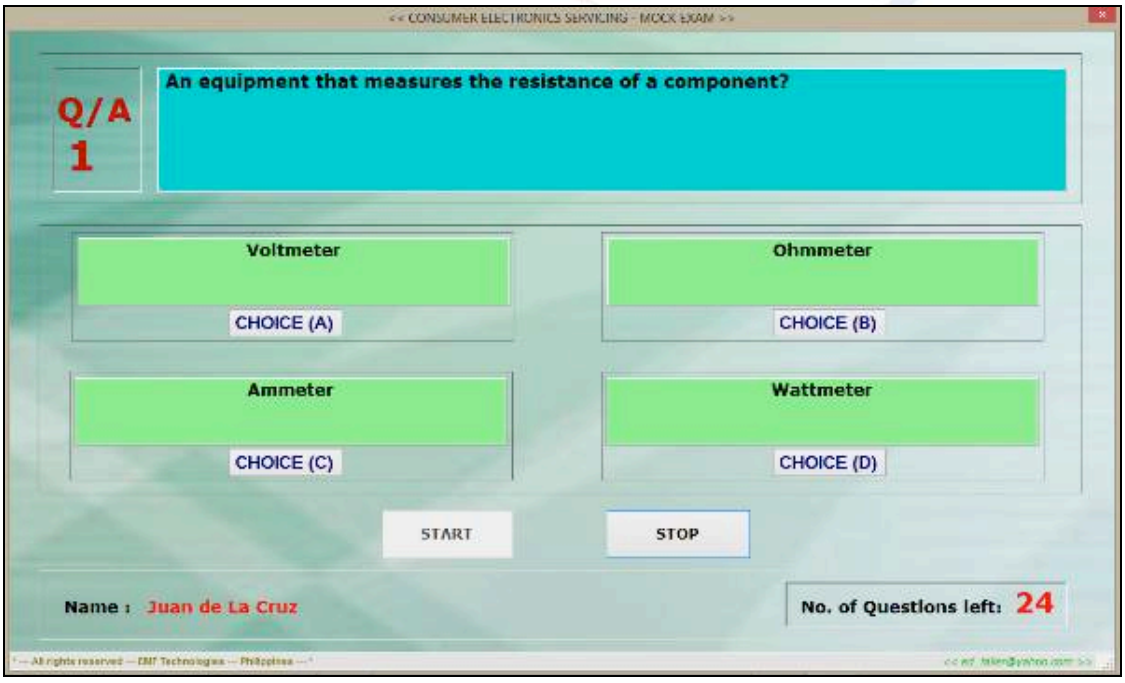

Fig. 2. Mock Exam Window

Results And Discussion

The survey questionnaire is divided into five categories namely: layout & user interface, software content & operation, general functionality, end-of-chapter quiz and computerized mock exam as shown in Table I:

Table I: Survey Results on all 5 Categories

Category Types	Average Percentage
Layout & User Interface	89%
Software Content & Operation	89%
General Functionality	87%
End-of-Chapter Quiz	91%
Computerized Mock Exam	87%
Average Total:	**89%**

Key Results: 90 & above = Excellent, 85-89 = Very Satisfactory, 80-84 = Satisfactory,
75-79 = Good and 74 & below = Poor.

Based on the given results, the average percentage for most of the categories are very satisfactory and an excellent result for the end-of-the chapter quiz. The overall result suggest that the Computer Aided Learning Software has a very satisfactory evaluation.

Conclusions

The proponent developed a Computer Aided Learning Software (CALS) for lessons on consumer electronics servicing course with the aim to supplement the traditional teaching methods in technical-vocational course instruction. The CALS lessons are presented in text as well as graphics and main modules are available for learning. These lessons can be learned with minimal assistance from the instructor and can be reviewed as often as the user wants it. Furthermore, to check or validate the users learning, a chapter quiz for every module was created.

The main objective of the study was met through addressing the specific objectives:
1. The learning enhancement and review materials were developed based on the selected lessons in Consumer Electronics Servicing and it was concluded that it can be used as an alternative teaching material since each chapter contains lessons such as descriptions and graphic representation of the components or tools being utilized in the laboratory.
2. The end-of-chapter quizzes from the selected lessons in Consumer Electronics Servicing was developed and concluded that it can facilitate a one-on-one learning since students can concentrate on a specific topic that they choose.
3. The computerized mock exam with summative assessment from the selected lessons in Consumer Electronics Servicing was developed and concluded that it can serve as a reviewer for National Competency (NCII) written exam since it can be simulated as many times as needed

Lastly, the proponent conducted an acceptance testing using a survey questionnaire. The results showed that the End-of-Chapter Quiz category has an average of 91%

which was interpreted as excellent and the rest of the categories where interpreted as very satisfactory. Thus, the proponent can say that the CALS developed was acceptable and functional.

Recommendations & Future Works

The Computer Aided Learning Software as an acceptable and functional program also has its limitations. From the users as well as the evaluators the proponent came up with the following recommendations to improve the system:

- An improved layout and user interface with more interactive and graphic functionality of the lessons and review quizzes.
- Additional lessons as well as quiz/exam data can be accumulated to the CALS system through a central database for better manipulation and retrieval which will serve as a databank.
- Conversion from stand-alone to a client/server based architecture which will allow the following features:

    - Central database
    - Central monitoring station for student's progress and assessment
    - Support of multi-user functionality

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Students and Teachers Perceptions of ICT Use in Classroom: Pakistani Classrooms

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Abstract
The use of Information and Communication Technology (ICT) has become a major driving force in transforming education throughout the world. The usage of ICT in Pakistan has increased many folds in the last 10 years. The latest educational policy of the Government of Pakistan has stressed on using ICT in schools. The curriculum documents have also suggested teachers to integration ICT in their classrooms teaching and learning processes. This study focuses on the use of ICT in schools of Pakistan and it is restricted to four major cities of Pakistan. The study investigates students' and teachers' use of ICT in their everyday life. The study also explores students' views of their teachers using ICT in classroom teaching learning and assessment. The data were collected using survey questionnaire from students studying in secondary schools (classes 7, 8, 9, 10& 11.) and teachers teaching to secondary classes. The schools were invited to participate in this study. The study finds that students and teachers have access to computers in schools and at home and they use computer for different purposes, such as, entertainment, communication, and education. The study also highlights differences amongst teachers and students about what technology to be used in classroom and for what purposes. The study discovers two opposite views. On the one hand teachers believe they use ICT effectively while on the other hand students disagree with their teacher's idea of ICT integration in classroom.

Keywords: *ICT Integration, Technology, Perceptions, Teachers, Students, Classroom teaching*

Introduction and Background

Teacher education programme in Pakistan went through a rigorous review process that started in 2004 and concluded in 2009. The review process was initiated with the financial support of United States Agency for International Development and technical support of UNESCO, Pakistan. The committee formed to evaluate teacher education studied teacher education curriculum, teaching practices of teacher educators and resources available at the teacher education institutes (Jamil, 2004; UNESCO 2009; EDC, nd). The review resulted in changes in the teacher education curriculum, training of teacher educators at the national level and providing resources to teacher educational departments and institutes. The review committee suggested National Professional Standards for Teachers in Pakistan, a guide line for teacher educators teaching preservice teacher education courses at the college or university level. The Standard 7 focuses on ICT and suggests to teacher educators to equip preservice teachers with the skills to use different educational technologies, both hardware and software (Ministry of Education, 2009; National Accreditation Council for Teacher Education, 2009). The Standard 7 presumes that preservice teachers will integrate ICT in their classroom teaching practices during their school teaching experience, which is an essential component of the Bachelor Education (B.Ed.) programme.

This study investigated teachers' usage of ICT in their everyday lives and how this usage influenced teachers' ICT usage in their classrooms, especially focusing on teachers' teaching, learning and assessment practices. The study also explored teachers' perceptions of ICT efficacy on teaching and learning. The schools selected for this study were state and private schools, four from each category. The researchers approached public schools to participate in this research project but all our requests were turned down by the Principals. The schools participated in this research are from the private sector.

World Economic Forum in its latest Networked Readiness Index. Pakistan is ranked 118 on Usage index and ranked 123 in the Individual usage index (Dutta, Geiger & Lanvin, 2015). Pakistan Telecommunication Authority (PTA), the regulatory body of telecommunication services in Pakistan, has reported the telephone density at 62.79%, with mobile phones making up 60.7% of this telephone density (PTA, 2015). The data available with PTA shows that mobile phones are used all over the country with some exceptions of poor service quality in the Gilgit Baltistan province of Pakistan. The recent surge in the sale of low cost smart phones have made it possible to access internet wherever mobile services are available in Pakistan. A recent study published in 2015 suggested that Pakistan will have 40 million smartphone by end of 2016 (Baloch, 2015).

Integration and adoption of technology in classrooms of developing countries undergo several stages and challenges which then determine the case of how successful the integration has been in execution of learning outcomes (Richardson, 2011). Pakistan saw a fast paced penetration of computers and internet in the personal lives of teachers and students but the pace of integrating ICT in classrooms for learning purposes is slow. It appeared that the major decline in adopting technology comes not from students but mostly from teachers (Bingimlas, 2009). Not only teachers are resistant to adopt technology but other factors such as lack of hardware and software,

attitudes of teachers towards technology, lack of confidence, lack of competence play a very pivotal role to undermine the effective integration (Bingimlas, 2009). Another study by Youssef (2008) presented direct and indirect effects of ICT on students' academic performance and organizational change. This study did not find any link between the effects of ICT investment on students' academic performance.

Literature Review

The very early researches tried to define a computer-using teacher (Pelgrum & Plomp, 1991). The definition derived from the survey was teachers using computer sometimes in relation to their work with the students. According to the findings of this study, 75% of the teachers were computer-using teachers. A few years after this study, Becker (1994) developed a sophisticated mechanism and analysed the same data set. The result of this analysis was very different and only 25% teachers could be considered computer-using teachers. Since then the number of computer using teachers have expanded as new and inexpensive technologies have continued emerging and their penetration has increased many folds in teachers' everyday lives and their teaching usage, inside and outside the classrooms. This has further complicated the concept of a computer-using teacher as the idea of computer usage has shifted from mere an end product user to collaborator in designing educational technology.

Computer self-efficacy is explained by Christensen and Knezek (2006) as confidence in using computer with competence in different classroom teaching and assessment settings. The many recent studies (Peralta & Costa, 2007; Compeau & Higgins, 1995; Liaw, Huang and Chen, 2007; Yuen & Ma, 2008; Christensen and Knezek, 2006) have found a link between teachers' use of ICT and their perception of computer self-efficacy. The higher the self-efficacy of teachers the more open teachers are to experiment with technology in their classroom teaching practices.

Earle (2001), Zhao and Frank (2003) & McKenzie (2004) identified four main purposes of technology use by teachers: (1) to develop material to prepare their classroom teaching (e.g. classroom presentations); (2) doing administrative work (e.g. compiling students data, typing assessment tasks and feedback etc.); (3) to facilitate students' learning in a classroom; (4) teacher directed use of ICT to complete the assigned tasks. The first two uses of computer benefit teachers directly and thus keep teachers' interest high and engaged in the teaching and learning process. The use 3 & 4 of computer help teachers in managing their classes and has immediate benefits for teachers and students though the fourth use of computer is rarely practiced in classrooms. Hawkins (2002) and Tiene (2004) observed an increase in ICT adoption in less developed countries, such as Pakistan. This adoption as noted by them also focused on meeting the needs of the users, that is, teachers and students. Tiene (2004) also observed that ICT integration efforts by schools in less developed countries have resulted in very little changes in classroom teaching practices of teachers. The reason of this as suggested by Tiene (2004) was "overly ambitious and overly optimistic" (p. 90) ICT integration plans which were beyond what these schools and teachers could achieve. The schools focused on procurement of hardware and software ignoring teachers in the whole process and thus this exercise resulted in minimum use of the expensive equipment procured by school administration.

Cheng and Townsend (2000) and Cheng (2001 & 2007) in their studies on ICTs in the Asia-Pacific schools highlighted four reasons for the lack of ICT integration in classroom teaching and assessment; first, ICT usage was incongruent with the educational aims; second, there was a gap of training to use the hardware and software available (free) and provided (purchased) to teachers; third, there existed a gap between ICT and its integration with the curriculum; fourth, difficulty in bridging the technological change and cultural norms gap that existed in Asian societies. Tien (2004) added another reason to these by suggesting that the end-user, that is, teachers, lacked trouble-shooting ability also hampered ICT integration process in schools and in classrooms. Dede (1998) warned the schools and teachers that adapting to technological innovation also demands innovations by schools and teachers on their end too, that is, innovation in classroom pedagogy and assessment and innovative school organization and management of resources.

There are a number of studies such as Yildirim (2007 & 2011), Slaouti & Barton (2007), Balanskat et al. (2007) and Chigona & Chigona (2010) investigated factors that hinder teachers' use of ICT in classrooms. The studies found out that teachers used technology to prepare teaching notes and assessment worksheets and plans instead of focussing on improving students' academic performances and making classroom into constructivist classrooms. These researches revealed many other obstacles that teachers face such as classrooms having more students than they are designed to accommodate; insufficient training of end users to use different technological devices available in schools; non-existent technical and pedagogical support to teachers; rigid school structures and syllabi; de-motivated teachers, students and school administration; lack of coordination between school administration and teachers; lack of access to required resources; time pressures to complete the given curriculum; lack of mentoring opportunities for newly inducted teachers in schools and which discourage teachers from integrating ICT into their classroom teaching.

Teachers' attitude towards ICT and their perceptions of ICT effectiveness plays an important role in their making use of ICT in their teaching and assessment activities in the classrooms. Studies conducted in Europe (Huang & Liaw, 2005; Korte & Hüsing, 2007; Becta, 2008) have highlighted conflicting perceptions of teachers towards effectiveness of ICT in making teaching learning interesting and classroom constructivists teaching and learning places. There were teachers who believed that the use of ICT have had positive impact on students' and their own learning; helped in individualizing learning and also helped in strengthening the link between classroom learning and the learning outside the classroom. However, there is evidence in these researches suggesting that some teachers believe that the benefits of ICT were not visible in students' performance. A study by van Braak, Tondeur & Valcke (2008) showed that teachers' positive attitude towards new technological innovations would increase their integration in classroom teachings and assessment strategies. Woodrow (1992) recommended a positive attitude towards educational innovation for a successful transformation of educational practices and places.

The present generation of students is tech users and they often question the ICT facilities available in their schools and how their teachers used it in classrooms. A study conducted by Geoffrey (2010) in a private university revealed that students wanted their teachers to use ICT in their teaching because students found it useful and

believed that it helped them to learn whatever the teacher was teaching. Students also asked the administration to provide them better ICT equipment and faster internet connectivity in their classrooms and computer labs. Students who participated in this research agreed with the idea that ICT improved enhanced academic performance. This research also suggested that availability, accessibility and the competence of the users affect the learning process. A study by Littlejohn, Margaryan, & Vojt (2009) conducted at a study with university students and they identified the gap that existed between the use of technology by students and how and what they are expected to learn from it. This study revealed that the study patterns of university students throughout their 4 year degree programme remained unchanged. This study indicates that study practices of students are influenced by their prior study experiences as the result did not show any correlation between the usage of ICT by the students and their expectations of how they might learn. Omwenga (2005) argues that its not just the use of ICT but also the context and the need to apply the pedagogy. The limitations of the use of technology also depends on the teacher and students ability to handle it and apply in the learning process.

The use of ICT in school by the teachers and the students is at times seen as very beneficial, mostly in the case of students, a study revealed that students of three age groups 8, 10, and 12 in six secondary schools who participated in focused group interviews saw technological tools not just helpful in presenting work but also an opportunity to learn and complete effectively and efficiently (Deaney, Ruthven, & Hennessy, 2003). The Punjab province of Pakistan initiated an ICT lab project in 2009 in 6 districts which aimed at providing public schools with ICT equipment and encouraged teachers and students to use them. Hameed and Qadir (2014) conducted a study to find out the perceptions of students regarding usefulness of this proejct . This study highligthed very interesting point that although adequate facilities were provided under this proejct to seocndary school but only those teachers and students used them who were either teaching or studying computer science subject. Teachers and students from other subjects were also not using computers because they lacked IT skills. Another finding from this study was that teachers and students from urban areas used these facilities. This study highligted the aspect of providing training to teachers and studetns alongwith the ICT equipmet so that it can have a postive impact on teaching learning settings, that is classrooms. There was another study by Bughio, Abro, Rashdi (2014) indicated the positive link between training to use of ICT equipment the students' academic competency and performance. Hassan & Sajid (2013) found that students were postively inclinced towards ICT and considered it an important part of quality teaching and learning environment. However, successful integration of ICT is still a matter of debate because of digital divide among students and teachers and difference of perceptions among each.

Methodology and methods

This study used the survey research design. Two different survey questionnaires were designed for two groups of research participants, that is, teachers and students with the intention of mapping their ICT usage in their daily lives and in their academic settings. The survey questionnaire comprised of three sections: (1) Non-academic usage, (2) academic usage, (3) beliefs about ICT usage in academic settings. The data was collected from four schools, two from Punjab province and two from Sindh province. The secondary schools approached to participate in this research have at

least 1000 students and teachers also agreed to participate in this research project. The teachers selected for this study were from the secondary section of the school, that is, they were teaching to classes 7, 8, 9, 10 and 11, both matric and Cambridge classes.

The number of questionnaires distributed amongst students in four schools was 1200 and the researchers received 75% (900) questionnaires back from students. The number of questionnaires found unusable due to incomplete information was 120 and these were dropped from the final data set leaving researchers with 780 questionnaires for final data analysis. The researchers distributed 45 questionnaire amongst teachers and received 40 completed questionnaires. After first analysis, 8 questionnaires were found unusable because they contained incomplete information. These were also dropped from the final data set. The final data set used 32 questionnaires, representing 71% of the distributed questionnaires amongst teachers. The data was analysed using SPSS's 20. The researchers used descriptive statistics to analyze responses received from the participants.

Findings & Discussion

The first purpose of this study was to map out the access and usage ICT devices. The data received from students and teachers showed that 95% of students and teachers have access to ICT devices, such as desktop PCs, laptops, Tablet PCs, iPads, and internet enabled smartphones. The usage of these devices also had many similarities such as to contact others, to search for information, to prepare assigned tasks. There was one difference observed and that using ICT devices for social networking purposes. Students (100%) tended to use ICT devices more for the social networking purposes as compared to their teachers (70%). Teachers spend less time (5-6 hours per week) using ICT devices which include personal and academic use as compared to students who spend three times more than their teachers and mostly for communication purposes using social networking websites.

The second purpose of this study was to identify how students and teachers use it in their classrooms. The former used ICT devices to search information, to plan and prepare their assessment tasks while the latter's use of ICT devices was restricted to classroom teaching, such as finding content that they need to teach, finding activities or worksheets to use in their classrooms. The teachers assigned tasks such as researching a topic and presenting their research in the class and students (100%) used PowerPoint presentations for this purpose. The other usage was administrative work such as keeping students' attendance record and recording and preparing marks sheets. These findings support the findings from the earlier conducted studies by Earle (2002), Zhao and Frank (2003) & McKenzie (2004). This study also found incongruence between the responses of students and teachers. On the one hard students said that their teacher provided no opportunity to them to use technology in classroom and they themselves use it very rarely, most of the teachers, on the other hand, provided an account of using technology in classroom very frequently for instructional, evaluative, communicative and organizational purposes.

The third focus of this research project was to identify the gaps between teachers' use of ICT and whether students' idea of ICT use in classroom matched with this. The students believed that their teachers did not use ICT as a collaborative learning tool and did not focus on the application aspects of the content taught in the classroom and

many students (70%) felt that teachers' use of ICT in classrooms was restricted to PowerPoint presentations in the classroom. The teachers felt that they were integrating ICT in their classrooms but students found their teachers' usage of ICT in the classroom teaching and assessment as insufficient. They wanted their teachers to move beyond finding information and reading them and present the information in PowerPoint presentations and include collaborative learning and design project based assessment tasks. The students felt that their teachers lacked ICT knowledge and skills and should integrate ICT more in their teaching and assessment activities because the present usage pattern provide very little opportunities to use technological tools in their classroom learning.

The fourth focus was of this research project was to identify obstacles faced by teachers in their school settings while planning and executing ICT integration in the classrooms. The responses of teachers showed that they struggle to use ICT in classrooms because of their poor skill of using ICT as a teaching tool. The schools approached for this study did not have an ICT progarmme to support teachers to use ICT in their classrooms and to provide training to teachers if they lacked knowledge and skills in this area. The teachers who participated in this research believed that ICT is a useful tool and they need to use it creatively and more in their classroom teaching as it helped students in enhancing their academic performance. The finding that schools do not have an ICT policy and a programme is true for all schools, whether public and private and because of lack of such a policy, schools do not have an ICT trained person to support teachers in planning and teaching ICT integrated lessons.

