CREATING AUTHENTIC LEARNING EXPERIENCE USING QR-ULMPS AND CHAT BOT

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ABSTRACT—This study developed a QR-based U-Learning Material Production System (QR-ULMPS) that provides teachers with aneducation tool to motivate college level students enrolled in a liberal arts course. QR-ULMPS was specifically designed to support thedevelopment of u-learning materials and create an engaging context-aware u-learning environment for students. A quasi-experimentalresearch design was used to evaluate the overall effectiveness of QR-ULMPS; the Unified Theory of Acceptance and Use of Technology(UTAUT) assessed the feasibility of using QR-ULMPS to implement teaching activities; while the Instructional Materials Motivation Survey(IMMS) was used to measure the students' learning motivation after using the proposed u-learning system. From the results of the UTAUTquestionnaire, we found that teachers rated the system postively and were willing to accept and adopt QR-ULMPS into their course content.Teachers also agreed that QR-ULMPS was a useful tool to motivate students' learning during outdoor teaching activities. Moreover, resultsof the IMMS questionnaire indicated that students assigned to the proposed u-learning system achieved better results than participantslearning via conventional methods. We believe that the proposed u-learning system is advantageous because it enhances student motivationand allows for higher levels of engagement, particularly during outdoor learning activities. Thus, we conclude that the proposed u-learningsystem can create a learning experience that both interests and engages students. Although QR-ULMPS is not mature enough to be usedacross a sundry of educational domains, it provides an innovative opportunity for teachers to integrate a novel teaching methodology thatchallenges traditional educational norms.

1)INTRODUCTION: In modern societies, the pervasive nature of handheld mobiledevices such as tablet computers, personal digital assistants(PDAs) or smartphones can extend the learning environment far beyond classroom walls . Such rapid development of technology has forced digital learning to adopt a mobile learning (m-learning) platform. This mobile learning model provided a new delivery mechanism to overcome time and space limitations of traditional classroom learning Recently, the concept of context-aware ubiquitous learning (u-learning) was identified as a novel learning environment, an environment through which students can be taught appropriate content at the right time and in the right place. This novel learning environment can detect contextual information in the real world and adapt accordingly to provide customized learning content through mobile devices in response to different learning contexts or situations.

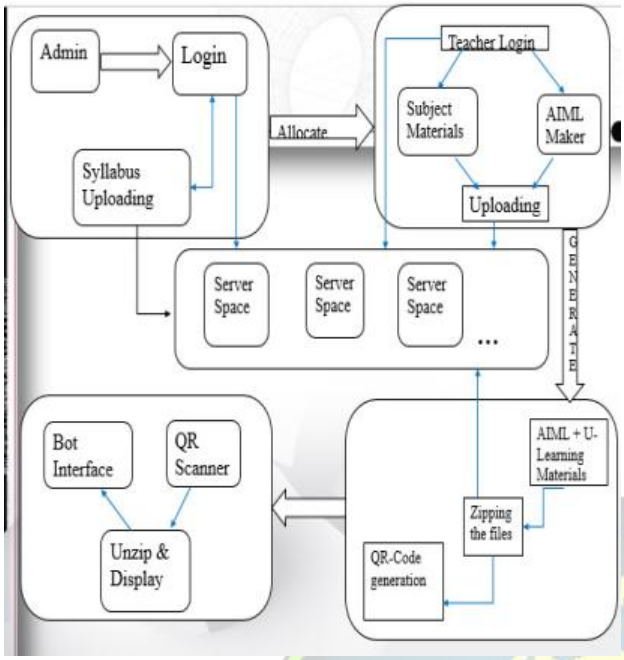
Our study endeavored to create a QR-based U-Learning Material Production System (QR-ULMPS), which consists of three sub-systems: a QR-based multimedia materials editing system;a multimedia material sharing server; and a context-aware u-learning system. Through the editing system and the sharingserver, teachers have the ability to produce unique teachingcontent, share u-learning materials, and engage students in authentic learning activities. The u-learning system allows students to gainsubstantial learning knowledge through observation and practice in outdoor settings. To test the real-life applicability of our system, twelve teachers and forty-eight students were recruited to participate in our experiment, and theywere asked to demonstrate whether or not QR-ULMPS couldimprove the outdoor teaching and learning process. The goal of this study was not only to support teachers in building context-aware u-learning environments, but also to support students inenhancing their learning motivation and interest in authenticeducational activities.M-learning is learning across multiple contexts, through social and content interactions, using personal electronic devices. M-learning focuses on the mobility of the learner interacting with portable technologies. This mobile learning model provided a novel delivery mechanism to overcome time and space limitations of traditional

classroom learning. QR Code is capable of handling several dozen to several hundred times more information. QR-ULMPS was a useful tool to motivate students' learning during outdoor teaching activities. Moreover, results of the IMMS questionnaire indicated that students assigned to the proposed u-learning system achieved better results than participants learning via conventional methods. u-learning system is advantageous because it enhances student motivation and allows for higher levels of engagement, particularly during outdoor learning activities. U-learning system can create a learning experience that both interests and engages students. In Addition to this we have investigated the AIML technology based Chat bots and proposed the idea of using these chat bots in the QR-ULMPS system. We believe that the proposed u-learning system is advantageous because it enhances student motivation and allows for higher levels of engagement.

