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MOBILE APPLICATION FOR TEACHING AND ASSESSING STUDENTS NEEDING ADDITIONAL CURRICULAR SUPPORT (SNACS) IN DENTAL EDUCATION

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ABSTRACT*--The current web 2.0 generation of students are having more technological literacy than their subject literacy. Development of innovative mobile application with different teacher and student interface for teaching and assessment is not much studied in dental education.The basic requirements needed for a mobile application to be used by the students and the teachers were chosen. The teacher interface was enabled to create and send short study material, assignments and objective type tests. The students' interface was enabled to receive the notifications and answer the objective tests. The teacher would be able to monitor the individual progress of all the enrolled students. The first year undergraduate dental students from a private dental college enrolled and used the app with a mentor on teacher interface. Qualitative analysis of the efficacy of mobile application was studied using questionnaire and focus group discussion. The mobile application "SNACS" was successfully devised. The students used the application for that academic year and gave a positive feedback. The app was found to be more user-friendly and improved the academic performance of the students. It helped them to change their study habits positively.Within the limitations of the study, the mobile application "SNACS" was working effectively in the android mobiles and it helped the Students Needing Additional Curricular Support to improve their academic performance.*

Keywords-- *Mobile technology, Mobile application, m-learning, e-tutoring, Online Assessment, Teaching and learning Technology*

I. INTRODUCTION

The rampant growth in technology in recent years has led to heavy dependency on technology among the individuals. Not an exception, the technological literacy of the present day students is higher than their subject literacy. This demands a variety of instructional strategies to make a positive impact in them. Many health educators have started using technologies in different forms like simulations, mobile applications and multimedia

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presentations for classes matching the curriculum. McCoy et al[1] reported improved learning outcomes and active learning by the students with the use of multimedia in medical education.

The students of the digital generation vary completely from the previous generations in the way they access, process and apply the knowledge. Mobile technology application in medical education was proved to be effective at Institutional level and also to enhance learning in the clinical postings. Just in time learning using mobile devices were also emphasized.[2]

Learning is augmented by technology which provides a scope of getting multiple opportunities for giving feedback to the students. It also addresses the needs of the students with varying learning styles.[3] Recently, many studies are done on psychology of learning, retention and student performance in all the branches. There is a rise in the awareness of teachers about the various methods of augmenting traditional teaching methods that includes E learning and M learning to suit the WEB 2.0 generation of students. Mobile learning (M-learning) is an asynchronous learning technology based on person to person interaction anytime anywhere. Several authors have quoted the need for research in use of mobile in education and the facilitating factors. [4-7]

Bruce et al compared learning using mobile based device loaded with content and library exercise and discussed that mobile based aid was an effective additional learning tool. Though the mobile learning has been studied in distance learning, there is still lack of voluminous evidence on its use in higher education especially health professions education.[8]

II. METHODOLOGY

Background of the invention and prior art:

E-learning is growing at a rapid rate in the fields of education and training. Students' access to mobile computing device is growing rapidly because of its familiarity and preference. Mobile applications used by the students themselves for education includes flash cards for learning or keeping reminders which are available in Google play store etc. However, such application does not provide personal interaction between the students and the teachers within the same mobile app. Further there is lack of flexibility to the teachers in customizing things. In addition, there is lack of a related website to document the progress and lack of modality to customize test questions by teachers to any number of attempts to any duration as they wish. The mobile app developed and discussed in this study is an attempt to develop an educational system for higher education which is devoid of above said drawbacks.

Development of the mobile application:

An Android compatible internet based application was proposed to be developed. The features aimed were the teacher device to enrol the students selectively in subjects, provide them assignments and conduct objective tests and also follow them up continuously. The students should be able to receive the corresponding notifications, perform the objective tests repeatedly until they get it correct. The teacher should be able to review the progress of the individual students and also to generate a report of the log.

