Analyses of Task Based Learning in Developing "M-Learn" Mobile Learning Software Solution: Case Study

MAJLINDA FETAJI, BEKIM FETAJI
Contemporary Sciences and Technologies Faculty, Department of Computer Sciences
South East European University
Ilindenska bb, SEEU Campus, bld.305.12
Republic of Macedonia
m.fetaji@seeu.edu.mk, b.fetaji@seeu.edu.mk, http://www.seeu.edu.mk

Abstract: - Developing mobile software solutions in order to enhance learning in University environments by using the new mobile communication technology is becoming a very popular research focus. However there is a lack of research on the instruction method that should be used in the development of mobile learning software as a very important factor in the learning process and in the software engineering process. In this paper we investigate, develop and analyses a mobile software solution in using the Task Based Learning model. The research focuses on the developed software solution and reviews learning modeling approach focusing on task based learning that from the findings is concluded as the best approach for mobile learning. For testing purposes developed is a software prototype called M-Learn and its analyses has been investigated and recommendations for developing similar software solutions have been defined.

Key-Words: - Task based learning, mobile software development, Learning instructions, m-learning

1 Introduction

The role of mobile devices and software in learning and education is of greater impact nowadays. The new portable communication and wireless technologies are very promising in enabling fixed and mobile wireless communication. The mobile devices are lately increasingly penetrating the educational life first of all because of the opportunities they offer in the increased intensity and dynamics of the way of life in the globalised world today. Interactivity and collaboration in such circumstances can be enhanced using mobile devices like cell phones, PDAs, Wireless Laptops and such system software's. This is much important for different socio-economic, cultural, and distance groups of students which otherwise is hard to get education and this way get education opportunity. But the design of such systems must be carefully designed in order to fulfill the learner's requirements. We argue that task based learning is a promising instructional method to improve the efficiency and effectiveness in mobile learning.

Under the realized research developed is a software solution named M-Learn, with an aim to support ubiquitous, individual, personal learning and teaching and to promote anywhere and anytime learning approach. M-Learn is an application that runs on the server and renders in the browser of a mobile device or a computer. Current course management systems, like WebCT, do not support a mobile device connection and are designed only toward the PC environment. This is the reason why we have focused on developing a simpler learning management system which can be accessed from a mobile device or a computer. Students can learn from anywhere, anytime using a wireless device such as a mobile device phone. It is very cheap to get and easy to use one. According to different commercial advertisement research [8], today almost every university student has a cell phone which is very important fact for the initiative for designing mobile applications for learning.

Why mobile devices are important? They can reach anyone and be in touch anytime, from anywhere. Students gain considerably from such a device because of its portability thus portability of learning materials they need to be in continuous contact and have access anytime, anywhere. Using these devices it is easier to reach and communicate to anyone, anytime from anywhere by which the previous constraints of time and location are minimized and turned into advantage.

2 Analyses of the Importance of Using Mobile Devices in Learning

The portability features and portable and wireless technologies of mobile devices enable learning from anywhere, anytime removing the limitation of time and location which implies that mobile devices enable students to use their time more efficiently. These technologies are offering new way of learning and teaching which is more comfortable in accessing and

sharing electronic learning content. "Just-in-time" instruction via mobile devices is very important and giving opportunity for education to distance students. Anytime /anywhere access to the learning content promotes collaboration [1], [9], flexibility [8], personalized learning, interactivity, learner-centered and self-paced learning, ubiquitous and learning in a run or mobility in learning [9]. Learning is not constrained by schedules and physical spaces; rather, it is pervasive and ongoing [1]. Learning becomes more situated, personal, collaborative and lifelong and embedded in everyday life [3] and even more constructive informal/learning [10], and possesses location awareness [7]. The ability to use the device anywhere and anytime is one of the major factors that distinguish mobile personal devices from stationary office-based devices [1]. Because of the numerous video/audio features of today's mobile devices, they provide audio/video support and possibility to run different web applications that previously were aimed for computers only. It is less expensive to supply a mobile device in comparing with a desktop computer, thus providing anytime/anywhere and less expensive Internet access. Ubiquitous Internet access increases productivity in learning [1]. Online access to information "just-in-time" rather than searching for hand taken notes makes the leaning process more efficient. Mobile devices provide opportunities for visual and literary expression thus the literacy and numeracy of learners improves. Users use mobile devices to process, compute and retrieve information instantly.

The small size and weight makes the mobile devices very popular because of the ease of use and port. PDA's and cell phones have installed applications which provide basic functions like adress book, calendar, scheduler and even a WAP (Wireless Application Protocol) browser and can install additional applications or features where many additional mobile device applications are free [23]. More advanced phones have cameras and infrared or Bluetooth connectivity and modems. This means they can be used to transfer information to another similar device and connect other devices, like laptops and PDAs to the Internet. Mobile devices' total connectivity to networks make mobile learning more efficient learning approach then e-learning or traditional learning.