2)REALTED WORK: In recent years, researchers have investigated various waysof incorporating tiny computer sensors into context-aware u-learning applications Examples of these tiny sensors may include RFIDs, contactless smart cards, barcode tags or sensor network nodes. Sensors can be used in the u-learning environment to provide both active and adaptive support to students, promoting curiosity and encouraging initiative in the classroom. Among tiny computer sensors, QR code technology is a very suitable pairing tool for u-learning applications for three main reasons. First, QR codes can scan and encodelarge amounts of data, including, but not limited to URLs, text,and numerical characters.Second, the low technical barrierof creating and reading QR codes allows educators to includeteaching content in the context of u-learning Third, mostmobile devices are equipped with QR code readers. Therefore,QR code technology can be feasibly accessed via mobile devices in different context-aware u-learning environmentsThe potential use of QR code technologies in an educationalcontext has been investigated quite recently. Law and So pre-sented a comprehensive review on the use of QR codes in edu-cation. The researchers introduced a number of examplesthat covered a wide variety of educational applications, integrating QR codes and mobile devices into subjects rangingfrom life science to math, English listening exercises, and evenaccessing library catalogs. Along the same lines, Hwang andcolleagues developed a web 2.0-based u-learning system that combined mobile phones with QR code and web 2.0 technologies. This system allowed students to generate QR codes and download related learning materials directly onto their mobile devices. The students could also collaboratively build a database of learning materials to share their individual knowledge and personal learning materials with peers [19], [20]. Alternatively, Chen and Choi proposed a learning project that integrated an online mapping service with a comprehensive content management system.This system allowed for the connection of physical locations or objects, such as books and digitalartifacts and documents, through QR codes. All of these studies reveal the vast potential of applying QR code technologies insupport of educational applications as an innovative teachingtool.

For this current study, the application of QR code technology not only supported students in accessing online informationmaterials via mobile devices, but also fulfilled all of the context-aware u-learning environment needs of teachers using the system. QR-ULMPS enables teachers to create u-learning materials and related QR codes directly through the simple user interface, and this proposed system provides personalized learning opportunities which offers students a more authentic and memorable learning experience.

3)SYSTEM DESIGN AND ARCHITECTURE:



This study describes QR-ULMPS, a proposed system thatserves to improve the creation of u-learning materials, enhance learning during outdoor activities, and further develop context-aware u-learning environments. The principal goal of the studywas to provide an alternative method for teaching conceptsrelated to cultural heritage in an outdoor environment. As portability and mobility are necessary factors for an authentic outdoor learning experience, our QR-ULMPS needed to incorporate touchscreen mobile devices [17]. For this study, we employed smartphones to access information contained in the QR-ULMPS, and equipped each smartphone with wireless communication abilities to achieve both portability and mobility. Thesesmartphones were preloaded with software based on the Android 2.3 platform. The QR-ULMPS was designed using Javaprogramming language, which could be executed on Java Machine (JVM) regardless of the existing mainframe architectureOf note, the QR-ULMPS could also support cross-platformcapabilities, allowing our system to potentially offer additionalapplications for enterprise, tourism and entertainment purposes.QR-ULMPS is made up of three sub-systems: (i) the QR-based multimedia materials editing system,(ii) the Multimedia material sharing server, and (iii) theContext-aware u-learning system. The QR-based multimediamaterials editing system supports teachers by making it simpleto author teaching content and create QR codes. Once teachers create course content, multimedia material packages are automatically generated by the editing system and subsequently canbe delivered to students. In this study, the multimedia materialpackage was regarded as a metadata, which was then used totransmit teaching content between the three sub-systems. Ineffect, the multimedia material package could be used to combine course content and multimedia materials in a way that provided an enhanced lesson to students. Teachers would be able toupload entire multimedia material packages onto the Multimedia material sharing server, and further define the specifications unique to particular u-learning environments. This server actsas a remote database that is used to share and transfer teachingcontent and resources on the Internet with students. Once themultimedia material package has been defined as a lesson, students in any learning context can scan the linked QR codes and download predetermined u-learning materials via the context-aware u-learning system. The system will command appropriately related content to appear on the screen of the smartphone.The QR-based multimedia materials editing system strives tosupport teachers seeking innovative teaching methods through avariety of ways. Via the editing system, teachers can create,modify, and delete multimedia material packages in an easy touse and intuitive manner. Most importantly, teachers do notneed to have prior programming knowledge or understand howto generate QR codes to easily produce high quality, multimedia-rich teaching content using this system.