Conclusion

The data showed that both teachers and students used ICT in their everyday lives, for both, the academic and non-academic purposes. Majority of the students and teachers have access to a personal ICT device equipped with internet connectivity and they use it for different purposes from communicating with other too to completing assigned task by their teachers. The study also found both the students and teachers believed that ICT is a very important tool to maximized learning in classrooms but students believed that their teachers' use of ICT was least creative and students wanted their teachers to go beyond PowerPoint presentation and showing videos in the classroom, that is, using ICT to create authentic teaching and learning classroom experiences.

The study also highlighted the need for having ICT programme in schools as teachers felt that to make most of the available ICT devices; they need training and guidelines from schools in the form of an ICT policy. This schools participated in this study did not have clear directions for teachers about what technology to use and this resulted in the procurement process of ICT equipment in schools. The schools will buy ICT equipment without consulting teachers and not knowing whether they can use it or not. The example of this was purchasing electronic board in schools without clearly setting rules about who should use and how this can be used. The lack of ICT programme also resulted in the recruitment policy of schools as they had not hired an ICT trained person to support teachers and students. This finding is also true to all schools in Pakistan, whether state or private schools.

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The Use of MARIE CPU Simulator in the Computer Architecture Course: A Brief Exploratory Study of the Students' Perception Learning

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Abstract
It seems that the combination of teaching practices creates interesting results in several areas of knowledge. The teacher has to always bear in mind that he/she has to present educational contents regarding his discipline always trying to present it an attractive way through new teaching dynamics. The challenge is to not to distance from the curricular content by using a broader educational proposal, intensifying the interaction with the students with the problems related to the professional area with artifacts and tools. Under such circumstances, the computer simulation can be a valuable teaching tool for the necessary contents in the formation of students. Through exploratory research it is possible to exemplify the strategy of using a simulator in the presentation of specific content, in the case presented here the introductory study of the operation of the CPU and data bus in the architecture of a hypothetical processor. The data collection instrument, in relation to the student´s perception of their learning experience interrelating the theoretical part with the simulator seeking to capture a first impact on the use of the simulator. The quantitative and qualitative data present in the questionnaires were processed using IBM SPSS® software. The analysis conducted through descriptive statistics, standard measures of dispersion and percentiles, absolute and relative frequency and Spearman correlation coefficient. The teacher activity in the classroom changes considerably, in the sense of not requiring the various repetitions of the concepts involved that usually occur, requiring an assistance that seeks to facilitate the use of the simulator.

Keywords: cpu simulator, teaching tools, pedagogical practices

Introduction

This study aims to present a strategy for teaching Processors and Assembly Language for students of Computer Science, Information Systems and Technology in Analysis and Systems Development, and the students' perception of learning in the Computer Architecture discipline. Through exploratory research it is possible to exemplify the strategy of using a simulator in the presentation of specific content, in the case presented here the introductory study of the operation of the CPU and data bus in the architecture of a hypothetical processor.

It can be said that the simulation proposed in this study can be used as a support to the communication channel between the teacher and the student (JOCHEMS; VAN MERRIËNBOER; KOPER 2003). Considering as a support a virtual environment with specific format that is used to present and display a content. Thus, the simulation works as a media that communicates its content in one or more ways (NUNES, GAIBLE 2002).

Simulations

Computer simulation environments have the potential to engage students in a learning experience that enables a deep understanding, as opposed to surface learning, which only requires memorization. It can be noted that an active participation and involvement in discussions, student-student or teacher-student, are required to perform a simulation.

Simulation is a form of experiential learning. Simulations consist of teaching scenarios, where the student is placed in a world defined by the teacher. It represents a reality within which students interact. The teacher controls the parameters of this world and uses it to achieve the desired teaching results. Simulations serve as laboratory experiments where the students themselves are the test subjects. They experience the reality of the scenario and gain knowledge from it.

Simulations can be performed in different ways. The main element is the content of its context. Students must make decisions within their context. Success is often determined by the engagement of the participant. The goal is to acquire knowledge and understanding, developing critical thinking.

Purposes of CPU Simulation

The study of the main functions of the Central Processing Unit (CPU) in the disciplines of Computer Architecture and Organization, always poses a challenge to the understanding of students to the extent that it gathers new knowledge combined with a data processing dynamics in the machine level.

Basic Operations and Operation of the Processor

The study of Processors is essential in the disciplines of Computer Architecture and Organization, allowing the understanding of the interrelationship between hardware and software.

One possible strategy for presenting the initial concepts of operation of processors and their programming in machine language is the presentation of a simplified processor as a hypothetical machine (STALLINGS 2013) where it is possible to introduce, with reduced complexity, the concepts regarding the use of basic registers such as: accumulator, program counter, instruction register, in addition to addressing memory access, the use of buses and input and output devices. Therefore, by using this idea of simple processor the Computer Architecture and Organization books intend to introduce concepts that are basic to the understanding of any processor, such as CPU (Central Processing Unit), ALU (Arithmetic Logic Unit) and registers.

The strategy applied in the computer courses where the simulator was used consisted of an analytical presentation of a hypothetical machine with 16-bit instructions, divided into 4-bit operation code and 12-bit address to which each instruction refers. This machine was then studied analytically and the CPU simulator was introduced afterwards to strengthen and deepen the students' knowledge.

MARIE CPU Simulator

The simulator MARIE (**M**achine **A**rchitecture that is **R**eally **I**ntuitive and **E**asy) (NULL, LOBUR 2010) is a graphical learning environment that didactically presents the operation of the architecture of a hypothetical machine. In this environment the students are able to: create and edit programs in Assembly language; assemble source code in machine code; run the machine-code programs developed; and observe and debug their programs using various tools provided within the simulator. The screen of MARIESim environment is shown below in Figure 1:

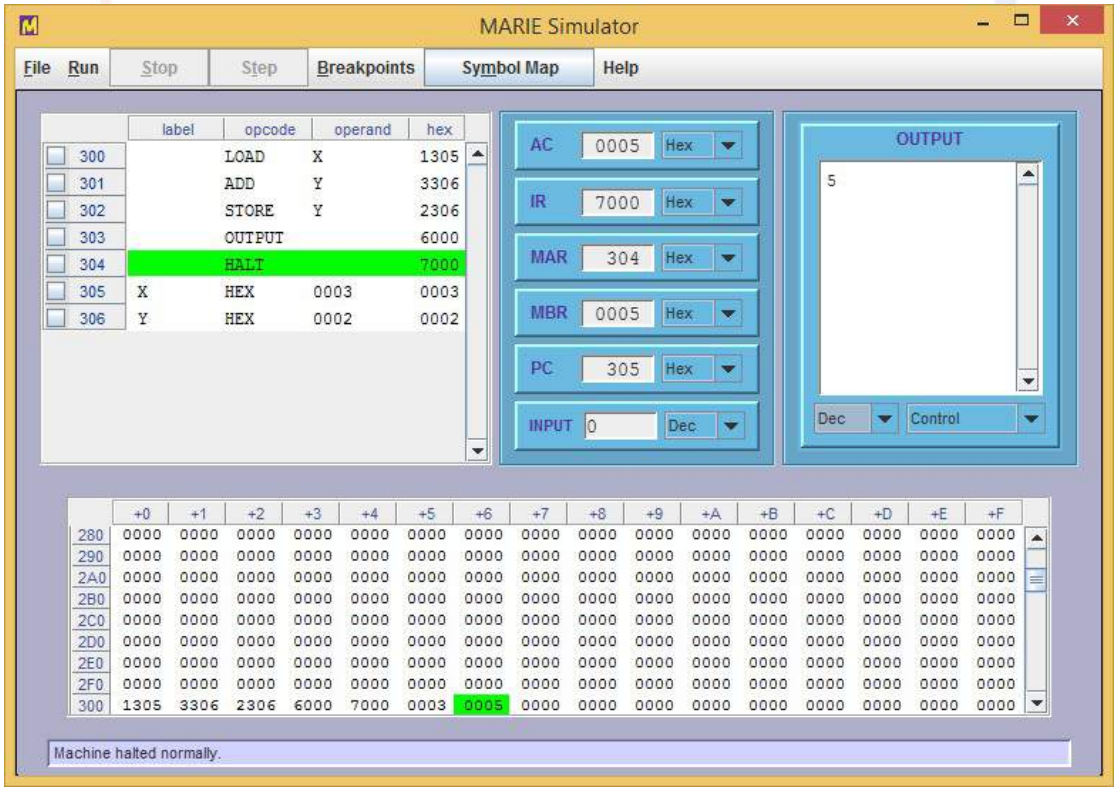

Figure 1: MARIESim Environment Source: NULL; LOBUR 2010

The simulator also offers the option of using the path simulator environment that data roam when the instructions are run by the processor of the hypothetical machine under study, in this case, MARIEDataPath. Figure 2 shows this environment.

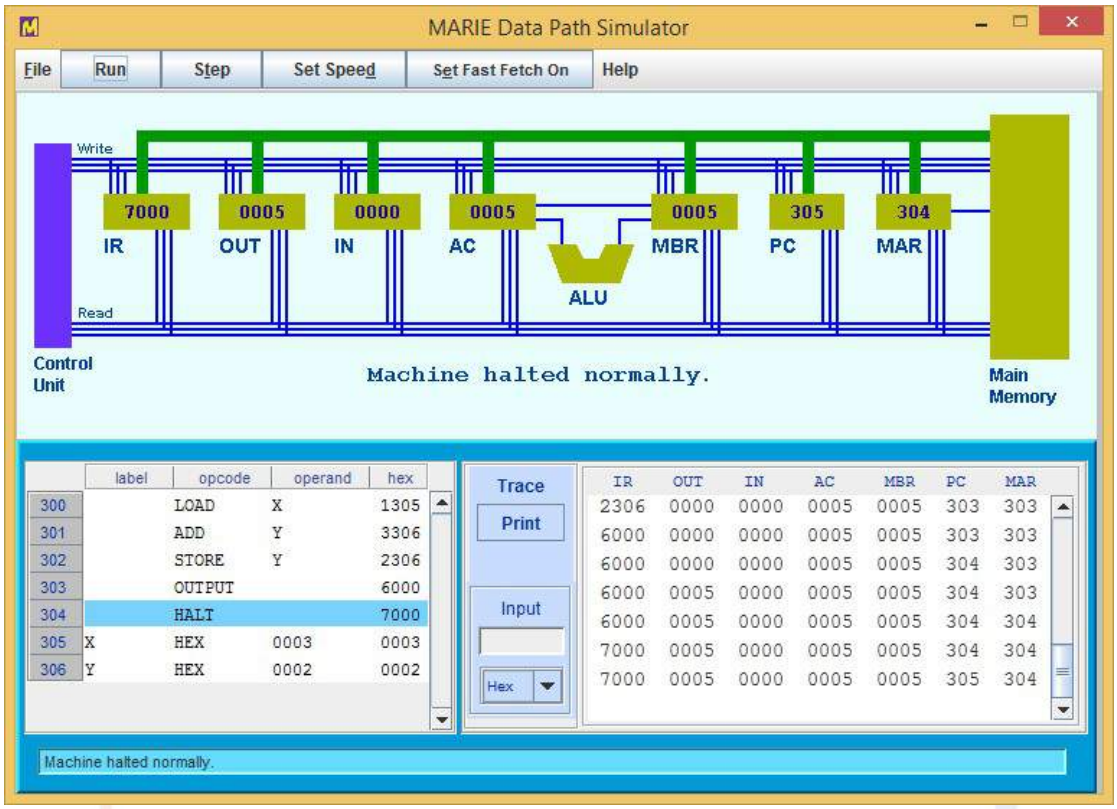

Figure 2: MARIEDataPath environment Source: NULL; LOBUR 2010

Materials and Methods

The methodology used in the survey with the students was based on an exploratory study by accessibility, with quantitative approach regarding the students profile and qualitative regarding the evaluation of their perception of learning with respect to the MARIE CPU Simulator. The sample consisted of thirty one (31) students from Universidade Presbiteriana Mackenzie, in the School of Computing and Information Technology.

The data collection instrument, in relation to the students' perception of their learning experience interrelating the theoretical part with the simulator, was presented to the students at the end of the class, seeking to capture a first impact on the use of the simulator. This instrument consists of a questionnaire with 28 variables (questions).

The variables are divided into four categories (see Table 1), namely: Respondent's profile; 2) Student's perception of overall achievement; 3) Student's perception regarding the ease of understanding of the subject using the simulator; 4) Student's perception regarding the ease of understanding of the internal operation of the processor using MARIE simulator (LABES, 1998 e VIERRA, 2009).

The questionnaire was handled to the students with explanatory instructions, the purpose of the study, the voluntary nature of participation, in addition to ensuring the

anonymity of participants. The quantitative and qualitative data present in the questionnaires were processed using IBM SPSS® software. The analysis of information was conducted through descriptive statistics, using measures of central tendency (mean, median) and the corresponding standard measures of dispersion and percentiles, as well as absolute and relative frequency, which are the only ones presented in this study.

We also used the Spearman correlation coefficient, because unlike the Pearson correlation coefficient, it does not require the assumption that the relationship between the variables is linear, nor does it require that the variables are measured in class interval; it can be used for variables measured at the ordinal level. The Spearman ρ coefficient varies between -1 and 1. The closer to these extremes, the greater the association between the variables. The negative sign of the correlation means that the variables vary in the opposite direction, that is, the highest categories of a variable are associated with the lowest categories of the other variable. (LARSON and FARBER, 2009).

Data Analysis

The research variables are ordinal and divided into four groups according to their purposes, as shown in Table 1.

Table 1 Relationship between the variables of the questionnaire and their functions

Variable or statements	**Purpose of evaluation**
V1 to V4 (gender, age, income and semester)	(1)
V5. I have difficulty with the subject.	(2)
V6. I have failed the same subject.	(2)
V7. I find difficulty in other related subjects.	(2)
V8. It is easy to understand the content of the subject.	(2)
V9. I have no difficulty with mathematical logic.	(2)
V10. The use of MARIE simulator is easy.	(3)
V11. Establishing the relationship with the theory has become easier with the use of MARIE simulator.	(3)
V12. I prefer when the teacher uses the MARIE simulator.	(3)
V13. I prefer when I use the MARIE simulator.	(3)
V14. With MARIE simulator I can understand what happens internally to the device.	(4)
V15. I have failed the subject of Computer Organization.	(2)
V16. I have failed the subject of Computer Architecture.	(2)
V17. This is the easiest subject of the semester.	(2)
V18. The use of MARIE simulator increased my interest in the subject.	(3)
V19. With the simulator I can study other subjects without teacher assistance.	(3)
V20. I prefer to study without the use of MARIE simulator.	(3)
V21. The use of MARIE simulator facilitated the understanding of how the registers work.	(4)
V22. The use of MARIE simulator facilitated the understanding of how	(4)

the main memory works.	
V23. The use of MARIE simulator facilitated the understanding of how the processor works.	(4)
V24. The use of MARIE simulator facilitated the understanding of how registers relate to the main memory.	(4)
V25. The use of MARIE simulator facilitated the understanding of how registers relate to the ALU.	(4)
V26. The use of MARIE simulator facilitated the understanding of how registers relate to the operation of the processor.	(4)
V27. The use of MARIE simulator facilitated the understanding of how the main memory relate to the processor.	(4)
V28. The use of MARIE simulator facilitated the understanding of how the main memory relate to the operation of registers.	(4)

Legend of field Purpose of evaluation:

(1) Respondent's profile
(2) Student's perception of overall achievement;
(3) Student's perception of the ease of understanding of the subject using the simulator;
(4) Student's perception regarding the ease of understanding of the internal operation of the processor using MARIE simulator.

The variables were initially addressed by means of absolute frequency (due to the small size of the sample) of each category, the results of which are shown in Table 2, Table 3 and Table 4 below:

Table 2. Student's Profile

Answer	**V1**	**V2**	**V3**	**V4**
1	2	15	6	0
2	29	14	6	0
3	X	X	4	27
4	X	X	0	3
5	X	X	3	1
6	X	X	2	0
7	X	X	4	0
8	X	X	6	0

V1 scale (gender)
(1) male; (2) female

V2 scale (age group)
(1) 15 to 20 incomplete;
(2) 20 to 25 incomplete;
(3) 25 to 30 incomplete;
(4) 30 to 35 incomplete;
(5) 35 to 40 incomplete;
(6) 40 to 45 incomplete;
(7) 45 or above.

V3 scale (income)

(1) I have no income at the moment; (2) R$ 1,000.00 to R$ 2,500.00;
(3) R$ 2,501.00 to R$ 4,000.00; (4) R$ 4,001.00 to R$ 5,500.00;
(5) R$ 5,501.00 to R$ 7,000.00; (6) R$ 7,001.00 to R$ 8,500.00;
(7) R$ 8,501.00 to R$ 10,000.00; (8) Above R$ 10.000,00

V4 scale (academic semester)

(1) First; (2) Second;
(3) Third; (4) Fourth;
(5) Fifth; (6) Sixth;
(7) Seventh; (8) Eighth

Table 3: Student's perception of overall achievement.

Answer	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
1	4	**23**	5	0	2	5	3	3
2	9	3	10	2	2	7	2	6
3	**14**	1	**12**	**15**	8	**11**	**13**	8
4	0	0	4	14	**16**	3	11	**10**
5	0	4	0	0	3	5	2	4
Total	31	31	31	31	31	31	31	31
Answer	**V13**	**V14**	**V15**	**V16**	**V17**	**V18**	**V19**	**V20**
1	4	3	**27**	**25**	4	3	3	9
2	8	1	0	1	9	7	11	6
3	8	**11**	2	2	**13**	**12**	**13**	9
4	8	10	0	0	4	4	2	4
5	3	6	2	3	1	5	2	3
Total	31	31	31	31	31	31	31	31

V5 to V20 scale

(1) I totally disagree with the statement; (2) I disagree with the statement;
(3) I do not disagree nor agree with the statement; (4) I agree with the statement;
(5) I completely agree with the statement

Table 4: Student's perception regarding the ease of understanding of the relationship of the structures and operation using MARIE simulator.

Answer	**V21**	**V22**	**V23**	**V24**	**V25**	**V26**	**V27**	**V28**
1	2	3	2	1	2	2	1	2
2	2	1	1	2	4	3	5	3
3	**14**	**13**	**14**	**14**	**16**	**14**	**14**	**12**
4	9	10	8	9	5	7	5	7
5	4	4	6	4	4	4	5	6
Total	31	31	31	31	31	31	31	31

V21 to V28 scale

(1) I totally disagree with the statement; (2) I disagree with the statement;
(3) I do not disagree nor agree with the statement; (4) I agree with the statement;
(5) I completely agree with the statement

Table 5 shows the variables V21 to V28, which are specifically related to the learning involving the MARIE simulator, indicating their cumulative relative frequencies.

Table 5: Cumulative relative frequency of variables V21 to V28

Answer	V21	V22	V23	V24	V25	V26	V27	V28
1	6%	10%	6%	3%	6%	6%	3%	6%
2	13%	13%	10%	10%	19%	16%	19%	16%
3	58%	55%	55%	58%	71%	65%	68%	58%
4	87%	87%	81%	87%	87%	87%	84%	81%
5	100%	100%	100%	100%	100%	100%	100%	100%

For the variables related to learning, that is, V5 to V28, we tabulated the values of higher concentration of answers, for each variable and their apparent meaning, Table 6.

Table 6: Apparent meaning of the predominant answers in each variable

Variable	Highest occurrence	Apparent meaning
V5	3	The student has average difficulty with the subject.
	1	The student never failed the Computer Architecture subject.
	3	The student has average difficulty in other correlated subjects.
	3	The student has average understanding of the content of the subject.
	4	The student has great facility with mathematical logic.
	3	The student finds it moderately easy to use MARIE simulator.
	3	The student is able to establish with average facility the relationship between theory and MARIE simulator.
	4	The student prefers it when the teacher uses the MARIE simulator instead of the student itself using it.
	NO	There was no concentration in the answers to this variable, thus not allowing a conclusion as to its meaning;
	3	The student is able to understand with average facility what happens internally to the device using MARIE simulator.
	1	The student never failed the Computer Organization subject.
	1	The student never failed the Computer Architecture subject (internal consistency with V6).
	3	The student has average difficulty in the Computer Architecture subject compared to other disciplines of the semester.
	3	The student believes that using MARIE simulator moderately increased the interest in the Computer Architecture subject.