Beside these advantages, there are also disadvantages of using mobile devices in learning: small screen size, limited processor capability, memory capacity and storage space, limited battery life and need of charge. All these limitations lead to other disadvantages: if the device has no buttery life, all information may be lost. The limited processor capability may longer the response time. The small screen size may not display all the information on it or it may be needed to scroll from left to right which is not comfortable at all. Desktop applications need to be redesigned and repurposed for mobile devices. These limitations are the main factors why we need to develop a model for developing mobile learning management system focusing on the learning content, learner needs and their learning /instructional styles. In this paper we discuss and propose a task based model for developing a mobile learning management system.

3 Literature Review of Learning Modeling Approaches

In Software Engineering mobile learning software there is evidently a lack of support for instructional techniques and pedagogical learning models, as well as procedures or guidelines how, when and for what particular situation each pedagogical learning model should be supported in the software development process and its conjunction and correlation with the instructional strategies [8].

Instructional strategy is a very important concept that needs to be addressed because the main purpose of any learning activity should be clear to the learner ([3], [4]). Instructional design in an e-learning environment can foster the alliance between technology and education for pushing higher education to transform the academic environment. A properly executed instructional design can help faculty and academic departments develop new modes of instruction that use various technologies and teaching strategies. Instructional design represents analysis of learning needs and systematic development of instruction. Instructional design models typically specify a method in using the technology that if followed will facilitation of the transfer of knowledge, skills and learning process [3]. This learning dimension should provide the context of instruction and desirable outcome. The learning environments require high level of self-organization and metacognitive abilities from the learners engaged in the process of learning that should be captured by the instructional techniques.

There are five main instructional strategies that are currently considered: Problem Based, Project based, Inquiry-based Learning, Task based and Game based learning [2], [3], [4], [6] and [7].

Problem based learning represents the learning that results from working with problems that needs solving. The entire learning process is set around a problem introduced and the knowledge is developed as a consequence of trying to solve the problem. Official description offered by [6] generally describe it as "an instructional strategy in which learners confront contextualized, ill structured problems and strive to find meaningful solutions and learn in the process of doing it." In general it is an approach to learning focusing on

the process of solving a problem and acquiring knowledge. The approach is also inquiry-based when learners are active in creating the problem. The learners are elevated to the position of analyst and problem-solver and have specific objectives and deadlines to meet. According to [6] there are two critical issues involved in presenting the problem. First, if the learners are to engage in authentic problem solving, then they must own the problem. A second critical issue in presenting the problem is to be certain that the data presented does not highlight critical factors in the case. Either the problem must be richly presented or presented only as a basic question. Learning should be synthesized and organized in the context of the problem.

Project-based learning (PBL) is a model that organizes learning around projects. Definitions of "project-based instruction" include features relating to the use of an authentic ("driving") question, a community of inquiry, and the use of cognitive (technology-based) tools [4]. Project-based instruction is an authentic instructional model or strategy in which learners plan, implement, and evaluate projects that have real-world applications beyond the classroom [4]. Projects sometimes go off track, with teachers and students pursuing questions that are peripheral to the subject matter of interest. The solution, according to [4] is to find ways for projects to center on "learning appropriate goals."

Inquiry-based Learning according to [6] represents an instructional strategy were involvement in learning implies processing skills and metacognitive abilities in order to seek answers to questions and issues while at the same time constructing new knowledge. "Inquiry" is defined as seeking information by questioning. According to [6] it usually begins with posing a problem or question, followed by generating and pursuing strategies for investigating, collaborating, reflecting, and justifying the solutions of the problem or answers to the question, and communicating the conclusions.

Task-based learning is an educationally sound, effective and efficient instructional strategy for learning focusing the learning activities around tasks. The term "task-based learning" according to [2] originated primarily from the work done in language education. According to [2] the learning tasks play a fundamental role in determining the learning outcomes. According to [2] it has three advantages:

1. Learning built round tasks is more effective than traditional didactic memory-based or purely apprenticeship-type learning;
2. Learning structured round the tasks is an efficient approach to learning;
3. Task-based learning is likely to lead to more relevant and appropriate education.

Task-based learning offers action and reflection, while in contrast, rote learning is low in action and in reflection. According to [2] incidental learning, such as occurs in on-the-job learning, is rich in action but may be low in reflection. Classroom, or formal, learning is frequently high in reflection but low in action.

Game based learning or also lately referred to as digital game-based learning [1],[7] goal based scenarios and instructional games and simulations are alternatively used to describe the instructional strategy were learning activities are organized around a game or simulation. The academic community regarded game based learning as part of problem based learning using simulations and did not give much of attention in its research, and still today there are a lot of opinions in this regard [7]. Educational games and simulations are defined as activities that have rules and constraints, a goal, and an emphasis on competition and also has the additional feature of having a primary objective of enabling a student to learn either facts, skills, attitudes, or all three. [5] and [7] suggests that transfer of knowledge is aided when students actively construct explanations for events. Perhaps the biggest benefit for game -based learning is the fact that it involves students who need to learn complex skills and need to transfer these skills to real life.