The Graphical User Interface (GUI) of the editing system, as displayed on a computer screen. There are fourmain components: Lesson Management, Teaching Content Setting, Multimedia Materials Setting and Current Presence Sequence. The Lesson Management section provides drop-downmenus for teachers to create new files and maintain/organizetheir existing multimedia material packages. In addition, teachers can call up other functions using the Lesson Managementsection to prepare customized u-learning materials or generateassociated QR codes. Once teachers have created a multimediamaterial package, they are able to edit individual teaching con-tents and add reference data using features found in the Teaching Content Setting section. In the Multimedia Materials

Setting section, teachers can select related multimedia objects (e.g.images, audio/video files) to reinforce learning enjoymentOnce teachers have uploaded multimedia objects, they can pre-program the implementation sequence of different multimediaobjects joined together to form relevant teaching content usingthe Current Presence Sequence section, which also containstools for controlling the amount of screen time allocated to each object.

The basic learning environment for students:

This study used small handheld devices enabled with wirelessconnectivity to allow the context-aware u-learning system to beboth portable and mobile. Since the u-learning system was installed onto smartphones, students were able to locate and scanQR codes attached to corresponding real-life objects and instan- taneously receive related teaching materials on the screen oftheir smartphones. In this unrestricted learning space, wherereal objects in natural environments can be used to impartknowledge to the learner, students were able to engage in u-learning activities without traditional educational constraints imposed by classroom walls. Various multimedia objects using our context-aware u-learningsystem. When students call up the control panel, they can press "the video button" to display the relevant video file, which isdisplayed on the screen. By using the u-learning system, students can gain knowledge from multimediaobjects and also associate these objects with relevant entities. When students call up the control panel, they can press the "search" button to transfer the keyword(s) foundin the teaching content to a Google web search page and be presented with relevant supplementary information Moreover, students can also press the "link" button to show a pop-up list providing relevant web pages meant to re inforce learning knowledge demonstrated throughout the lesson.

4)METHODOLOGY - This study was conducted in conjunction with "Introduction toTaiwanese Cultural Heritage", a liberal arts course taught at theAletheia University in Taiwan. This course was created to introduce indigenous art and historical monuments located in the north of Taiwan to college level students. Two segments of thecourse were dedicated to describing the impressive lifetimeachievements of Dr. Reverend George Leslie Mackay. Duringthe active learning phase of the course, the teacher made arrangements for all students to visit Oxford College, the Taiwanese institution founded by Dr. Mckay. Important artifacts suchas private journals and personal mementos were carefully preserved at the college to commemorate the reverend's legacy. To avoid potential negative impacts and minimize any disturbance to the course, the instructional content was designedby a teacher who was directly responsible for administering thecourse. This teacher prepared all outdoor teaching activities andmaterials without any input from the researchers of this study.The teacher also ensured that all students could access the same.course content and both the control and experimental groupsused identical learning environments for the duration of thisstudy. The learning goals of the course were as follows: 1) Tounderstand Dr. Mackay's educational background and lifetimeexperience; 2) To understand the healthcare services providedby Dr. Mackay in Taiwan; 3) To understand the preaching of Dr.Mackay in Taiwan; 4) To understand the history of establishingthe Presbyterian Church in Taiwan; and 5) To understand thehistory of establishing Oxford College in Taiwan. The goal ofthis course was to enhance the students' knowledge of Dr. Mackay and his contributions to Taiwan; students would spend timedelving into the details of his background, his life in Taiwan, hisreligious endeavors and his professional career.

Research objectives:

Our study required a two-fold investigation: first to determinethe teachers' acceptance of QR-ULMPS and also to assess students' learning motivation after using our context-aware u-learning system. Thus, we designed two separate experimentalprocesses to investigate the effectiveness of this new tool.

This study proposed that QR-ULMPS is a novel teachingtool that supports teachers in designing u-learning materials andallows for the creation of appropriate context-aware u-learningsystems. Therefore, a comprehensive qualitative analysis can show the acceptability rate of QR-ULMPS among teachers. Our two research objectives in this experimental process are listed as follows:

- What are the critical factors that can influence teachers to use QR-ULMPS in their outdoor teaching activities?

- What factors would influence teachers to adopt QR-ULMPS into their lesson plans?

In addition, this study implemented two different teachingmodels by splitting student participants into one of two groups.The first group followed the conventional method, where theteacher explained different concepts to the group of studentsusing traditional teaching methods. The second group used mobile smart phones containing our context-aware u-learning system to learn about new concepts in the real-world setting. Ourgoal was to evaluate the difference these two teaching modelsmight make on student motivation and learning performance,where the independent variable would be the use or non-use ofour u-learning system and the dependent variable would be thelevel of students' learning motivation.Since this study utilized two teaching models, it was important for both groups to use materials based on the same instructional content, delivered in identical learning environments. In the first model with the control students, the teacherdelivered the Oxford College teaching content and led all activities by herself. She used teaching aids such as the coursetextbook, a variety of Mackay's relics, and presentation teaching materials such as images, presentations, text, etc... In thesecond model, all teaching contents and materials were delivered through the u-learning system for the experimental group.Students could learn the content and engage in all activities inthe Oxford College curriculum without being led by a teacherThus, the instructional content used and the real-world learningenvironment for all students were controlled for in this studyOf note, our study was conducted to answer the following four
research objectives:

- Is there a marked difference in the students' motivationand learning when comparing the two teaching models?
- Are there variations between the two teaching models when evaluating the four factors measuring students' motivation?
- What are the critical factors that motivate students to engage in the learning process when using the proposedcontext-aware u-learning system?
- What factors would influence students to accept the context-aware u-learning system?

