Observations on the Computer Usage and Performance in Identification of Geometric Transformation among Secondary Schools: Case Study in Selected Schools in Perak.

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Abstract

Over the past years, substantial investment in educational infrastructure system has been made. Considerable attention and resources have been focused on the application of computer technology in the classroom. It is part of the effort made to improve the teaching and learning process. In order to study the effectiveness of computer technology in teaching and learning especially in mathematics, a study on students' preparation and interest on computer technology has been carried out. In this study, the author also observed on the students' performance especially on the topic of geometric transformation.

The purpose of this paper is to identify the students' preparation and interest in using computers and application of computer technology in learning mathematics and to highlight the problems that the students encountered in learning geometric transformations. The study involves a sample of 378 Form Five students from three different schools in Perak. From the survey, the students showed positive attitude towards the use of computer in the school and 57.8% indicated that they strongly believe that technology would help them in the learning process. They believed that drill and practice type of software is most suitable for learning mathematics. Analysis from the questions given on transformation and combinations of transformation showed that 62% of the students were not able to answer the questions correctly. Among the problems listed by the students were: difficulty in visualizing the transformation, confuse with the transformation and difficulty in finding the image of the transformation. The evidence and data gathered from the study will be used to develop a courseware on geometrical transformation.

Introduction

Presently, computer is part and parcel for the working world. Therefore, students of today need to be exposed on how to use computer effectively as to prepare them for their working life in the future. This can be done by including computer as an integral part of the current curriculum of the school system. Even in the workplace of today, computers are so important that most businesses cannot function without them. This causes educators to be concerned, and justifiably so, when they realise that the student's exposure to computer is limited.

A great deal of effort has been put into improving the use of computer in teaching and learning. However the results have not always been successful. There has been substantial investment in computers for education but it has produced very little impact (Loveless 1995; Willis 1996). Such is also the case in the Malaysian education system. According to Gan (1997) many efforts to integrate computers into education in the Malaysian schools have not gone beyond the stage of pilot projects. The smart school mega project (costing about RM300 million), an offspring of the Multimedia Super Corridor (MSC) initiative which began as a pilot project in 90 schools throughout Malaysia in 2000 have shown positive signs of a roll out to the other schools in the country soon. This initiative would certainly benefit the teaching and learning process in the country generally and the teaching of Mathematics specifically.

Conceptual Framework of Study

School geometry deals with the investigation of shapes and objects in two or three dimensions, their locations, relationships and properties. As shapes and objects are studied, discoveries about similarities and differences among them are made. Recognition of shapes and objects in a variety of forms, and as components of complex forms becomes possible. Students are expected to have much experience with basic identification of shape such as triangle, circles and rectangles and with identifying and measuring line segments and angles from preschool through secondary school education. In studying of relationships among geometric shapes, students traditionally learn only by using a protractor, compass and ruler. Through the study of geometry, students will learn about geometric shapes and structures and how to analyse their characteristics and relationship.

Studies have shown that students are failing to understand geometric concepts and are failing to develop adequate geometric problem-solving skills (Carpenter et al. 1980; Fey et al. 1984; Kouba et al. 1988). According to Gorgorio (Wan Fatimah et al. 2001) students have difficulties in geometrical transformation such as translations, reflections, rotations, dilations and expansions, which are part of the curriculum. Students have shown lack of ability to connect diagram with its symbolic representation and ability to interpret the figure. Geometrical transformation is difficult because it requires high abstractive thinking and logical deduction. Students' performances are poor when it comes to items that involve the understanding of features and properties of shapes.

Computer technology is currently being used in teaching and learning of mathematics. For example, teaching geometry with the assistance of computers would allow students to move from empirical to logical thinking. It will also encourage students to make and test conjectures, facilitate precision and exactness in geometric thinking, encourage the development of autonomy, and act as a mirror, reflecting the geometric thinking of students

for teachers and themselves. By using computers in teaching mathematics, teachers can provide a framework for the concepts to be learned. Then students can work in groups to investigate the problems at the computer in more depth. These groups can share their findings and results in a collaborative process that makes the instructive process richer.

