Utilization of Outdoor Activity to Improve Non-Science Background Students' Understanding of Science Concepts

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ABSTRACT

It is necessary to expose university students to certain science or engineering related courses in Technology Management programme, irrespective of their backgrounds. Teachers and learners are frequently faced with challenges in the teaching and learning process due to insufficient exposure. Consequently, this article therefore investigates the impact of using learning object and learning activity on non-science students' understanding of science concepts. An experiment was conducted by making use of two groups of students in Technology Management programme in a Malaysian university. The first group was not involved in any outdoor activities related to the concepts of speed, distance, and displacement while the second group was fully involved in outdoor activities related to the aforementioned concepts. The performances of both groups were compared at the end of the semesters. The descriptive statistics and analysis of variance revealed that students in the second group performed better than the students in the first group. A significant difference in the performance of the two groups was also emphasized by the analysis of variance. The findings therefore imply that the engagement of students with relevant learning objects or activities has high possibility of enhancing their understanding and facilitating knowledge transfer.

Keywords: *Physics concepts, Teaching & learning, Outdoor activity, Engineering science, University students, Effective learning.*

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Highlights of this paper

- This article therefore investigates the impact of using learning object and learning activity on non-science students' understanding of science concepts. An experiment was conducted by making use of two groups of students in Technology Management programme in a Malaysian university.
- The findings therefore imply that the engagement of students with relevant learning objects or activities has high possibility of enhancing their understanding and facilitating knowledge transfer.

1. INTRODUCTION

The teaching of Engineering Science (physics) to university students without science background tends to be so demanding for the teachers. In like manner, it becomes so difficult for the students to understand the expressed knowledge. In such a situation, it becomes imperative for teachers to develop inventive methods of knowledge transfer so as to ensure that effective learning takes place. Consequently, researchers' have seriously engaged in developing of pedagogical styles and learning approaches focusing on student-centred environment (Beetham and Sharpe, 2013; Bannan *et al*., 2016). Nevertheless, the application of each approach is possibly restricted to a precise set of students and environment. Although utilizing mobile phones may improve knowledge transfer and knowledge construction (Kearney *et al*., 2015), outdoor activities are required to ensure easy knowledge acquisition by students of science and engineering related courses part of which is physics (Vygotsky, 1978). Thus, a comparison of students' academic performances in two groups is discussed in this article with a view to addressing the challenges facing the teaching of Engineering Science (physics) to non-science background undergraduate students of Technology Management programme in a Malaysian university. Students in the first group did not engaged in any outdoor activity in the first semester while students in the second group engaged in outdoor activity related to Engineering Science (straight line motion in physics) in the second semester while learning.

2. LITERATURE REVIEW

In recent times, scholars have progressively paid attention to inventing the best teaching methods for effective knowledge transfer to learners. This concern compelled the search for alternative teaching approaches that will complement the traditional teaching method. Among the widespread alternative approaches is the student-centred learning that gives students more opportunity to be in control of their learning process.

In order to advance student-centred learning approach and to deemphasize the teacher-centred learning approach known as the traditional method of teaching, UNESC (2012a) and Christensen and Knezek (2018) emphasize the necessity for an instructional paradigm shift which will help in achieving a fundamental change regarding students' learning methods. The student-centred learning, which anchors on the on social constructivism theory, is in line with the Vygotsky (1978) classroom principles. It proposes that "learning and development is a social, collaborative activity" and "classroom activity should be reality-based and applicable to the real world" (Vygotsky, 1978). Similarly, Wenge (1998) and Brown (1991) affirm that the learning processes should involve sharing of ideas and strategies that foster solution and innovation in an interactive manner. The reason is that teaching practices have revealed that students are likely to participate and learn better while interacting as a group in the process of engaging in group assignments or projects.

Outside classroom engagement affords the students opportunity to obtain extensive and enduring comprehension. Learning in this situation is internalised for students to develop the ability to produce their own understanding through personal practices rather than acquiring knowledge from textbooks only (Costa, 2015).