Participants:

This study invited twelve teachers from the target school tovolunteer as evaluators of this study. The teachers selected werecontracted by the school to teach liberal arts courses, such ascultural heritage conservation, aboriginal cultures conservation,the aesthetics of architecture, understanding digital humanities,activation arts, community development, historical interestcourses, etc. Among the teacher participants, five out of twelvewere male and seven out of twelve were female. Each teacherpossessed basic level computer skills.Forty-eight first-year college students (aged 18-20, M =18.7, SD = 0.75) from one class were surveyed. Among thestudent participants, twenty-eight out of forty-eight were maleand twenty out of forty-eight were female. None of the studentswere exposed to the design instructional materials in advance.

Assessment:

This study adopted the Unified Theory of Acceptance andUse of Technology (UTAUT) model to evaluate teachers' over-all acceptance and satisfaction of our system. UTAUT are technology acceptance guidelines formulated by Venkatesh et al and it evaluates four factors: Performance Expectancy,Effort Expectancy, Social Influence, and Facilitating Conditions, which are used to explain the intention(s) of using aninformation system and can describe subsequent usage behavior.Performance Expectancy measures the extent to which anindividual believes that using an information system will helphim/her to improve job performance. Effort Expectancy is related to the degree of ease associated with the use of the information system. Social Influence deals with the importance anindividual places on whether others believe he/she should use anew information system. The final factor, Facilitating Conditions, evaluates how much the individual believes the existingorganizational and technical infrastructure can support their useof the system. UTAUT has been used extensively to investigatethe determinants of Information technology acceptance in several studies. The UTAUT was adopted as the primary theoretical construct for designing the teachers' satisfaction questionnaire, andthe four factors can validate the

opinions each teacher had ofthe QR-ULMPS. However, in order to successfully applyUTAUT to the needs of this study, we modified the questionnaire slightly by applying changes to the Facilitating Conditionsfactor to reflect the degree to which an individual believes thathe/she has sufficient abilities to use our system. The modifiedUTAUT questionnaire was composed of fourteen questions that must be answered using a 5-point Likert-scale, with responsesranked from 1 (strongly disagree) to 5 (strongly agree).

To evaluate the student experience, the IMMS was our surveying tool of choice because the IMMS was derived from the ARCS model as a way to quantitatively assess learners' motivation. Every question of the IMMS is relevant to one of the fourfactors in the ARCS model: Attention, Relevance, Confidence, and Satisfaction - and the questions measure an individual'slevel of learning motivation .The first factor, Attention, emphasizes that a lesson must gain and sustain a learner's curiosity, arousal and interest. The second factor, Relevance, is related to how well a connection is made between the instructional content and a student's learning needs and goals. Thethird factor, Confidence, is related to how successful a studentis in accomplishing the learning process. The final factor, Satisfaction, is related to the student's positive feelings about their learning experience(s). IMMS has been used as an evaluationtechnique administered in several studies to measure qualitativeand quantitative findings .

With the successful application of the IMMS in previousstudies, we chose to use a modified IMMS questionnaire toevaluate the motivation of college students towards the twodifferent teaching models. Specifically, the terminology used inthe survey was slightly modified to suit the field of u-learning.The IMMS used in our study contained 36 questions, all of which were also answered using the conventional 5-point Likert-scale.

Procedure:

Before starting our study, we asked all student participants tosign informed consent forms to indicate their willingness toparticipate in the study with permission. During the informedconsent process and pre-screening for our study, we asked eachstudent to write down any background knowledge they hadabout Dr. Mackay. This baseline information was used as a benchmark to assess students' prior knowledge on the experimental materials, and further support the teacher in designingsuitable instructional content for these students.All participating students were randomly assigned into eitherthe experimental or control group in this study. The experimental group consisted of twenty-five students using the proposed u-learning system, and the control group had twenty-three students learning about the course content via the traditional education model. The results were collected using theIMMS questionnaire after both groups completed their respective learning activities. Moreover, three weeks after the experiment was finished, all participating students were scheduled towrite the midterm exam of the course. All questions in this exam were designed by the teacher who was responsible for administering the course. As only some of the examination questions were directly related to the instructional content of our study, we picked these questions out from the exam to explainthe differences in students' learning effectiveness. Descriptive statistics were applied to evaluate the experimental results obtained from each student experience. All statistical analyses were conducted using a two-sided alpha level of0.05. The quality of population variances was checked beforethe use of any test that required this information. Finally, theindependent samples t-test and the Mann-Whitney U test wereapplied to analyze the difference in the students' motivationbetween the two teaching models.

