Software Agent in E-Learning Mobile Application for Kindergarten Students

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Abstract*—*Many new technologies including software agents have been used for teaching and learning. It is the time to divert from the learning theories to information technology. Using the internet has enriched the e-learning in many schools and universities in many countries, since the new technologies (including the internet) that are being used in teaching nowadays are very attractive for students and especially for kids. In this paper, we propose a mobile application that presents a web-based lesson for children and then measure their ability to learn. For the evaluation of our application, we ran a usability test with children between 4 and 6 years of age, and discuss the findings. The results of our paper showed that the software agent in e-learning mobile application for Kindergarten (KG) students is promising. 85% of the students showed the application usability.

Keywords*—*E-Learning; Children; Software Agent; Mobile Application.

I. INTRODUCTION

Over past few years and with the emergence of the World Wide Web, web based applications have been used in education; for teaching, learning, and for (distance) learning. Many universities and schools all over the world offer online courses for their students or even for distance learning, where students and instructors no longer need to meet in the same place and at the same time, students can share material as well. Software agents have been used both in e-learning [1] and in distance education [2]. In our study, we focus on Kindergarten students and how they are influenced by e-learning.

Mobile learning is an emerging field of educational research that rapidly expanded; its practice can be seen in schools, college, and universities as well as in the workplace. Mobile devices are currently the most commonly tools used for communication or reading. Modern mobile devices allow interactive work and it is easier to work with them (for example the tablet) than the personnel computer. For all these reasons, it is necessary to adapt learning materials for mobile devices [8].

Many studies have addressed the influence of new technologies, especially the computers and the internet, on children; their social and educational benefits and side effects, such as increased distraction caused by WLAN in classrooms and IT addiction [6] [7] [8] [9]. Nowadays, many children are familiar with the computer and other technological devices. Mobile computer and communication devices include not only notebooks that provide relatively low level of mobility, but they also include smartphones and tablets that provide better mobility. They use mostly operating system Android, iOS or MS Windows Phone. Having relatively long working time, instant response to user commands, software and hardware extensibility, and communication abilities are some of their advantages [8]. Children and young people are familiar with internet as well, since they now frequently use the Internet for learning (by having access to information, knowledge, opinions, education tools, etc.), communicating (express ideas, share information and experiences), interacting socially with others, creating and sharing content, playing and be entertained (games, movies, music, books, etc.). Children (from different ages) responsiveness to the different technologies has been pointed to in early studies [6]. For children, e-learning is one of the teaching techniques that are more attractive and interesting than traditional ones, in which the tutors only transfer the information rigidly.

According to [1], 'Software Agent' is any entity that can perceive an environment through sensors and act on it

through mechanisms of action (effectors). Agents are systems that operate in a complex and possibly dynamic setting, perceiving and acting autonomously within it and achieving a set of goals for which they are programmed.

Responsiveness and engagement are the most important elements of interactivity that is a key characteristic of software agent. Our proposed system responds to the behavior of students; either it reacts positively (in the case or right answer) or negatively (in the case of wrong answer).

II. RELATED WORK

Authors of [2] proposed an integrated and extensible architecture for agent-based distance learning that provided component-based extensibility. Their study provided HTTP and IIOP connections for maintaining and delivering courseware and for allowing users to work collaboratively in teams respectively.

An Architecture for an emotional software agent was proposed in [1], that was embedded in a web-based e-learning environment. A Usability Test was run with a sample of children between 10 and 12 years of age in a computer lab in the school. The proposed agent had emotional reactions depending on the students' answers of grammar questions and their speed of answering. The simple facial reaction of the agent was not noticeable by some students, also the sample size was small, since the system was tested by only five children.

Reference [3] proposed three algorithms required software agent's interaction in virtual learning information system environment; agents interaction localization algorithm, the dynamic agents distribution algorithm (load distribution algorithm), and the agent communication algorithm based on using agents intermediaries. The main objectives of these algorithms were to reduce the response time for any agents' changes in virtual learning environment by increasing the information exchange intensity between software agents and reduce the overall network load, and to improve the communication between mobile agents in distributed information system to support effectiveness.

A study of the affective states exhibited by students using an intelligent tutoring system with and without an interactive software agent was conducted in [4]. The tutor was an agent called Scooter, and the study resulted in the fact that Scooter was well-liked by students, and improved student learning outcomes relative to the original tutor Scooter that did not have a large effect on students' affective states or their dynamics.

A recent study [5] has discussed the impact of using software agents in e-learning and analyzed its development trends. Many of the agents properties which can improve the services offered to assist student or to support teachers were presented. Some advantages (such as being cost effective, allowing student to study anywhere as long as there is access to a computer with internet connection, etc.) and disadvantages (such as Lack of personal community and connection, Social isolation, etc.) of using software agents in e-learning were discussed as well.

Reference [8] has described the experience of teaching and the development of mobile applications and mobile devices such as smart phones, tablets, and notebooks for computer science teaching and for users with special needs. Both the possibilities and the enhancements of using mobile technology in teaching informatics and programming were presented.