Classroom is supposed to be a place for constructivist activities and group practices, rather than the traditional teaching and learning which anchors on teacher-centred approach (Atif, 2013). The classroom is supposed to be a place where students are actively engaged in relevant activities that facilitate the students' learning process. For this reason, scholars contested against the adoption of only the traditional teaching method in knowledge transfer. It has been largely criticized because it limits students to understanding concepts based on that which is found in standard textbooks, thereby preventing the learners to have the opportunity to be actively engaged in the classroom (Atif, 2013).

Previous researches have proved that using a single style of student-centred learning may possibly not be the best for a specific group of students or all fields of learning. Thus, scholars and educators have constantly been exploring possible means to develop the best approach and style for knowledge transfer to any particular group of students. Wang *et al.* (2018) separately investigated the outcome of the model-based flipped classroom supported by modern teaching technology on students' overall performance in communication and cooperation, application and learning, curriculum learning, and participation. The findings indicated that the model-based flipped classroom supported by modern teaching technology imparted significant improvement on academic performance.

The knowledge transfer and the knowledge construction operating in any traditional education process were invalidated by the flipped classroom practices. When teachers teach, knowledge transfer happens. But the construction of knowledge takes place outside the class when assignments, homework, actual operation or practice are done by students. In other words, the construction of knowledge among students in the traditional education system largely depends on the extent of their engagement through practices. Similarly, Resnick (1987) acknowledges that learners' ability to process, to absorb, and to apply learned knowledge is mostly contingent on the use of existing knowledge, experiences, and cognition to interpret new information outside the classroom by the learners.

In flipped classrooms, the transference of knowledge occurs with the support of information technology after the class while the construction of knowledge is completed in classrooms with the help of teachers and fellow classmates. The aim of the flipped classrooms is to make better the students' acquisition of knowledge, to increase opportunities for knowledge construction and to reduce the encountered difficulties in the learning process (Wang *et al.*, 2018).

The understanding of the method of knowledge construction among students has been extended by the free fall motion experiment. The finding implies that there would be no reconstruction in students' knowledge if they do not display new and correct scientific constructed concept in reality. There will be activation of correct concepts but a suppression of existing preconceptions after the acceptance of the new knowledge will occur (Petitto *et al.*, 2004). It is therefore confirmed that, for the knowledge construction process to occur, pre-conceptions have to be suppressed without any disrupting reconstruction. Therefore, assimilation or accommodation is the method of constructing knowledge. The construction of knowledge is described as gradual control of previous impressions similar to the processes of assimilation or accommodation. So, the construction of knowledge is a constant and gradual process, not a hasty transformation (Wang *et al.*, 2016).

The cognitive-development theory described assimilation "as the process by which new external stimulus is incorporated into existing cognitive structures of an organic entity and how new knowledge adapts to existing information; accommodation is where the host changes its own cognitive structure to adapt to new changes to the environment" (Wang *et al.*, 2016).

3. METHOD

3.1. Procedure of Outdoor Activity

The instructor asked the students to download their favourite football match from YouTube. Before the football match was watched, students were instructed to sketch on a paper size of A4 a football field. They were further asked to focus on every kick of the ball that led to scoring, and then mark the spot where the ball was kicked. Students recorded the time that the ball was kicked and the exact time it entered into the goal post. An estimated measurement of the distance from which the ball was kicked to the goal post was taken. Thereafter, the point was marked on a similar football field outside the classroom using a tape rule. Then, to obtain the ball's speed, the ball's distance was divided by the period/time it took the ball to reach the goal post. This calculation gave the difference between the ball displacement and distance travelled by the ball.

3.2. Data Collection

The data collection included two groups' end of semester results. The research was conducted using the university real code for each semester, A121 and A122. In the first semester (A121), there was no outdoor activity in the learning process, but in the second semester (A122) students engaged in outdoor activities. The assessment for each semester constituted the following: 60% coursework (assignments and test), and 40% for the end of semester examination.