In statistics, the independent samples t-test is used to detectdifferences between two normally distributed groups on a singlevariable. In contrast, the Mann-Whitney U test, which is alsoused to compare two groups, evaluates a single, ordinal variablewith no specific restrictions on the distribution. Both statistical tests require two independently sampled groups and the testassess whether two groups differ on a single, continuous variable. The main difference between these two tests is that theMann-Whitney U test tends to be more appropriate for data onnon-normal distributions, whereas the t-test has greater efficiency for data with normal distributions.

The qualitative data was collected in two parts. The first partwas gathered through observation of students interacting withthe context-aware u-

learning system. The second part of thedata collection was from administering the survey and throughindividual interviews. These data were used to illustrate students' personal comments and opinions of the proposed u-learning system.

Moreover, all participating teachers were invited to use andexperience the proposed QR-ULMPS prior to the start of thetest phase involving student participants. At the beginning ofthe experiment, we explained that the purpose of this evaluationwas to provide teachers with the opportunity to add a novel toolto their outdoor teaching activities, and we asked teachers togive feedback on our QR-ULMPS so we could implement fur- ther improvements. We also asked all teacher participants tosign the informed consent form and obtained their permission to collect information for the study. With the approval of all teachers who participated in the study, each teacher consented topartake in a two-week mandatory training course to learn howto author u-learning materials via guidance classes focused onQR-ULMPS. When this training process was complete, all participating teachers could independently create simple u-learning materials.The opinions from participating teachers were collected using the UTAUT questionnaire after the authoring work wasproduced; the responses of each survey question averaged, andthe standard deviation (SD) was obtained. After completing thequestionnaire, teachers were interviewed individually to obtaintheir personal observations on the QR-ULMPS.

5)EXPERIMENTAL RESULTS -This study collected statistically relevant data from teachers andstudents, and gathered evaluation results from two experimentaltrials. We conducted several one-on-one interviews to obtainfeedback from all participants and used the comments to improve our proposed system. The findings of our experimental results are discussed in the following subsections.

Results of the teacher survey:

Twelve teachers were invited to participate in this researchstudy. The experimental results indicated that the majority ofthe participants had a positive outlook towards QR-ULMPS

Results of student survey:

Forty-eight first-year college students participated in this research study. The experimental results showed that the proposedcontext-aware u-learning system could have a considerableimpact on student's motivation and learning.

The Shapiro-Wilk test is a test of normality and evaluates thedistribution of groups in statistics. In this study, the test wasused to examine the difference between the motivation of participants in the control and experimental groups, evaluating twodifferent teaching models. The result of the Shapiro-Wilk test found that no significant departure from normality was present($W = 0.957$, p-value = 0.304), indicating that the difference instudents' motivation may come from a normally distributed population. Therefore, it was determined that parametrictests could be used for the evaluating the remainder of the analyses.

The independent samples t-test was conducted to comparestudents' motivation between the experimental and controlgroups. The result indicated that there was a statistically significant difference between the experimental group ($M = 3.809$,$SD = 0.251$) and the control group ($M = 3.532$, $SD = 0.193$), $t(46) = 3.233$, $p = 0.003$.

A total of ten questions in the midterm exam of the coursewere relevant to our instructional content. Specifically, thesequestions were comprised of five multiple-choice questions(four points each) and five question–response problems (fivepoints each). The maximum possible score was 45 points. Inthis study, we utilized the mid-term exam score from these tenquestions to evaluate the difference between the learning effectiveness of participants in the control and experimental groups.

The Shapiro-Wilk test was used to evaluate the distributionof the midterm exam scores for any differences between the twoteaching models. The Shapiro-Wilk test showed that no significant departure from normality was found ($W = 0.957$, p-value =0.079). This means that the difference in students' learning likely comes from a normally distributed population.

The independent samples t-test was conducted to comparestudents' learning and acquired knowledge between the experimental and control groups. The results show that the midtermexamination performance of the experimental group improvedsignificantly ($t(46) = 2.107$, $p = 0.041$). In addition, the midtermexam scores showed that the experimental group (M =

31.20,SD = 8.073) outperformed the control group (M = 26.30,SD = 8.008). Since the experimental group scored higher thanthe control group, it demonstrated that there was a significantchange in learning effectiveness from using our proposed system

6)DISCUSSION: This study proposed that QR-ULMPS could encourage teachersinterested in building a context-aware u-learning environmentfor their students to use QR codes that supports the delivery ofcourse content via mobile devices. We wanted to see if the proposed u-learning system could serve as an instructional tool formotivating and engaging students in liberal arts courses, especially those conducted in an outdoor setting. The results wereobtained by collecting and analyzing data from various sources,including questionnaire evaluations, midterm exam scores, direct observations and personal interviews. The following sections discuss the findings we uncovered in this study.