However there are no clear procedures, methodologies or rules what learning modeling approach is more appropriate to use when developing e-learning solutions and especially its conjunction and correlation with the instructional strategies discussed previously.

M-learning modeling approaches are very important in the process of the development of m-learning solutions as software products. Although recently in the m-learning community there is acknowledged the importance of pedagogy however there is little research on learning modeling approaches.

The design and development of m-learning cannot be based only in the existing practice of technology, it is necessary to understand the relation between theory and practice to ensure that the design of practice is founded on the learning theory. This concept defined by [2] is given in the figure below:

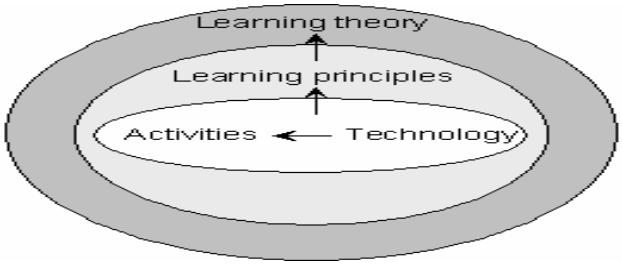

Figure 1 - Theoretically grounded evaluation of technology [2]

It describes that the different learning activities that are driven in the learning environment are supported by the m-learning instructional technologies stated above. The learning principles are formed by the learning activities to be done to produce the learning outcome. The learning activities are crucial to define the features and abilities the learning environment has to support and are supported by the technology.

According to [7] the m-learning solutions development process adopts one of the following learning modeling approaches:

1. The content-oriented,
2. The tool-oriented, or
3. The task-oriented approach

The content-oriented approach deals with management of learning content. It is mainly concerned with supporting authoring, structuring, delivering, sharing, re-using, and querying the content (Helic, 2006). The design and authoring of m-learning content requires major input from instructional designers, graphics designers, and programmers. Normally the instructors are expected to develop the content for m-learning on their own. However content creators search for a theoretical basis to justify their designs [7], [10] and [11]. Normally the instructors are expected to develop the content for m-learning on their own. However they are not aware of the effective methods which can be used to present their content to users. Especially the novice instructors need additional support in developing interactivity since it involves programming. Support might include collaborative tools for enriching the learning content by writing comments and annotations, tools for tracking the student progress with the content, or tools for adapting the content to the students' preferences [4] and [7].

Tool-oriented approach is based on using the technological infrastructure in the learning process. Learning sessions which follow this approach are organized around the use of the developed software [4]. The developed software solution is the main vehicle into increased transfer of knowledge. This learning modeling approach provides clear support and focuses the learning process around the developed tool of instruction as medium.

Task-oriented approach deals with learning tasks or learning activities which learners need to perform in their learning sessions. Those tasks are typically structured in very simple learning sequences that the students need to pass in a sequential mode [4]. This learning modeling approach clearly support and focuses the learning process on previously created scenarios of sequential tasks that will guide the learner activities into more efficient and higher level of knowledge transfer.

4 M-Learn Case Study in SEE University

In order to investigate the possibilities of using MP3 files and mobile devices a research on electronic content was initiated. Based on this previous research developed are usability guidelines by grounding the user interface on usability theoretical framework, possible constraints, and unique properties of mobile computing.

Three categories of usability have been formulated: user analysis, interaction and interface design. Usability guidelines will be suggested in aiming for designing highly efficacious, user friendly and usable mobile interface to support dynamicity of mobile and handheld devices.

According to Nielsen [6], usability means the measure of the quality the users' experience when interacting interface. Moreover, usability is not a surface gloss which applied at the last minutes or before the releases of the system or product; but it is deeply affected by every stage of the analysis, design, and development [6].

The developed software solution has been developed in using Microsoft Visual Studio Net 2008 and as platform ASP (Active Server Pages) have been used. Following are several screenshots with explanations regarding the user interface.

The software solution can be evaluated using mobile device (or a web browser from any computer) using the link below: http://projects.seeu.edu.mk/m-learn

In order to Login please use a valid student account or for testing purposes: Username: ve09342 and for Password: 123abcD

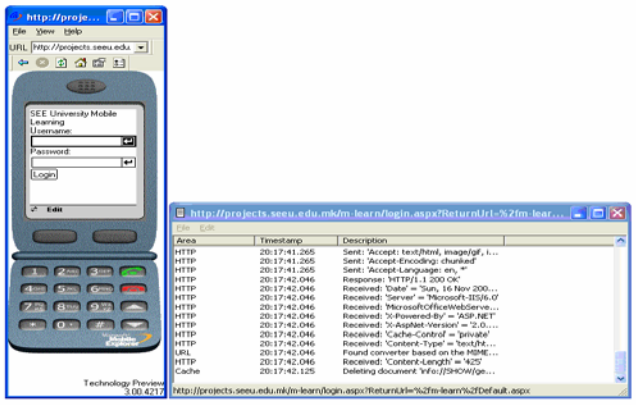

Figure.1. LOGIN Screenshot of the M-Learn application in mobile emulator

5 Development Platform

The project has been developed under the .NET framework platform using C# language. For content generation purposes we have decided to use the factory pattern which is able to generate parameter specific content in accordance parameter values. In e.g. if

required to generate an HTML compatible content the parameter is HTML or default NULL. If required RSS content, the parameter is RSS, and so on. Currently we have developed only HTML and RSS support but future generation of browse specific content is easy as we have developed the core features into an abstract content generation component.