4. RESULTS AND DISCUSSION

4.1. Results

At the end of the semester, descriptive statistics were used in analysing the results of the 115 students: semester A121 comprised 47 students (40.9%) and semester A122 comprised 68 students (59.1%). Table 1 shows the comparative results of students in the two semesters. It indicated that in semester A121, no student score "A+", 17.1% scored "A', 19.1% scored "A-", 19.1% scored "B+", 17% scored "B", 6.4% scored "B-", and 17% scored "C+". In semester A122, 5.9% scored "A+", 45.6% scored "A", 16.2% scored "A-", 20.6% scored "B+", 4.4% scored "B", 2.9% scored "B-" and only 1.5% scored "C+".

Table-1. Examination results of two groups of students.

Grade	A121 Frequency	A121 Percentage	A122 Frequency	A122 Percentage
A	8	17.0	31	45.6
A-	9	19.1	11	16.2
A+	-	-	4	5.9
B	8	17.0	3	4.4
B-	3	6.4	2	2.9
B+	9	19.1	14	20.6
C	1	2.1	1	1.5
C-	-	-	1	1.5
C+	8	17.0	1	1.5
F	-	-	-	-
X	1	2.1	-	-

Figure 1 depicts the mean of the examination grades of semesters A121 and A122.The overall course work constituted 60 percent of the result while the final examination constituted 40 percent, making an aggregate of 100 percent of the total mark.

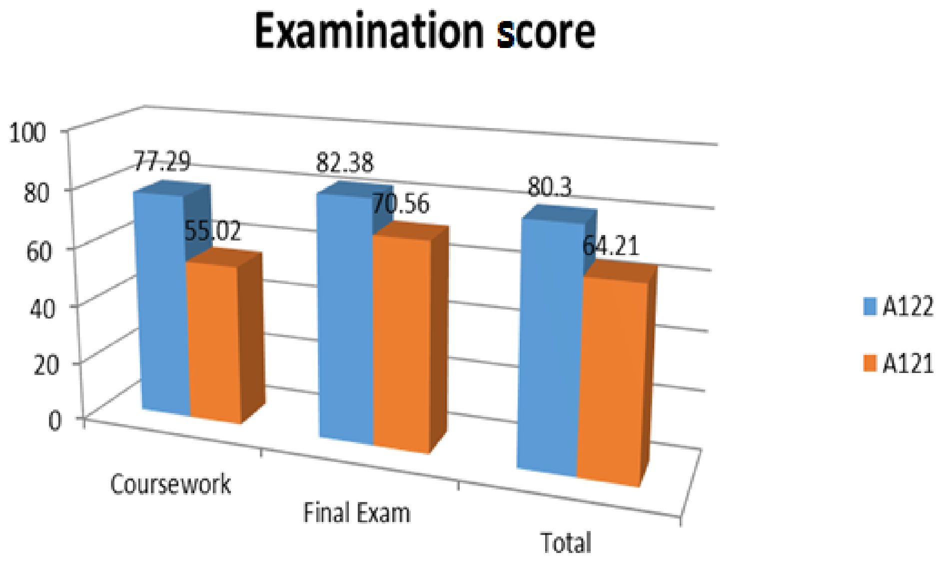

Figure-1. Mean of semester A121 and A122 results.

The results indicated that semester A122 students had the highest average score (mean=77.29) compared with the semester A121 students. The final examination also revealed similar performances. The semester A122 students scored the highest marks (mean=82.38) compared with A121 (mean = 70.56). In general, the semester A122 students had the highest score (mean=80.30).

Figure 2 is a presentation of the students' various grades in percentage in semester A121 and A122. The percentage of the students in semester A121 that scored "A" and "A-" was 36.1%. The percentage of the students that scored grade "B+" was 19.1%. Grade "B" was 17.0% and grade "B-"was 6.4%. The semester A122 produced better result: 5.9% scored "A+", 45.6% scored "A" and 16.2% scored "A-".