Feasibility of instructors using QR-ULMPS for implementing teaching activities:

From the results of the UTAUT-based survey, it can be concluded that QR-ULMPS was accepted as a useful tool forteachers in executing outdoor teaching activities. Based on themean scores of each factor in the UTAUT model, the Performance Expectancy results revealed that teachers were in agreement that the QR-ULMPS can be helpful to their instructional work and enrich overall pedagogical value of their course. Regarding the evaluation of the Effort Expectancy factor, the results showed that teachers felt the QR-ULMPS was an easy toolto use and operate. In addition, the Social Influence factor indicated that the teachers believed that it was important how others encouraged and promoted them to use QR-ULMPS in the planning of their course content. In general, the Facilitating Conditions factor revealed that teachers were confident enough intheir abilities and skills to be proficient in using the QR-ULMPS. From the above results, we can rationalize that theteachers are likely to accept and adopt QR-ULMPS into theircourses.

The individual interviews were used to record the perceptions of the teachers and evaluate the acceptability of QR-ULMPS from the teaching perspective. In the study, the teachers responded positively to the use of QR-ULMPS in creatingan ideal context-aware u-learning environment, and they alsoexpressed interest in using this system in their other curricula.In addition, a majority of the teachers surveyed indicated thatthe proposed u-learning system could be helpful in motivatingstudents' learning and attract students' attention. Therefore,these positive opinions and suggestions are in agreement withthe results of the UTAUT questionnaire.

At the conclusion of the study, teachers provided suggestionsof for how to enhance the overall usefulness of QR-ULMPSand improve the overall user experience. It was deemed necessary to de-bug various technical problems encountered and theteachers felt that the system required further advancements andupgrades. We also realized that it was crucial to instruct teachers on how to use the QR-ULMPS prior to the start of thecourse, and we must allow sufficient time for teachers to become familiar with the operation, configuration, and executionof the proposed system. There are also some limitations that must be addressed and explicitly identified to the instructors, sothey may be better equipped to design course content that areconform to within the confines capabilities of the u-learningsystem. With sufficient practice and preparation, teachers canbecome confident in using QR-ULMPS as an effective course
content delivery system that motivates students in the learning.

Benefits of using the context-aware u-learning system for student's learning motivation:

We measured the impact of implementing the proposed u-learning system on student motivation by comparing the responses obtained from the IMMS, a survey that was administered to both the experimental and control groups. The resultsrevealed that the students in the control group were moderatelymotivated by the conventional teaching model, while the students in the experimental group were slightly more motivated tolearn when the proposed u-learning system was used. Thisheightened motivational effect likely influences students' learning performance. The result of the midterm exam revealed thatthe students learning in the experimental group scored higherthan the control

group, demonstrating a significant improvement in learning effectiveness. This may be attributed to howthe proposed u-learning system facilitated students' learningmotivation and encouraged them to pay more attention in class.

From the results of the IMMS, the maximum difference ofthe mean scores from the control and experimental groups wereobtained from for the Satisfaction factor. Thus, the positiveimpact of the u-learning technology on students' satisfactionprovides a particularly encouraging result for future applications in the realm of education. Many studies have indicatedthat pursuing outdoor field trips through the specialized u-learning system can provide more interesting learning scenarios for students. Therefore, integrating such alearning application into the course curriculum can usually result in high levels of satisfaction after using this system. The study also demonstrates demonstrated that there was alarge difference in the mean scores between the two groupswhen comparing the Relevance factor and the Confidence factor. Therefore, we believe that the learning content presented bythe proposed u-learning system was crucial and relevant to students' learning interests and expectations. This novel learningmethod was able to give students confidence that allowed them to learn the required instructional content using the proposed u-learning system, and further encouraged participants to complete the learning tasks.

During the learning activities conducted within this study,the students who participated in the experimental group demonstrated high levels of engagement and enjoyment while usingthe proposed u-learning system to gain course relatedknowledge. These students expressed their satisfaction in terms of system usage, the possibility of receiving instructional content in different formats in the future, and the feeling of havingcontrol of the learning activity as they could explore certaintopics further according to their own needs, or re-learn teaching materials as required.

Several students indicated that they achieved high levels ofconcentration when performing the learning tasks through theuse of our u-learning system. They also claimed that this u-learning system could potentially support students in memorizing and understanding the necessary content required by the course objectives. Indeed, once the learning activities werecompleted, some students automatically formed discussiongroups to discuss the features of the u-learning system, including some detailed analysis of various aspects of the teachingmaterial and any mistakes they discovered within the teachingcontent.

