

*E-Learning Approach and Logical Mathematical & Spatial Intelligences
in Learning Solid Geometry*

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Abstract

E-learning is the use of electronic media and information and communication technologies (ICT) in education. It is now an educational approach to effective learning. Learning mathematics like solid mensuration thru electronics means is more effective to students only if they have higher level of logical – spatial intelligences. The purpose of this study is to determine the effectiveness of solid mensuration (or solid geometry) e-learning. The proponents used experimental method to determine the effectiveness of the educational approach of e-learning in relation to logical – spatial intelligences. The results showed that the e-learning method is favorable to students with higher level of logical – spatial intelligences.

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Introduction

E-learning is the use of Internet technologies to enhance knowledge and performance (Ruiz, et. al., 2006). There are a lot of studies about e-learning to enhance the academic performance of the students. This relates to learning outcomes.

Web-based technology has noticeably transformed the learning and teaching environment. Proponents of online learning have seen that it can be effective in potentially eliminating barriers while providing increased convenience, flexibility, currency of material, customized learning, and feedback over a traditional face-to-face experience (Hackbarth, 1996). Online learning differs from the face-to-face setting. Online learning mode includes discussion through text only; can be structured, dense, and permanent, while face-to-face mode includes verbal discussion but impermanent.

Student performance is considered multidimensional concept. However, researchers have been interested in differences in performance between the two modes of instruction.

According to Howard Gardner (1991), students possess different kinds of minds and therefore learn, remember, perform, and understand in different ways. The identified intelligences affecting the learning on solid mensuration are logical-mathematical and spatial intelligences. Logical-mathematical intelligence is the ability to effectively use numbers and to reason. Students strong in this intelligence succeed in traditional math and science classes. Learning is enhanced through use of calculators, quantification, classification, critical thinking and problem solving across all subjects. Spatial Intelligence is the capacity to accurately perceive the visual/spatial world and create internal mental images. Useful teaching strategies include giving students opportunities to create visualizations, using color cues on worksheets, chalkboards, drawing and graphic symbols to represent concepts.

The study compares the academic performances between two classes of students in solid mensuration – experimental group and control group. Solid mensuration (also known as solid geometry) is a course is the study of various solids. It is the study of the measure of volume, area, height, length, and many more. This subject is used extensively in the practice of engineering. The knowledge of this subject is a necessity to engineers in any project construction.

The experimental group was subjected to e-learning mode while the control group was only handled under traditional approach – lecture method.

The study was conducted on September 2013. It covers only one chapter on solid mensuration. The experimental group used Moodle open-source learning platform. The teacher developed the learning material for the e-learning mode. Lecture material was also developed for the control group. Pretests and posttests were administered to the two groups.

Objectives of the Study. The main objective of the study is to determine the effectiveness of the solid mensuration e-learning. Specifically, the study aimed: (1) to determine the level of logical and spatial intelligences of the subjects in the

experimental group; (2) to determine the level of logical and spatial intelligences of the subjects in the control group; (3) to determine the mean pretest and posttest scores of the subjects in the experimental group; (4) to determine the mean pretest and posttest scores of the subjects in the control group; (5) to determine the mean gain test scores of the subjects in the experimental group; (6) to determine the mean gain test scores of the subjects in the control group; (7) to determine if there are significant differences on the level of logical and spatial intelligences between experimental and control group; and (8) to determine if there is a significant difference on the mean gain test scores between experimental and control group.

Null Hypotheses. (1) There are no significant differences on the level of logical and spatial intelligences between experimental and control group. (2) There is no significant difference on the mean gain scores between experimental and control groups.

Methodology

Research Design. This study used pretest-posttest experimental research design.

Subjects of the Study. The subjects of the study were the two Math 114E classes (of the School of Engineering & Architecture) under one teacher only. The afternoon class was designated as the experimental group while the evening class was designated as control group. The study was conducted on September 2013.