	3	The student believes that the MARIE simulator does not exempt the aid of the teacher.
	NO	There was no concentration in the answers to this variable, thus not allowing a conclusion as to its meaning;
	3	The student believes that the use of MARIE simulator moderately facilitated the understanding of how registers work.
	3	The student believes that the use of MARIE simulator moderately facilitated the understanding of the main memory work.
	3	The student believes that the use of MARIE simulator moderately facilitated the understanding of how the processor works.
	3	The student believes that the use of MARIE simulator moderately facilitated the understanding of how registers relate to the main memory.
	3	The student believes that the use of MARIE simulator moderately facilitated the understanding of how registers relate to the ALU.
	3	The student believes that the use of MARIE simulator moderately facilitated the understanding of how registers relate to the processor.
	3	The student believes that the use of MARIE simulator moderately facilitated the understanding of how the main memory relate to the processor operation.
	3	The student believes that the use of MARIE simulator moderately facilitated the understanding of how the main memory relate to the registers.

Legend: NO = there was no tendency of concentration in one single answer.

With respect to the Spearman coefficient, two groups of correlation between variables were built. They are as follows:

> Group 1: correlation of variables V1 to V4, versus variables V5 to V28. The purpose of the correlations of this group is to observe if there is a significant correlation between the social profile of the student and the others relating to learning and the use of the simulator. See Table 7.
> Group 2: correlation of variables V5 to V9 (previous student performance), versus variables V10 to V28 (use of simulator). The purpose of the correlations of this group is to observe whether there is a significant correlation between the previous student performance and the others relating to the use of the simulator. See Table 8.

Below we present Tables 7 and 8, with the Spearman coefficient corresponding to each correlation.

Table 7: Spearman coefficient of the correlations of Group 1 variables

Group 1	V1	V2	V3	V4
V5	**0.141**	-0.105	0.053	-0.049
V6	0.096	**0.364**	-0.104	0.045
V7	0.000	-0.129	-0.257	**0.128**
V8	-0.198	0.157	-0.110	**0.218**
V9	-0.240	0.109	**0.127**	0.075
V10	-0.304	0.116	**0.224**	0.110
V11	-0.125	0.061	0.154	**0.216**
V12	-0.045	-0.046	**-0.037**	-0.063
V13	-0.317	-0.010	-0.074	**0.081**
V14	**0.100**	-0.302	0.093	-0.053
V15	-0.101	**0.313**	0.096	0.186
V16	0.149	**0.273**	-0.114	0.061
V17	0.124	**0.165**	-0.034	-0.011
V18	-0.275	0.007	-0.056	**0.293**
V19	-0.328	0.028	**0.033**	-0.037
V20	**0.371**	0.057	-0.256	0.247
V21	0.037	-0.172	**0.172**	-0.079
V22	0.023	-0.147	**0.138**	-0.101
V23	0.000	-0.244	-0.077	**0.191**
V24	-0.031	-0.032	**0.022**	-0.068
V25	-0.078	0.010	**0.167**	-0.229
V26	0.101	0.007	**0.125**	-0.136
V27	0.108	-0.062	**0.205**	-0.321
V28	0.038	-0.014	**0.128**	-0.389

Table 8: Spearman coefficient of the correlations of Group 2 variables

Group 2	V5	V6	V7	V8	V9
V10	-0.533	-0.260	-0.375	**0.376**	0.193
V11	-0.546	-0.361	-0.358	**0.626**	0.427
V12	-0.078	-0.030	-0.069	**0.046**	-0.123
V13	-0.149	-0.329	-0.167	**0.123**	-0.129
V14	-0.171	-0.519	-0.404	**0.183**	-0.131
V15	0.179	**0.403**	0.026	-0.126	-0.128
V16	0.157	**0.885**	0.200	-0.204	-0.149
V17	-0.184	-0. 002	**0.235**	0.177	-0.009
V18	-0.494	-0.428	-0.271	**0.303**	0.237
V19	-0.409	-0.092	-0.150	**0.142**	-0.074
V20	0.294	0.161	**0.322**	-0.031	-0.178
V21	-0.400	-0.141	-0.162	**0.314**	0.230
V22	-0.444	-0.169	-0.188	**0.347**	0.272
V23	-0.353	-0.151	-0.039	**0.511**	0.232
V24	-0.359	-0.078	-0.299	**0.368**	0.347
V25	-0.429	-0.249	-0.343	0.174	**0.320**
V26	-0.244	-0.062	-0.351	0.303	**0.377**
V27	-0.301	-0.144	-0.241	0.241	**0.261**
V28	-0.303	-0.110	-0.291	**0.228**	0.062

Final Considerations

In the course of the class, using the simulator presented, it can be seen that it is possible to provide an appropriate measure of realism to the group of students that would only be possible in an electronics laboratory using mounting boards, integrated circuits and measuring instruments (oscilloscopes, logic analyzers and multimeters).

With these results, it can be inferred, in a qualitative manner yet, that the desired results of teaching and learning have been achieved. Therefore, it is important to allow a continuity of experiments so that quantitative studies can be carried out in order to enable the development of a more in-depth analysis of the impacts that this type of instrument generates in the student learning level.

Thus, for a more objective analysis, it is understood that there should be a statistical follow-up of the classes where the simulation technique is used, compared with others using the conventional method. It would also be important for a quantitative measure of their impact could be obtained.

Regardless of further studies, with the experiments developed it was possible to observe that the techniques applied have caused a significant interest among students, including with regard to the continuity of studies focused on the construction of other circuits in the simulator environment.

It is worth noting also that after the application of the technique, the students have proved to be able to satisfactorily resolve the vast majority of the problems posed in class and on tests.

With the processing of data using descriptive statistics, the following inferences can be made based on Table 5:
The student realizes that the use of Marie simulator facilitated, at least above average, their learning in relation to:

- registers (V21).
- main memory (V22).
- how the processor operates (V23).
- how registers relate to the main memory (V24).
- how registers relate to the ALU (V25).
- how registers relate to the processor (V26).
- how the main memory relates to the operation of the processor (V27)
- how the main memory relates to registers (V28).

With respect to the teacher, it was found that their activity in the classroom changes considerably, in the sense of not requiring the various repetitions of the concepts involved that usually occur, requiring an assistance that seeks to facilitate the use of the simulator, as well as clarify the concepts that eventually are not as clear for some students.

The correlations developed using the Spearman coefficient indicate, in Tables 7 and 8, the following evidence:

a) Group 1 Correlations

- V1 (gender) has no correlation with the other variables from V5 to V28, except V1 in relation to V5; V1 in relation to V14 and V5 in relation to V20 where the highest value for the Spearman coefficient was found for the category.

- In relation to V2 (age group) there is an apparent correlation with V6 and V15, indicating that older students are more prone to failure in the subjects of Computer Architecture and Organization.

- In relation to V3 (income) of failure and other variables from V5 to V28, its influence appears in a number of variables, but without any significant Spearman coefficient except V10 and V27, indicating certain ease of use of Marie simulator as incomes rise.

- In relation to V4 and other variables from V5 to V28, its influence appears in a number of variables, though without any significant Spearman coefficient except for V17 and V20, indicating an improvement in the understanding and interest in the Computer Architecture subject.

a) Group 2 Correlations

- In relation to V5 (difficulty with the subject) and the other variables from V10 to V28, no significant correlations were found, except V20, pointing to a tendency of preference to study without the simulator.

- In relation to V6 (existence of previous failure) and the other variables from V10 to V28, its influence appears in a number of variables, though without any significant Spearman coefficient except for V15 and V16, indicating an improvement in the understanding and interest in the Computer Architecture subject.

- In relation to V7 (difficulty in correlated subjects) and the other variables from V10 to V28, its influence appears in a number of variables, though without any significant Spearman coefficient except for V17 and V20, pointing to the belief that the subject is easy and the students prefer to study without using the Marie simulator.

- In relation to V8 (facility to understand the contents of the subject) and the other variables from V10 to V28, its influence is strong in a number of variables, with the highest concentration in relation to Spearman, in V11 and V23, pointing to the belief that the subject is easy and the students prefer to study without using the Marie simulator.
- In relation to V9 (having no difficulty in mathematical logic) and the other variables V10 to V28, its influence appears in a number of variables, but without any significant Spearman coefficient except V25, V26 and V27, pointing to the belief that the Marie simulator improved learning and understanding, the interoperation of the structures of a virtual processor.

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Augmented reality in primary science classroom

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Abstract
Teaching science in 1st grade students is a great experience, we both try to transfer science contents and also integrate some essential skill for using in class; writing and reading. Implementing Augmented Reality (AR) in science class is a lot of benefits, one important thing is making learners' experience more engaging. Two modules on living or nonliving things and ecosystem had been developed in our science AR classroom. The alphabet cards were used to be the tangible interactions by spelling the name of living or nonliving things and combine some to create their own ecosystem. Experiments were performed with local primary schools. Results suggest that AR is effective in maintaining high levels of motivation among children, and also has a positive impact on the students' writing, reading and science learning experience.

Keywords: Augmented reality, Tangible interfaces, Collaborative learning

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Introduction

Teaching science in ealry primary school is one of the challenge work because we should let them understand the science content and let them read and write the science content that they have learn in the right way also. The new digital landscape in Thailand which is influencing and challenging conventional delivery modes in education. Augmented Reality (AR), is a live direct or indirect, view of a physical, real world environment by using computer generated sensory input such as sound, video, graphics or GPS data. Which is one of the newest technologies explored in edutainment, making learners' experience more "engaging".

Figure 1: Students can explore the meaning of the word by using AR application.

Objectives

To find out the result of learning after using AR primary science classroom in the content of organism non-organism and ecosystem.

Participants and course settings

A group of 25 first grade students from Ban Maad School, Ubon Ratchathani, Thailand took part in this study. During the first term of 2015. Chosen by the purposive sampling.

Methodology

Researchers used Quai- Experimental Research which is one group pretest – Posttest Design (figure 2)

O_1	x	O_2

Figure 2: one Group pretest – Posttest Design.

The experiment was in the fist term of year 2015 by starting the 1st week with the test of reading, writing and the content of organism non-organism and ecosystem by dictation, reading one by one with teacher and paper quiz. And start the 2nd – 4th week

with learning science content with AR by using their own tablet to identify the words that they created by spelling the alphabet and vowel cards (figure 3) and finding the word cards which the same meaning of the picture they painted in their ecosystem (figure 4). Then on 5th week we took a test of reading, writing and the content of organism non-organism and ecosystem by dictation, reading one by one with teacher and paper quiz again. Finally we surveyed of the parents' satisfaction feedback which using questionnaire in general questions to find out the motivation of learning in reading, writing and science content after their child learnt with AR, the questions associated with a 5-point Likert scale ranging from 'strongly disagree' to 'strongly agree.

Figure 3: The words that students created by spelling the alphabet and vowel cards.

Figure 4: Students painted their own ecosystem and put the word which the same meaning of the picture they painted.

Research Findings

During the class with AR, researcher found that students had more interested, more concentrate in the content and wanted to learn by using AR by themselves. They were happy and wanted to learn more about content of science with AR also. Our findings are supported by findings of other 3D IVR studies (e. g., Passig & Miler, 2014).

The improvement of writing and reading skill stem from the possibilities embedded within this technology which presents abstract concepts to a concrete, visual, three dimensional experience and directly meaning of the word. when analogies are presented to children by means which they are familiar with and which they think concretely significant; they deal with them successfully (Goswami, 1992; Halford, 1993).

Results

AR is effective in maintaining high levels of motivation among children, and also has a positive impact on the students' writing, reading and science learning experience. Average score of reading skill before they used AR was 4.04 after the AR lesson their average score was 9.08, the average score of writing skill before they used AR was 3.76 after the AR lesson their average score was 9.12 and the average score of the science content before they used AR was 7.98 after the AR lesson their average score was 9.06. The parents' satisfaction feedback was the highest.

Conclusion

Augmented reality is one of the tools that can engage kids to have more interesting in primary science content and reading and writing skill also. AR is effective in maintaining high levels of motivation among children and has a positive impact on the students' learning experience, especially among the weaker students. (Rubina, 2008). Some kids who wrote the general word correctly, tried to make new words after they finish the basic one such as they tried to spell the common name of fish not only write down the word “fish”.

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Development of an Online Cognitive Evaluation System

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Abstract
Undergraduate study is an one basically to our job. If we can choose the best and fit for our behavior, it will be the best to develop highly cognitive skill to prepare for a job in the future too. This research to development of an online cognitive evaluation system for high school students to find out what ability behind them for guide the suitable way to university. Cognitive question items were chosen from 3 fields; 30 items from emotional Intelligence of Daniel Goleman , 30 items from tests of cognitive abilities of Woodcock-Johnson and 30 items from multiple Intelligences of Howard Gardner. The system was made by web application, collecting data by interview using semi-structured technique of a focus group discussion from the 7 experts; 2 computer programmers, 2 evaluation and measurement lecturers, 1 software analysis designers, 1 psychologist and 1 high school teacher. We found that the average of IOC of the system is 0.87

Keywords: Online cognitive evaluation system, Web application

Introduction

Many high school students don't have much time to spend in what they love or what they want to be in the future. When the time that they must go to the university come, some of them can not choose the best field which fit their ability to study. This will be a big problem in their university life even in work life in the future. So if the high students have chance to know their abilities, it will be better for preparing their life with the way that they love.

The online cognitive evaluation system is a norm-referenced measure of cognitive ability based on 3 kind of abilities: emotional Intelligence, cognitive abilities and multiple Intelligences. This system was designed to measure cognitive processing abilities which important to the future of our students and they can access the system easily everywhere and everytime by web application.

Objectives

To develope and find out the IOC of the online cognitive evaluation system.

Participants and course settings

A group of 200 twelve grade students of Ubon Ratchathani, Thailand Chosen by the purposive sampling.

Methodology

Researchers used Appserv that component Apache Web server, PHP Script Language, MySQL DataBase Management System and phpMyAdmin Database Manager to developed the system (figure 1)

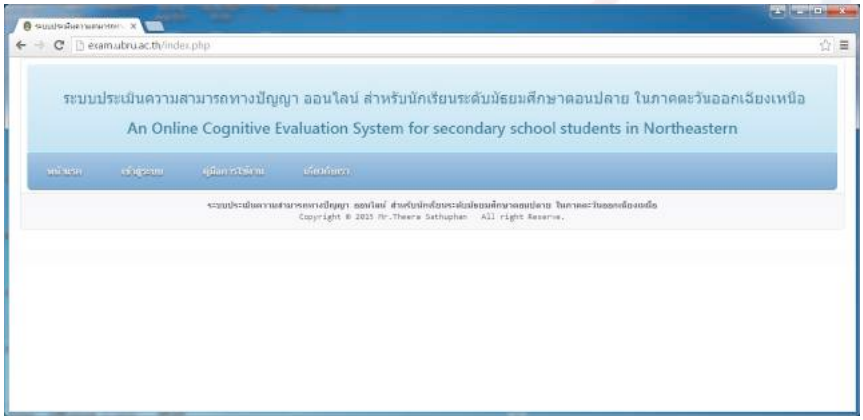

Figure 1 : An Online Cognitive Evaluation System

Researcher used cognitive question items which were chosen from 3 fields; 30 items from emotional Intelligence of Daniel Goleman , 30 items from tests of cognitive abilities of Woodcock-Johnson and 30 items from multiple Intelligences of Howard Gardner (figure 2). And collecting the data of improving the system by interview, using semi-structured technique of a focus group discussion from the 7 experts; 2 computer programmers, 2 evaluation and measurement lecturers, 1 software analysis designers, 1 psychologist and 1 high school teacher.

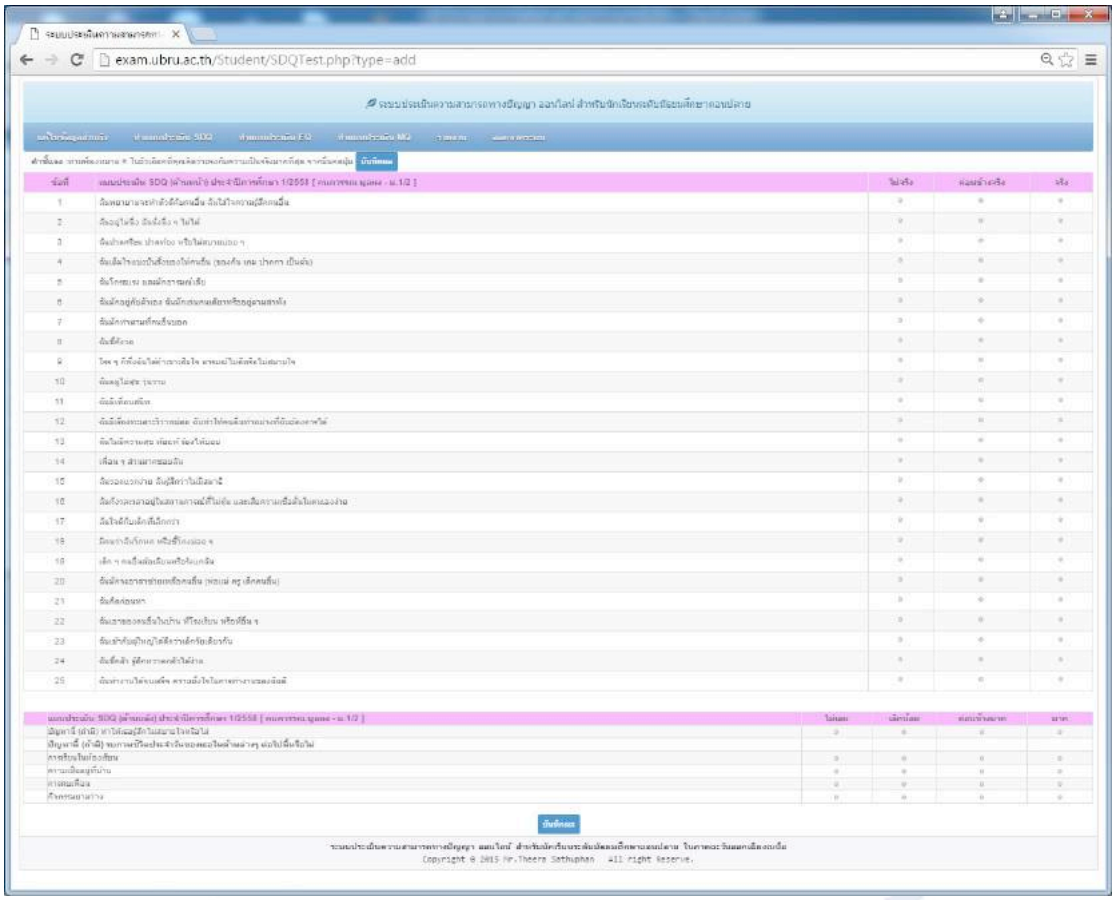

Figure 2 : Emotional Intelligence Questions

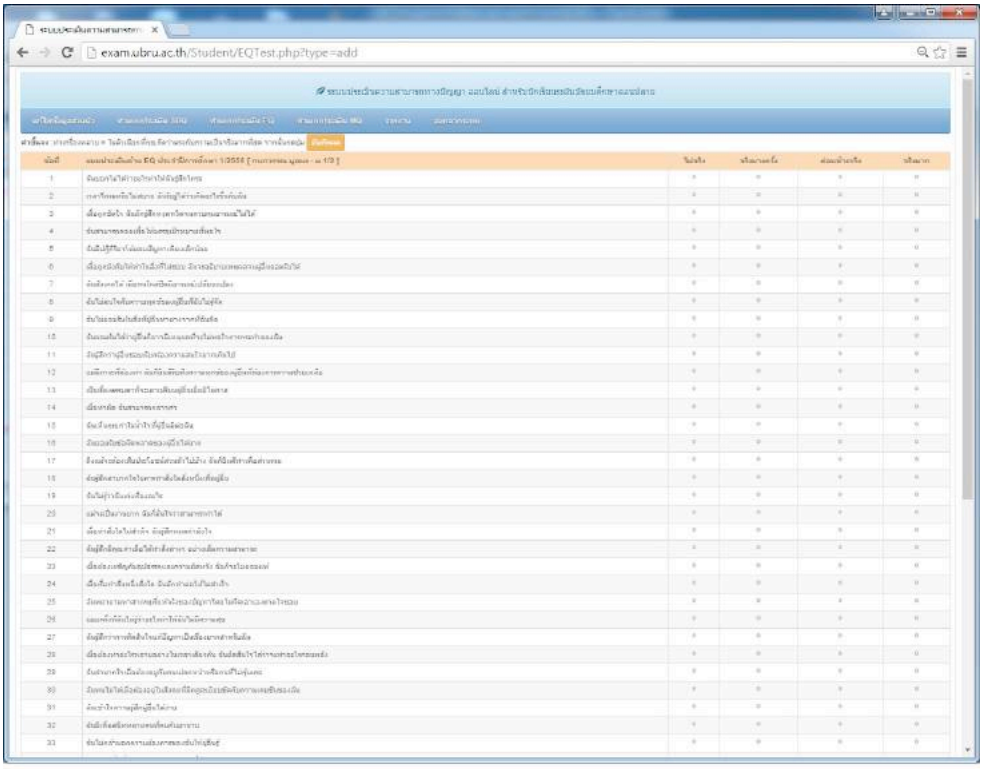

Figure 3 : Cognitive Abilities Questions

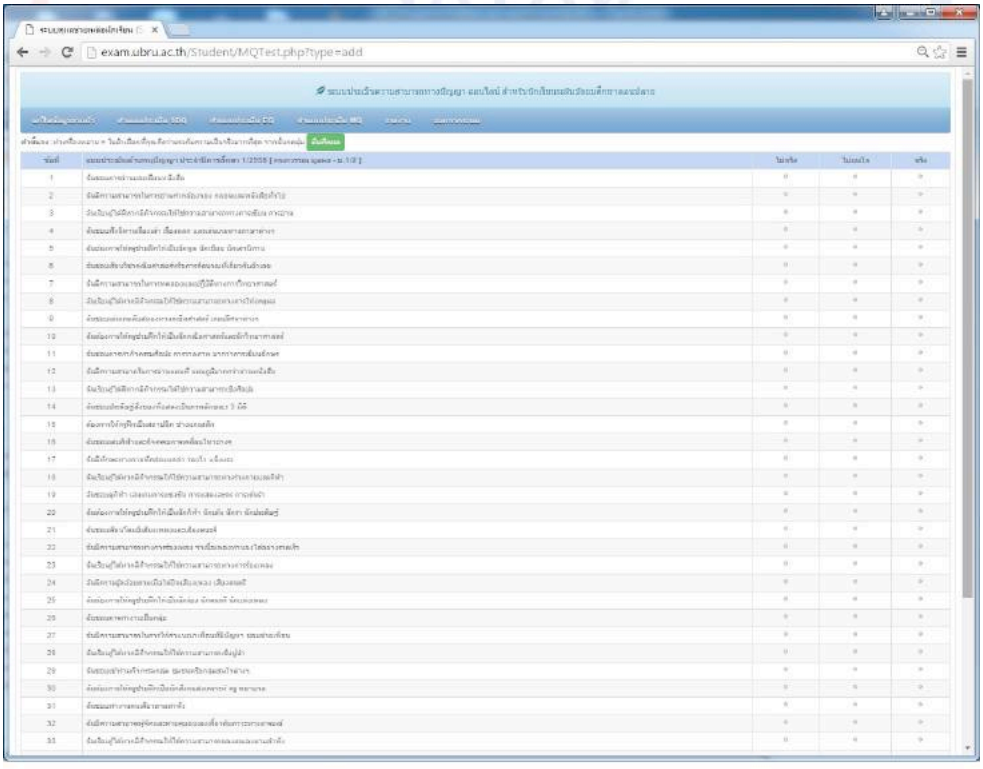

Figure 4 : Multiple Intelligences Questions

Results

After a focus group discussion from the 7 experts we found that the average of IOC of the system is 0.87. Almost all the suggestion from the experts, they want the system get easy to access and have easily interface for using also.

