ENHANCING STUDENT LEARNING IN MATHEMATICS CLASSES BY MEANS OF ONLINE COLLABORATIVE TOOLS

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Abstract

The higher education sector is continuously working towards the improvement of support mechanism by means of strengthening of education technology and various other strategies. This requirement differs from the nature of the subject. For technical subjects, it is much easier to take the assistance of technology, such as online tools, videos, animation, interactive applications and much more. Whereas, subjects like Mathematics and Language learning, has a totally different scenario. However, the higher educational institutions are adopting a various innovative approach in order to enhance the student learning experience. This research paper focuses on some of those methods, which are adopted to improve Mathematics education at the foundation level in one of the higher educational institution in the Sultanate of Oman. The foundation level education was introduced to bridge a gap of basic requirements, which some of the students lack while completing their higher school and takes admission in the diploma or bachelor studies. Foundation Mathematics is one of the subjects which is being taught at this level. Although, there is a provision that student can opt for clearing a challenge exam and get admitted to the first semester, still many of the students opt for studying foundation due to various factors. In their school education, they are not allowed to use smartphones or devices during their classes. Whereas, in college, they can use their devices for educational purposes. The module leader prepares a session plan according to the learning outcomes and maps various activities with the support of various tools. Some of these tools are online, which are accessible on mobile phones. One such useful tool is Kaizala, which allows students to collaborate with each other in order to participate in various activities being conducted by the faculty members. It supports almost all the multimedia content such as audio, video, animation, interactive quizzes, polling, sharing of images, etc. In this research paper, the authors have described the implementation of such collaborative tools in various ways, in order to enhance student understanding. Finally, the method was found to be very useful and it has improved the results. Part-time students also found it quite useful, as they were able to participate in the class activities even if they are unable to make-up to some of their classes due to some official reasons. There were students who were repeating the subject for more than one time and who have also found such methods as quite useful ones. Overall, the experience of introducing online collaborative tools to improve the learning mechanism of Mathematics related subject was found to be very good.

Keywords: Smart education for Mathematics, e-resources, online collaborative learning, education technology, social media for education

1 INTRODUCTION

During past few years, to overcome the limitations of the traditional way, various researches attempted to examine the use of technologies into the teaching and learning process in the higher education. Tsvetozar

Georgiev, Evgenia Georgieva, Angel Smrikarov (2004) discussed the existing devices and technologies that can be used to initiate mobile learning as new stage of the progress of distance learning and e-Learning. They have also presented the advantages of using mobile learning devices over the e-learning. They concluded that the assimilation of technologies will make the education process more flexible and will fulfill the needs of life-long learning. Nadire Cavus and Dogan Ibrahim (2008) examined the impact and usage of wireless technologies in learning new technical English language words by means of Short Message Service (SMS) of text messaging and found that a noticeable improvement in the students performances. Similar to this many authors have studied and discussed about the impact of incorporating technologies in the learning of various subjects (Virvou and Alepis (2005), Uzunboylu, Cavus and Ercag (2009), Presnsky (2007), Mallikikharjuna, Sasidhar and Satyendra (2010), Sarrab and Elgamel (2013), Samsiah and Ziden (2013), Mohammed T, Al-Hariri, and Abdulghani A, Al-Hattami (2017)).

Some of the researchers conducted surveys (on students and instructors) in their countries (of their work) and conclude that the students and instructors have positive insights of mobile learning (Yusri, Goodwin and Mooney (2015), Hunaiyyanm Alhajri and Al-Sharhan (2018)). Their study depicts that the mobility, flexibility, ubiquity, ease of access, improved communication between the leaners and facilitators is very much appreciated. They found that the financial and devices used were not obstacles in the path of their collaborative learning. They found that the faculties who teach social sciences (mathematics, science, and other subjects) and more interested and involved as compared to those who teach ICT subjects. Their study helped them in designing and developing the mobile learning system for their institutes. It was also reported that this learning have some social and cultural barriers.

2 ISSUES FACED AND NEED FOR COLLABORATIVE APPLICATION

The General Foundation Program (GFP) is the initial stage for the newly joined students in which they study all basic and fundamental modules. The GFP Mathematics at the Middle East College (MEC) have three different modules namely General Mathematics, Pure Mathematics and Applied Mathematics. At the beginning of Spring 2019, there were 345 students, out of which 71 students were repeating the module more than once and there were 4 students who were registered as Flexi mode students (Students working outside Muscat city (SWOM), who attend the classes after every two weeks for two weeks).

