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Integrating and Enhancing Mathematical Knowledge in Jelebu Secondary Schools

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Abstract. The essence of STEM education is to prepare students that would eventually enter the workforce with STEM knowledge. This project was conducted in Jelebu, Negeri Sembilan involving four secondary schools in the quest to improve students' mastery and interest in mathematics. More than one hundred Form 2 students with mathematical knowledge ranging from low to medium are involved. There are two phases of teaching and learning being incorporated, namely i) short lectures on selected topics ii) activities comprising of group activities and 'treasure' hunt activity. Students' achievements are assessed in the form of pre-test and post-test, of which the questions on both tests are identical. By conducting pre-test and post-test, the level of students' skills before and after the learning process could be assessed. Findings show that this project has improved the basic knowledge and skills of students in Mathematics. Each school shows some increase in mean marks. Statistical paired t-test indicates there is significant difference between the two test results for each school. Students also participated well by showing high levels of interest and enthusiasm when activities are carried out.

1. Introduction

Education is imperative for a nation to achieve its mission in economic progression and national advancement. A benchmark to assess a nation's success is dependent on the knowledge, skills, and competencies of its population. Nations with higher percentages of their population with higher education levels are more inclined to benefit from greater economic prosperity. Education also form a basis for the development of a nation. Through education, individuals of a nation have the possibility to improve their lives, become productive members within the community and contributes to national advancement of the nation. Therefore, one could predict the nation's future by monitoring and assessing the current situation in schools.

Effective of Science, Technology, Engineering and Mathematics or better known as STEM education is vital for the future success of students. According to reference [1], integrated curriculum such as STEM education could aid in preparing students to a more relevant and open experience. Reference [2] concluded that the focal reason of having STEM education is to increase students' ability in dealing with matters concerning STEM such as personal, social and global issues. Nonetheless, the Program for

International Student Assessment (PISA) for 2012 revealed that about 60% of the Malaysian respondents did not achieve the minimal benchmark in mathematics and about 43% in science [3]. It was reported that in 2012, low percentage of Malaysia students (between 33-40%) were learning science at school level [4]. This statistics is quite alarming considering the Malaysian Government have invested substantially in education and furthermore, Malaysia is serious in the integration of STEM education. The pathway for STEM integrated education in Malaysia could be found in the Malaysian Education Blueprint 2013-2015 [3].

Recognizing the importance of STEM education, a team of lecturers from Universiti Teknologi Malaysia with mathematics and engineering backgrounds, embarked on a project with the lower secondary school students in Jelebu, Negeri Sembilan. This project particularly concentrates on the mathematics subject and aspired to contribute towards the improvement in the students' mastery and interest in Mathematics. Specifically, the project objectives are:
   i) improve students' knowledge of mathematic
   ii) increase students' interest in mathematics
   iii) enhance students' confidence level when performing mathematical problems

Mathematical knowledge is the foundation to the diverse discipline of sciences. Mathematics could be categorized into five types, namely facts, algorithms, concepts, relationships between concepts and problem solving. Problem solving is a very important aspect in mathematical learning. Students are expected to foster new knowledge and skills through problem solving process, solve problems encountered in mathematics curriculum and apply various mathematical concepts in different contexts. With the proper guidance given, students could improve their skills, proficiency and communication skills in mathematics. Through the mathematics related activities being carried out, the students' interest in the Mathematics subject will increase and further encourage them to continue to pursue Mathematics for a brighter future. Their mind would also be more open to continuing their studies in science related field at a higher level after completing school. This project also gives students the awareness of the importance of mathematics in their lives, in particular to acquire knowledge for self-development and lifelong learning.

2. Data and Measuring Instrument

The project involved form 2 students with mathematical knowledge ranging from low to medium. Most of these students are from the low income group. It was conducted in the Jelebu District, Negeri Sembilan involving four schools. The schools could be considered rural schools and they are,
i) Sek Men Keb Undang Jelebu (SMKUJ)
ii) Sek Men Keb Dato Undang Musa Al-Haj (DUMA)
iii) Sek Men Keb Dato Undang Syed Ali Al-Jufri (DUSAJ)
iv) Sek Men Keb Triang Hilir (Teriang Hilir)

The project was conducted for 2 conservative weeks and was divided into 2 sessions, namely session 1 (week1) and session 2 (week 2). Ideally, 30 students from each school were selected to come for both sessions, however the number of student attendance varies according to schools and sessions. Figure 1 shows the number of students' attendance for two weeks. The number of students who attended both sessions 1 and 2 are shown in Figure 2. Three topics are selected based on form 2 syllabus, and they are i) Linear equations in one variable ii) Value and Proportion and iii) Circle.