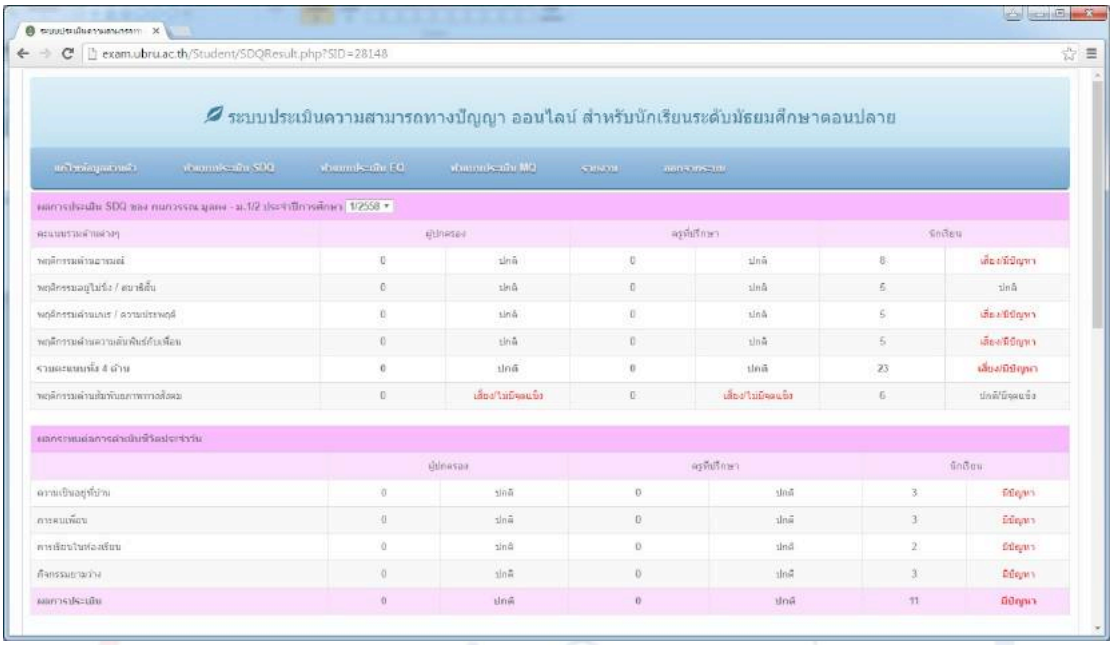

Figure 5 : analysis result of emotional intelligence and cognitive abilities.

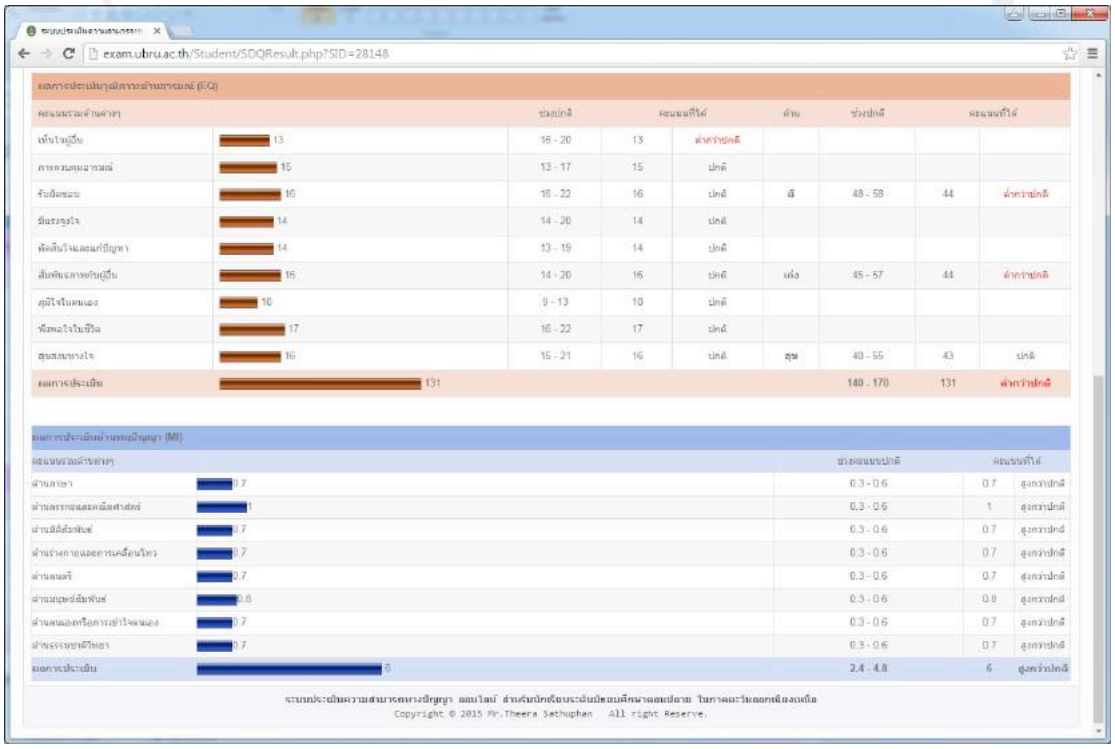

Figure 6 : (continue web page) analysis result multiple intelligence.

Conclusion and Suggestion

The first step to let students know their truly abilities will be the valuable beginning of basic study in university because if students can know what should be the way that they choose go for their future, it will be good to use the most ability that they have. It is suggested that further study choose prepare for non online system also because some area of rural can not access the internet.

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Blogging Revisited: The Unpredictable Learning Journey

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Abstract
Studies have shown that blogging supports active learning which brings in the process of active knowledge construction. This comprises of reflective learning. This paper aims to explore the students' learning journey through reflective blogging. Based on what blogging advocates, 45 students were asked to post their reflection via their blogs. This activity was new to the students. This was their first time blogging. The data collected was qualitative, comprising of students' reflections from the blog, and survey on student's learning experiences using blogs as reflection tool. The implications for the use of blogs as a medium to provide and promote reflection for the students are discussed. On the other hand, data findings have shown unforeseen variables which influenced the instructor strategies in encouraging the students to post and maintaining the purpose of reflection for the students' learning. This was also brought to discussion.

Keywords: blog, reflection, learning design, higher education

Introduction

Baker (2003) describes the learning log as a learning diary, created concurrently with the learning experience, and reporting on the learning content as wells as the process (including time taken, sources used, and so forth).

The term weblog (Barger, 1997), refers to a personal web page, kept by the author in reverse chronological diary form. It is a "log on the web" and a "log of the web". As a log on the web, it is kept first and foremost on the web, either on a static web page, or via a database backed website, enabled through "blogging" software. As a log of the web, it frequently refers to other Internet locations via hyper linking. (Wagner, 2003) In 1999, the web-log was nicknamed the BLOG as it expanded to accommodate diverse users ranging from families to special interest groups and from communities to corporations.

Since then, the definition of web-log continues to expand. Walker's (2003) definition, for example, notes that: A weblog, or blog, is a frequently updated website consisting of dated entries arranged in reverse chronological order so the most recent post appears first. Typically, weblogs are published by individuals and their style is personal and informal. Huffaker & Calvert (2005) described web-log as an online journal which made up of reversed chronological entries infused with text, images or multimedia, blogs embody a place where individual expression and online community development coexist. With nearly 50 million blogging in 2005, this platform for personal expressions has grown immensely (EDUCAUSE Learning Initiative, 2005).

The popularity of blogging among young people has motivated educators to seek methods of adopting and adapting computer-mediated communication tools at the tertiary level (Halic, Lee, Paulus, & Spence, 2010). Furthermore, blogging has been measured and evaluated for its worth in educational environments. Prior research has revealed that blogging offer encouraging advantages for both instructors and students (Abate, Gomes, & Linton, 2011). One of the encouraging benefits is that blogging supports active learning. Active learning brings in the process of active knowledge construction. Active knowledge construction includes reflective learning. As a receptive learning tool, blogging can be used to frame assignments within a theoretical context that encourages students to acquire information and report what they have learned (Glogoff, 2005). According to Richards (2001), the basic tenet of constructivism involves a constructivist scaffolding whereby the students revisit the learning space, build upon prior knowledge, reflect on what they have learned, and drill deeper for more information. Being also known as a knowledge management tool, blogs accommodate the possibility for relatively undifferentiated articles of information passing through an organisation to be contextualized (Williams, and Jacobs, 2004). Thus, learners obtain an overall understanding in a manner that adds value, thus generating 'knowledge' from mere 'information' (Williams, and Jacobs, 2004, Du and Wagner, 2005). In other words, reflection via blogging is crucial in supporting active learning.

Dewey (1933) argued that reflection on individual experience is critical for enhancing learning and for making meaning of the experience. Quinton and Smallbone (2010) presented reflection as a mental process which incorporates critical thought about an experience and demonstrates learning that can be taken forward. Both researchers

further mentioned that a reflective student will practice and demonstrate transferable self-knowledge, based on a questioning approach to themselves, their situation and the roles of others, in order to create a new and different frame of reference. Reflection also allows the student to describe "aha" moments that synthesize knowledge and practice (Karsten, 2012). Furthermore, when students are provided with opportunities to examine and reflect upon their beliefs, philosophies and practices in relation to the contextual conditions of their field, they are more likely to see themselves as active change agents and lifelong learners within their professions (Mezirow, 2006 as cited in Ryan, 2012.)

Prior to these beliefs, this study highlights the students' learning journey through reflective blogging. At the same time, data findings have shown unforeseen variables which influenced the instructor strategies in encouraging the students to post and maintaining the purpose of reflection for the students' learning. This study was the first cycle.

Context

The study on adopting Blogger as a platform for reflection was conducted on a group of 45 students whom were taking the course Pedagogy in Education. When graduate, this batch of degree students are to be teachers in schools. This course conducted twice in a week-2 hours per session. The session ran for 12 weeks. The course was aimed to equip students with pedagogy skills. Before informing the students on their task in the first week, the students were asked if they were familiar with the term blogging and have they blogged. Half of the class heard of the term blogging while all the students have never blogged.

"This is my first experience being a blogger."

"Blogger is a new thing for me, because I never think or plan to have a blog."

"Newbie in the world of blogging."

They were also questioned on whether they have read a reflective post. The answer was negative from each of the 45 students.

"...writing weekly reflection is something new for me because before this, I never had this weekly reflection for other subjects."

The instruction was given on the first week of class. Based on the class situation, the initial outline had to be thoroughly grounded into the students' understanding, to ensure that each student could move towards the same learning outcome. It took two weeks to ensure the students were computerized to the same wavelength on the given task. The first session of the first week involved explaining the reflection assignment. During the second session of the first week, the lecturer would make sure every student set-up their blog and the functions of blogger were also illustrated. The sole reason was due to the fact, students' zero experience of setting up a blog. Zero experience would equate to further complications of not able to complete the steps, and the possibility of unexpected technical problems. These issues should not be

taken lightly as it would be detrimental to students' motivation to start work. One example can be seen from the following excerpts taken from a student's blog post.

"I never liked putting my hands into the world of IT to be honest. It's the most complicated thing for me."

"The entire process of creating our blog (including downloading Windows Live Writer) took approximately 1 and a half hours long!"

During the session, those students who had finished setting up the blog, were instructed to assist their friends who were struggling to put their blog up. The purpose of the action was to expose them on how to teach students with zero knowledge in IT skills. On the other hand, the importance of the session was very clear. Students appreciated the preparation and efforts made for the task.

*"That is why, we are lucky that we are setting up the blogger and as well as installing the windows live writer in class. *smiley* When we face some obstacle such as the windows live writer could not be installed, we could not find the right username, we are not sure whether if our blogger was set up right and so on, we have lecturer and friends there to give us a helping hand to help and guide us."*

On the second week, the lecturer would showed samples of post which were of reflection type, to the students. The samples served as a model for the students to follow. At the same time, the students were reminded of the assignment's grading policy which they needed to fulfill in order to obtain marks for the assignment. A firm enforcement type of motivation was needed the first time in order to give that extra push for the students to move.

A different approach was taken for this assignment. Instead of giving the students the free rein in writing a post in regards to what they have learnt every week, the lecturer provided the question or theme or topic to reflect. All the topics or questions given were related to the items discussed during class. This was done every week until the end of semester. The following were samples of the questions:

- What have you discovered when you are asked to set-up your blog and guide your friends in setting up the blog?
- The best school of taught for teaching your major
- What are the important parts of a lesson plan?
- Based on today's class, identify and explain seven methods for Effective Powerpoint Slide Presentation for teaching and learning.
- What rules would you implement if you were the classroom teacher?

The purpose of this action was to guide the students on what to reflect. Moreover the students were not familiar with the act of blogging nor reflecting. This assistance would grant the students a way to "take control" of the learning process which occurred while blogging a reflective post. One question or topic was given every week for the students to reflect on. The students were given one week-duration to reflect on their learning for that week.

Methodology

The following qualitative method was used to capture students' learning process during their reflection assignment. At the end of the semester, the question –"What form of learning do you experience when writing the weekly reflection" was given to the students via forum in the Moodle platform. The students were to reply via the forum. The replies were then analyzed.

Data Analysis

The "unpredictable" association with authentic learning

The students' replies pointed to an active learning activated during reflection process which was authentic learning.

Authentic learning

The first white paper in Educate Learning Initiatives, 2007 series on authentic learning, "Authentic Learning for the 21st Century", described authentic learning activity: "An authentic learning activity is designed to draw on the existing talents and experiences of students, building their confidence through participation and helping them see the connection between personal aptitude and professional practice." It was further explained that the activity is conformed to the needs of the new "participatory learner," one whose expectations for active, hands-on involvement in learning have been increased by the proliferation of creative chances made accessible through Web 2.0 applications."

According to the analyzed data, students argued that reflecting via blogging was a form of authentic learning. It was interesting to note that the feedback given by the students fit according to the characteristics based on the prior description on authentic learning extracted from the white paper series on authentic learning.

The active and hands-on involvement in learning, according to the students, were translated as expressing what has been learnt in class in a form of reflection. The student described the form of reflection or *so-called products were our experiences and our creativity in writing…."*which are then finally known as *"creation of meaningful blogs"*. One student equate the blog reflections akin to *tangible, useful product which to be shared with the world*. As mentioned earlier, the questions given for their reflection task were guided

"… weekly reflection also let us learn directly from learning experiences in classroom."
-forum reply student 1

"…we tend to relate what we have learn to the real life situation. By writing the weekly reflection, we learn how blend the information into our own perception."
-forum reply student 2

"…the tasks given by the lecturer is always based on the real tasks, or simulated tasks that provide us with opportunities to connect directly with the real world of teaching."
-forum reply student 3

"…I and my friends have the opportunity to express own form of understandings and explain how we applied it in our nature of living, also get the chance to exchange blog posts to grasp the identity of each individual perspectives."
-forum reply student 4

According to the comments given by Student 3, real life tasks, or simulated tasks refer to the guided questions. The guided questions made them reflect based on practical situations for teaching. It was also interesting to note on phrases and terms used in regards to authentic learning such as "*nature of living*" and "*grasp the identity of each individual perspectives*".

A specific narration of practical situation was described by Student 5:

"It is based on whatever we have discussed in the classes that week. Sometimes they are not direct, but our tasks actually require us to really focus in class and learn directly from our environment. For example, when we were assigned to choose a best mock teaching presenter, we had to really remember why he/she was effective and how their teaching style affected the class and especially how we personally felt about the lesson. This kind of personal experience becomes more meaningful and is remembered better because we can relate to it and apply it to our own teaching style. This is a form of authentic learning."
-forum reply student 5

What was narrated by Student 4 reflected the same argument made by Donovan, Bransford, & Pellegrino (1999). The team mentioned that authentic learning "allowed students to explore, discuss, and meaningfully construct concepts and relationships in contexts that involve real-world problems and projects that are relevant to the learner."

In other words, despite being new in the world of blogging and reflecting, the students were able to identify the relevance of the task in assisting their learning process. Moreover, the students were also able to pair it with the appropriate pedagogical method-authentic learning. Besides that, it is also a clear illustration that reflection via blog platform provided an open space for meaningful engagement. This further demonstrates that reflection via blog is extremely valuable to support learning in an authentic context.

The "unpredictable" association with other items

There were other "unpredictable" association which the students brought up.

1. Brainstorm

This teaching and learning technique encourages the students to go through a process whereby the students are to generate ideas, let their creative juices flow, and solve problem. A techniques which can be individually managed, it is applied to a variety of activities such as case study writing, and mind maps.

"…allows them to brainstorm the things they have learned during the class hours by somehow allowing the learners to actually relate their knowledge or understanding into the reflections"
-forum reply student 6

Student 6 believed that reflection was not the end of learning. Reflection via blogging granted the student to write down new ideas or modify received information into a different level of knowledge. The continuous process of "branching new knowledge" of learning was a right condition for brainstorm.

2. Memorization

Memorization is seen as a method of knowing without learning, of answering without understanding. Lately, memorization has garnered a hike of defenders. They argued that memorization keeps the brain running and even fuels deep insights. Unfortunately, this might not happen if one goes the same path as Student 7, sitting by a desk and taking down notes.

Student 7 consider memorization was more than just taking notes and engraved in the brain. This flat situation of regurgitating the notes was indeed sufficient to drown the student's method of studying. On account of that, the student felt reflection gave "strength" to memorize the topics "effectively".

"By just sitting at a desk, taking notes and regurgitating curriculum content, I won't be getting 100% absorption of the information to the brain, but by doing this weekly reflections it gives me the strength to memorize more effectively all those topics I studied for the particular week."
-forum reply student 7

It was enlightening to note that reflecting via blogging enable Student 7 to bravely "memorize" all the topics for the subject.