Teaching with technology can change the role of traditional mathematics teacher. Tringa (1993) showed that students' achievement of mathematics concepts increased when learning with computers as compared to traditional lecture method. In fact the largest gains have been with the use of mathematical drill and practice software (Clements 1987 a & b; Clements & Nastasi 1992). Niess (1994) believes that using computers, teachers can simulate real world conditions and problems for their students to apply the mathematics they have learned. Through this application, they also learn more mathematics, solidify what they know and recognise the importance of knowledge.

Many studies have investigated the effect of teaching mathematics with computers. It has been shown that the use of computers can increase the mathematical achievement of children in schools (Clements et al. 1993). Findings by Mayes (1993) recommended that using technology in the instruction of mathematics is a powerful method in improving mathematics education.

Realizing the importance of knowledge in computer, the author decided to conduct a survey to gauge the students' perception and knowledge in using computer in selected schools in Perak.

Objectives of the Study

In general the aim of this study is to observe the students' preparation and interest in using computers and application of computer technology in the learning of mathematics especially in geometric transformation. The objectives of the study are as follows:

1) To investigate the students' perception towards computers to improve learning process especially in mathematics.
2) To investigate students' visualization of geometric transformation.
3) To identify the problems that students encounter in the learning of geometric transformation.

The evidence and data on the topics and the problems that the students' encountered in visualizing geometric transformation gathered from the study will be used to develop a courseware on combinations of transformation.

Methodology

This study was carried out on the Modern Mathematics of the year five of the secondary school. Students entering the fifth year of secondary school have already been introduced to translation, reflection and rotation. In Chapter 5 of the syllabus, students will be required to investigate the combinations of transformation and also to determine the final products on the geometrical figures.

The study was carried out using the survey method through questionnaires. It was part of an early study to recognize the problems in visualizing geometric transformation between three types of schools that is a technical school, a rural school and an urban school. The sample of the study comprised of three hundred and seventy eight students. The schools were categorised into three types: School A, B and C. School A is a technical school; school B is an urban school while school C is a rural school.

The questionnaire consists of three sections: Section A, B and C. Section A consists of the student's biodata and background knowledge or skill on computer. Section B is on the students' perception on mathematics and technology. In the second section, students answered questions based on the Likert scale from value 1 to 5. The range is from Value 1 is Strongly Disagree till value 5 Strongly Agree. Section C tests on the students' visualization of geometric figures using transformation and combinations of the transformation. There are ten questions in this section. The first three questions are on simple transformation, which are basically review questions. In the next seven questions, the students are supposed to find the right image from the geometric figures given according to the transformation. The students were also asked to list the problems that they encountered while answering the questions on the combinations of transformation.

Limitations of the Study

The respondents in this study were form five students from Perak. Considering the fact that these students were chosen from selected schools, the result of the study might not be representative of the entire population of form five students in Perak.

Findings and Discussion

Students' Background

Table 1: Students' Distribution

School	Total
A	202
B	143
C	33
Total	378

Table 1 shows the demographic distribution of the respondents. There were 202 students from school A, 143 students from school B and 33 students from school C. These respondents were grouped according to the majors/courses taken in their school. There were 66 respondents undertaking Civil Engineering, 70 from Mechanical Engineering, 66 from Electrical Engineering, 104 from Pure Science, 33 from Economics, 10 from Science and Information Technology and 28 from Social Science.

Table 2: PMR and SPM Trial Results for Mathematics

	SPM Trial						Total
	A	B	C	D	E	F	
PMR/ A	44	29	12			2	87
B	22	41	32	15	6	9	125
C	5	3	7	11	11	36	73
D				1	4	57	62
E						2	2
Total	71	73	51	27	21	106	349

Table 2 shows the cross tabulation of the Lower Secondary Examination (PMR) and Malaysia Education Certificate (SPM) Trial results for mathematics for year 2001. The grades range from A to F. A correlation analysis between the results of PMR and trial SPM for mathematics is significant with correlation coefficient, $r = 0.667$. This means that if the student performs in PMR, he/she will also perform in the trial SPM.

352 (93.1%) respondents have been using computer and 203 (53%) respondents have computer at home. 113 respondents use computers for learning purposes at least once a week, 58 twice a week, 63 more than 2 and 5 once a month. This means that 139 respondents had never used computer for learning purposes. 47 respondents have at least used one computer software application for learning. 53.4% of the respondents preferred in using tutorial-game type of software and 51.9% believed that drill and practice type of software is most suitable for learning mathematics.