Testing of the mobile application:

The study was approved by the Institutional Ethical Committee code, IGIDSIEC2016 NRP04FASMPRI. The efficacy of the mobile application was tested qualitatively using questionnaire and focus group discussion. 44 first year Bachelor of Dental Surgery (BDS) course students of a private dental college in South India were enrolled in the app after duly getting the consent form signed. One teacher was enrolled who could sensitize on the basics of first BDS subjects in consensus with the individual subject experts. Series of assignments and objective type tests were given to the students in the mobile app. The progress was monitored continuously. Noncompliance were addressed from time to time. The students were subjected to a questionnaire and focus group discussion to determine the effectiveness of the mobile application. Two students with IOS system mobiles voluntarily and enthusiastically got an android mobile for using the application.

The efficacy of the app was rated using a pre-validated questionnaire by the students. It had the questions on whether the student used the app, if so whether it was useful to them and if yes to rate it in a scale of 1 to 5. The questions were also asked to find out whether the use of app modified their study habits and also to express their perception on their academic improvement. In the focus group discussion done after the analysis of the questionnaire, the students were asked about how user friendly and helpful was the application. They were also asked about their suggestions for improvement. During the focus group discussion one investigator discussed and the other investigator recorded the points generated in written form.

III. RESULTS

Development of the mobile application:

An android based mobile application was developed and named as "SNACS" to dedicate it for the benefit of Students Needing Additional Curricular Support. Fig.1 depicts the architectural diagram of the mobile application. The application needs active internet connection for functioning. The application has two user interfaces one for the students and the other for the teachers. Any number of students and teachers can be registered in the app depending upon the capacity of the server. The application is not uploaded to Google play store yet, since it is filed for patent in both Intellectual Property of India as well as in the International Patent Consortium Treaty.

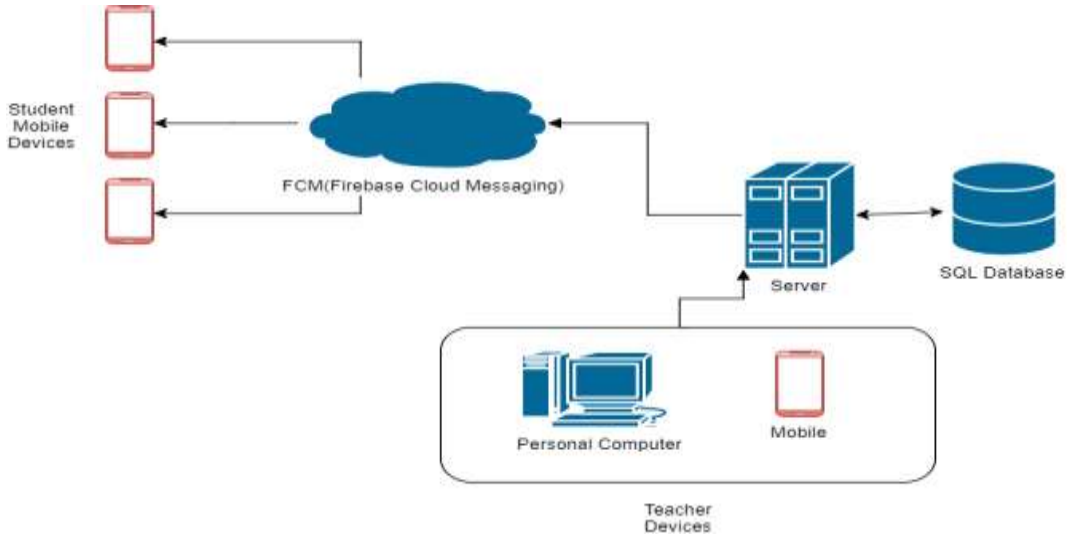

Figure 1: Architectural diagram of "SNACS" mobile application

Both the teacher and the students need to register in the app. Fig.2 shows the options for each subject available in the application. The teacher can create and send assignments and objective type tests for the students. The teacher will be able to see the individual progress of all the students and also generate the report of activities from the webpage. Fig.3 depicts the display of student progress in the app. The students will receive notification every time an assignment or test is added to the app. The moment the student opens it, notification will be received in teachers mobile with student ID. Noncompliance of the students could be easily detected and further action could be taken to motivate them at the earliest. The attempt of tests and assignments are colour coded, green as completed on time, orange for not completed but time duration is still there and red for those which are not completed within the duration assigned by the teacher.