3. Observation

It was unexpected to come across this item from the student reply. For this reason, it was noted such occurrence could be due to the question given for reflection. The guided questions (though it was given after the class) force the students to be alert and not to miss out anything. Of course, the habit was further enforced by the grades

which they needed to collect. This silent happened technique would train the students on observation skill, a much needed for one for the teaching profession.

"... I learnt in how to evaluate and observe the lectures every class. Because we need to write the daily reflection, so that we need to really observed what happened in the class. Of we are not attending the class it very hard for us to write the reflection."
-forum reply student 8

Conclusion

"*I also managed to learn the way of the Blog, something I thought as something easy, but didn't expect how hard it would be.*"
-forum reply student 10

Despite the hardship and struggle which the students had to face when completing their reflection via blogging, the unexpected learning compensates for it. The feedback from Student 11 and Student 12 furnished the overall learning experience from reflection via blogging.

"...writing blog posts throughout our course as part of learning has been an effective approach to assess students in terms of understanding, ability to translate learning into writing and be proactive in remembering one week's worth of lesson…weekly blog posts has the ability to bring out the best out of students' cognitive development as it requires students' full effort into translating the lessons into their own terms of understanding."
-forum reply student 11

"If the lecturer gives the topic and tell the answer too for surely I won't have chance to learn by myself. It also help me to remember what happen in class. Always after class I will forget what happen in the class but in pedagogy class I can remember because I'm writing the weekly reflection. Because the lecturer gives the weekly reflection, I recall back and remember back if not I will just forget what happen in the class."
-forum reply student 12

In order for the students to receive a full positive exposure from reflection via blogging, it is suggested to provide the questions for their entries. Besides acting as guide in fulfilling the learning objectives of the course, the students may not need to waste their time thinking what to write. On the hindsight, this statement would only worked to certain situations and students. Therefore, the lecturer needs to identify the type of students he/she is teaching at the beginning of the semester. Another suggestion would be only to provide the questions for the first three weeks of the course. Decide the need of giving guided questions after analyzing the content of the entries.

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SCORM Content: Technological and Educational Tool Mediator in the Teaching and Learning of Physics

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Abstract
This research shows the results of several experiences in the physics teaching-learning process, include teaching strategies intervene with the Information and communication Technologies (ICT) in Virtual Learning Environments (VLE), present many conceptions of the Learning Objects and make apparent that are mediator elements in teaching processes in the use of technological tools in the non-presently academic training (e-learning). In the research use the SCORM standard that get a contribution in the academic growth of the student. As fundamentally construct, the intention of the presentation of this integrator elements aren´t show in linear form, in order to preserve own dynamical processes of the implements of this educational tool. In this case has an implementation in the Universidad ECCI – Colombia is in the Physics courses, using a material that refer to the Parabolic Movement, searching in the class the Knowledge Building. Parallel, in the same perspective, actually, the research group works in the constructions of SCORM content with the didactic sequences applied in the Universidad Pedagógica Nacional in physics courses for future teachers, in search of the basics as the movement of any particle. Pretend study the interaction of the senses in the phenomenological construction of the mechanical physics.

Keywords: Learning and teaching processes, Systematic processes, SCORM standard.

Problem

The academic activities that develop autonomously and outside classroom hours, constitute essential to the development of content of course and the own thematic elements of supporting the teaching-learning process, this strengthened dynamics of the work face-to-face in the classroom.

The execution of the decree 1295 of 20 April 2010 forced the Colombian universities to change their curriculum structure by academic credits. The intensity of face-to-face hours has been reduced and distributed in independent work, that should be used for the student requiring autonomy and discipline, the activities suggested by the teacher does not reflect guidelines or recommendations, the teacher considers what is the relevant or not for the personal development for the student, and evaluates the learning or not, these activities has been the subject of debate. As peculiar result, many of the students of Electronics degree of the Universidad Pedagógica Nacional - Colombia (UPN) and students of engineering programs in several areas of the Universidad ECCI - Colombia (UECCI), lacked of formality and study habits which leads to raise even more, the dropout rate programs, given the poor results they get from their academic work.

Therefore, it is important to re-determine the evaluative practice, particularly in academic spaces in which working the teaching of physics, the evaluation process may involve student experiences and contributes to the structuring and generation of self-knowledge. This paper shows the results of applying an alternate assessment designed to independent work hours, seeking to enhance the performance and teaching – learning, through b-learning strategy built in non-face-to-face and face-to-face activities in the course Physics I, whose central theme is the Newtonian mechanics.

Given the current technological tools for interaction with different themes, it is possible to select a strategy, it probably does not become relevant for the group of students that we work, to get a meaningful conceptualization compared to what has been reached in face-to-face activities, notoriously permeated by social, cultural and family context of each of the actors in the system, bearing in mind that is not necessarily accomplish with each educational context.

Thus is considered that in the interaction with the virtual environment a space "comfortable" and "intimate" for the student, where they can develop their ideas without inhibitions such as might occur in the classroom, to have few social skills or other situations which may intimidate, directing the student to a positive emotional state for learning, in this way the hours of individual and autonomous work are provided for the student to interact with the variables that will occur without fear of being judged by their colleagues, consequently an academic exploration as a mean truly free and independent, where the emergence of the dynamic in which is immersed generates a process of meaningful learning in the students and relationships arising from variables is encouraged and between variables that are recreated in the system, they generate a rewarding learning process, maybe it does not arise in the classroom environment and subsequently feedback with teamwork.

It is identified as a problematic the use of a virtual learning environment, compared with real classroom environments, we specify, that the virtual environment is not only a space to put up information, it is understood as an academic space with interactive processes, academic motivations that are related with the context, which should support the student´s interest in using their hours of independent work, focusing on complementary activities that succeed in implementing virtual environments.

Conceptual Aspects

Currently the dynamics of teaching at the school have been change from the different conceptions of it, in this regard is the need to involve relevant tools to strengthen these processes. For it should be focus on aspects such as the material used not only in classrooms, but instead also the students should use to perform their academic activities, giving importance to the many possibilities that now provide the society and media and communication.

Consequently, from autonomous activities can be identified basic elements among which are text, guide, and instructional booklet, orientation guide to learning, simulations, and technological elements. The intention of the developed work is focused on existing activities, improve and carry them to b- learning environments for enhancing cognitive, technological and learning issues.

The cognitive aspects belongs to attention, perception, memory, language and thoughts, considering that attention refers to the targeting mechanism, channeling and filter any of the cognitive processes; perception understood as the ability to interpret and understand the world individually from the stimuli received through the senses, which are affected by the emotional and symbolic interpretation that are handled within the same and different interactions with experience its context and in context; Memory is a process by which it is stored temporarily or permanently information, constructs knowledge and knowledge itself, which was acquired by sensory transducers so that it can be consulted before a need or a stimulus; language is an innate ability that they have to learn a language or a code that is used for individual to communicate, this depends on the perception, interpretation and reaction to the stimulus and finally engages thoughts, process that generates and modify ideas, by induction, deduction and abduction, Funmayor; Villasmil (2008).

From the technological view we must also take into account the different aspects that are addressed, primarily focus on the possible use of ICT mediated by a computer, using platforms that allow content LMS (Learning Management System). Bearing in mind that the interaction with these tools between student and teacher, also emerge various actors of the teaching - learning context that link the university and the student social context.

Thus the virtual education model, integrates tools of synchronous, asynchronous interaction and self-training, offering the possibility and the challenge to the teachers to incorporate them into their model of learning, the students take advantage, its own benefit and enhance their learning mechanisms.

Another purpose by using virtual tools is focused on benefit social learning and collaborative learning, through social software. The purpose of this model is to

contribute to the integral formation of individuals who may have an ethical behavior in virtual and real environments.

Now, considering that the hours of independent work, are a must in the curriculum of different programs covering the non-contact hours of classroom, and a proposal for education by encouraging learner autonomy to enhance cognitive thinking skills, which means, according to Aebli (1998) "learning to learn" and "learn to think" as intrapersonal skills that foster responsibility, commitment and organization of free time.

Pedagogical Requirements

The possibility of implementing this type of strategy overcomes the use of a Virtual Learning Environment, consisting pedagogically from each of the relevant aspects that gives us the pedagogical theory of constructivism as Carretero (1999), however, it must be remembered that in one way or another, when designing proposals that include instructional design, often fall on the theory of behaviorism.

From this point of view, the main idea in designing this Virtual Environment Learning (VEL) is that students perform a construction of their knowledge, not being a true copy of reality, but rather a construct used as a benchmark for the schemes they have built from their context, focusing on the appropriate of the operation of a device by the evident phenomenology functional models of Da-Vinci, Goldberg machines and experimentation in physics by using software.

Learning Strategies

It can be considered from three different points of view, which involve aspects to work on virtual learning environment, which will support the independent work of students.

Introductory and Testing Phase

- Recognition the importance and usefulness by the implementation of a virtual classroom
- Register on the platform
- Introductory Activity: three procedures are performed, one concerning at the participation in a test forum with a theme completely different of the thematic course, downloading a file from platform and uploading the Biography as a PDF file.

Proposal phase

Presentation of Syllabus schematically with proposals activities from each one of the themes, such as workshops, written, presentation of tests online, work with readings and make feedback process, always with the support of collaborative forums.

Interdisciplinary Phase

In this section. It is worked the interdisciplinary that allows physical with an educational proposal within the dynamics of the subject, which is the appropriation of concepts worked (e.g., vectors, kinematics, Newton's laws, and more…) in the course make a rigorous study of functional models of Da-Vinci, Goldberg machines and experimentation using software. Monitoring is performed by the intention to visualize the physical abstractions from the functions of each activity, bearing that the student makes a study of systems from different points of view.

Activities

The activities proposed in this Virtual Environment, are represented as follows,

Context Section

This section has a representative picture of some issues tackled in the course, they will show the objectives of the course, in this case is Physics 1, show to the students a generalized map of the course content and a manual for use and participation in collaborative forums. This section is expected that students will perform a reading of the basic concepts developed during the semester.

Platform Recognition Section

Many of the students have not had the chance to interact with virtual learning environments, of any kind, for this proposed three activities with the intention for recognize and explore the Moodle platform, the activities are downloading a file (Manual forums), participate in a forum of discussion about a topic unrelated to the course, e.g. the wonders of the world that each of the students want to visit and the final activity is to implement the upload of files using the virtual classroom in the exercise of creation of an autobiography. The objective of this section is to ensure that students have contact with the platform and with its future use.

Material Support Section

In this space provided to the students, the material that complements the learning process, e.g. some workshops on mathematics, such as first-order equations, systems of linear equations, reading analysis, among others.

Self-work and Collaborative Work Section

Proposed a forum for general discussion that support processes developed for the classroom work, the students discuss and comment on issues that are of general interest and this are not necessarily linked with the course. Consequently, proposed activities in the course, as materials, workshops and for the corresponding event reserved for each of them can make the final delivery of his work in each of the issues approached.

Cross Curricular Section

In this section the work that the student performs in his independent work hours (IWH), different from that reflected in the reinforcement activities, this is to generate study dynamics with a transversal activities involving relevant aspects worked in the course, using strategies such as "Física del Artefacto - The Physics of the Artifact", simulation of Goldberg machines using the software Algodoo, construction of functional models of Da-Vinci machines, attainment laboratory practices using the Tracker software.

Initially, The Physics of the Artifact is important for the students dedicate their independent work hours to research and go deeply in every involved concept on the artifacts of their everyday use and their operation from the physics perspective. Construction of working models of Da-Vinci machines, showing the evidence of Newton's laws in each situation, design and create Goldberg machines using the simulation software (Algodoo), the intention lies are the dynamics in numerous situations, for example, making changes in the friction between the materials, changing the lengths of displacement, emerging forces in the system and finally demonstrate the relationship between theory and practice by laboratory practices and analysis of the data acquired by processing the video of the phenomenon, using the Tracker software.

Experimental Activity Section

In this section collected the documents that prepared the students from different practices make in the laboratory.

Finally, is very important show that the employee of the ICT in the classroom is a learning tool, and if is approach for the teaching and the student, potentially the academic processes.

Results

Some aspects have reached, through the following results:

The chance of the interaction with the virtual environment, show another way doing activities using ICT, allowing to the students implement numerous strategies for communication and dissemination of problems related to the subjects of the course.

We find that for the first interactions with VEL by some students, do not have any motivation for using it, but with the use of these, they are claiming that the activities are developed through the virtual environment, because they find collaborative spaces where the asynchronous interaction with the other promotes a knowledge building.

From the possibility of using tools that support educational face-to-face processes, it has shown that the use of various multimedia materials captivates the student, as long as the support material is not an element that hinders the possibility of understanding of physics, that aren´t experienced in the theoretical work in the classroom dynamics.

In terms of teaching and learning physics begins an exercise in renunciation of the linear causality, the exercise of these activities emerging physics allows a new way to understand physics more contemporary and systemically, where the equations that are got could be understood as an approximation but not as a definitive law. Physics that is learnt and thought with the aim to be meaningful in life. Taking this into account is considered that physics is developed from the dynamical systems that respond to recent time and not to physics thought a century ago, that kind of physics that perhaps could be different if the minds who created it had had the access to the new tools that we have nowadays, surely the world that was built from physics a century ago. It would change radically dispossess from determinism that delimit the nature. e.g. Like the determinism that evidence lineal differential equations

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Playful Coding: Game-Based Teaching for Programming Courses

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Abstract
In the Information Age, the Learn-to-Code movement in the Computer Science Education starts to go viral around the world in the. And educators start to encourage people learn programming in a early age. But learning programming is difficult for kids because of the abstract concept, which make kids hard to understand and be confused. However, the traditional curriculums of the computer program are adopted the teaching demonstration which ask students to learn by the demonstration teaching step. After the curriculum, Most of students are still not able to create their own programming project or fix the problems they encounter. These results usually make student lose their motivation to keep learning programming. Using Game-Based teaching in programming course can make kids understand the real problem through a situation simulation. And kids will also know the program development process by "playing games". Furthermore, it can inspire kids to learn to imitate and build up their logic thinking that can enhance their problem-solving ability.
The objective of this research is to study how to use games in the "Program the Word" which is a project to teach kids and teenagers programming in Chiayi Dongshi to guild kids to learn the introductory programming in the Game-Based environment. By observing the interactions of instructors and young learners to understand how to create a friendly teaching and learning environment for the programming courses.

Keywords: Game-Based Teaching, Programming Education, Interactive Learning Environment

Introduction

In today's rapidly changing world, people must continually come up with creative solutions to unexpected problems. Collaboration, critical thinking, communication, problem-solving ability, and creative design are the important skills which are outlined by the Partnership for 21st Century Learning, are vital for today's students to survive in tomorrow's job market. According to that more and more countries focus on fostering young students with these skills.

Hartmann, Nievergelt, and Reichert (2001) considered that learning programming is the core competency in the Information Age. The other survey showed that kids can get recognition skills through the program curriculum such as inferential capability, logical thinking, planning, mathematical capability, and problem-solving skills(Maheshwari, 1997). In the United States, the government strongly promotes computer education in recent years. According to ACM Model Curriculum for K-12 Computer Science, the American government advocates kids to learn computer foundational concepts and simple algorithmic thinking. In September 2014, UK government started to introduce coding to the school timetable for every child aged 5-16 years old, they believe that we should start teaching these concepts at a young age to help produce future generations foster these competencies.

But it is difficult for kid to learn coding because of the abstract concept - knowing how to design a solution to a problem, subdivide it into simpler code subcomponents, and conceive hypothetical error situations for testing and finding out mistakes(Esteves, Fonseca, Morgado, & Martins, 2008). In order to let kids easily know the abstract concept and enhance their motivation, educators and researchers try to teach kid with game-based environment. Woodhead (2002) mentioned that games will let children be in a pleasant environment to enjoy the earning. Compared to traditional teaching environment, a game-based learning environment can encourage children to participate with initiative (DeVries, 2002). The game-based learning can let child get knowledge in a relaxed environment, and further strengthen their problem-solving ability and collaborative ability with games (Bruckman, 1998; Whitebread, 1997).In the previous researches had demonstrated that learning programming in context can increase learners' motivation(Savin-Baden, 2003; Savin-Baden & Major, 2004). For example, Board games provide a natural context for introductory data structures and algorithms, as both the layout of the game and the playing style are typically discrete(turn-taking)(Bezakova, Heliotis, & Strout, 2013). It has the potential to use tangible game as educational strategy for kid to learn abstract concept of programming.

We know the benefits of learning programming from a lot of educational researches, technological engineers and SC educators. But if we only teach kid texting syntax and practice the example from textbooks, it might be just a nightmare for young students who already have tremendous pressure academically in this generation. As Papert (1993) believed that the best learning experience for most people comes when they are actively engaged in things which are meaningful to them. According to several studies, they presented the successful result of using game-based strategies for kid to learn programming in the western countries. But are those strategies also suitable for Taiwanese teachers and young students to use or learn? It is a challenge for Taiwanese educators and teachers to build up a good environment and efficient

instructional strategy to inspire our kid to learn. Just like Vicki Davis, a Computer Science Teacher and IT Director at Westwood Schools, said "Coding is something that every person and student can do, they just need the door opened".

"Program the Word" is a project to bring learn-to-code movement to young learner in Taiwan. It is a nonprofit organization and has started to teach kids programming in Chiayi Dongshi since 2013.The project manager, Dr. When Yu, Su, mentioned that "Program the Word" organization is stepping in because our current education model is not making progress fast enough. He thinks that Taiwan must prepare today's youth now in order for them to seize the opportunities of the future and this project will be one of significant starts for Taiwanese Computer Science Education. In order to keep make a massive impact, it is necessary to bring new methods into this environment to make the learning and teaching more and more well. The purpose of this research is to help "Program the Word" keep being a friendly learning and teaching environment by practicing the Game-Based strategy and also establish a set of effective teaching strategy as a reference for future study.

Literature Review

How to create a friendly environment for children to learn programming is an important issue in programming teaching education. There are four sections in this Section 2: programming language for kid, Game-Based learning in programming course and related strategy in teaching programming were discussed. And final section is a summary of this chapter.

Programming Teaching for Kid

Learning to code doesn't just mean kid can become a developer - it strengthens problem solving and logical thinking skills, and is useful for a range of other disciplines, careers and hobbies. The purposes of programming learning are to enhance kid's ability of thinking logic and argument reasoning, using them to save problems around them. Papert (1980) considered that learning programming can let child enhance mind expanding and logic thinking. But most of computer learning courses are out-of-step with today's need, they were not designed to help student develop as creative thinker (Resnick, 2007). The traditional course depends on explaining and demonstrating program examples by teacher, and students follow the steps to practice. The research pointed out that are two shortcomings in this pedagogy: First, many students can only finish the program exercises which they are learning, even students who perform well in the course often can't face the challenge that they encounter in the future. Second, student easily loses their passion without interacting with teacher and peer, specifically the young aged student. According to the researches and surveys, there are summarized two main problems that cause student hard to learn programming:

1. Student's lack of problem solving skill.
There are several reasons that are attributed to the students' poor problem solving ability and an insufficient understanding of different programming control structure. The first one is that students are unable to break a problem down into sub-problems and identify the correct programming structures to these sub-problems (Lahtinen, Ala-Mutka, & Järvinen, 2005). That will make students don't really understand the real

problem statement. The other study revealed that novice spends less time to think about the real problem and busy to start doing programming. That make them easy fail and feel disappointed at final (Bishop-Clark, 1992). The second is that students don't know how to do the meaningful connection with previous experience and knowledge. Perkins and Martin (1986) consider that is attributed to students' "fragile" programming knowledge. The authors describe fragile knowledge in terms of missing knowledge, inert knowledge, misplaced knowledge and conglomerated knowledge. With "fragile" programming knowledge, novice can't appropriately use their knowledge to build up their programming structure. The final one is that novices usually don't know how to express their solution with their own logic structure. Bishop-Clark (1992) found that if novice can't organize knowledge to a structure, they usually can't answer the correct answer.

2. Student's lack of appropriate feedback from educator and peer.
Getting construction and corrective feedback are important in the programming learning. Gomes and Mendes (2007) considered that student get feedback in a instant interaction can reduce students to drop out the course. In the traditional education, students do not have less opportunity to interact with teacher and peer. Resnick (2007) proposed that teachers should support kid to interact and share idea with others when learning new knowledge.