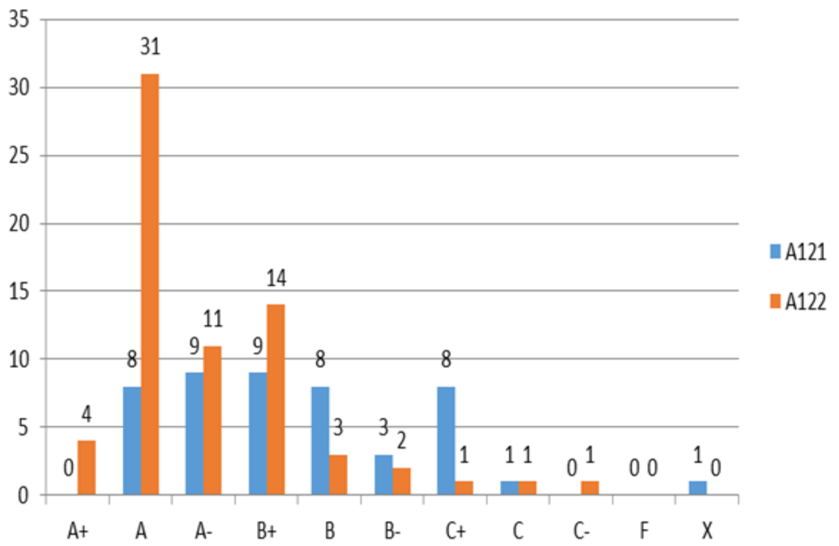

Figure-2. Frequency of the various grades in semester A121 and A122.

Table 2 is a presentation of the examinations' mean score. The following constituted the final semester results: 60 percent of coursework (assignment and test) and 40 percent for the final exams. The mean score for first semester A121 was 77.27% which accounted for 66.37% of the coursework. The mean score at the conclusion of the semester examination was 55.02%, representing 22.01% of the concluding semester examination. For the second semester A122, 82.38% was the mean, representing 49.46% of the coursework while the mean score at the conclusion of the semester examination was 70.56%, representing28.22% of the end of semester examination. The total mean score in semester A122 was 77.75% compared with 68.49% in semester A121.

Table-2. Mean of semester A121 and A122 results.

Assessment	Mean	
	A121	A122
Coursework	77.29	82.38
60 percent	46.37	49.46
Final exam	55.02	70.56
40 percent	22.01	28.22
Total (100%)	68.49	77.75

Table 3 presents a comparison of the independent sample t-test and mean scores result of both groups of students in semesters A121 and A122. The results revealed a higher performance of average score (mean=82.38) from the A122 students than the students from A121. Also, students' performance in semester A122 final exams had the highest score (mean=70.56). On the whole, the highest score (mean=77.75) was from the semester A122 students. There was a significant statistical difference in the independent sample t-test result between the A121 and A122 results. The following were the overall results: coursework ($t=-2.833$, $p<0.01$), final exam ($t=-4.563$, $p<0.01$) and total score ($t=-4.438$, $p<0.01$).

Table-3. ANOVA for semester A121 and A122 results.

Assessment	Semester (mean)		T	Sig.
	A121	A122		
Coursework	77.2851	82.3825	-2.833	0.005
Final exam	55.0213	70.5588	-4.563	0.000
Total	68.4894	77.7500	-4.438	0.000

4.2. Discussion

The results show that students in semester A122 perform better than the other students. The findings imply that the employed outdoor activity during the learning process has significant influence on their learning and knowledge construction. The following are the highest and lowest grade scored in both semesters: four (4) students had "A+" and three (3) three students had "C- to C+" grade in semester A122. In semester A121 there was no student with "A+" grade and 9 students had "C to C+" grade. The findings therefore suggest that the use of outdoor activities has high possibility in enhancing students' learning process. The findings from this study substantiate other existing findings regarding the positive influence of outdoor activities on students' learning process (Brown, 1991; Wenge, 1998; Costa, 2015).

5. CONCLUSION

This study extends our current knowledge concerning the influence of outdoor activities in improving students' learning process. This article highlights the concept that it is possible for students without science background to easily learn basic science concepts by the incorporation of outdoor activities relevant to each topic in the learning process. This article has established a better performance from the engaged students in semester A122 than the unengaged students in semester A121. A major limitation, however, could be the difference in the class size of the students in both semesters. In order to reduce much difference between the two groups of students, future research should embrace the examination of the same set of students.

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