6 Web Flow Logic of Usage

According to the Task Based Learning methodology the process of acquiring material from this application is in this order:

1. Login to personalized page
2. Browse registered courses
3. Browse course weeks
4. Browse course week tasks.

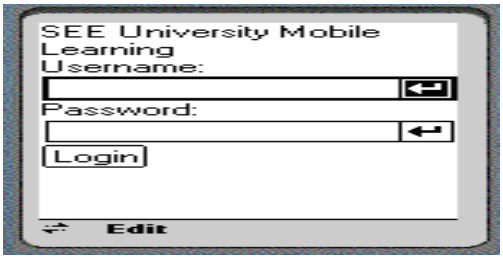

Figure.2. Login Page

The login page is integrated with the infrastructure authentication services and provides direct matching of usernames and passwords with the ones from the domain services. It means that users do not have to setup and remember new password for using this service, but they can use the passwords they are already using. This is very helpful functionality since it enhances and shortens the user acceptance curve.

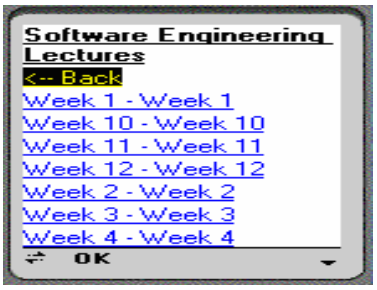

Figure.3. User Profile Page

The user profile page contains the list of registered courses for this semester. Each of the registered courses is listed with its corresponding course code and course title.

This is also very familiar for students because they already are aware of the courses they have registered in the enrollment phase, so they simple can choose one of the courses available in the enrollment list.

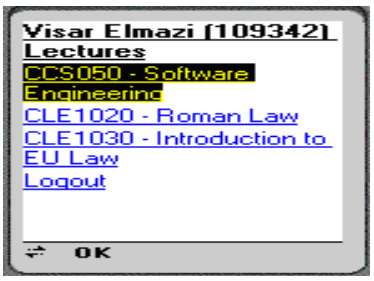

Figure.4. Course Profile Page

The course profile page provides the order list of weeks and selecting the material corresponding to the specified week. The student can choose to go back the course list page to chose another course if prefers so.

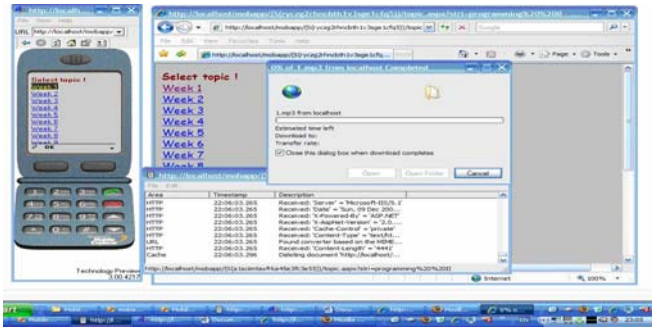

Figure.5. Testing View of Week Content in Browser and Mobile Emulator at same time

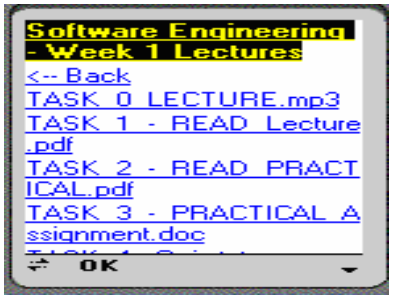

Figure.6. Week Content for Subjects Organized for Task Based Learning

After the student chooses the required learning week, the complete task set is provided to him in the form of list orders by the requirements of the task based learning methodology. Starting from the course introduction and slowly progressing to the upper level of the tasks, closing with appropriate tests.

7 The Experiment

The content developed for e-learning and m-learning is very different from the classical one - the print based. Preparing quality m-content delivered digitally is probably the major aspect for long term success of any m-learning endeavor. It is the content, however, that learners care for and they judge it with how much they learn from it. However understanding and managing attention is considered as very important determinant of successful learning. In order for the e-learning content to be considered successful it has to be good in getting attention. Attention by its nature is intangible asset and it is difficult to document its presence and to asses it. Attention cues when the learners begin to feel some mental workload, [1]. In order to assess the correlation between the e-content and attention we have chosen an approach of combining different methodologies: Psychometric tests, Psycho physiological measuring, and ELUAT (E-learning Usability Attributes Testing) methodology, which we named as PTPMELUAT methodology.

This methodology approach was realized in order to assess the correlation between the e-content and attention approaches in combining different types of measurements.

