Mobile AI Analytics System for Improving Educator's Awareness on Student's Knowledge

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Abstract: New technologies have provided educators to track and store student's learning activities in the form of big data sets in online environments. Big data refers to the capability of storing large quantities of data over an extended period and down to particular transactions. Analytics also refers to the scientific process that examines data to formulate conclusions and to present paths to make decisions. In this paper we demonstrate a mobile artificial intelligence (AI) analytics system that acts as learning platform for the students and to introduce the current possibilities in incorporating AI and analytics within the mobile application that can analyze the user's knowledge in a particular subject by providing a series of questions to the users to be answered. A validation test using pre and post test questionnaires and focus group discussion with student participation in using the mobile AI analytics system has facilitated in improving educator's awareness on student's knowledge of the subject matter.

Keywords: Analytics, education, android application, AI, Self-Analysis, learning

I. INTRODUCTION

Android [1] is one of the most widely used operating systems (OSes) for smartphones, with a global market share of 87.7 % in terms of sales to end users [2]. Its open specification facilitates the development of applications and their release on the Android application market [3].

According to an article [6] "The rapidly advancing mobile computing technologies along with abundant mobile software applications ("mobile apps" hereafter) make ubiquitous mobile learning possible". Generally, the major affordances of mobile computing technologies for learning include, user mobility resulting from device portability, relatively strong computing power in small devices, and always-on connectivity. These affordances lead to tremendous potential for innovative uses of mobile technologies in education. In addition, other mobile devices such as smartphones or iPod touches are vastly gaining popularity due to the availability of various easy-to-use mobile software applications.

There were more than 800,000 mobile apps for iOS devices in Apple's AppStore and Android OS devices on Google Play (formerly Android Market) respectively across over 20 categories as found in Wikipedia.

The innovation in creating mobile applications for education have been attracting interests among the educators since it's highly has the capacity to facilitate teaching and learning. However, appropriate and relevant applications are not available always. Huge number of educators judge the apps by the review or by themselves testing the applications. These are one of the reasons that leads one to create an own mobile application for education with the necessary features that are relevant for teaching and learning. In addition, educators creating their own mobile applications for learning and teaching creates an advantage use of mobile technology that aids student learning. However, designing a mobile application remains a challenge for the educators as most of the application in the market are usually constrained or have feature limitations by app creators.

The objective of this paper is to demonstrate an app that acts as a learning platform for the students and to introduce the current possibilities in incorporating artificial intelligence and analytics within the mobile application that can analyze the user knowledge in a particular subject by providing a series of questions to the users to be answered.

This paper is organized as follows: Section 2 highlights the proposed methodology. In Section 3, a detailed Literature review is provided. Conclusion is drawn in Section 4.

II. METHODOLOGY

A. Problem Definition

Teaching and learning analytics is an increasing educational problem with an increase in quality teaching in higher learning institutions such as Universities, Colleges and Polytechnics. Throughout the past years, educators and researchers are constantly looking for better approaches to improve the learning environment so that students are able to benefit the most out of it. For example, it is important to highlight points of modification where the educator can intervene or improve their teaching methods, in order to create a conducive learning environment. With that in mind, there are a few problems that can be identified with the conventional teaching and learning approach such as:

1. Inabilities to spatial visualize the relationship between reality and theoretical concept [8] & [9].
2. Students are unable to comprehend how the knowledge is structured [9].
3. Difficulties in relating and applying the knowledge to other domain [10].
4. As the number of students increase at the time of shrinking funds, lecturers are confronted with large audiences (>700 students), there are difficulties in

conveying the subject matter of mass to individual student and be understandable for everyone [11].

5. Difficulties in solving problem when it is asked differently than the ones in their exercises and instructions [12].

As a result of efficient and efficacious analysis of teaching analytics the societal costs in general student population can be decreased by reducing for example, the amount of time in generating questionnaires, grading and solutions [10].

On the other hand of technological constrains, there are many factors which are taken into consideration by which the pre-defined keyword (android applications for teaching and learning) gets affected. There are significant number of android applications for teaching and learning one of the main lists of application in the market is a simple application that can test the user knowledge in a particular subject by providing series of questions which are answered by the users.