III. OUR PROPOSED APPLICATION

In our study we propose a mobile application that works on mobile devices with Android Operating System (such as tablets and Samsung smart phones) for e-learning. The proposed system works a software agent as a whole, since it reacts and responds to the students' answers on some questions. Our mobile application, named "Color App" basically presents a web-based video that aims to teach colors to kids (from 4 to 6 years old) in English, then examine them with a set of questions are used to measure how much the kids have learned from that video. Figure 1 shows the application interface.

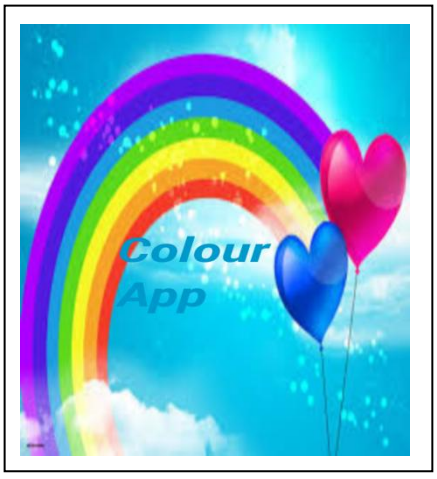

Fig.1. Color App Interface

The questions can be considered as a usability test of our system. A sample of the questions, the positive reaction, and the negative reaction are presented in Figures 2, 3, and 4 respectively.

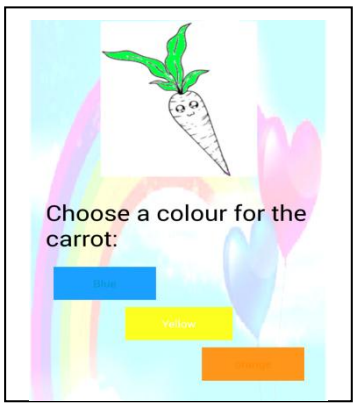

Fig.2. A Sample Question

Fig. 3. Positive Reaction

Fig. 4. Negative Reaction

The application we propose aims to test the possibility of teaching kids using the e-learning techniques. The usability test has conducted in an international school on students from KG-level 1 and KG-level 2. The test consists from 10 questions that are related to the presented video in advance. The students were notified that the application is being tested itself but not them. Actually, the application adopts the idea of reacting depending on the student's answer for each question, the reaction is based on emotional facial expression, since the emotional face of human behavior plays a key role in the learning process [1]. The right answer results in positive reaction in the form of a happy and encouraging face, while the wrong answer is responded by a sad face. In addition to testing the application by answering the questions, we have observed the kids while they were testing the application, and taking notes about their interaction with it and how they are influenced by the system's reactions to their answers. After test completion, a simple questionnaire (in a form of few semi-structured interviews with key questions) is used as well to make sure that kids have realized and understood the system's reactions to their answers and how much those reactions encourage them to continue the test and how much fun was the application use. Our sample of kids consists of 20 students (11 boys and 9 girls). The reason for applying our study on kids, is that it is reported that children are very sincere [1], and sometimes strict, when assessing technology. Children can easily take on the role of software tester because they use technology [8].

The design of an e-learning application needs to take into account both usability and didactic efficiency. Usability is associated with the functions provided, visual arrangements of the application, content elements, modes of interaction with the application's functions and navigation through the application and content elements. Didactic effectiveness includes aspects related to the educational planning of content elements, educational techniques that are adopted, level of detail, updates, and accuracy of proposed contents [10]. Figure 5 addresses the main steps (the work flow) of our study:

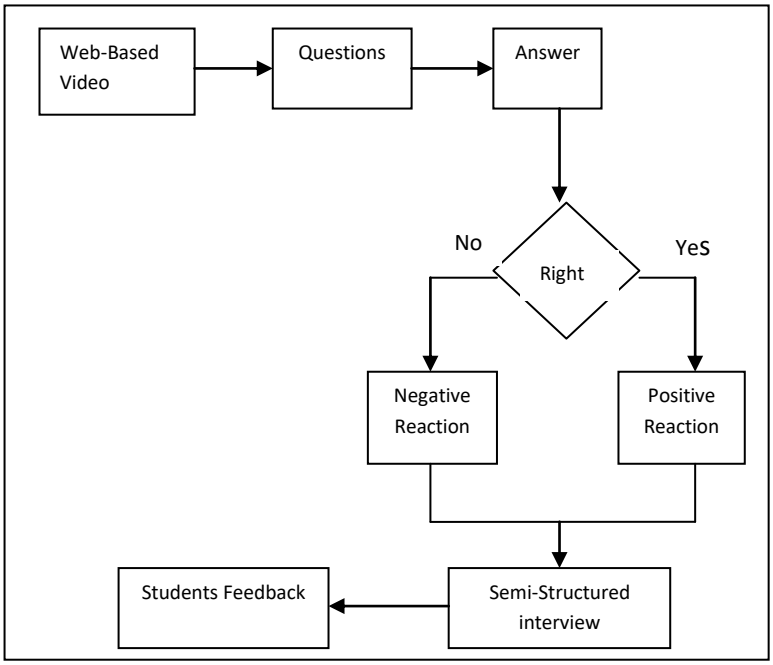

Fig. 5. Our Proposed Application Steps

IV. EXPERIMENTAL RESULTS

The experiments are conducted in an international school on students from KG-LEVEL 1 and KG-LEVEL 2 who already has a background in using mobile devices with touch screens. The experiments started with presenting a web-based video about colors (their shapes and names) to the students, then they have been tested by a group of questions. The test consists from 10 questions that are related to the presented video in advance. The right answer results in positive reaction in the form of a happy face, while the wrong answer is responded by a sad face. In addition to the test, observing the kids while answering was considered .Since our sample of students consists of kids of 4-6 years age, we have helped them reading the questions. The usability test aims to check the student's ability to use the applications easily. After test completion, a simple semi-structured interview with key questions was conducted with each student. The experiments have shown great interest in the application. Only 15% (three students from KG-LEVEL 1) of the students have answered incorrectly (one question for each). The questions are written and read in English language and in a form of multiple-choice. 100% of the students (20 kids) show interest in our application and some of them have asked to try it again. All students (100% of the sample) have answered the three questions of the interview after testing the application positively, i.e. after watching the video and answering the test questions, students have been asked whether they found the application good/useful, fun, and could they realize the meaning of the system reaction to their answers. All the twenty students (100%) found it good, had fun using it, and could easily understand the reactions. From observing the students while testing the application, we have realized that they were smiling when they see the happy face as a result to a correct answer and when asked them about its meaning, 30% of them said "It means good answer", 40% of them said "Great job", and the remaining 30% of them said "I won". From the three students (which is only 15% of the overall sample) who made incorrect answers, two students (which is 67% of them) had similar facial expression to the sad face results from the incorrect answer, so they understood that they had wrong answers and were not happy.

V. CONCLUSION

E-learning, software agent, and mobile applications are three important topics nowadays with the great development in new technologies and intelligent software. Our study proposes a mobile application that aims to teach kids using some web based material, since education is a good field where new technological applications can be applied. The kids' ability to learn in this way is tested using some questions with immediate reaction (positive or negative) based on the answer (correct or incorrect respectively). According to the experiments, the application is easy to use, useful, and funny for 4 to 6 years old kids.

VI. FUTURE WORK

For the future, we propose the following:

- Creating a software agent 3-D character with obvious and different reactions according to the students' answers.
- Increasing the number of students (i.e. the sample size).
- Conducting the experiments with older students.

REFERENCES

[1] N. Konstantakis and D. Stamatis. "An Emotional Software Agent in an E-Learning Environment for Children". Proceedings of the Multidisciplinary Academic Conference. Pp. 1-8. 2015.

[2] J. Suzuki and Y. Yamamoto. "Building A Next-Generation Infrastructure for Agent-based Distance Learning". International Journal of Continuous Engineering

Education and Life-Long Learning, Vol. 12. Nos. 1-4. pp. 299-317. 2002.

[3] Z. A.M. Abu Sarhan. " Software Agents Interaction Algorithms in Virtual Learning Environment". World of Computer Science and Information Technology Journal (WCSIT). ISSN: 2221-0741 Vol. 4. No. 2. pp. 18-25. 2014.

[4]Rodrigo, Ma. Mercedes T. Baker, R. S.J.d. Agapito, J. Nabos, J. Repalam, Ma. C. Reyes, Jr., Salvador,S. San Pedro, and M. Ofelia C.Z. ."The Effects of
an Interactive Software Agent on Student Affective Dynamic s while Using an Intelligent Tutoring System". IEEE Transactions on Affective Computing. Vol. 3 Issue 2.pp. 224-236. 2012.

[5] D. Jelonek. " The Development of Software Agents in e-Learning 3.0". The 7th International Conference on Information Technology. Pp. 332-337 . 2015.

[6] E. A.Wartella and N. Jennings. "Children and Computers: New Technology—Old Concerns". The Future of Children CHILDREN AND COMPUTER TECHNOLOGY. Vol. 10 • No. 2 – 2000.

[7] M. Spitzer. "Information technology in education: Risks and side effects". Trends in Neuroscience and Education. Volume 3, Issues 3–4. Pp. 81–85. 2014.

[8] R. Fojtik. "Mobile Technologies Education". ScienceDirect. Procedia - Social and Behavioral Sciences 143. Pp. 342 – 346. 2014.

[9] L. Osin. "Computers in Education in Developing Countries: Why and How?". Education and Technology Series. Vol. 3. No. 1. 1998.

[10]C. Ardito , M. F. Costabile, M. De Marsico, R. Lanzilotti , S. Levialdi, T. Roselli, and V. Rossano. "An approach to usability evaluation of e-learning applications". Universal Access in the Information Society. Volume 4. Issue 3. Pp. 270-283. 2006.