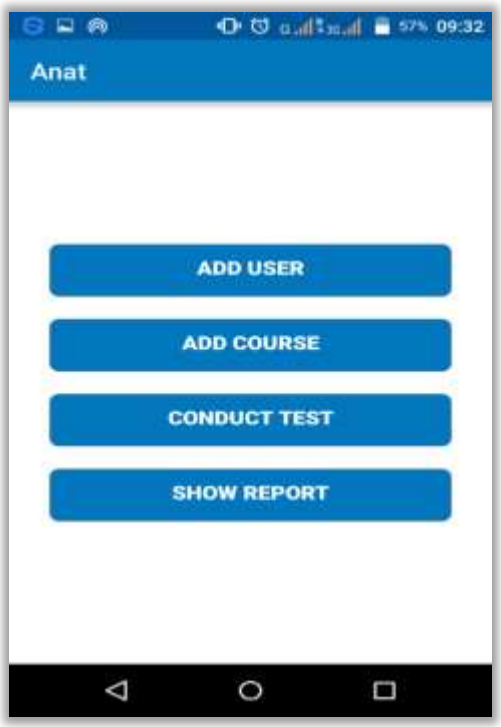

Figure 2: Options for each subject in SNACS app

The present invention enables the teachers to make a schedule for guiding self-directed learning to happen in the students of higher education by employing the developed educational system. It also supports the students of higher education by enabling them to receive objective tests in the app with more number of attempts to make them thorough with the key elements in a topic.

Testing of the mobile application:

All 44 students responded for the questionnaire and all of them accepted that they used the mobile application. Fig. 4 shows the students rating in a five point scale on how useful was the application. Fig. 5 shows the perceived improvement of study habits of the students in a five point scale. Fig. 6 shows the expected improvement in their academic performance following the use of mobile application. The focus group discussion revealed that in general the students were excited to use the mobile application for studies purpose. All students opined the app to be user

friendly. The students expressed the strengths of the application as "felt good to be under teachers' individual attention"; "I was able to give the tests when travelling in the bus"; "Multiple choice questions testing in the app helped me to remember key points in the subject"; "It was comfortable as a reminder alarm to study"; "I was focussed in everyday learning which otherwise I would not"; "I got the habit of touching my book everyday as a compulsion". The challenges expressed by the students were "To follow on everyday basis was little overload"; "Parents were worried that I'm using mobile for longer time"; "Felt it forced me to study always".