The experiment was based on the developed PTPMELUAT methodology consisted of 3 (three) types of testing and measurements:

1. Psychometric tests
2. Psycho physiological measuring - Biofeedback test
3. ELUAT (E-learning Usability Attributes Testing)

The psychometric test was the first testing realized and it was independent from the other two. The objective of the first testing was to assess the visual conceptualization and the type of learner the students respondents were.

The second and third testing and measurements were realized simultaneously and were conducted in parallel. The objective of the second testing was to measure the attention of the student respondents based on their task based learning process. The objective of the third task was to measure the e-learning effectiveness assessing the e-content. The student participants were given 4 tasks:

1) TASK 1 - Read the lecture material
2) TASK 2 - Read the practical material
3) TASK 3 - Work on practical assignment and
4) TASK 4 - Answer the Quiz question by writing the result of the practical assignment.

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1. Learning built round tasks is more effective than traditional didactic memory-based or purely apprenticeship-type learning;
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3. task-based learning is likely to lead to more relevant and appropriate education.

Task-based learning offers action and reflection, while in contrast, rote learning is low in action and in reflection. According to [10] incidental learning, such as occurs in on-the-job learning, is rich in action but may be low in reflection. Classroom, or formal, learning is frequently high in reflection but low in action.

Before each task each student was first tested using the second biofeedback test and then moved to doing the next task. While doing the tasks they were at the same being observed and measured using the ELUAT methodology and then went back to the second testing, and then back and forth until they have finished all their tasks.

8 Task Based Model of the Mobile Learning Solution

We have adapted the three stage Framework for Task-Based Learning for learning Languages, proposed by [2], to model the learning process in M-Learn:

1) Pre-task - Introduction to the topic and task.
2) Task planning and report.
3) Task Realization - Learning and practice.
4) Post Task - Evaluation

Therefore, we formulate the stages of the TBL model as follows.

8.1 Pre-Task

For each course, Instructors for each week topic session need to identify and outline the goals and learning outcomes of the session. They will have to choose content related to the tasks.

- checking the syllabi for the certain week topic,
- research on the possible electronic content related to the topic,
- checking available time needed to complete the task or finalize the session,
- Prepare the content of the week topic in a form of electronic file.

Besides, instructors need to create well defined, thoughtful, effective evaluation tasks whereas the content related to tasks is already created and needs to be exploited to students before they realize the evaluation tasks.

The methods for exploiting the chosen material are presented by audio .mp3 files or .doc and .pdf text files

or .ppt presentations which are available electronically in the system prototype.

86.2 Task Planning and Report

In this stage learners are preparing thoroughly, in order to get familiar to the task.
Learners prepare own input for tasks by:

- planning a report,
- writing a conclusion review from the previous week topic,
- writing a conclusion review from the content,
- thinking of issues in a relation to the previous week topic,
- extend the previous week topic reading.

Each review needs to be submitted.

8.3 Task Realization

This stage of the task cycle is presenting the performance of the task which is the process of learning including practicing from available content in the current week topic of the course.

8.4 Post Task

In this stage of the task cycle, an evaluation of the learning is performed. It is in a form of assignment, assessment quiz or report of the main conclusions of the topic which needs to be submitted. This stage presents performance of a task where the three stages of the task cycle are applied:

1. A Pre-Task stage is the stage of the learning process.
2. Task planning and report is the task planning and report of the learning process.
3. Task planning and report is the task performance.
4. Post task stage is instructor evaluation of the results.
5. Blended ”four-layered service-oriented model” and Task Based model of Mobile Learning Management System [mLMS].

As cited by [5] who adapted this model for ubiquitous learning, define four levels of hierarchy for community-oriented services, the first level is a connectivity service, it can be provided to wired and wireless users. In all cases suitable authorization and accounting facilities should be made available to allow Intranet and Internet access. The second level in [5] is the availability of traditional web-based services directly or indirectly covering many facets of m-learning. The third one should upon the second one and it’s designed to support distributed computing and resources as an aggregated single environment. The last one is related to a scenario where resources and contents are not only provided by the official infrastructure but also by the whole university community.

M-Learn is modeled by four-layered service oriented model, blended with the Task Based model in the last layer.
The first layer presents connectivity service, it can be provided to wired desktop computers or wireless devices. This layer service the authorization of users which allow Intranet and Internet access.
The second level is availability of traditional web-based services directly or indirectly.
The third layer defines a coordination space and interaction rules in order to allow the application to coordinates services as in any classical service-oriented model.
The last fourth layer is related to a scenario where resources and contents are presented in a task-based model for learning according to curricula-based learning in University environments.

9. Usability Framework

Primarily, the usability framework of guidelines is grounded on the usability guidelines for desktop computer applications [1, 2, 3]. Based on the findings from the study and the review of factors stated below, proposed are guidelines as a structure of the usability framework. The framework is grounded on the following factors:

- Usability attributes: Learnability, efficiency, memorability, errors, and Satisfaction (as defined by Nielsen) [3, 17].
- Human factors, and
- Technological factors: Interaction: user – mobile device; and Technical aspects/limitations of the device.