Game-Based Teaching in Programming Course

Many of us have grown up playing games, and in primary education games have a high presence in non-formal and informal segments of our learning. Unfortunately, in formal education, games are still often seen just as an unserious activity, and the potentials of game for learning often stay undiscovered. But in recent years, the researchers considered that there are specific educational domains where game-based learning concepts and approaches have a high learning value in CS education. These domains are interdisciplinary topics where skills such as critical thinking, group communication, debate and decision making are high importance. Garris et al pointed out that using game not only means having fun, it can be as a strategy to elicit the learner's motivation and skill with doing, reflecting, understanding and applying. The authors described how and when learning occurs when learners interact with a game (Figure 1) and believed that is a beneficial way for learners to learn through cycles of a game context (Garris, Ahlers, & Driskell, 2002). Programming is not a single skill but a complex cognitive activity, where a learner must simultaneously build and apply several higher order cognitive (such as abstraction), in order to solve a particular task. The Game-Based environment provides a construction tasks to make the programming more intuitive to learn(Jiau, Chen, & Ssu, 2009). There are also several success examples with using games in the programming course. In the RAPT (Reality and Programming Together) program has studied the use of game as an application to teach traditional computer science concepts in the CS course (Bayliss, 2007). In Lewis & Clark College, researchers used the board game to teach students the topic in traditional programming courses. These results indicated that there were positive and significant impacts of using games in introductory programming.

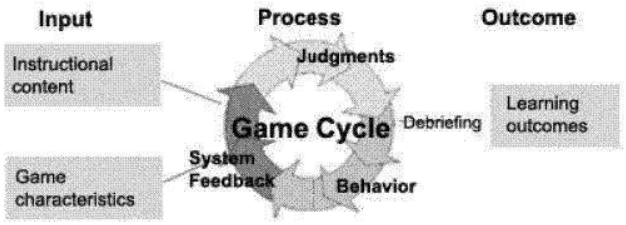

Figure 1: Model of game-based learning by Garris et al (2002)

Potential Problem

Using games in order to support the teaching of traditional outcomes in an introductory course is something that requires a good deal of planning and preparation. Bayliss (2007) mentioned that using games in an introductory course may not be very successful because here are some of the potential problems that may occur when trying to introduce games as an application area into computer science courses. The following things might be potential pitfalls that need to be avoided: "Game technology fails"- When using game with technology, we need test carefully that they can be demoed in the real situation. When these games worked, the students found them to be fun, but when they didn't work they were horrible and detracted from trying to learning how to solve problems through programming; "Not everybody likes games"- Games are easy to bring into assignments on graphical user interfaces due to their visual nature as well as in the study of algorithm through specific game algorithms such as character movement algorithms. But not every type of games would be suitable for students to learn. For example, there are a number of studies that show women are much less likely to enjoy violent (Wilson & Shrock, 2001). It is important for educator to think about the gender when choosing a game; "Games aren't serious"- advocates that support the potential of Game-Based teaching and learning argue that games can positively impact students' learning by providing an intrinsically motivating and engaging learning environment for students in ways that traditional school cannot (Meluso, Zheng, Spires, & Lester, 2012). But other opponents consider that game in the educational system suggests that games are for entertainment that they cannot be used to support student learning. It is important to think how to balance the "play" and 'learning' for assignment when using game to guild students to learn; "Not enough time"- The biggest hurdle to overcome in using games in introductory computer science courses is the amount of work that is involved for those who want to use games while meeting traditional course outcomes throughout the course. How to convey the programming concept to kid with games in a limited time is another point for educator to think about.

Related Usage of Games in Teaching Programming

There are many types of game that are suitable for teaching introductory programming, including computer game, board game(e.g. board, card, dice games), and games that are based on dedicated device(e.g. Lego robot, Cricket). According to Li and Watson (2011), the researchers divided the usage of games into three main categories: "Authoring-Based Approach", "Play-Based Approach" and "Visualization-Based Approach". "Authoring-Based Approach" uses game development as the student's main learning activity. There are two features in this

approach. First, it attempts to decrease the student external cognitive load by graphical and simple learning tool. The learner can gain an understanding of programming concept and create learner's own project further. Second, it focus upon problem solving aspects rather than syntax error. For example, Scratch uses blocked-based language for the young student to create their projects without taxing programming. Ozobot and Dash Robot are the toy robots with exciting coding adventure for kid to learn and they can also use blocked-based language to program their own project. "Play-Based Approach" is to convey knowledge by game playing. This approach used to consists of a series of tasks which are related to special concepts. By completing these missions and watching the strategy executing, learners can gain knowledge of concepts. For example, LightBot is a puzzle game where players must navigate a robot around a grid-based environment illuminating certain ground. Robot Turtle and Littlecodr are the board game to teach kid ages 4 and up about programming fundamentals (e.g if-else). Those games removed the need to type syntax and instead allowed learners to solve game tasks. They focus on underlying concepts and problem solving skills instead of syntax specifics. "Visualization-Based Approach" lies between previous approaches. The approach usually uses micro-worlds for the purpose of concept visualization and to demonstrate code execution in a visual context that there are no story, goal, or learning task to solve. For example, Turtle is the type of this approach. It not allow learners use it to create their own game. It is a tool for learner to see the effect of code execution.

Not all uses of game need to be complex, but it has to be practiced carefully in the classroom. Games are flashy and it is easy to become lost in sometimes. Student might immerse in playing and forgot to study the objectives of programming. Some lecturers think that the game are often perceived as unserious activity, and made the learning objectives would not be reached. All game assignment should directly relate to course outcome. It is important to use games in the correct context when using them as a educational tool and think the question at "what do we want that learners learn". Drake and Sung (2011) listed considerations that can guide the choice for appropriate games:

1. To design a game or to use exiting game.
2. To save class time to explain and get some emotional resonance.
3. The rule of game should be simple.
4. The game should be quick to play. e.g. 5-15minutes.
5. Too many players will be hard to test, two people are the best.
6. The hidden information, such as hands of cards not visible to the other players, should be avoided.

Our Method

This research adopted AR (Action Research) methodology, which can be described as a family of research methodologies that involves an intervention or change on part of the researcher while research occurs. AR is a cyclical process that integrates the processes of planning, acting, observing and reflecting on the results generated from a particular project or body of work(Kemmis, McTaggart, & Retallick, 2004). This choice was made in view of the advantages of AR because it can provides the researcher with a large degree of flexibility to control changes, and help we find the critical problems and the of discovering how to improve the process

Data collection design

There are going to carry out this research model (Figure 2) for a first step to understand a preliminary exploratory experience within a Game-Based learning and teaching context. In this Pre-exploratory process, the researcher was the main instrument of the observation and action. This participanting observation was an attempt to discover the meaning, dynamics and processes involved in the events. The observation will focus on the following these things:

1. How students and teacher interact with each other and with the environment:
2. the game-based classroom activities
3. the use of the types of games and
4. challenges, possibilities of teaching and learning within the game strategy.

Figure 2 A model for collecting the preliminary exploratory data

Participants

Our participants are the teacher from NCKU and primary and junior high students in Chiayi Dongshi. “Program the World” organization cooperates with local Christian church and provide free courses for those kids and teenagers. Each a set of courses context usually be designed by 2-3 teachers and practiced in the classroom. We has different types of student in one classroom: beginners; students with some knowledge of programming (e.g.Scratch); students with relevant experience in programming projects(e.g. Arduino project). There are usually 15-20 students in a classroom. Most of them are male, the female are usually less than male.

Procedure

According previous studies and data collections, we will separate the lesson into different levels with games and strategies that are suitable for teaching the major topics of programming. The students will be divided into different group by their previous experience of programming. Teachers will assist student play these games with others and let them do a simple project for testing. At the beginning, middle and end of the process, There will be some open-ended questions for students to understand the students’ views about the project they had developed and their learning in this environment. The teachers at the end of each session wrote a report with the key points of the each session. All interaction between teachers and students, which will be entirely recorded and saved at each session by video, as a tool to provide context at a later time for identifying the potential problems and next planning

Conclusion

Findings and Future Work

The following were several problem statements of teachers and student after preliminary exploratory. On the teachers’ part:

1. *To adjust to changing circumstance when in the class* –Sometimes, teacher 're going too fast will make students hard to catch up with teachers. Teachers have to adjust teaching schedule to fit students’ needs. But that will make teachers delay course progress.
2. *To keep teaching with enthusiasm* – Teachers have to pay more patients on each student because young students can’t perform well at first. How to make teachers keep teaching when they feel frustrated and exhausted is an important thing to think.
3. *Teachers’ experience transmission*– How to make the senior teacher’s teaching experience delivery to the new teacher is an important thing. That can make new teacher know the teaching environment and students quickly.

On the student’ part:

1. *The language barrier* - Most of students were afraid of the English interface. Some of them even lost the motivation when they can’t understand the English words.
2. *The fragile programming knowledge* – Most of students had already learned

the Scratch which is similar to App inventor, but when they use App inventor to create game. They couldn't bridge up previous experience to fix the problem.

3. *Having a strong dependency on teachers*- Some of students stopped thinking when they encountered the problems and just waited for teachers to come to help them.

In order to let teachers and students can overcome these problem, we will have to change some steps to improve our framework next time. The next work is to save those problems by AR research. We will keep come out different game-based teaching and to establish a system to help teacher and young learners in a friendly teaching and learning environment in programming course in a long-term.

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E-Learning Approach and Logical Mathematical & Spatial Intelligences in Learning Solid Geometry

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Abstract
E-learning is the use of electronic media and information and communication technologies (ICT) in education. It is now an educational approach to effective learning. Learning mathematics like solid mensuration thru electronics means is more effective to students only if they have higher level of logical – spatial intelligences. The purpose of this study is to determine the effectiveness of solid mensuration (or solid geometry) e-learning. The proponents used experimental method to determine the effectiveness of the educational approach of e-learning in relation to logical – spatial intelligences. The results showed that the e-learning method is favorable to students with higher level of logical – spatial intelligences.

Introduction

E-learning is the use of Internet technologies to enhance knowledge and performance (Ruiz, et. al., 2006). There are a lot of studies about e-learning to enhance the academic performance of the students. This relates to learning outcomes.

Web-based technology has noticeably transformed the learning and teaching environment. Proponents of online learning have seen that it can be effective in potentially eliminating barriers while providing increased convenience, flexibility, currency of material, customized learning, and feedback over a traditional face-to-face experience (Hackbarth, 1996). Online learning differs from the face-to-face setting. Online learning mode includes discussion through text only; can be structured, dense, and permanent, while face-to-face mode includes verbal discussion but impermanent.

Student performance is considered multidimensional concept. However, researchers have been interested in differences in performance between the two modes of instruction.

According to Howard Gardner (1991), students possess different kinds of minds and therefore learn, remember, perform, and understand in different ways. The identified intelligences affecting the learning on solid mensuration are logical-mathematical and spatial intelligences. Logical-mathematical intelligence is the ability to effectively use numbers and to reason. Students strong in this intelligence succeed in traditional math and science classes. Learning is enhanced through use of calculators, quantification, classification, critical thinking and problem solving across all subjects. Spatial Intelligence is the capacity to accurately perceive the visual/spatial world and create internal mental images. Useful teaching strategies include giving students opportunities to create visualizations, using color cues on worksheets, chalkboards, drawing and graphic symbols to represent concepts.

The study compares the academic performances between two classes of students in solid mensuration – experimental group and control group. Solid mensuration (also known as solid geometry) is a course is the study of various solids. It is the study of the measure of volume, area, height, length, and many more. This subject is used extensively in the practice of engineering. The knowledge of this subject is a necessity to engineers in any project construction.

The experimental group was subjected to e-learning mode while the control group was only handled under traditional approach – lecture method.

The study was conducted on September 2013. It covers only one chapter on solid mensuration. The experimental group used Moodle open-source learning platform. The teacher developed the learning material for the e-learning mode. Lecture material was also developed for the control group. Pretests and posttests were administered to the two groups.

Objectives of the Study. The main objective of the study is to determine the effectiveness of the solid mensuration e-learning. Specifically, the study aimed: (1) to determine the level of logical and spatial intelligences of the subjects in the

experimental group; (2) to determine the level of logical and spatial intelligences of the subjects in the control group; (3) to determine the mean pretest and posttest scores of the subjects in the experimental group; (4) to determine the mean pretest and posttest scores of the subjects in the control group; (5) to determine the mean gain test scores of the subjects in the experimental group; (6) to determine the mean gain test scores of the subjects in the control group; (7) to determine if there are significant differences on the level of logical and spatial intelligences between experimental and control group; and (8) to determine if there is a significant difference on the mean gain test scores between experimental and control group.

Null Hypotheses. (1) There are no significant differences on the level of logical and spatial intelligences between experimental and control group. (2) There is no significant difference on the mean gain scores between experimental and control groups.

Methodology

Research Design. This study used pretest-posttest experimental research design.

Subjects of the Study. The subjects of the study were the two Math 114E classes (of the School of Engineering & Architecture) under one teacher only. The afternoon class was designated as the experimental group while the evening class was designated as control group. The study was conducted on September 2013.

Research Procedure. The following is the procedure used by the proponents: (1) Administration of multiple intelligence self-evaluation test; (2) Administration of pretests; (3) Learning intervention – e-learning and lecture modes; (4) Administration of the posttests; and (5) Tabulation, analysis and interpretation of data.

Statistical Treatment. The study made use of the *arithmetic means* and *t-test* to analyze and interpret the data collected.

Results and Discussion

Profile of the Subjects. Table 1 shows the profile of the subjects of the study. There were two Math 114E (Solid Mensuration) classes in the School of Engineering & Architecture who took part – one class with 42 students (afternoon class) designated as experimental group and another class with 26 students (evening class) designated as control group.

Table 1. Profile of the Subjects

Group	No. of Students	Percentage
Experimental Group	42	61.76%
Control Group	26	38.24%
Total	**68**	**100.00%**

Level of Logical – Mathematical Intelligence of the Subjects in the Experimental and Control Groups. Table 2 presents the level of logical – mathematical of the experimental and control groups. The mean score of the subjects in the experimental group is 3.61 which means "High." The mean score of the subjects in the control group is 3.82 which means "High."

Table 2. Level of Logical – Mathematical Intelligence of the Subjects

Group	Mean	Description
Experimental Group	3.61	High
Control Group	3.82	High

Level of Spatial Intelligence of the Subjects in the Experimental and Control Groups. Table 3 presents the level of spatial of the experimental and control groups. The mean score of the subjects in the experimental group is 3.21 which means "Fair." The mean score of the subjects in the control group is 3.47 which means "High."

Table 3. Level of Spatial Intelligence of the Subjects

Group	Mean	Description
Experimental Group	3.21	Fair
Control Group	3.47	High

Mean Pretest and Posttest Scores of the Subjects in the Experimental Group. Table 4 presents the mean pretest and posttest scores of the experimental group. Their mean pretest score was 65.95 while their mean posttest score was 71.90. Their mean posttest score was higher than their mean pretest score.

Mean Pretest and Posttest Scores of the Subjects in the Control Group. The mean pretest score of the control group was 67.26 while their mean posttest score was 77.78. Their mean posttest score was higher than their mean pretest score.

Difference on the Pretest Scores between Experimental and Control Group. Table 5 shows that the mean pretest score of the experimental group was 12.98 with a variance of 19.58 while the control group was 13.81 with variance of 20.64. It showed that the experimental group was more homogeneous than the control group. When the pretest scores were tested at 0.05 level of significance and using t-test, it resulted to a t-stat of 0.74 and its t-critical is 2.00. Since the t-stat is lesser than the t-critical, then the null hypothesis is accepted. It means that there is no significant difference on their pretest test scores. It is interpreted that their pretest test scores are equivalent. It is concluded that the experimental and control groups are comparable.

Mean Gain Test Score of the Subjects in the Experimental Group. Table 4 shows the mean gain score of the experimental group. Their mean gain score was 5.95. The result showed a positive numbers which means there is an increase in their performance.

Mean Gain Test Score of the Subjects in the Control Group. The mean gain score of the control group was 10.52. The result showed that there is an increase in the performance since their mean gain score is positive.

Table 4. Mean Pretest, Posttest and Gain Scores of the Subjects

Group	Mean Pretest Scores	Mean Posttest Scores	Mean Gain Scores
Experimental Group	65.95	71.90	5.95
Control Group	67.26	77.78	10.52

Table 5. Significant Difference on Pretest Scores between Experimental and Control Group

Group	Mean Pretest Scores	Variance	t-Stat	t-Critical
Experimental Group	12.98	19.58	0.74	2.00
Control Group	13.81	20.64		

Difference on the Level of Logical – Mathematical Intelligence between Experimental and Control Group. Table 6 shows that the logical – mathematical intelligence mean score of the experimental group was 3.61 with a variance of 0.24 while the control group was 3.82 with variance of 0.20. It showed that control group was more homogeneous than the experimental group. When the mean scores were tested at 0.05 level of significance and using t-test, it resulted to a t-stat of 3.35 and its t-critical is 2.00. Since the t-stat is greater than the t-critical, then the null hypothesis is rejected. It means that there is significant difference on their mean scores. It is interpreted that the logical – mathematical intelligence scores of the control group were higher than the experimental group. It can be concluded that the control group is more logically and mathematically inclined than the experimental group.

Table 6. Significant Difference on Level of Logical – Mathematical Intelligence between Experimental and Control Group

Group	Level of Logical-Mathematical Intelligence	Variance	t-Stat	t-Critical
Experimental Group	3.61	0.24	3.35	2.00
Control Group	3.82	0.20		

Difference on the Level of Spatial Intelligence between Experimental and Control Group. Table 7 shows that the spatial intelligence mean score of the experimental group was 3.21 with a variance of 0.25 while the control group was 3.47 with variance of 0.35. It showed that experimental group was more homogeneous than the control group. When the mean scores were tested at 0.05 level of significance and using t-test, it resulted to a t-stat of 3.75 and its t-critical is 2.00. Since the t-stat is greater than the t-critical, then the null hypothesis is rejected. It means that there is a significant difference on their mean scores. It is interpreted that the spatial intelligence scores of the control group were higher than the experimental group. It

can be concluded that the control group is more visually and spatially leaning than the experimental group.

Table 7. Significant Difference on Level of Spatial Intelligence between Experimental and Control Group

Group	Level of Spatial Intelligence	Variance	t-Stat	t-Critical
Experimental Group	3.21	0.25	3.75	2.00
Control Group	3.47	0.35		

Difference on the Mean Gain Test Scores between Experimental and Control Group. Table 8 shows that the mean gain test score of the experimental group was 5.95 with a variance of 94.92 while the control group was 10.52 with variance of 75.87. It showed that control group was more homogeneous than the experimental group. When the gain test scores were tested at 0.05 level of significance and using t-test, it resulted to a t-stat of 2.03 and its t-critical is 2.00. Since the t-stat is greater than the t-critical, then the null hypothesis is rejected. It means that there is a significant difference on their mean gain test scores. It is interpreted that the mean gain test scores of the control is higher than the experimental group. It can be concluded that traditional learning with lecture method is better than online learning.

Table 8. Significant Difference on the Mean Gain Test Scores

Group	Mean Gain Test Scores	Variance	t-Stat	t-Critical
Experimental Group	5.95	94.92	2.03	2.00
Control Group	10.52	75.87		

Analysis on the E-Learning and Logical – Spatial Intelligences. The study showed that the e-learning approach may not be appropriate to students with low logical – mathematical and spatial intelligences. There is a need to reinforce it with verbal instruction to enhance the online method.

Conclusions and Recommendations

The following conclusions are drawn: (1) The experimental group possesses high level of logical – mathematical intelligence and fair level of spatial intelligence; (2) The control group possesses high level of logical – mathematical and spatial intelligences; (3) The posttest scores of the experimental group are higher that their pretest scores; (4) The posttest scores of the control group are higher that their pretest scores; (5) The experimental group showed improvement in their score performance; (6) The control group showed improvement in their score performance; (7) The control group showed higher level of logical – mathematical and spatial intelligences than the experimental group; and (8) The control group performed better in the test compared to experimental group.

It is respectfully recommended that: (1) E-learning with appropriate intervention can improve students learning; (2) Metacognition be included in online learning studies; and (3) Another study should be conducted in other mathematics and professional engineering subjects.

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Gamification or Game-Based Learning? Designing an Online Writing Course

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Abstract
Good Writing: What and How is an online writing project conceptualized, designed and launched at the Centre for English Communication (CEC), Singapore Management University (SMU) in response to a call from the Ministry of Education (MOE) Singapore. Initially conceptualized as a response to SMU students' feedback on feeling unprepared on writing fundamentals when they enter university, the course will serve as a pre-course primer for SMU students matriculating in 2016.
Academic writing has been taught in universities for over 50 years, relying on conventional *chalk and talk* methods. In conceptualising this project, CEC too, converged towards established definitions of what good writing is, and evidence from research on the fundamentals of writing for academic purposes. However, CEC has diverged from conventional thinking by opting to use gamification. Opting for a divergent pedagogy, i.e. looking at different methods of teaching writing, has raised the following questions for course designers:

1. Online, how do we get the depth of teaching and learning conventionally possible in face-to-face instruction?
2. How do you motivate and engage incoming university students in an online writing course?
3. Which is more appropriate – using gamification or game-based learning?
4. Do you have to be a Subject Matter Expert (SME) as well as an Instructional Designer (ID)?
5. Do you produce the course in-house or engage a vendor?