Figure 3: Report of student progress displayed in SNACS app

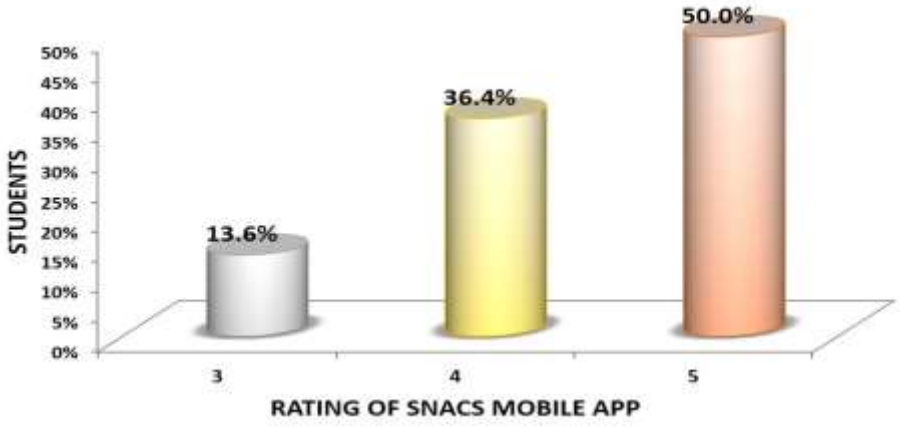

Figure 4: "SNACS" efficacy

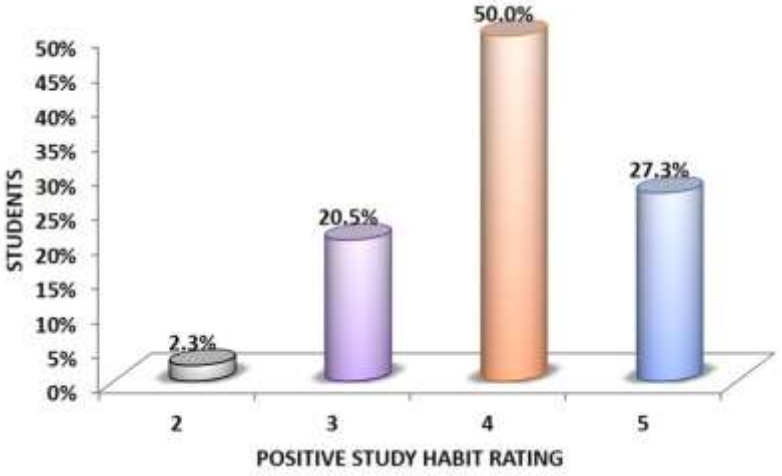

Figure 5: Improvement in study habits

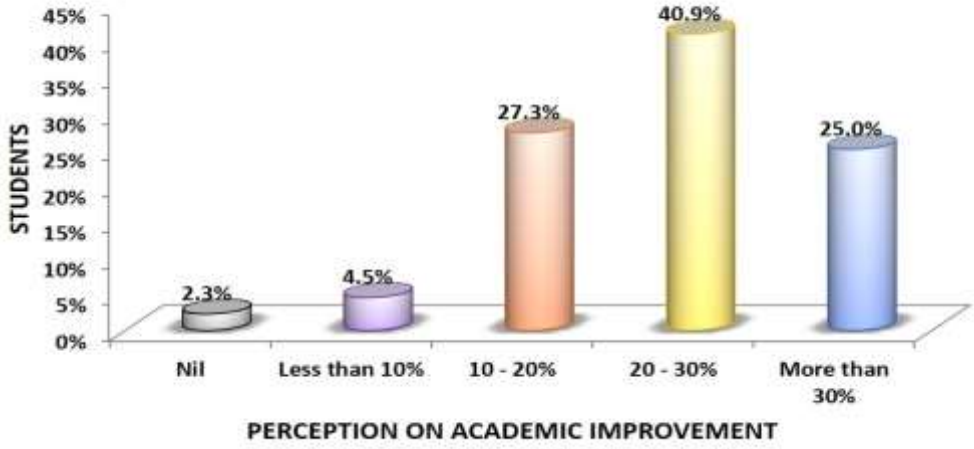

Figure 6: Academic improvement perception

IV. DISCUSSION

Davies et al have discussed the conceptual framework for mobile learning in which the contextual learning is supported by repetition and ability to consolidate the knowledge gained and to reflect on it. The SNACS app developed and tested in the present study follows the conceptual framework that allows the students to learn and also to undergo assessment for learning. Spaced relearning by scheduling the topics repeatedly adds more value by enhancing the memory of the students.[9]

Moses et al[10] conducted a survey among the final year medical students and concluded the mobile learning to be popular among the students and the need to promote access to mobile application and thereby promote the quality of medical education. The author had recommended for making effort to create mobile technologies to suit students' needs. In the study population 85% had android based mobile wherein the current study except for two out of 44, all had android based mobiles. The other two with IOS based device also bought an android device out

of their own interest to participate in the mobile learning process. The study participants of the current study alike to the reference study had internet access in their mobiles.