9.1. Influencing Factors

The learner is the main attribute to take into consideration in the process of mobile application’s design and in general. We need to design for the learner and not for the technology. Learners’ human factors directly influence the acceptance and usage of mobile technologies thus and mobile learning systems.

- Type of learner, previous skills, educational background. The grate number and diversity of students in a university environment imposes different types of learning styles. Students have different learning styles and preferences in the way they conduct learning. Some students respond strongly to visual forms of information, like pictures, diagrams, and schematics; others get more from verbal forms-written and spoken explanations [29]. Some function better in collaboration and others individually. We need to conduct a research to identify the type of learning content based on the types of

learners we have to deal with which place the learner at the centre of a more personalized experience. We need to take into consideration other actors that could use the system, like teachers, parents, and friends and specify different context of use [30]. This increases the acceptance of the learning system. Further more, it is found that people with better education and cognitive abilities are more likely and have positive attitude to use mobile phones. The successful adoption of mobile technologies is becoming crucial in adoption of mobile learning in university education. Students are the people that grow with the technology and in some way are technology-dependent. Even more, students get more curious about the new mobile and wireless technologies with their new advantages. This has a positive impact in its' adoption in everyday life and specifically in learning. From our research we identified that students who have earlier had experience using mobile devices and technologies (classified as experts) are more motivated, not afraid and exited to use mobile phones for learning.

The efficiency and acceptability of mobile learning systems, besides depends on the previous learners' experience with mobile technologies and devices.

- Cognitive, perceptual, and recognition abilities. The human learns throw generating a vision for what he learns, precepts or recognizes. How will the user see the interface depends on the vision they will create. The same object may give different images for different users. One user can generate different images for the same object from different point of view. Perception ability differs for different individuals. The research literature states that visual perception is more efficient because is based on recognition of visual objects, rather then remembering or reproduction of information from human memory. It limits the level of small details they can see. Recognition enables the user when he reuses the interface to recognize objects, processes, information, etc. Visual objects are ease recognizable which would be of grate help for wide range of users.
- Demographic factors such as age, ethnicity, and gender. This inter-depends from other factors like educational background, cognitive abilities and skills. Gender has different impact in mobile usage; females use it more as addictive tool and to show affection to their family, while males use it for information seeking purposes [19]. Males have more positive attitude to use mobile phones.
- Cultural and social factors.

Previous research has indicated that the impact of technology is heavily dependent upon the specifics of the educational culture into which the technology is introduced [14]. Learners in a university environment in a multiethnic country may belong to different cultural, social and religion entity. For example, used interface elements (text, images, menu and button names, command names and options) need to not be in conflict with there cultural, social and religion comprehension. That may directly affect user performance. For example, certain images might be a symbol for joy and happiness for one culture while for the other might be abrasive. Factors that are sensitive and reliable to cultural differences must be identified and carefully used.

9.2. Technological Factors

The small display area, its color, and the amount of displayable information, different operating systems platforms are major points which need to be considered when creating interfaces for mobile applications. Different resolution on different devices might influence the visual perception of objects therefore another type of additional information is needed, for example audio information is good choice. It is better to combine audio and pictures than audio and text [15]. The screen size affects the human visual perception and attention [15], viewer's quality of experience [14], and the usability of a mobile device [16]. A research has shown that if the screen size is small (around 1.65 inches diagonal), then people may consider the device to be not sufficient for learning, even though students tended to have a positive overall opinion of m-learning regardless to the screen size [18]. Another research showed that from different mobile devices learners choose once' with bigger screens, but the same time they required light weight devices. The screen size directly affects the amount of information displayed, the smaller the screen the less display space. This implies need for scrolling the content, which is not preferred by users [18]. Both scrolling and initial visibility obviously depend on screen size [18]. This implies that smaller pages on the screen would increase the learner's satisfaction. The small screen size influences the consistency which is an important factor of usability design [17]. Beside all this limitations, [19] states " … that the small screen size and keyboard will not be an issue in the future since we are starting to see the development and use of the virtual screen and keyboard with mobile devices". The slow bandwidth and reliability of the wireless connection is considered as a major problem in accessibility of mobile content. Findings from the [19] research on PDA's usage for learning are that the poor WAN network functionality did generate dissatisfaction among students. The low bandwidth and slow wireless connections directly influence in increased latency and time for getting response.

10 Psychometric Tests

The Trail Making Test (TMT) is measuring abilities of visual conceptualization and visual-motor tracking as well as attention and concentration. It has two forms - form A and form B. In form A, subjects are asked to complete number connection task (1, 2, 3…) while in form B, subjects are asked to complete a number - letter connection task (1-A, 2-B, 3-C...), requiring them to switch between two sets of stimuli, hence adding the cognitive load of directing behavior according a complex plan. - Rey Auditory Verbal Learning Test (RAVLT) is one of the most common and useful methods of assessing memory functioning. Using the word list-learning paradigm, subjects are asked to remember as many words as they can in five repeated readings.