The problem originates when the developers of the application could not determine if the users really understand what they have learnt through the application. As there is less implementation on the idea for the developer to get back the data of what the user has answered or how much knowledge is retained by the user of the application.

B. Related Work

There are many mobile application which helps students learn a particular subject such as elmni [5] for learning Arabic, Soloearn which helps the users to learn programming languages such as C++, Java and Python [5].

Apart from learning languages and programming there are application which helps the user to learn more on practical subjects such as mathematics: Math – Quiz Game is example of these applications. These applications has a major disadvantage as the authors stated in the problem definition that these kind of application does not provide feed back on the knowledge retain by the user while using these apps.

C. The proposed solution

In our application we implemented an Artificial Intelligence feature that can understand the users level of understanding by users answering the questions given for a specific subject.

This application holds a feature that can do real time analyzes when the user is answering the question and the application does it by itself by gathering the data of series of answers given by the users, which will trigger the AI to increase the difficulty level of the question to test to what extent the user has the knowledge. Apart from that to provide feedback to the users by showing where the user has gone wrong and train the user by series of questions, answers, practical and theoretical examples to enhance the knowledge further.

AI Test, Realtime Analyze, Feedback, Training (TAFT) is the proposed solution by the authors to advance the learning approach through mobile applications.

D. Mobile AI analytics system

The authors has developed an application by considering the above criteria TAFT. Our application is implemented in

an android operating system which is widely used by huge number of users [1]. The main development benefit for developing for android devices is that it support a high range of useful libraries and many open and free tools that can be used for developing rich applications.

In the application explained as follows, we used two types of database namely (i) Shared Preferences Interface in android to access and modify preferential data as key and value and to use small data [6]. Every file of Shared Preferences is managed by the framework and can be either private or shared, (ii) Firebase is a platform for the development of mobile and web applications, Firebase provides the tools and infrastructure to build better applications and grow successful businesses. Firebase has been using four services: Realtime Database, Authentication, Cloud Storage, and Crash Reporting.

The layout of the application is shown in Figure 1. The authors aims to create a test application called quiz app that contains the functions such as QUIZ and TRAIN where the main function is the quiz function which is used to test the users knowledge on a certain subject and train function to educate the user on certain subjects.

E. Motivation of work

This work focuses on the implementation of a mobile analytics apps using AI technique, i.e. to improve educator's awareness on student's knowledge. A major challenge facing instructors in improving students' knowledge is helping students to understand what they have learnt better. In general, textbooks cannot perform actions such as analyzing students questions and answers with interactive timely feedback. Hence, the motivation is to implement a mobile AI with analytics app that could be perform these actions.
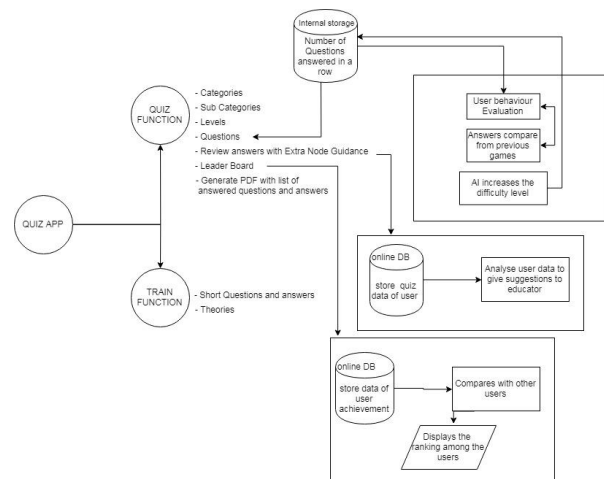

Fig. 1 Layout of the AI analytics APP

F. The developed application

The GUI of the application is friendly and easy to use and understand by the user as shown in Figure 2 since the application mostly uses icons rather than words. The use is automatically logged in through google games services [7] to remove the hurdle of registering the users and signing in

every time the user runs the application.