7)CONCLUSIONS AND FUTURE WORK:

This study proposes the use of a tool called the QR-based U-Learning Material Production System (QR-ULMPS) that trulyhelps teachers build a context-aware u-learning environment. Inthis new and technologically enhanced learning environment,students can interact with real-world problems, and furthercombine real-world resources with a wealth of digital worldinformation to find knowledge appropriate to their needs.Therefore, QR-ULMPS was designed to resolve issues encountered when using conventional outdoor teaching approaches,which are often very time-consuming and labor-intensive. Witha high level of technical support built into the QR-ULMPS, teachers can easily incorporate outdoor teaching activities intotheir domain knowledge, with demonstrable benefits in student learning and motivation.

In relation with the feasibility survey, the instructors participating in this study were able to learn about and use the QR-ULMPS to build a context-aware u-learning environment. Thequantitative analysis proved that teachers were satisfied withthe proposed QR-ULMPS. It is evident that teachers were alsolikely willing to continue using this technology and expressedinterest in integrating the u-learning system into their othercourse curricula. These quantitative results reiterated the resultsobtained from the qualitative analysis that advocated the feasibility of instructors using QR-ULMPS. Therefore, although the QR-ULMPS is not yet mature enough to be used in a sundry ofeducational applications and domains, it can provide an opportunity for teachers to conduct classes that differs from, andquite possibly improves on, traditional teaching methods.

In reference to the benefits survey, the students participatingin the experimental group indicated that they felt satisfied withthe proposed u-learning system and achieved high levels ofconcentration while performing the necessary learning tasks.The quantitative analysis proved that

students were moderatelymotivated by the use of our context-aware u-learning system.

These quantitative results were complimented with the qualitative analysis and the midterm exam scores, which providedproof of the benefits of using this system in supporting thelearning process. We believe that the proposed u-learning system not only results in positive effects on students' motivation,but our system can also promote better learning outcomes. Further studies should be conducted to validate this deduction.

Although this study provides persuasive results, it is advisable to conduct a similar research study that spans across an extended period of time to avoid the novelty effect, in which userperformance typically improves when new technologies areintroduced. It could be useful to determine what effect this system can have on student learning during a long-term study inwhich the proposed u-learning system can possibly result ingreater benefits. Moreover, though our context-aware u-learning system seems to be innovative and interesting, a collaborative learning environment was not implemented for thisstudy. It is expected that students who have the option to participate in collaborative learning through active discussions,knowledge sharing and problem solving are more likely to enjoy the learning process and solidify their knowledge acquisition. Thus, in our follow up study, we propose that acollaborative environment should be made available wherestudents are encouraged to produce content, share u-learning materials, and learn collaboratively during outdoor activities.Furthermore, the parameters of this study only allowed for therecruitment of 48 student participants and we could not collectformal pre/post-test data to evaluate each individual's learning background and performance. Such limitations can result inimprecise experimental outcomes. Thus, the researchers aim torevise the experimental design to overcome these limitations,with efforts focused on recruiting participants and applying aformal evaluation process to provide more accurate experi-mental outcomes. Finally, we plan to implement standardizedethical consent policies in all of our follow up experiments because we believe that ethical approval must be obtained fromlegal institutions, and this action can ensure our evaluation process and study procedure is conducted with integrity and fairness towards all participants.

Based on the results of this study, we believe our work canencourage teachers to develop a context-aware u-learning environment, which supports students in obtaining adequateknowledge during outdoor teaching activities. We intend toprovide engaging self-learning opportunities for students toreview teaching content and brush up on related materials in away that is suitable to their unique individual needs.

8)REFERENCES

[1] C.-M. Chen and Y.-N. Tsai, "Interactive augmented reality system forenhancing library instruction in elementary schools," J. Computers &Education, vol. 59, no. 2, pp. 638-652, 2012.

[2] M. M. Organero, P. J. M. Merino and C. D. Kloos, "Adapting thespeed of reproduction of audio content and using text reinforcement [23] C.-P. Lin and B. Anol, "Learning online social support: an investiga-for maximizing the learning outcome though mobile Phones," IEEEtion of network information technology based on UTAUT," Cy-Trans. Learning Technologies, vol. 4, no. 3, pp. 233-238, 2011.berPsychology & Behavior, vol. 11, no. 3, pp. 268-272, 2008

[3] V. Garaj, "m-learning in the education of multimedia technologists [24] E. M. van Raaij and J. J. L. Schepers, "The acceptance and use of aand designers at the university level: A User Requirements Study,"virtual learning environment in China," J. Computers & Education,IEEE Trans. Learning Technologies, vol. 3, no. 1, pp. 24-32, 2010.vol. 50, no. 3, pp. 838-852, 2008.