From the beginning of Spring 2019, we have arranged several extra classes/peer tutoring sessions/ workshops for our students, especially the group of students mentioned above to improve their performance in these modules and thereby improving the overall performance of the GFP programme. These classes were conducted on weekly basis (twice in each week) for all three modules, so that the students will have chance to attend at least one of the sessions. The students were informed about these sessions via emails as well as verbally by their instructor during the class timings. Even after putting all of our efforts, we were unable to reach out most of the students and all these efforts resulted unproductive, as hardly 2-5 students were registering and attending these sessions.

After discussing with the students, especially the students obtaining lower marks, we came to know that they want to attend the sessions, but they are not able to so due to several reasons such as: “having another session during the same time”, “tired due to continuous classes”, “transportation issues” and other personal issues. This led us to look for a way to be in contact with such students even at the location of their choice and as per the time convenient for them.

Authors were already familiar by various workshops organized by Centre of Academic Practices (CAP) at MEC, that some of the faculties have formed groups in WhatsApp and used it to discuss the problems of the students even after the college hours (Gupta, Liago and Gupta 2017). But due to personal reasons, we felt that not all of the students (especially female students) feel comfortable in sharing their personal contact information, which is must in WhatsApp group. So, we tried to search for an application having features similar to WhatsApp, but more private, so that students need not to share their personal contact information. Reason of looking for application similar to Whatsapp was that here all the students are very well familiar with WhatsApp and if they find an application which is similar to it, it will be easy for them to learn and hence participate in the activities.

3 METHODOLOGY

Most of the students are unable to attend the extra classes/ peer-tutoring classes because of their class timings, transportation and any other personal issues. This resulted in dropping down their performance in the module. Dean (2008) explored the integration of non-traditional activities to enhance the learning of mathematical concepts. He used hands-on activities, written explanations, and oral communication, which

demand a new mathematical concept that help students to relate a new mathematical concept with their prior knowledge or a real-world application. This activities helped him to reach a divers learners of his class. He found that assimilating such activities have not only increased the abilities to use mathematical knowledge of his students' to different applications, but also helped then to improve their communication skills. In view of his work, we planned to use a mobile application Kaizala from Microsoft as a non-traditional way of teaching, which will provide sufficient time to our students to think and in turn will increase their abilities to solve problems. We have included some small video explanations with mathematical reasoning for the better understanding of the students.

3.1 Application Used Collaborative Activities in Classroom - Kaizala:

Microsoft Kaizala is a social media networking application which is similar to any other social media applications like, WhatsApp in use but is more aided. This application support **Math keyboards** which support and improve the students' performance and communications skills. The advantage of using Kaizala is that with this application students can collaborate with the facilitator or other students anytime and anywhere by giving them training, quiz, survey and poll. (Microsoft Kaizala – Office 365 2016). One additional benfirt of using Kaizala over Whatsapp is that here students need not to share their contact number to be member of the group. This will overcome the social and cultural barriers as investigated by other researches as well in their work (Hunaiyyanm Alhajri and Al-Sharhan (2018)). They can become member by just registring through a link or by a QR code.

The following are some of Kiazala's features:

- Training- This tool provides option of sending videos/ text/ study material followed by a quiz to test their understanding. It is also used for flipped learning.
- Quiz-this tool allows conducting a quiz after a lesson is finished.
- Survey- this is used to conduct the survey.
- Games- there are some good and creative games which can be played for brainstorming.
- Poll-this allows to conduct polls to gather feedback from students.
- Teacher can immediately clear doubts of students. More exercises can be given and can be corrected by using voice or image.
- Online videos including videos developed by the teacher videos can be easily shared among the students.

3.2 Other Applications Available for Similar Purpose:

There are many other online applications which are available for similar purpose. Such as padlet, whatsapp, LiveBoard etc. But Kaizala has its own advantages due to rich amount of embedded features. Unlike Kaizala, it's not possible to conduct online poll, on other mobile apps mentioned above. Online poll or even activities such as quizzes are really important for academic purpose apart from team communication. The only advantage of LiveBoard app over Kaizala is, it functions even without internet connection. The group members can connect to a shared page with teacher through hotspot option (WiFi) of the host device. Many free and open source applications are also available to customize and implement for various e-learning purposes (Naidu, Singh, Al Harrasi, & Al Balushi, 2017). Not only this, there are some game based applications which can be customized for collaborative activities among the students especially as brainstorming exercises (Naidu, Balushi, & Bhatia., 2017).

4 IMPLEMENTATION

A group was created in Kaizala. A link was shared to the group. Students were instructed on the advantages and procedures in using this app. At the initial stage, these online classes were conducted by the one instructor only. After observing valuable impact of these classes, and its results in improving the pass percentage of the students, these groups were extended to the peer tutoring students and the other module instructors. A raise in the number of student was observed in these groups as compared to their numbers at the beginning. Also, some of the repeater students have improved their performances. This also helped and trained the peer tutors to become more confident in conducting workshops and activities. Due to use of this online application, the number of students approaching to the faculties during the office hours is reduced. This application helped students to work collaboratively in group and learning from each other through their active participation group discussion.