Research Procedure. The following is the procedure used by the proponents: (1) Administration of multiple intelligence self-evaluation test; (2) Administration of pretests; (3) Learning intervention – e-learning and lecture modes; (4) Administration of the posttests; and (5) Tabulation, analysis and interpretation of data.

Statistical Treatment. The study made use of the *arithmetic means* and *t-test* to analyze and interpret the data collected.

Results and Discussion

Profile of the Subjects. Table 1 shows the profile of the subjects of the study. There were two Math 114E (Solid Mensuration) classes in the School of Engineering & Architecture who took part – one class with 42 students (afternoon class) designated as experimental group and another class with 26 students (evening class) designated as control group.

Table 1. Profile of the Subjects

Group	No. of Students	Percentage
Experimental Group	42	61.76%
Control Group	26	38.24%
Total	68	100.00%

Level of Logical – Mathematical Intelligence of the Subjects in the Experimental and Control Groups. Table 2 presents the level of logical – mathematical of the experimental and control groups. The mean score of the subjects in the experimental group is 3.61 which means “High.” The mean score of the subjects in the control group is 3.82 which means “High.”

Table 2. Level of Logical – Mathematical Intelligence of the Subjects

Group	Mean	Description
Experimental Group	3.61	High
Control Group	3.82	High

Level of Spatial Intelligence of the Subjects in the Experimental and Control Groups. Table 3 presents the level of spatial of the experimental and control groups. The mean score of the subjects in the experimental group is 3.21 which means “Fair.” The mean score of the subjects in the control group is 3.47 which means “High.”

Table 3. Level of Spatial Intelligence of the Subjects

Group	Mean	Description
Experimental Group	3.21	Fair
Control Group	3.47	High

Mean Pretest and Posttest Scores of the Subjects in the Experimental Group. Table 4 presents the mean pretest and posttest scores of the experimental group. Their mean pretest score was 65.95 while their mean posttest score was 71.90. Their mean posttest score was higher than their mean pretest score.

Mean Pretest and Posttest Scores of the Subjects in the Control Group. The mean pretest score of the control group was 67.26 while their mean posttest score was 77.78. Their mean posttest score was higher than their mean pretest score.

Difference on the Pretest Scores between Experimental and Control Group. Table 5 shows that the mean pretest score of the experimental group was 12.98 with a variance of 19.58 while the control group was 13.81 with variance of 20.64. It showed that the experimental group was more homogeneous than the control group. When the pretest scores were tested at 0.05 level of significance and using t-test, it resulted to a t-stat of 0.74 and its t-critical is 2.00. Since the t-stat is lesser than the t-critical, then the null hypothesis is accepted. It means that there is no significant difference on their pretest test scores. It is interpreted that their pretest test scores are equivalent. It is concluded that the experimental and control groups are comparable.

Mean Gain Test Score of the Subjects in the Experimental Group. Table 4 shows the mean gain score of the experimental group. Their mean gain score was 5.95. The result showed a positive numbers which means there is an increase in their performance.

Mean Gain Test Score of the Subjects in the Control Group. The mean gain score of the control group was 10.52. The result showed that there is an increase in the performance since their mean gain score is positive.

Table 4. Mean Pretest, Posttest and Gain Scores of the Subjects

Group	Mean Pretest Scores	Mean Posttest Scores	Mean Gain Scores
Experimental Group	65.95	71.90	5.95
Control Group	67.26	77.78	10.52

Table 5. Significant Difference on Pretest Scores between Experimental and Control Group

Group	Mean Pretest Scores	Variance	t-Stat	t-Critical
Experimental Group	12.98	19.58	0.74	2.00
Control Group	13.81	20.64		

Difference on the Level of Logical – Mathematical Intelligence between Experimental and Control Group. Table 6 shows that the logical – mathematical intelligence mean score of the experimental group was 3.61 with a variance of 0.24 while the control group was 3.82 with variance of 0.20. It showed that control group was more homogeneous than the experimental group. When the mean scores were tested at 0.05 level of significance and using t-test, it resulted to a t-stat of 3.35 and its t-critical is 2.00. Since the t-stat is greater than the t-critical, then the null hypothesis is rejected. It means that there is significant difference on their mean scores. It is interpreted that the logical – mathematical intelligence scores of the control group were higher than the experimental group. It can be concluded that the control group is more logically and mathematically inclined than the experimental group.