[4] C.-C. Chen and T.-C. Huang, "Learning in a u-museum: developing a [25] Y.-S. Wang, M.-C. Wu and H.-Y. Wang, "Investigating the determiontext-aware ubiquitous learning environment," J. Computers & Ed-nants and age and gender differences in the acceptance of mobileucation, vol. 59, no. 3, pp. 873-883, 2012.learning," British Journal of Educational Technology, vol. 40, no. 1,

[5] C.-F. Lai, Y.-M. Huang and S.-Y. Chen, "A

M-Learning Content Rec-pp. 92-118, 2009.ommendation Service by Exploiting Mobile Social Interactions," [26] J. M. Keller and K. Suzuki, "Learner motivation and e-Learning deIEEETrans.LearningTechnologies,DOI(id entifier)sign: A multinationally validated process," Journal of Educational10.1109/TLT.2014.2323053, 2014.Media, vol. 29, no. 3, pp. 229-239, 2004.

[6] H. Peng, P.-Y. Chuang, G.-J. Hwang, H.-C. Chu, T.-T. Wu and S.-X. [27] 27 J. M. Keller, "First principles of motivation to learn and e3-Huang, "Ubiquitous performance-support system as mindtool: A caselearning," Journal of Distance Education, vol. 29, no. 2, pp. 175-185,study of instructional decision making and learning assistant," Journal2008.of Educational Technology & Society, vol. 12, no. 1, pp. 107-120, [28] W.-H. Huang, W.-Y. Huang and J. Tschopp, "Sustaining iterative game2009.playing processes in DGBL: the relationship between motivational

[7] Andprocessing and outcome processing," J. Computers & Education, vol.research issues of context-aware ubiquitous learning," Journal of Ed-55, no. 2, pp. 789-797, 2010ucational Technology & Society, vol. 11, no. 2, pp. 81-91, 2008[29] K.-Y. Chin, Z.-W. Hong and Y.-L. Chen, "Impact of using an educa

[8] T.-Y. Liu and Y.-L. Chu, "Using ubiquitous games in an English lis-tional robot-based learning system on students' motivation in elemen-tening and speaking course: Impact on learning outcomes and motiva-tary education," IEEE Trans. Learning Technologies, DOI (identifier)tion," J. Computers & Education, vol. 55, no. 2, pp. 630-643, 2010.10.1109/TLT.2014.2346756, 2014

[9] Christo Ananth, G.Poncelina, M.Poolammal, S.Priyanka, M.Rakshana, Praghash.K., "GSM Based AMR", International Journal of Advanced Research in Biology, Ecology, Science and Technology (IJARBEST), Volume 1,Issue 4,July 2015, pp:26-28

[10] E. Arendarenko, "A study of comparing RFID and 2D barcode tag [31] M. P. Fay and M. A. Proschan, "Wilcoxon-Mann-Whitney or t-test?technologies for pervasive mobile applications," Master's Thesis, De-On assumptions for hypothesis tests and multiple interpretations ofpartment of Computer Science and Statistics, University of Joensuu,decision rules," Statistics Surveys, vol. 4, pp. 1-39, 2010.2009.[32] S. S. Shapiro and M. B. Wilk, "An analysis of variance test for nor-T. Lotlikar, R. Kankapurkar, A. Parekar and A. Mohite, "Comparativemality," Biometrika Trust, vol. 52, no. 3/4, pp. 591-611, 1965.study of Barcode, QR-code and RFID System," International JournalComputer Technology & Applications, vol. 4, no. 5, pp. 817-821,Kai-Yi Chin was born on July 21, 1978 in Nan-

[11] M. Virvou and E. Alepis, "Mobile educational features in authoringPh.D. in Information Engineering and Computertools for personalized tutoring," J. Computers & Education, vol. 44,Science from Feng Chia University (Taichung,no. 1, pp. 53-68, 2005.Taiwan). She is currently an Assistant Professor

[12] W. Tsou, W. Wang and H.-Y. Li, "How computers facilitate Englishat the Department of Digital Humanities atforeign language learners acquire english abstract words," J. Comput-Aletheia University (Taipei, Taiwan). Her re-ers& Education, vol. 39, no. 4, pp. 415-428, 2002.search interests include computer-aided learning,

[13] C. Y. LAW and W. W. S. SO, "QR codes in education," Journal ofmultimedia applications, mobile technology,Educational Technology Development and Exchange, vol. 3, no. 1, pp.ubiquitous learning, and web technology.85-100, 2010.

[14] E. Ozcelik and C. Acarturk, "Reducing the spatial distance betweenprinted and online information sources by means of mobile technolo-Ko-Feng Lee was born on May 27, 1987 ingy enhances learning: Using 2D barcodes," J. Computers &Educa-Kaoshiung

County, Taiwan. From Septembertion, vol. 57, no. 3, pp. 2077-2085, 2011.2007 to July 2014, he received a B.S. and an

[15] M. J. Weal, D. T. Michaelides, K. Page, D. C. D. Roure, E. MongerM.S. in Information Engineering and Computerand M. Gobbi, "Semantic annotation of ubiquitous learning environ-Science from Taichung Feng Chia Universityments," IEEE Trans. Learning Technologies, vol. 5, no. 2, pp. 143-(Taichung, Taiwan). Now, he is a Ph.D student156, 2012.in Information Engineering and Computer Science.