In the referred study, 72% of medical students already had at least one educational mobile application and 65% had one to five medical mobile applications. Majority of them were of lab value references, drug dosage calculators, medical dictionaries etc. This is a positive sign that depicts the interest of the students in using mobile applications. Although M- learning had already started, assessing the students via mobile application had not been studied in dental education. The mobile app developed in the current study helps to assess the students objectively and also monitor their progress individually. Asynchronous learning and assessment together in single application is an innovation in higher education. The query of whether the student will be genuinely answering or will refer and answer doesn't matter much since the assessment is only formative and will be a part of assessment for learning and is not of high stakes. Ultimately the student should learn. Many of the Massive Open Online Courses (MOOC) certify the students based on that.

In a study by Fan Si et al[11] 81% of the medical students were found to be using web 2.0 based applications through their smart phones. Sarrab et al[12] discussed that the usefulness of the mobile application, degree of innovation and user friendliness were few of the factors that influence the adoption of m-learning. In the current study, the student were motivated to use the SNACS app due to the above stated reasons as revealed in focus group discussion.

Saskia et al[13] developed and tested a mobile app for the learning of biochemistry. The app was considered to be useful for learning by more than 75% students. The use of mobile application was concluded to enhance the learning experience of the students with a positive attitude and was helpful to tackle the demands of higher education. Similarly in the current study, the participants were eager to use the technology and were benefitted by the mobile application. The innovation in the current application is that it's not subject specific. It could be customized for any field of education and for any level of education. The application also gives scope for follow up of individual students by the teacher to intervene early if not compliant.

Larry et al[14] discussed the effectiveness of Just in time learning using mobile devices in improving the clinical skills. However the connectivity issues, unstandardized platform of the range of available mobile devices, confidentiality were addressed as the challenges of m-learning. In the current study, the students having IOS devices were unable to use the SNACS app. But it was overcome by their enthusiasm by readily getting an android based mobile on a since the cost of android devices are far less than IOS devices.

Larry et al[14] summarized the various innovative mobile technology devised for medical education at various Institutes to suit each level of education. The mobile apps were classified as point of care teaching, calculators and study resources types. Majority of them were preloaded study materials, dosage calculators, videos on procedures and some flash card based apps with preloaded quiz questions. However, the current app designed by the researcher is easily customizable in any field for any level of education. The key difference is the teachers able to get the individual report of all students, to keep a track on all and also to support them with learning. The teacher can send the objective test questions based on the students need. This interactive mobile application between the students and teachers is a boon for training the Students Needing Additional Curricular Support.

Kieran[15] discussed the negative aspects being the possibility of the technology to be inadequate in hardware or software to support the applications. The current mobile app satisfies the device responsive design where the

display of the application is good regardless of the screen size of the mobile but does not support IOS devices. High risk of distraction by social media was discussed as a greater challenge by the author. Majority of the students in the present study had not felt difficulty to overcome the social media distraction. The higher education students are more self-directed and they are capable of taking control over their actions. Conversely, overuse of technology and negligence of content by the educators should also be taken care of.

The simplicity in getting access, possibility of learning anytime and anywhere, availability of cost effective connectivity, technology enabled contextual learning, comfortable, fast and continuous mode of communication makes mobile learning a success mode in all fields. Seamless learning with mobile first is the future of global education.

The limitations of the study includes that the SNACS mobile application devised is android based and cannot operate in other systems like IOS. Attachment of bigger files as learning materials should be supplemented by e-mail groups or Whatsapp groups. Future research can be done by combining the mobile application with other educational principles and methods like mastery learning model, Ebbinghaus forgetting curve and training to cater to multiple learning styles of the learners with supplements.

V. CONCLUSION

Within the limitations of the study, the android based mobile application was found to be an effective and user friendly tool for the Students Needing Additional Curricular Support (SNACS). It augments the traditional teaching and formative assessment of the students. The interactive platform add versatility to the teaching as well as learning experiences that stands apt for web 2.0 generation students.

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