11 Psycho Physiological Measuring

Is realized with Instruments constructed by Biofeedback Computer Systems Laboratory, Research Institute for Molecular Biology and Biophysics, Novosibirsk, Russia. We have realized this measurements having as subject 36 students from East European University- Tetovo, Macedonia.

Time of reaction to the obstacles which appeared occasionally on the racer's way measures the power of the distributed attention and correlates with the performance level. The game-based biofeedback technology in our study was used to achieve the following goals:

- to model situation of ambiguity
- to reveal individual stress response pattern
- to train self-regulation techniques

The experimental situation involved high level of ambiguity for subjects because:

- Biofeedback method appeared to be new and unknown for a subject
- Information incompleteness for a subject was based on the use of uncertain instructions
- A subject was aware of the aim of the experiment but was not instructed how to achieve this aim

In this test, attention concentration level was registered determined by the latent response time (RT) to obstacles (rocks appearing on the road).

Successful performance during stress test depended on the subject's skill of heart rate control. We calculated: reaction time (RT), omissions (inattention), commissions (impulsive reactions) and time of performance (PT) as indicators of attention and concentration and heart rate (HR) as indicator of stress-regulation ability.

We had student participants out of which: 36 healthy students, 12 girls, 24 boys, mean age 20, 9 ± 2, 15. Example for RT of one student:

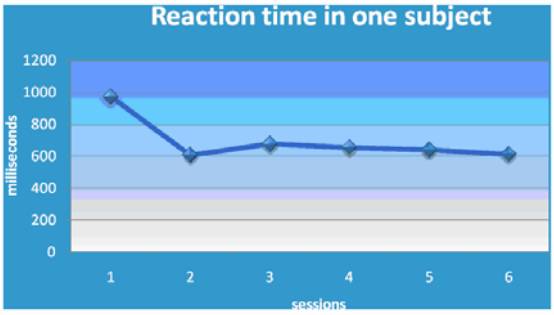

Figure.7. Reaction Rime (RT)

The reaction time is diminished 60%, which is an excellent result.

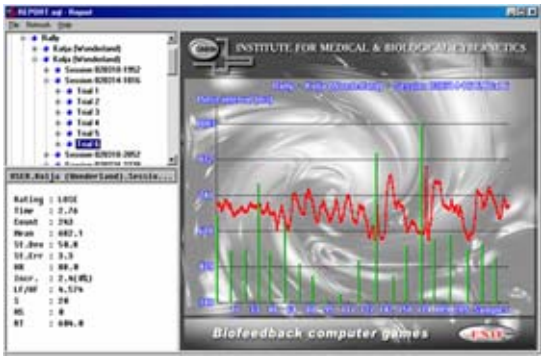

Figure.8. Display of the original instrument

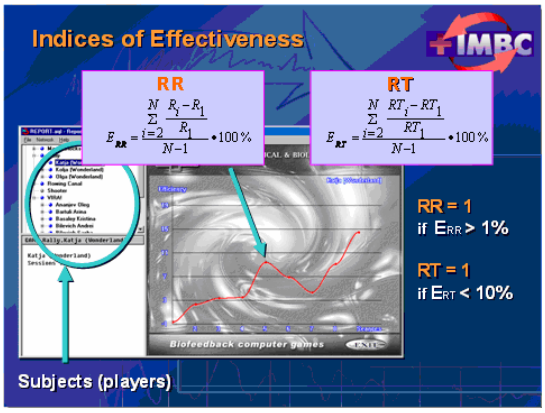

Figure.9. Indices of Effectiveness

12 ELUAT Testing

ELUAT methodology [8] combines an inspection technique with e-learning effectiveness evaluation based on 4 (four) usability attributes we have set. The usability attributes we have set are: 1) Time to learn, 2)

Performance speed; 3) Rate of errors; 4) Subjective satisfaction. The e-learning-methodology is necessary for presenting and evaluating e-learning in an efficient aspect. The testing procedure and methodology is similar to the previous testing realized under the other 4 experiments. The observed route of a learner has been used to give feedback information on the level of learning and its effectiveness.

13 Results

Psychological tests: Rey Auditory Verbal Learning Test (RAVLT) showed highly organized ability for learning new knowledge as well as attention and concentration, which can be seen from the progression in the obtained new knowledge. Female subjects are learning much faster than the male subjects.

The Trail Making Test (TMT) showed generally that visual conceptualization and visual-motor tracking as well as attention and concentration are highly organized in both groups of subjects. In form A, male subjects have better time of completition the form than the girls (boys on 75 percentile, girls on 50 percentile) which differs from the data in the literature. In more complex task, as form B, girls have better performance than the boys, but both groups are at 50 percentile.

Correlations: a) Reaction time: commission
b) Reaction time: omission
c) Reaction time: heart rate
e) Reaction time: time of performance

A high positive correlation between RT and omission, RT and commission and RT and performance time (PT) in all 6 trials was obtained. In addition there is negative correlation between RT and HR.