This application saves the data on the device for a particular game in case the device is offline and then uploads the data to the firebase: data includes the user id, user name, score, last played, categories played, number of questions answered etc. and this application does not collect private data for security purposes.
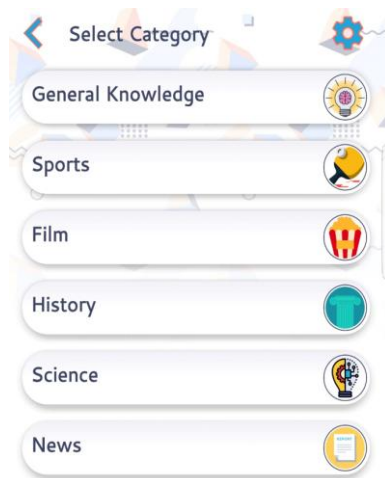

Fig. 2 Categories in a pull down menu

When the user attends a particular quiz the AI mechanism automatically processes the level of user and provide question to test different level of difficulties and the data that is gathered from here will be used by the application to deduce the actions of the user better and provide useful questions and training sessions accordingly as shown in Figure 3.
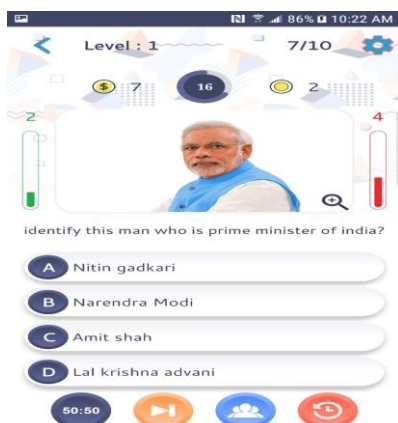

Fig. 3 A quiz with AI enforcement

The screen snap shown in Figure 4, pops up in the end of the quiz to show the knowledge analytics i.e. right and wrong answers and the score if the user has successfully completed the level the user has choose then the user will have an option to move to more advanced levels. Review answers section shows the questions and answers one by one to the users to their understanding and will have an option for noting down any information with an option called extra note. Additionally, generate PDF will allow the user to generate a pdf file to view their progress of the quiz with right answers and the wrong answers and the user will be able to save it in their device.
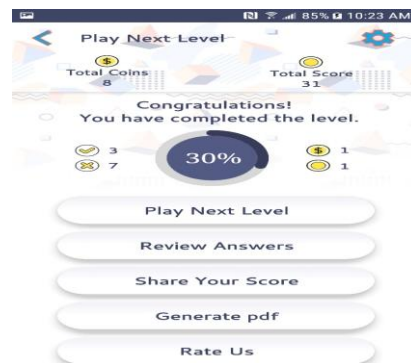

Fig. 4 Knowledge analytics

Fig. 5 Leader board

The users may also approach the leader board which is a small function to motivate the users by showing their ranks compared to other players or their friends as shown in Figure 5.

III. SYSTEM TESTING

On completion of the design, fifty-five students participated in the one week trial of the prototype of the mobile AI analytics system, in Jan 2019. As part of the one week trial of the system, students completed a pre and post-test questionnaire. The questionnaires consisted of three sections:

(a) Interest in, and knowledge of, aspects of the mobile AI analytics system,;

(b) Access and experience with mobile phones; and

(c) Views of traditional teaching and learning.

Answers to questionnaires in section (a) required a combination of ratings on 5 point Likert scales (1 strongly disagree to 5 strongly agree) and open ended questions. Section (b) contained some yes/no questions (for example, do you have a mobile phone?) as well as questions requiring an answer on 4 or 5 point scales. All questions on views of traditional teaching and learning used 5 point Likert scales.

The mobile AI analytics system was introduced to the students following seven weeks conventional course lectures. The pre-test questionnaires were administrated in

the class in which the mobile AI analytics system was introduced. Students were informed that the questionnaires were not a test and that the results would be used to provide information about how the mobile AI analytics system could be improved. Students were advised that they would receive another set of questionnaire at the middle of the six weeks course. It was not pointed out that this would be the same questionnaire as the students might then be inclined to try to remember their answers to the first survey. The post-test questionnaires were administrated in the class about six weeks later, after the mobile AI analytics system had been designed and improved. Comparisons between pre and post-test responses were made using t-tests for related groups.