5 RESULTS

Kaizala messenger provide the ability for students to send messages almost without limits. Students use Kaizala through a variety of mobile devices, such as smartphones or tablets and can message one another through texts, images, voice notes, and videos. Kaizala has a good and attractive user interface and students are already comfortable using the application as it has same interface like WhatsApp.

5.1 Effectiveness

In our classes, using Kaizala proved very helpful in encouraging students to practice and solve exercises at home. Immediate feedback combined with motivating students to work and attempt exercises outside the class makes for better student learning. After involving Alumni and peer tutor students, this become more effective. Students actively participated in solving questions at their homes at their own pace and once they get stuck/confused, ultimately they'll stop practicing. But through this innovation, they can put their question (or the point where they get stuck) in the Kaizala. Studies shows that if one get immediate feedback on their work, the person will be more productive and motivated (Hattie, J. and Timperley, H. (2007), AITSL (2017)). In the group, another student may know the solution and will help out. The role of instructor comes once they all are not able to answer. This app helped students post their problems and they'll get their solution.

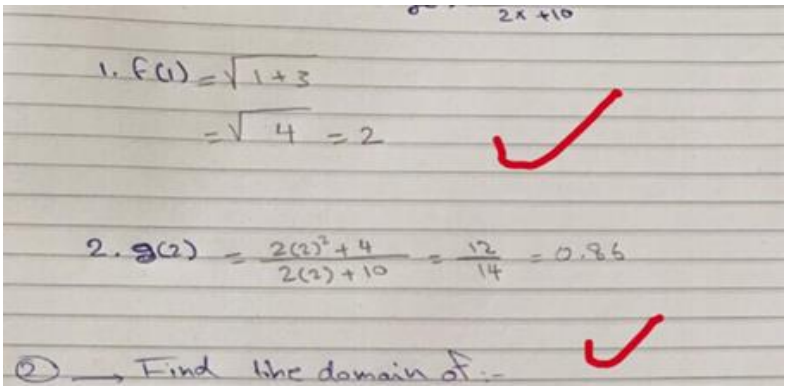


Figure 1. Solution to a problem shared by a student on Kaizala group

They will be motivated by the whole process. In some cases, diligent students are even motivated to ask more questions for practice. Figure 1 shows an image shared by one of the group members in Kaizala, which he has shared the solution to a problem and received immediate feedback if its correct.

5.2 Assessments and Final Outcomes

It was found out that this method is helpful in improving communication with students. After involving Alumni and peer tutor students, this becomes more effective. Lectures were conducted by recording videos, training the students and giving them quizzes online. This method shall serve as additional resources to students especially those in SWOM (Students Working outside Muscat city) category.

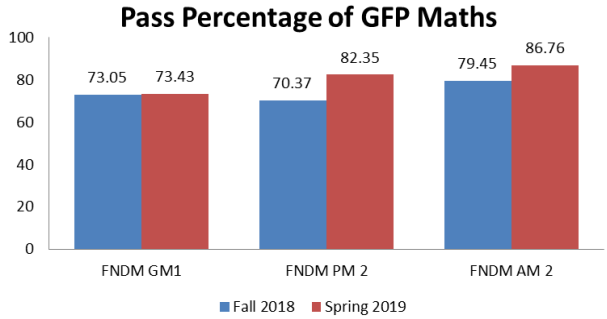
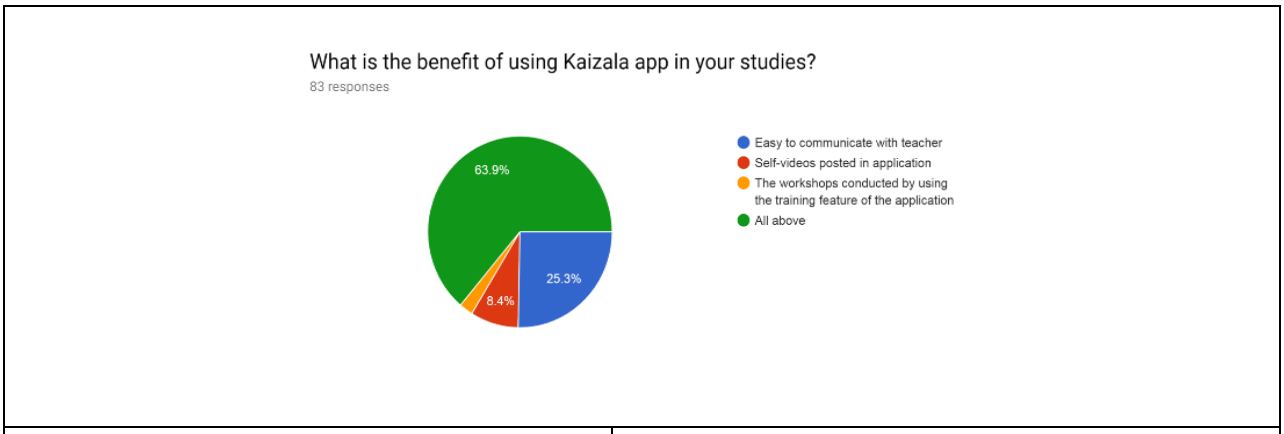