In confronting these questions, CEC recognises opportunities, challenges and constraints in going online to teach cognitively challenging skills like writing.

Keywords: academic writing, adult-centred online learning, game-based learning

Introduction

To prepare incoming freshmen cope with the rigour of academic writing at the university, the Centre for English Communication (CEC) at the Singapore Management University (SMU) designed a web-based writing course entitled *Good Writing: What and How*. The project was initiated by the Ministry of Education (MOE), Singapore in 2014 as one outcome from a working Committee on ICT-Enabled Learning (CIEL). This project provides an online learning platform both for SMU undergraduates and the public to learn about writing.

The course is designed as a primer on writing fundamentals before students undertake the Programme in Writing and Reasoning (PWR) in their first year at SMU. Since PWR is taken by 85% of first year students annually at SMU, having a strong foundation in writing before the course starts is critical.

Contexts

In Singapore, children enter formal education at the age of 7 and go through six years of compulsory education at the primary (elementary) level (Ministry of Education Singapore website, n.d.). At the end of the sixth year, they sit for a placement test known as the Primary School Leaving Education (PSLE) and enter secondary education for four or five years depending on the students' academic ability. For secondary education, students can go to mainstream schools or specialized schools like the School for Science and Technology, School of the Arts and the Sports School. At the post-secondary level, students have the option of enrolling in more industry-based courses offered by the Institute of Technical Education College and the polytechnics. Alternatively, they can take the route towards pre-university preparation by enrolling in junior colleges or centralized institutes before proceeding to enter university (Ministry of Education Singapore website, n.d.).

The different routes taken by students before they enter university have exposed them to varying rigour of academic writing. As such, it is crucial to ensure that they enter university equipped with basic academic writing skills.

In SMU, all freshmen go through a common curriculum which include Foundation Core, University Core, Asian Studies, Global Studies, Technology Studies, Entrepreneurship Studies, Modes of Thinking and General Education (Singapore Management University, 2016). The Programme in Writing and Reasoning comes under the Foundation Core. It equips students with skills such as critical analysis, synthesis and argumentation for them to write persuasively and convincingly in academic, business and professional settings. These foundational skills ensure that they are applied to other courses while students are at the university. Bearing all these in mind, the writing course needs to take into consideration the profile of the learners.

Learners

Today's learners belong to Generation Y, also known as the millennials. Being millennials, they have traits that are different from their previous generations of Baby Boomers and Generation X especially in the way they think and process information. They have been referred to as 'Digital Natives' (Prensky, 2001) who use the digital

language of computers, video games and the Internet. Howe and Strauss (2003) observed and identified seven core traits of millennials and they are: special, sheltered, confident, team-oriented, conventional, pressured, and achieving.

Millennials are brought up by their parents to feel special and important. As such, they crave for prompt, frequent and constructive feedback about their performance. Having helicopter parents who are ultra-protective and over-involved, millennials lead sheltered lives. Hence, they need to learn to take responsibility for their own learning. Because of their sense of confidence, millennials tend to multi-task and underestimate the time needed to complete a task. As for being team-oriented, millennials learn collaboratively, that is, they like to be in a group but they do not necessarily like working on teams. They are also conventional, that is, they want everyone to get along with each other. Due to over-programming, millennials feel the pressure to succeed and thus expect others to make adjustments in their favour. As for achieving, millennials focus more on their grades rather than personal development.

The above traits have implication on the way millennials learn and these have become the impetus for using gamification in designing a web-based writing course.

In designing a web-based writing course, one consideration is how to incorporate technologies in academic literacies without disrupting the appreciation of the written tasks. Which approach is more effective – using gamification or game-based learning?

Approach

Karl M. Kapp, Professor of Instructional Technology, Bloomsburg University, Bloomsburg, Pennsylvania differentiates games and gamification as follows:

Games refer to "A system in which players engage in an abstract challenge, defined by rules, interactivity, and feedback, that results in a quantifiable outcome often eliciting an emotional reaction" (Kapp, 2012: 280).

Gamification refers to "Game-based mechanics, aesthetics, and game thinking to engage people, motivate action, promote learning, and solve problems" (Kapp, 2012: 280).

Instead of dealing with each definition separately, I would like to focus on the key words, in bold, from both definitions that are relevant in content creation. Collectively, these key words form the basis for gamification. The purpose of creating game-like elements in a non-gaming environment is to engage the learners as they embark on this self-directed learning as a source of motivation to promote learning and problem-solving. As they immerse themselves in the game, rules are needed to govern the play. The games they play involve interaction with the content (not so much interaction with other players as this is a single user game) and feedback is provided for the learners to gain mastery of the game and achieve the goal of playing the game. This can be in terms of the collection of points after each task completion. Simply put, gamification is the use of game design elements and game mechanics in non-game contexts as compared to game-based learning (GBL) which can be described as 'serious play' (Kapp, 2012) or 'playful learning' (Plass *et.al.*, 2015).

In designing the course, the team from CEC used strategies of game design elements to engage learners at different levels – cognitive, affective, behavioural and sociocultural (Plass *et.al.*, 2015) - to provide learners with a virtual experience to acquire writing skills using games. Game-like elements are inherently fun and their inclusion motivates learners to promote learning, engagement and tasks productivity that lead to a desired behavior as opposed to learning more conventionally. Gamification creates a more involved and an active, self-directed learner who are engaged, informed and educated through games. In this case, what is gamified is **the content**, through the addition of game elements, game thinking and game mechanics using digital storytelling. Gamification, as emphasized by Kapp (2012), should not be about badges, points and rewards or about trivialising learning, that is, playing games for its own sake rather than learning through the game.

At CEC, when the team first conceptualized the content, we wanted to use a simulation game. The initial motivation to use game-based learning was driven by our awareness that current learners, being millennials, have grown up playing video games and are familiar with the gaming formats for entertainment. Thus, using game-based learning extends existing familiarity with videos for entertainment to using videos for educational purposes. However, for a writing course which is skills-based, creating content is challenging especially when trying to avoid artificially creating content to incorporate game-based elements. Whether it is game-based or gamification, more importantly, the approach chosen in designing the course content should be based on the learning goals, the learners and the setting. The team is aware that we do not want the online writing course to be a video lecture of PowerPoint slides. We want animation and interaction. Overall, we want learners to have an engaging and immersive multi-sensorial learning experience with meaningful interaction.

Course Design

Course Structure

This stage comprises the course design, design review and concept revision. One of the considerations in the concept design was to ensure that the content did not cannibalise the main course which is the Programme in Writing and Reasoning (PWR). For each unit, the lesson objectives and learning outcomes were outlined before selecting the concepts to be covered. The skills set covered for the online writing course focuses on the following: 1) taking a stand, 2) making a claim, 3) knowing the audience and purpose, 4) organizing texts and 5) writing clearly, coherently and concisely. The skills for PWR cover critiquing, synthesizing and argumentation. The content for the online course covers what learners need to know prior to PWR.

The course designed was reviewed by a team comprising a faculty member from the School of Business, full-time Teaching Consultants at CEC and an adjunct instructor. The blueprint was revised to include the feedback from the review team.

The online writing course consists of five bite-sized units. Learners only need to spend between 10 to 15 minutes for each unit. Each unit comes with a video embedded with a set of tasks. The video makes use of animation and interactivity

which employs gamification. The game elements include feedback on each quiz with a notification of the correctness of the answer, and the number of correct answers in each game. Learners cannot progress to the next activity unless they achieve a minimum score of 80%. Feedback is given on the response to the tasks. At the end of the unit, the total points accumulated from the different tasks are displayed.

Course Development

A completed copy of the blueprint was handed over to the vendor who was responsible for employing its own Subject Matter Expert (SME). Despite having the blueprint, the vendor had difficulty contributing to the creative content and visual appeal for the video production. Each unit went through three cycles of iterations. And each time when the issues were fixed, new issues surfaced that needed to be addressed. It thus became difficult to sign off the completion of each unit.

After working with the vendor for six months, there was very little progress of the project, so its contract was terminated. During that time, a student assistant from the School of Information Systems (SIS) was brought on board to continue work on the remaining units and to rework on the earlier three units produced by the vendor.

The student assistant was a 2nd Year student from the School of Information Systems (SIS) who had completed the Programme in Writing and Reasoning during her freshmen year. She had experimented using the software GoAnimate but had to learn how to use the Articulate Storyline 2 software.

After the five units of *Good Writing: What and How* had been developed, they were piloted to 46 students who were doing PWR in the current term. The pilot allowed information gathering in the following areas: content coverage, presentation of content, timely interactive feedback, visual appeal of the content, appropriateness of the tasks, inoperable functionality (eg. When the right answer was given, the system flagged it as incorrect), browser incompatibility (eg. Would different browsers support the use of flash instead of html5?), and user interface (eg. Would the animation appear childish to SMU students?)

In designing a web-based writing course, some fundamental questions came to mind.

Questions

The questions asked touched on issues related to pedagogy, motivation, approach, expertise and production.

1. Online, how do we get the depth of teaching and learning conventionally possible in face-to-face instruction?
2. How do you motivate and engage incoming university students in an online writing course?
3. Which is more appropriate – using gamification or game-based learning?
4. Do you have to be a Subject Matter Expert (SME) as well as an Instructional Designer (ID)?
5. Do you produce the course in-house or engage a vendor?

Pedagogy

1. Online, how do we get the depth of teaching and learning conventionally possible in face-to-face instruction?

When developing an online course, we took the decision that such short modules could only cover the breath rather than depth. We think that depth will still occur in face-to-face teaching.

Motivation

2. How do you motivate and engage incoming university students in an online writing course?

This is tricky in terms of balancing the content (bite-sized) and the level of activity (interactivity) to motivate and sustain students' interest.

Approach

3. Which is more appropriate – using gamification or game-based learning?

We started off wanting a game-based, simulation, scenario-based learning but ended up using gamification because the nature of the content is skills-based as compared to content-based. We were also mindful of presenting the students with game-like interactive learning experience to ensure that learners are learning through the game instead of just playing the game.

Expertise

4. Do you have to be a Subject Matter Expert (SME) as well as an Instructional Designer (ID)?

We discovered that we needed to be jack of all trades – knowing the content and visualising how the product would look like. However, having a team of audio, video and graphic designers, beside the instructional designer, is the ideal situation, if possible.

Production

5. Do you produce the course in-house or engage a vendor?

It all depends on the team members. This can be done in-house if you have the relevant experts available. However, do not discard the idea of working with student assistant or interns for the project especially if budget is an issue.

The next section discusses the opportunities, constraints and challenges in developing a web-based writing course.

Opportunities

Firstly, working on this project has given the team the opportunity to convert our course materials to online format which is in line with the university-wide initiative towards introducing blended learning among students. It is also one way to prepare for the Emergency Preparedness for Teaching and Learning (EPTL) should there be an outbreak of diseases or environmental situation (eg. haze) which prevent face-to-face instruction. Secondly, this project involves positive opportunities for working with other parties within the university contexts such as the Centre for Teaching Excellence, the Integrated Information and Technology Systems (IITS) department, the Library, Office of Legal and students.

Constraints

The video production for the course is restricted to the use of the following software: GoAnimate and Articulate Storyline 2, the ones that were used by the vendor. To ensure consistency in terms of the look-and-feel of the rest of the units, the same software had to be used. Articulate Storyline 2 is used to create interactivity in the video. However, the types of interaction available are limited to drag-and-drop for matching task, multiple-choice option, and sorting. This software is also heavy in terms of storage that at one point, the personal laptop used by the student assistant crashed and she had to invest in a new laptop. As a result, the units which she was working on had to be redone.

Another constraint is in terms of copyright compliance. The university is covered under the institutional license for the use of print and non-print materials. However, if the course is made available to the public, a separate license and copyright law apply. Copyright clearance is also needed for the use of images and music for the video production.

These constraints added to the challenges the team faced in producing the web-based writing course.

Challenges

The main challenge the team faces is the issue of continuity due to the change of team members because of human resource issues - end of contract, resignation or transfer to another department. The Project Lead is the sole remaining member from the original team. Another challenge is having to deal with an incompetent vendor. After working with the vendor for six months, the team had to make a judgement call to terminate its service due to unsatisfactory standard of deliverables. The vendor was also unable to provide appropriate suggestions in terms of creative content and visual appearance for the project. Furthermore, the level of gamification provided was not appropriate for university-level students.

After producing the course, the team was faced with the issue of browser incompatibility, for instance, Chrome will no longer support flash, a feature that is used in the video. Another aspect is in terms of operable functionality in terms of the machine used to access the course. Apple laptops does not have flash installed in the machines and hence, learners using them will not be able to access the course. One

way to get around this is to convert the video to html5. However, in doing the conversion, some of the properties in the video may be lost. The video needs to be amended or redeveloped.

In terms of course inclusivity, we realized that the course is not able to cater to learners with hearing impairment or those who are visually challenged. For the former, having subtitles may help to a certain extent. As for the latter, heavy dependence on audio will result in having to narrate what is already presented in each video frame.

Moving Forward

A follow-up to this web-based writing course is to have it available in a mobile version as that is the trend in online learning. Another follow-up to this project is to study learners' perception and behavior on adopting the use of technology in academic writing. Other possible areas of study include looking at the effectiveness of course in terms of learners' completion rate and time-on-tasks in comparison to the learning goals.

Conclusion

Producing a web-based writing course has been a challenging endeavor that has resulted in a steep learning curve for the members in the project team. It is not just about converting readily available content from one learning platform (traditional teaching) to another (online teaching). What is at the heart of this course will still be the learning goals that instructors set out for the learners. Most importantly, it is about the learning rather than the platform for learning, and the effectiveness of the learning process. As educators, we will continue to explore for the most effective ways to bring learning to our learners. Technology remains a tool or a driver for learning; it does not replace the learners, the instructors or the learning.

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STIG: A Short Trip Itinerary Generator for Planning Trip- Ratchaburi Province Case Study

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Abstract
In this paper, a trip planning system is presented for planning short trip to the province of Ratchaburi, Thailand. The proposed system, the Short Trip Itinerary Generation, or STIG, provides a flexible trip planning for 1-3 days trip based on user preference and trip related information that can be specified by a tourist and by the system. STIG can work in two modes: Trip Planning Mode and Trip Mode, to generate the trip plan and follow the plan or making real-time adjustment to the plan, respectively. The computation of the distant between two point-of-interests can be carried out by the google mapping functions or by using the pre-stored information to minimize the risk of losing internet connection during the real-time Trip Mode. A location-based trip learning module is also implemented to provide enhanced experience for the tourist. STIG was evaluated by tourists from Bangkok taking short trip vacation to Ratchaburi Province, 95% of the respondents reported opinion that STIG for trip planning is very useful once it is used, and it will become an essential and beneficial tools making trip more fun and enjoyable.

Keywords: location-based learning, location-based trip learning, trip planning, trip itinerary generation, trip planning system.

Introduction

In Thailand, there are 77 provinces. Each province is divided in to a number of cities called Umphurs. Usually, the reference to a tourist attraction is associated with the Umphur, the point-of-interest is located. So, in an Umphur there are a number of tourist attractions. A Thai tourist would plan a short trip by identifying the main attraction in an Umphur that will be visited. He will also visit some other secondary tourist attractions before or after reaching the main destination. The attraction can be either a hotel, a resort, a restaurant, a temple, a natural attraction, or a man-made attraction. As of now, no trip planning tool is available for a Thai tourist visiting another province. In this paper, we will describe a trip planning system, specifically for 1-3 days short trip. The trip from Bangkok to the province of Ratchaburi, Thailand in chosen as the test case. This trip planning system, which will be referred to as STIG (Short Trip Itinerary Generator), will generate the itinerary of the trip automatically based on the information supplied or partially supplied. STIG can handle six types of short trips, with 340 pre-stored POIs, trip support information and location based learning or information related to a POI to provide enhance experience for the tourists [Ph.D. Dissertation].

Previous work

The information technology is used extensively to support the entire value chain of tourism. Among the applications of information technology for tourism, one of the most widely research topics is the trip planning (Katerina Kabassi, 2010, Damianos Gavalas, et al. 2012). In certain city, the tourist can use trip planning software to revise the itinerary and determine the attractions that really match the tourist's interest within allocated time frame and budget.

In general, there are five major approaches to trip planning solutions, namely ontology-based solution, software agent-based solution, computational algorithmic solution, case-based solution, and social media solution.

Ontology is widely used in trip planning work (K. ten Hagen, R. Kramer, M. Hermkes, B. Schumann & Patrick Mueller (2005)Kim and Gil, 2003; Chen et al. 2011; Park, Yoon and Kwon, 2012; Kongthon, Kongyoung, Haruechaiyasak and Palingoon, 2011; Moreno et al. 2013). Lee, Chang and Wang (2009) proposed trip planning to Tainan City in China. Lee employed ontology and multiple software agents to generate the trip plan. SigTur/E-Destination: an Ontology-based personalized recommendation of tourism and leisure activities was proposed by Moreno, Valls, Isern and Borras (2013) for tourists in the Tarragona. The main characteristic of an agent-based solution to trip planning is to have a number of functional software agents working collaboratively to give a tourist the best trip plan. There are a number of research work that utilizes software agent to implement various tasks needed to plan a trip (Sun and Lee 2004; Dickson ,Chiu and Leung, 2005 Castillo et al. (2008), Batat, Moreno, Sanchez, Isern and Vallas (2012)). Usually, software agent approach will combine with other techniques such as ontology. Starting from formulating the trip planning problem as the Orienteering Operation (OP) introduced by Tsiligirides (1984), a graph theoretic–based algorithm is used to find the optimal solutions (Gavalas, Konstantopoulos, Mastakas, Pantziou and Tasoulas, 2012). Vansteenwegen, P., Souffriau, W., and Van Oudheusden, D.,

(2011) provided a comprehensive survey of Orienteering Operation solutions. Case - based reasoning (CBR) is one of the approaches that can be applied to trip planning. The case based repository comprised of the past travel case information will be used for matching with a tourist trip profile so that the best matched - case can be recommended to the tourist. Lenz (1996) was the first to apply CBR technology to this domain in the CABATA system. Ricci and Werthner (2002) proposed a case based querying system for travel planning. Online social media is now very popular as a mechanism to aggregate user generated trip content. The Trip Advisor is the most successful commercial product of this category of trip planning system (http://www.tripadvisor.com/PressCenter-c4- Fact_Sheet.htm, Miguéns, Baggio, and Costa, 2008). Choudhury, Feldman, and Amer-Yahia (2010) described a two-step approach to generate tourist itineraries automatically from photos in the Flickr deposited by tourists.

STIG System Architecture

The trip planning system for short trips planning to a destination province is shown in Figure 1. The system provides two modes of operations: the Trip Planning Mode and the Trip Tracking Mode. In the trip planning mode, the system will take in the inputs and personal preference then it will generate the trip itinerary. Once, the user is on the trip, the Trip Tracking Mode will take in real time information such as actual time to start the trip, time of arrival to a destination, time of day and location, to generate the actual trip plan for the remaining time of the trip. The distant computation between an attraction at location i and another attraction at location j is based on google distant function with attraction-distant tables for each Umphur as a backup in case no internet or 4G connection in that area. The system is also location-sensitive in accessing the POI information structured as e-learning lessons with quizzes in order to provide a enhanced learning experience about the background of each POI. This architecture supports the 6 types of short trips as follows.

Type 1: 1-day trip: start from province K in the morning, back from province R in the evening or late evening.

Type 2: 1-day trip, visit attraction in the morning or afternoon or early evening, then travel to another province.

Type 3: 2-day trip, visiting attractions within the province R, spend 1 night in province R, then return to province K in the evening of the next day.

Type 4: 2-day trip, visiting attractions within the province R, spend 1 night in province R, the next day, the trip party will visit attractions on the way to another province.

Type 5: 3-day trip, spend 2 night in the province R. The first day, the trip party will visit attractions in the province R. On the second day, the trip party can travel within province R or visit attraction in a bordering province, then drive back to spend the night in province R at the same hotel. The next day, the trip party will go back to province K and visit attractions along the route back.

Type 6: 3-day trip, spend 2 nights at two different hotels in province R and return to province K in the third day.