A focus group of 11 students was also conducted by an academic member. During this time the focus group was asked their overall impression and understanding of the mobile AI analytics system and their suggestions for improving the system

IV. RESULTS AND DISCUSSION

The majority of the students (79%) had access to a mobile phone, rated their skills by using a phone as average in using computer based learning software in their learning (59%), and had used at least one application.

Pre and post questionnaire were available for 38 students (66%) as 17 students failed to complete a questionnaire at the end of the pilot study. Some students who failed to complete the questionnaire were added in the focus group. A comparison between the pre-questionnaire responses by those who completed both questionnaires and those students who only completed the first questionnaire revealed no significant differences in the responses of the two groups.

Comparisons of students' pre and post test survey responses showed that after the students who had used the mobile AI analytics system rated their knowledge (t=-4.46, df=35, p<0.001) (see Table 1). Students also rated their interest in using the mobile AI analytics system as significantly greater after understanding the topics (t=-2.27, df=36, p<0.05).

To determine whether the mobile AI analytics system aided the students to enhance their knowledge, pre and post test questionnaires asked students to solve selected problems of the subject matter. In the pre-test questionnaire average number of score was 2.6 with 25% of students able to answer at least two questions correctly out of four questions. This compared to a mean of 3.2 in the post-test questionnaire with only 7% of students unable to answer two questions correctly.

The evaluation results presented here represents the phase of the assessment, examining the first group of students who participated. The results are motivating. However further formative evaluation results are required to see whether the results hold and are sustained across time and over different settings and with different student group is planned. On the basis of these results it is suggested that the mobile AI analytics system helps students in the visualization process. Additionally it allows students to interact with the mobile AI analytics system to put knowledge gain in class into practice. The achievement of these learning outcomes was supported by the results from the evaluation, which showed that at the

completion of using the mobile AI analytics system students rated and demonstrated, that their knowledge the topics and applying the knowledge in answering the questions has significantly increased.

Table. 1 Mean and standard Deviations of responses to the Pre and post – test questionnaires

Question	Mean Pre Survey (Standard deviation)		Mean Post Survey (Standard deviation)	
How would you rate your present knowledge on the mobile AI analytics system?	3.1	(.54)	3.4**	(.64)
How would you rate your present knowledge on the way the mobile AI analytics system topic as learnt from the textbook?	3.1	(.80)	3.5**	(.69)
How would you rate your present knowledge on the way the mobile AI analytics system topic as taught by the instructor?	2.9	(.70)	3.4**	(.72)
Scale used 1 = very poor; 2 = poor; 3 = average; 4 = good; 5 = very good				
Learning the mobile AI analytics system topic is easy?	3.7	(.62)	3.8*	(.46)
In general I am interested in using the mobile AI analytics system?	3.0	(.10)	2.8	(.76)
I found the mobile AI analytics system to be useful and easy to use?	3.4	(.93)	3.2	(.96)
The mobile AI analytics system helped me in understanding the contents better?	2.6	(.87)	2.4*	(.73)
I solve similar problems better after using the mobile AI analytics system?	2.5	(.10)	2.6	(.87)
Scale used 1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree;5 = strongly agree				
Items where there were significant difference between pre and post test questionnaires *p<0.05, **p<0.01				

V. CONCLUSIONS

The employment of mobile AI analytics system for educator's awareness on improving knowledge is an essential pedagogic complement to modern teaching and learning. The present work in this research is an important contribution in the educational domain of information technology and students and instructors in the educational field. To improve students' knowledge on this matter, the researchers propose a pedagogic approach based on the use of mobile AI analytics system to help students to comprehend the topics better. The evaluations results of the mobile AI analytics system revealed that the system was useful and could help the students in understanding the topic better.

The design of the graphical user interface using android OS was a great help to students in interacting with the mobile AI analytics system as the students were familiar with such user interfaces due to their experience of surfing the Internet for related information. The use of appropriate colors and labels in the system also helped students to grasp the concepts presented.

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