Figure 2. Comparison of results before (Fall 2018) and after (Spring 2019) using the Kaizala application

Through this method, students' mathematical abilities will be enhanced and more motivated and interested in learning Maths. The results showing the comparison between the semesters Fall 2018 (without using Kaizala) and Spring 2019 (using Kazala) is shown in figure 2.

5.3 Feedback

Feedback was collected from the students who were involved in the learning through this application. Methods used in collecting feedback were both quantitative as well as qualitative. Majority of students have found the application excellent, and easy to use.



ABDULLAH MOHMMED RASHID AL HOSNI
Sent: Mon 19/08/19 12:07 AM
To: Bushra Al Kalbani

First of all, I thank Ms Bushra Al Kalbani for her efforts to the students. When I had opportunity to be in the Reference Center for Mathematics, I made my character st in front of students and teachers
And why was it a day for the math that I enjoyed all of the students who participatec the competitions and myself.
I myself enjoyed this event and benefited from it and I got to know new things and I in the college I did not know

peer toturs in Math
HAMED HAMOOD HAMED ABDULLAH ALKHARUSI
Sent: Sun 25/08/19 2:09 PM
To: Bushra Al Kalbani

Dear Miss Bushra,
After my short period with peer toturs in Math I got some benefits such as:
- Now I can understand the mathematics problems faster than before.
- Short time to solve the problems
- Now I can memorize the rules and no need to search for it.
This is about me! And about my colleges I saw that:
- They can understand faster than in the class and they don't feel shy because we are colleges.

This is what I got from the short period with them and I hope to get more time in future.

Regards,
Hamed Al-Kharusi

Thanks alot
AMANI KHAMIS MUBARAK AL NADHIRI
Sent: Sat 24/08/19 8:27 PM
To: Bushra Al Kalbani

Dear Ms.bushra,

I hope this email you finds well.
I benefited from Kaizala program a lot of things especially in the mathematics like how to solve the different Mathematical problems and how to find different ways to solving.
Finally, I want to thank you for everything's.

Regards,
Amani Alnadhiri

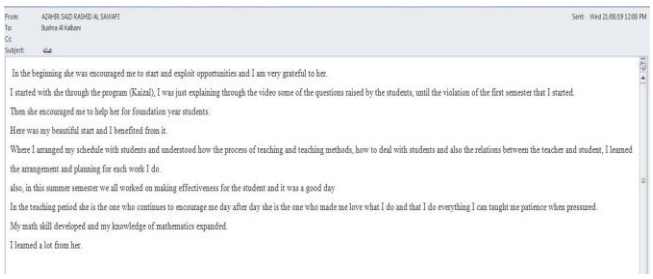

In the beginning she was encouraged me to start and exploit opportunities and I am very grateful to her.
I started with she through the program (Kaizal), I was just explaining through the video some of the questions raised by the students, until the violation of the first semester that I started.
Then she encouraged me to help her for foundation year students.
Here was my beautiful start and I benefited from it.
Where I arranged my schedule with students and understood how the process of teaching and teaching methods, how to deal with students and also the relations between the teacher and student, I learned the arrangement and planning for each week I do.
also, in this summer semester we all worked on making effectiveness for the student and it was a good day
In the teaching period she is the one who continues to encourage me day after day she is the one who made me love what I do and that I do everything I can taught me patience when pressured.
My math skill developed and my knowledge of mathematics expanded.
I learned a lot from her.

Table 1. Feedback from the Alumni, peer-tutors and current students

6 CONCLUSION

The method used by implementing Kaizala was found to be very effective and fruitful. Students' performance has increased as compared to previous semesters and now the important topics of discussions are easily accessible even from a remote location. Even if a student is missing any class due to any reason, they can still go through the activities that have taken place on that day through the group. Sometimes, students were coming up with alternate solutions to the problems, which they have shared in the group. And hence this gave multiple ways to solve one mathematical problem by the student, and the student had option to choose from different methods. Overall, response of the students was very positive. Moreover the intermediate collected through blitz feedback has shown a very positive feedback from the students.

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