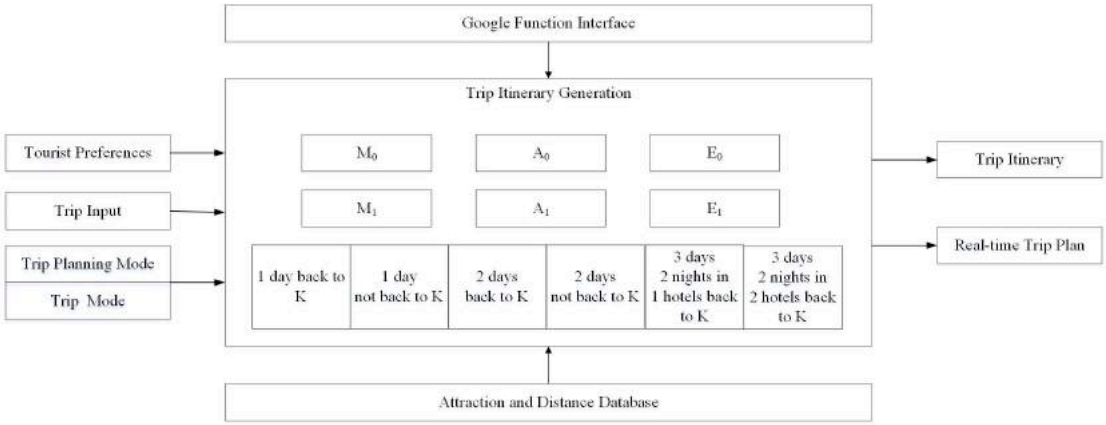

Figure 1. The architecture of the Short Trip Itinerary Generator for a trip from province K to province R.

Information Supports

The proposed trip planning system is intended for a 1-3 days trip planning for tourists from province K, to visit attractions in the destination province, R. The trip planning mechanism is time-driven to produce a workable itinerary and a tourist can use the itinerary as the base information to guide the entire trip with real time simulation and tracking to make any adjustment matching the current situation.

Supporting Database and Routing Information.

The data needed for trip planning consists of a number of tables.

Let n be the number of Umphurs. And p be the number of major attractions in an Umphur.

B2U(n) stores the time to reach the central district (Umphur Muerng) of an Umphur from province K.

U2U(n,n) is the Umphur to Umphur distance matrix of size n by n since there are n Umphurs in the destination province.

UA(n,p) defines n arrays, one for each Umphur, to store the attractions and associated information in each Umphur. The information for each entry comprises the name of the attraction, the location, routing information, and restaurants in the vicinity, shopping center and markets in the vicinity, hospitals or clinics in the vicinity, police stations in the vicinity.

UA2UA(p,p) is the matrix showing the distance between the distinctive attractions and associated information in an Umphur.

UHotel(n,h) is a list of hotels in each Umphur with location information.

UCoffeeShop(n,c) is a list of (h is the number of hotel.) coffee shops (c is the number of coffeeshops) in each Umphur with location information.

URestaurant(n,r) is a list of restaurants (r is the number of restaurant) in each Umphur with location information.

UCarService(n,s) is a list of car service shops (s is the number car service shops) in each Umphur for the major car brands with location information.

Trip Planning Enroute Processing Requirements

The processing from the province, K, to the destination province, R**.**

The distance from City, K to each of the Umphur in R, The data on the road from K to R: gas stations, hospitals, police station, car dealers with service shops, major restaurants, starting time for the trip, time to reach the first destination in the province R.

We need all these data since during a trip, many events can happen, some of which are sufficiently common such as fill in the gas tank, stop by at the hospital due to a sudden illness, go to police station due to an accident, and in some unforeseen reason, the car can have engine problem and need to be fixed at a service shop of that particular brand. In addition, the trip party might need to find a restaurant in order to find something to eat before continuing the trip.

Trip Processing within Destination Province

After reaching the first destination, the trip party will visit attractions in that Umphur and attractions in other Umphurs constrained by the remaining time of the day, and the time to going back to hotel or going back to Province K.

Input.

Main Input: The trip day, and time from city K; The destination; Umphur; R.; The main attractions for this trip; The day and time leaving the destination city R (such as time after the checkout from the hotel, after having breakfast, or lunch or dinner, or after the meeting).

Secondary Input: The stop-over points on the way to the destination R; Lunch or dinner location for each day of the trip; the accommodation.

Personal preference (or group preference): Types of attractions; Types of restaurants; Types of shopping; Walking Street.

The other attractions (other than the main attractions specified): The optional attractions that can be visited after the visiting the main attractions; Additional stop-overs on the way back from the destination R.

Setting and initialization.

Define the number of trip days

Define the types of trip

General conditions of visit: The list of attractions that must be visited on the trip; The list of restaurants that must be patronized; Preference: rank the preference of the type of attractions that can be recommended for the trip: natural, man-made, cultural, temple.

Accommodation selection or by recommendation: Specify the name of the hotel for first night; Specify the name of the hotel for the second night

Specify the major points of stop-over in the trip for the first day: Start time from K (t_1) ; Stop-over time (t_2) ;Time to reach the first destination in the province R (t_3) ;Lunch time (t_4) ;Time to reach the afternoon destination (t_5) ; Time to reach the evening destination (t_6) ; Time to check - in at accommodation (t_7)

Specify the major points in time for the second day trip

Type 1 trip (not applicable).

Type 2 trip: Specify time to check out and the name of the destination province; Time to stop-over while in province R.

Type 3 trip (second day): Time to check out. Time to the first destination of that day; Time to the second destination of that day; Time to lunch; Time to dinner; Time to reach city K using route r_1.

Type 4 trip, same as Type 2.

Type 5 trip, same as Type 2 trip, then followed by Type 3 trip.

Type 6 trip, same as Type 3 trip for the second day trip, except no need to specify the time to reach province K.

Specify the major points in time for the third day trip.

Type 5 trip, same as Type 3 trip for the second day.

Type 6 trip, same as Type 3 trip for the second day; The routes to destination province R and the routes back to the origination province K; The route to R The route to K; Stop over points

Default conditions: Dinner at 19:00 p.m., lunch at 12:30 p.m., start time from province K 8:00a.m.; time back to province K before 23:00 p.m.

Trip Planning Processing Algorithm

The sightseeing can be arranged in three intervals, M_j, A_k and E_l. M_j represents morning sightseeing before 12.00 p.m., A_j represents afternoon sightseeing from 12:00 p.m. to 17:00 p.m., and E_j represents evening sightseeing is from 18:00 to 21:00 p.m. Hence, a tourist can specify if he wants to do sightseeing in what interval for a trip day. Alternatively, the tourists can let the system recommend the attractions for a trip interval. As a result, there are eight possible combinations of making a trip arrangement for each trip day as follows.

Table 1

The eight combinations of a trip day.

M_j	A_k	E_l
j	k	l
0	0	0
0	0	1
0	1	0
0	1	1
1	0	0
1	0	1
1	1	0
1	1	1

For M_j, if j=1, the tourist will specify attractions for sightseeing in the morning, otherwise, for j=0, the system will determine the appropriate attractions for the morning visit.

For A_k, if k=1, the tourist will specify attractions for sightseeing in the afternoon, otherwise, for k=0, the system will determine the appropriate attractions for the afternoon visit.

For E_l, if l=1, the tourist will specify attractions for sightseeing in the evening, otherwise, for l=0, the system will determine the appropriate attractions for the evening visit.

The actual trip depends on t_1, the time leaving from the Province K, and t_3 the time arrival at the first destination specified in the destination province.

Consequently, for the trip planning algorithm, there are 6 trip types, and there are 8 trip interval combinations that need to be processed. Hence, there are 6 by 8 cases that need to be considered in order to generate the trip plan or trip itinerary.

Let u_i = Destination Umphur i, t_a = arrival time at Umphur i, t_{noon} = noon time as defined us time to have lunch.

Let us define the following functions:

DTime(loc_1, u_i) which returns the driving time or walking time from a location , loc_1 to an Umphur attraction, u_i in the destination province.

Attraction(loc_1, t, u_i, loc_j), this function returns the name of the attraction u_i at location loc_j, within the Umphur whose trip time (driving time plus sightseeing time) from loc_1 can be accomplished within t hours. This function accesses UA(n,p)

Restaurant(loc_1,t,u_i,loc_j), this function searches for the name and location of a restaurant at location loc_j within time t from location loc_1. This function accesses UResturant(n,r).

CoffeeShop(loc_1,t,u_i, loc_j), this function searches for the name and location of a coffee shop in Umphur u_i at loc_j within time t from loc_1. This function accesses UCoffeeShop(n,c).

Hotel (loc_1, t, u_i, loc_j), this function searches for the name and location of a hotel at loc_j within t hours of driving time from loc_1).

TripTime(Attraction), it returns the time of driving from the current location to the attraction plus the time visiting the attraction knowing the context of morning, afternoon and evening trip.

Visit(Attraction), this function gives the time spent on an attraction.

Case A for $M_0A_0E_0$

The system will recommend attractions to be visited, the attraction can be any POIs including restaurant, coffee shop, hotel, etc.

Morning trip (M_0)

$t_a = t_1 + DTime(loc, u_i)$

If $t_a < t_{noon}$,
then (check if sufficient time for morning sightseeing)
compute $t = t_{noon} - t_a$
case
case i: If $t \geq 2hr$ then A= attraction (loc_1, 2 hr,u_i, loc_j)
case ii: If $t \geq 1hr$, $\leq 2hrs$ then A= attraction(loc_1, 1 hr, u_i, loc_j)
case iii: If $t \leq 1hr$, then C=CoffeeShop (loc_1,t_{walk}, u_i,loc_j)
end
for case i and ii, $t_a = t_a + TripTime(A)$
R = Restaurant (loc_1, t_{drive}, u_i,loc_j)
$t_a = t_a + t_{drive}$
for case iii, after the coffee break, set t_a = 12.00 p.m. (then Lunch time)
R = Restaurant (loc_1, t_{walk}, u_i,loc_j)
$t_a = t_a + t_{walk}$

If $t_a > t_{noon}$,
then (no time for morning sightseeing, need to have lunch now)

R = Restaurant (loc_1, t_{walk}, u_i,loc_j)
$t_a = t_a + t_{walk}$
$t_a = t_a + t_{lunch}$ (t_{lunch} can be a preset value)
(End morning trip period for M_0)

Afternoon trip (A_0)

This period of trip would lead to the evening period of trip. But in general, the attraction selection can be from any Umphur, constrained only for the time and route to get back to Bangkok or back to the hotel, or on the way to another destination province.

$g_1 = t_{evening} - t_a$

If $1 \leq g_1 \leq 2$ hrs,
then A = attraction(loc_1, 1 hrs,u_i,loc_j)
$t_a = t_a$ + TripTime (A)
If 2 hrs $\leq g_1 \leq 4$ hrs,
then find one or two attractions that soft-align with evening trip destination
A_1 = attraction(loc_1,2 hrs,u_i,loc_j)
A_2 = attraction(loc_1,2 hrs)

If Near(A_1, A_2),
then $t_a = t_a$ + Trip Time(A1)
else $t_a = t_a$ + Trip Time(A_2)
$t_a = t_a$ + Trip Time(A1)+ Trip Time(A_2)

Evening Trip (E_0)

The evening trip mainly finding a restaurant/ for dinner and/ or visit to a night market a walking street.

R = Restaurant(loc_k, t_{drive}, u_i,loc_j)
$t_a = t_a + t_{drive}$

If walking street or night market nearby,
then (visit)
$t_a = t_a + t_{ws}$

Trip back to hotel or Bangkok

If going back to Bangkok,
then $t_a = t_a$ + DTime(loc_j,loc_2)
exit

If spending the night,
then
case1: has hotel reservation , t_{drive} = DTime (loc_k, loc_{hotel})
case 2: no hotel reservation, then H = Hotel(loc_1, t_{drive}, u_i, loc_j)
end

$t_a = t_a + t_{drive}$
exit

If driving to another province,
then $t_a = t_a + DTime(loc_i, loc_7)$

Case B for $M_1A_1E_1$

Now, Let us consider the cases for M_1, A_1, and E_1. For these three cases, there are certain pre-specified attractions that need to be visited.

For M_1

The following conditions are specified:
Condition 1: The attraction to be visited in the morning and A_1 and A_2
Condition 2: Lunch will be at restaurant R on location loc_3

$t_a = t_1$,

If near (A_1,A_2),
then
$t_a = t_1 + Visit\ Time\ (loc_1,A_1)$
$t_a = t_a + Visit\ Time\ (loc_1,A_2)$
else
$ta = t_1 + Visit\ Time\ (loc_1,A_2)$
(A) $t_a = t_a + Visit\ Time\ (loc_1,A_1)$

If only one attraction is specified,
then $t_a = t_1 + Visit\ Time\ (A)$
case i: If $t \geq 2hr$ then A= Attraction (loc2, 2hrs,u_i,locj)
case ii: If $t \geq 1hr$, $\leq 2hrs$ then A= Attraction(loc2, 1hrs,u_i,loc_j)
case iii: If $t \leq 1hr$, then C=CoffeeShop (loc_2,t_{walk},u_i,loc_j)
end

for case i and ii,
$t_a = t_a + TripTime(A)$
$t_{drive} = D\ Time\ (loc_3, R)$
$t_a = t_a + t_{drive}$

for case iii, after the coffee break,
set t_a = 12.00 p.m. (then Lunch time)
$t_{walk} = D\ Time\ (loc_3, R)$
$t_a = t_a + t_{walk}$

If $t_a > t_{noon}$,
then (no time for morning sightseeing, need to have lunch now)
$t_{drive} = D\ Time\ (loc_3, R)$
$t_a = t_a + t_{drive}$
$t_a = t_a + t_{lunch}$ (t_{lunch} can be a preset value)
(End morning trip period for M_1)

For A_1

After the morning trip, for the afternoon trip, after the lunch, the attraction specified for the visit is A_1 at location loc_3 and A_2 at location loc_4

$t_a = t_a + TripTime\ (A)$

Let $g_1 = t_{evening} - t_a$

Near (loc_1,loc_3,loc_4)

If A_1 is near,
Then
$t_a = t_a + Trip\ Time(A_1)$
$t_a = t_a + Trip\ Time(A_2)$
else
$t_a = t_a + Trip\ Time(A_2)$
$t_a = t_a + Trip\ Time(A_1)$

For E_1

Let R be restaurant destination/ for the evening at location loc_7.
$t_a = t_a + D_{Time}(loc_7, R)$
$t_a = t_a + t_{dinner}$
$t_a = t_a + D_{Time}(loc_i, loc_6) + t_{engagement}$
$t_{drive} = D_{Time}(loc_6,loc_7)$
$t_a = t_a + t_{drive} + t_{dinner}$

If walking street or night market near by
then (visit)
$t_a = t_a + t_{ws}$
$t_a = t_a + D\ Time\ (loc_7, R)$
$t_a = t_a + t_{dinner}$

Trip back to hotel or Bangkok

If going back to Bangkok,
then
$t_a = t_a + DTime(loc_7,loc_2)$
exit
If walking street a night market nearby
then (Visit)
$t_a = t_a + t_{visit}$

If spend the night,
then
case i: has hotel reservation , $t_{drive} = DTime\ (loc_k, H)$, H is the hotel
case ii: no hotel reservation, then $H = Hotel(loc_7, t, u_i, loc_j)$
$t_{drive} = D\ Time\ (loc_j,H)$
end

$t_a = t_a + t_{drive}$
exit

The Implementation of Short-trip Itinerary Generation System

Trip planning mode

The STIG system for Short-trip itinerary entails the implementation of 48 trip planning cases related to the 8 combinations of user specified attractions and related information, or the system recommended selections, and the 6 types of short trips as explained in Section III, STIG System Architecture. The STIG system is implemented as a web-based application using PHP language and MySQL database. The system is also interfaced to google mapping functions ("Google Maps APIs," 2016) so as to use the distance and driving time functions. The system will accept the inputs specified by the user, and then produces the itinerary of the trip. An example of the itinerary generated for a 2-day, one night trip is shown in Table 2.

Table 2
A sample of the trip itinerary generated by STIG.

Time	Programs	Remarks
09.00-09.40	Leave from BKK	
09.40-10.10	Porto Chino Shopping Mall	Breakfast 30 min
10.30-12.31	Arrive at Suan Pueng, Ratchaburi	
12.31-12.47	Lunch Location at Krua Ta Nao Si Restaurant	
12.47-13.47	Lunch	1 hr
13.47-14.15	Go to Scenery Resort	
14.15-15.15	Enjoy Scenery Resort	
15.15-15.18	Hot Spring at Boe Klueng	3 min to Hot Spring
15.18-16.18	Enjoy Hot Spring	1 hr
16.18-17.25	Arrive Amphur Mueng	1 h 7 min, 67.4 km
17.25-17.31	Krua Thung Song Restaurant	6 min, 2.1 km
17.31-19.31	Dinner	2 hrs
17.31-19.38	Arrive Western Grand Ratchaburi Hotel	
07.00-08.00	Breakfast at hotel restaurant	1 hr.
08.20-09.00	Depart from Hotel to Damnoen Saduak Floating Market, Damnoen Saduak District, Ratchaburi	40 minutes
09.00-12.00	Shopping at Damnoen Saduak Floating Market	3 hrs.
12.00-13.00	Lunch at Maikaew Damnoen Resort near Floating Market	1 hr.
13.20-15.00	Depart from Maikaew Damnoen Resort via Route 338	1 h 40 min, 97.4 km
15.00	Arrive Bangkok	Trip end

Trip Mode

For the Trip Mode, it is used during the trip to track the trip itinerary. At any point of the trip, if there is an unforeseen event causing the delay, the trip plan can be regenerated to accommodate the actual event [ ]. In this manner, it provides the real-time context aware trip planning capability. Moreover, since STIG is interfaced to google mapping functions, the tourist can easily access google location-based information if the internet is available. In the Trip Mode, the location based learning capability will be activated so that when the trip is near a destination attraction, the background information related to that attraction will be available for the tourist.

Evaluation

So far, in Thailand, there is no trip planning tools available for the public, not even the experimental trip planning system exists. Hence the users will be those with only travel directory and travel-related web content experience. To evaluate the usability and benefits of using STIG for a tourist, we have selected a sample of 80 Bangkokians to use STIG to plan the trip and experiment on the generation of various trip itineraries. Then they actually took the trip during the period from June 2015 to October 2015. After which, they answered the set of questions and a set of Likert-scale assessment. These volunteers will be referred to as respondent in this section.

In the evaluation of STIG, the respondents were 60% taking one-day trip, 30% taking two-day trips and 10% taking 3-day trip (representing long weekenders). Our respondents are predominantly university graduates with good skill in using mobile smart phones and tablets.

Findings

The respondents are 35 % female and 65 % male. Most of them are young adults between 22 and 40 years old. We also collect the annual income, and number of children and adults in the household. 25 % of the respondents reported having children in their household. A total of 20% of the respondents have the children on trip. The major finding as related to using STIG can be summarized as follows.

Most respondents plan the weekend trip in advance (80 %). Almost all of them prefer the itinerary of the trip and only open to minor changes. Only a small percentage (10%) would want to make the trip decision on-the-fly.

All the respondents have taken trip to Ratchaburi before, but only 30% took the trip in the last 12 months.

60% of the respondents prefer a one day trip to Ratchaburi, only 25 % would like to have a two-day and one-night trip.

95% of the respondents reported opinion that STIG for trip planning is very useful once it is used.

All the respondents run multiple simulations for the trips and select the best itinerary that all parties in the trip agree.

Overall, the respondents, after using STIG for trip planning and real-time adjustment of the trip plan feel that the STIG is a trusted tool for trip planning to a province in Thailand.

Compare STIG recommendation to the conventional advice from friends and internet search, the STIG recommends attraction is very acceptable in terms of where to go, how to go, where to eat and shop, where to stay and what activities to do.

Implication and Conclusion

The Short Trip Itinerary Generator, STIG, is an essential tool for planning 1-3 days short trip to a Province in Thailand. A tourist can specified a number of trip related information including the tourist's preference, or let the system make the decision of visiting attractions for the tourist. The tourist can use STIG to run multiple trip scenario, each time producing a trip itinerary, so that the tourist or group of tourists can choose the itinerary they like most. During the trip, the tourist can use STIG to monitor the progress of the trip. Any unexpected event causing the delay to the schedule can be accommodated by regenerating the itinerary that match the current situation. Since STIG interfaces with google mapping function, it derives all the benefits of identifying current position, time to destination, street view, and alternate route. STIG also maintains its own internal attraction data so that trip planning can be done any time with or without internet connection. The location-based e-learning capability is also provide enhanced experience for the tourists to learn about the background of the attractions.

From the evaluation data, most of the people who has used the STIG gave very favorable rating. SO, to deploy STIG for public use, a cloud-based implementation can be carried out so that it can be accessed from any location. Moreover, the model itself can be generalized and extended to cover the trip planning to any province in Thailand and the origination city can be any city. As for extending STIG for the general tourist from oversea, it is interesting to investigate the aspect of trip planning to generate itinerary for a group of tourist to visit multiple cities in a single trip. This future work must also take into consideration of multi-modal aspects of travelling from city to city.

In summary, STIG provide a new approach to trip planning that is realistic and applicable to extend accommodate longer trip for inbound trip from oversea.

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