Table 6. Significant Difference on Level of Logical – Mathematical Intelligence between Experimental and Control Group

Group	Level of Logical-Mathematical Intelligence	Variance	t-Stat	t-Critical
Experimental Group	3.61	0.24	3.35	2.00
Control Group	3.82	0.20		

Difference on the Level of Spatial Intelligence between Experimental and Control Group. Table 7 shows that the spatial intelligence mean score of the experimental group was 3.21 with a variance of 0.25 while the control group was 3.47 with variance of 0.35. It showed that experimental group was more homogeneous than the control group. When the mean scores were tested at 0.05 level of significance and using t-test, it resulted to a t-stat of 3.75 and its t-critical is 2.00. Since the t-stat is greater than the t-critical, then the null hypothesis is rejected. It means that there is a significant difference on their mean scores. It is interpreted that the spatial intelligence scores of the control group were higher than the experimental group. It

can be concluded that the control group is more visually and spatially leaning than the experimental group.

Table 7. Significant Difference on Level of Spatial Intelligence between Experimental and Control Group

Group	Level of Spatial Intelligence	Variance	t-Stat	t-Critical
Experimental Group	3.21	0.25	3.75	2.00
Control Group	3.47	0.35		

Difference on the Mean Gain Test Scores between Experimental and Control Group. Table 8 shows that the mean gain test score of the experimental group was 5.95 with a variance of 94.92 while the control group was 10.52 with variance of 75.87. It showed that control group was more homogeneous than the experimental group. When the gain test scores were tested at 0.05 level of significance and using t-test, it resulted to a t-stat of 2.03 and its t-critical is 2.00. Since the t-stat is greater than the t-critical, then the null hypothesis is rejected. It means that there is a significant difference on their mean gain test scores. It is interpreted that the mean gain test scores of the control is higher than the experimental group. It can be concluded that traditional learning with lecture method is better than online learning.

Table 8. Significant Difference on the Mean Gain Test Scores

Group	Mean Gain Test Scores	Variance	t-Stat	t-Critical
Experimental Group	5.95	94.92	2.03	2.00
Control Group	10.52	75.87		

Analysis on the E-Learning and Logical – Spatial Intelligences. The study showed that the e-learning approach may not be appropriate to students with low logical – mathematical and spatial intelligences. There is a need to reinforce it with verbal instruction to enhance the online method.

Conclusions and Recommendations

The following conclusions are drawn: (1) The experimental group possesses high level of logical – mathematical intelligence and fair level of spatial intelligence; (2) The control group possesses high level of logical – mathematical and spatial intelligences; (3) The posttest scores of the experimental group are higher than their pretest scores; (4) The posttest scores of the control group are higher than their pretest scores; (5) The experimental group showed improvement in their score performance; (6) The control group showed improvement in their score performance; (7) The control group showed higher level of logical – mathematical and spatial intelligences than the experimental group; and (8) The control group performed better in the test compared to experimental group.

It is respectfully recommended that: (1) E-learning with appropriate intervention can improve students learning; (2) Metacognition be included in online learning studies; and (3) Another study should be conducted in other mathematics and professional engineering subjects.

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References

Gardner, Howard. (1991). *The Unschooled Mind: How Children Think and How Schools Should Teach*. New York: Basic Books.

Hackbarth, S. (1996). *The educational technology handbook: A comprehensive guide*. Englewood Cliffs, NJ: Educational Technology Publications.

Ruiz, J. G., Mintzer, M. J. & Leipzig, R. M. (March 2006). The Impact of E-Learning in Medical Education. *Academic Medicine: IT in Medical Education*. Vol. 81 No. 3, 207 – 212.

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