In each session, two phases of teaching and learning are implemented, namely i) short lectures on the selected topics ii) students activities comprising of group activities. A 'treasure' hunt activity was also conducted at the end of session 2. In each session, students are divided into groups and a facilitator is assigned to each group. Students' achievements are assessed in the form of pre-test, conducted before session 1 begins and post-test, conducted after session 2. The tests questions are related to the three selected topics and to ensure consistency, the questions in both tests are identical. By conducting pre-test and post-test, the level of students' skills before and after the learning process could be assessed.

Thus, the quantity of students taking the pre-test and post-test tests in from the schools are the same as the number that was present for both sessions (see Figure 2).

3. Results and Discussions

The analysis for the pre (test 1) and post-test (test 2) are conducted based on those students who attended both sessions. Their test 1 and test 2 marks are shown in Figure 3. For test 1, students from Teriang Hilir has the highest average, followed closely by SMUKJ. Again, for test 2, Teriang Hilir has the highest average, followed by SMUKJ. Test results revealed that the average score of students for all schools increases for test 2. A statistical paired t-test was conducted to see if there is significant difference between the tests' means. The results, as given in Table 1, show that the P-value for all schools are found to be smaller than the significant value. This indicates that there is significance difference between the means of students' tests marks. The performance details for each student according to schools are given in Figures 4 (a)-(d). Almost all students show an increase in marks for test 2.
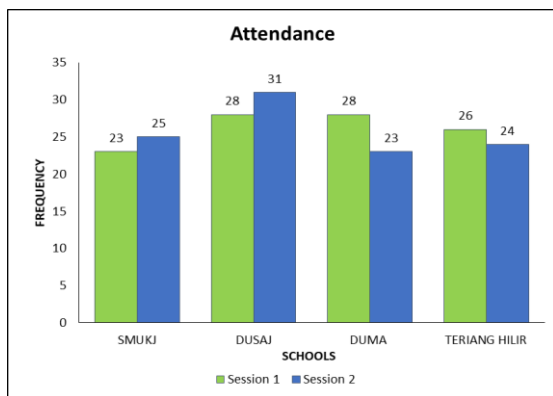
Figure 1. Attendance for session 1 and 2
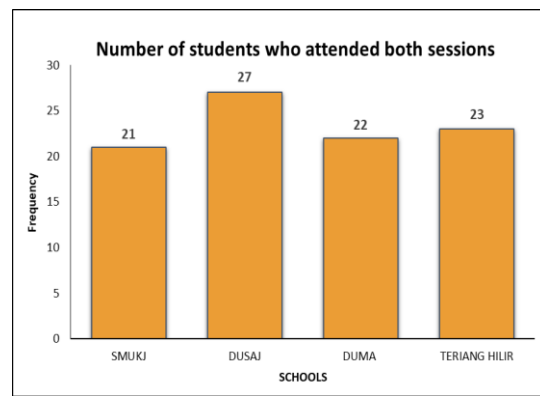
Figure 2. Attendance for both sessions
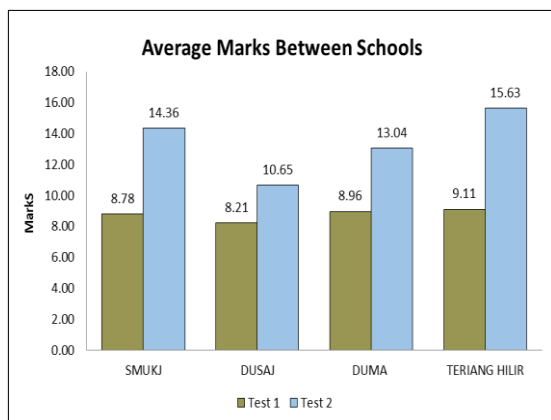
Figure 3. Average marks according to schools