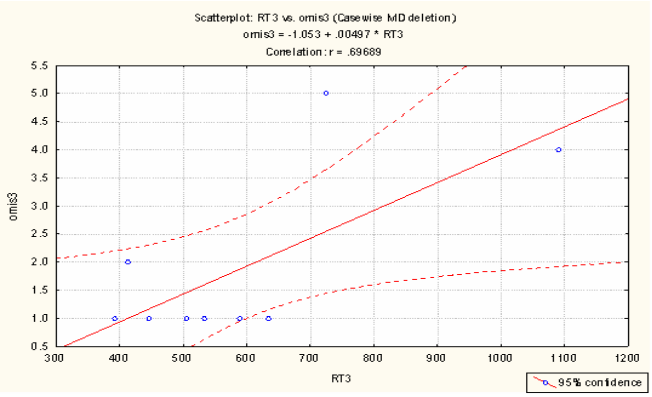

Figure.10. ScanPlot of the Results from the Machine.

14 Conclusion

This study analyzed the correlation between the Task Based Model of Mobile Learning Management System blended in the four-layered service-oriented model as the last layer. To elaborate this, we have developed the prototype M-Learn. We have argued the importance of mobile devices in the process of learning and therefore stated advantages of using mobile devices in learning and disadvantages which initiate the need for developing a model for designing a mobile learning system. The instructional method in University level learning has an important role. Therefore we have reviewed the instructional methods. Based on the realized research we have came to conclusion that the Task Based instructional method is the best approach for mobile learning because it engages students and guides them step by step in the learning processs. We have developed the TBM for mLMS, adapting the TBL Framework for Learning Languages and blended in the last layer of four-layered service-oriented model adapted by [5] for ubiquitous learning as suggested in [2], [10] and [11]. We have applied this model in developing the M-Learn mLMS for CST and BA Faculties in SEEU [8]. We recommend this model for developing mobile learning software solutions.

The research study reviewed the factors that influence usage and adoption of mobile devices and technologies, which directly affects the adoption of these technologies in learning; the importance of the factors to design a usability framework; and factors which affect the usability of mobile applications. A research was conducted using mobiles for learning through the developed prototype M-Learn, in order to identify the factors that influence the usability of mobile applications. Based on the literature review and our findings, we model the usability framework and proposed the following guidelines:

1. Identifying the type of learning content according to previously conducted investigation of the type of learners and intended users we have to deal (according to findings).
2. Human factors need to be carefully examined in order to identify interface elements (regarding on their appertaining) and types of information (visual, or/and audio or/and textual) regarding to low resolution and flexibility in interface appearances.
3. The system representation must be easy perceptible, whereas not to use objects that might generate different images for the same object from different point of view.
4. Use visual objects as good reminders for acquiring information which are easily recognized rather then recalled or remembered.
5. Use short terms, concise and easy understandable text, due to small display.
6. Technical factors need to be carefully examined in order to model the system functionalities to best suit to the mobile device which is intended to use.
7. Ensure small amount and chunks of information which can be easily found and provide shorter pages on the screen.

8. Minimize the number of screens and button presses required for completing a task due to limited input of mobile devices.
9. Use Tree view presentation of the functionalities and learning content for navigation, it increases the visibility of the system and the time to find information (according to findings). Menus are not suggested due to the limited input of mobile devices and the time it takes to search the required information [7].
10. Ensure consistency in the application interface: the terminology used, the structure of each screen and the screen content; similar information place on same locations to enable easy recognition, [1, 2],
11. Provide meaningful feedback, concise error messages [1,3] and reduce memory load [3], and provide back options [1],
12. Provide concise and evident information on each screen to make the visibility of the system apparent to minimize the time for information requiring.

This study also systematically tested the correlation between the two m-learning indicators electronic content and attention as defined in [8] and [9].

The results of measuring the attention and e-content through the realized tests we have concluded that the attention is dropping early in the beginning after the first task, being the reading task that requires the learners to concentrate on reading new information. Later after the second task attention is again increasing and it reaches its maximum at the fourth task being the quiz task. And later for the final task it drops again as a result of the relief that they have come to the end and expressed boring / fatigue.

Rey Auditory Verbal Learning Test (RAVLT) showed highly organized ability for learning new knowledge as well as attention and concentration, which can be seen from the progression in the obtained new knowledge. Female subjects are learning much faster than the male subjects. No changes in the time of performance. After a few bad results, the students manifested improvement of the total time for performance (adaptation in the test situation). The commission's number is much greater after the third task (they are bored or tired, or the task is to hard). Omissions are greater after the four task (attention is diminishing because of boring or tiredness). The greater impulsive reaction (commissions) after the 5-th task could be interpreted with the feeling of boring / fatigue. Statistical analysis showed significance at the level $p<0.03$.

We recommend focus on the three dimensions of strategic instruction given below in order to increase attention:

Think-ahead instruction (to activate students' background knowledge, motivate students, create student-interest and create an anticipation for learning);

Think-during instruction (for use as new subject-matter is explored); and

Think-back instruction (used to facilitate student review of main ideas and essential details, reflection, evaluation, and elaboration of the information presented during the lesson).

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