Table 1. Paired t-test results between pre-test and post-test

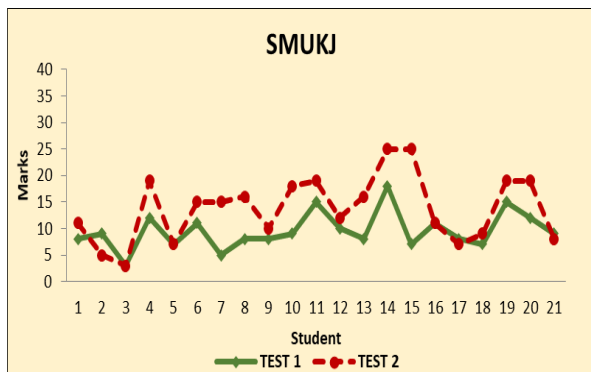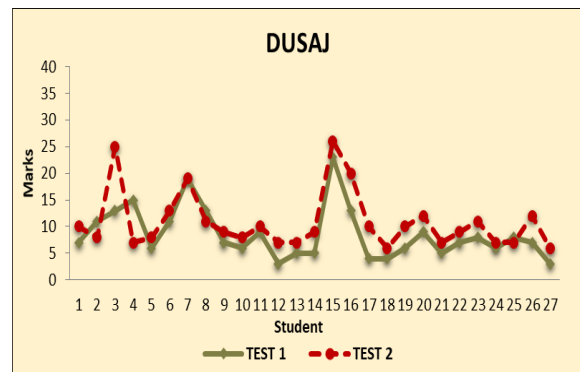| Schools	P-value
SMUKJ	0.000839365
DUSAJ	0.002540253
DUMA	0.002336366
TERIANG HILIR	2.95503E-06

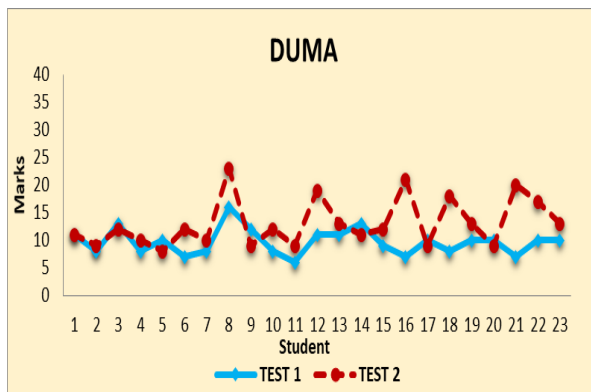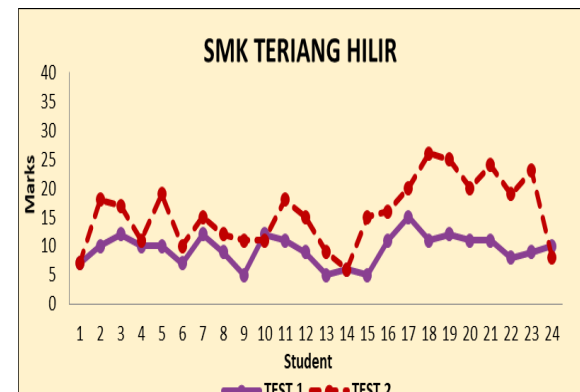Figure 4 (a)

Figure 4 (b)

Figure 4 (c)

Figure 4 (d)

Figure 4 (a)-(d). Performance details for each student according to schools

4. Conclusion

This project served as a platform for a team lecturers from Universiti Teknologi Malaysia to share their expertise in mathematics with the students' community in Jelebu. The project involved mathematics related activities which are design to increase students' interest in mathematics. Test results are very encouraging, showing that the average score of students for all schools increases for the post-test. Paired t-test for sample means between the post and pre-test for each school was conducted and the results revealed that there is significant difference between the means of the two test results for each school. Based on the increase in mean marks, it could be deduced that this project has improved the basic knowledge and skills of students in mathematics.

This project was intended to increase the students' awareness with regards to the importance of mathematics as a tool for self-improvement. It is hoped that students participating in this project would share and impart their knowledge and skills to the communities around them. Based on the successful

outcome, the project can be used as a base model for other schools in Malaysia. It is recommended that the project be improvised to suit the selected mathematics syllabus and also the level of mathematical knowledge of the students.

References
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