Students' Perceptions on Mathematics and Technology

Table 3: Students' Perception

Statements	Mean
Interest in mathematics	4.02
Technology can help in learning process	4.25
Support the use of technology	4.15
Need time to master the computer	2.61

In general 47.6% of the respondents showed interest in mathematics (mean 4.02), 57.8% strongly believe that technology can help them in the learning process (mean 4.25) and 49.5% support the use of technology (mean 4.15) in learning and teaching as in Table 3. This means that the students have positive attitude towards the use of computer in the learning and teaching process. However 32.3% of the respondents believe that they will need time to master the computer (mean 2.61).

Students' visualization on geometric figures

Analysis of the questions showed that almost half of the students could not answer the questions.

Table 4: Students correct answers

Topics	No. (%)
Reflection	209 (55.3)
Rotation	126 (33.3)
Translation	204 (53.9)
Translation & Rotation	180 (47.6)
Translation & Reflection	176 (46.5)
Rotation & Dilation	158 (41.8)

Table 4 shows the number of correct answers from the selected topics. Only 33.3% of respondents answered the question on rotation correctly. Findings also showed that 55.3% and 53.9% were able to answer questions on reflection and translation but less than 50% was able to answer questions on the combination of transformation.

Table 5: Descriptive Statistics of Schools

	Mean	Std. Deviation
School A	8.08	1.68
School B	7.60	2.18
School C	4.84	2.75

Table 5 shows the performance of the three schools. The result showed that school A (technical school) and school B (urban school) performed better than school C (rural school).

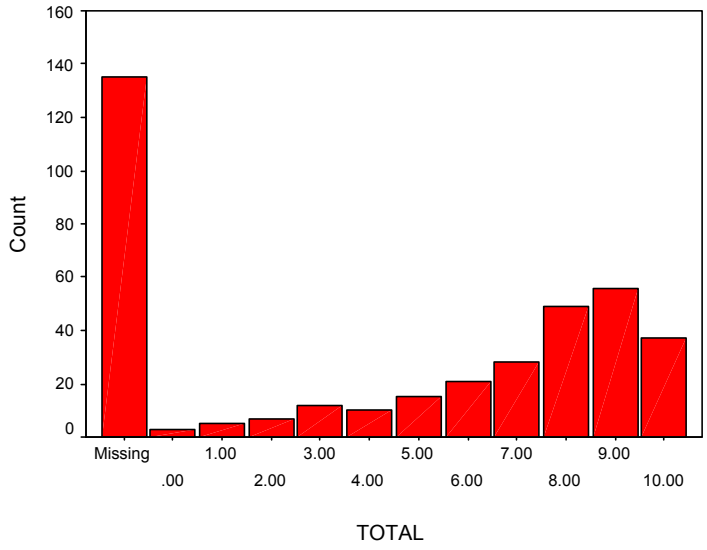

Figure 1: Total Correct Answers

Figure 1 shows the total number of correct answers out of 10 questions by the students. Only 37 respondents managed to answer all the questions correctly. 3 respondents

did not get any question correctly, while 135 respondents did not answer some of the questions.

Table 6: List of Problems

1.	Confuse of the center of the rotation.
2.	Hard to find the image of the angle.
3.	Cannot visualize the image of the figure for the combinations of the transformation.
4.	To find the direction of the rotation.
5.	Do not know which one to do first for the combination of transformation.
6.	Cannot determine the steps.
7.	Confuse of the direction of the translation.
8.	Confuse of the direction of the rotation.
9.	Did not know how to find the image.
10.	Cannot determine the angle such as 90^{o} ,180^{o} and 270^{o} .
11.	Confuse of the scale of the dilation.
12.	Teacher did not teach the topic.

Table 6 shows the problems that the students encounter on the topic. Most of the students commented that they have difficulties dealing with problems on the combinations of transformation.

Summary and Interpretation

A study was carried out on the topics of transformation and combinations of transformation. 378 students from 3 schools were involved in this study. The objectives of the study were to investigate the students' perceptions and interest in using computers and application of computer technology to improve learning process especially in mathematics, to investigate students' visualization of geometric transformation and to identify the problems that students encountered in the learning of geometric transformation.

From the study, the students showed 93% have been using computer and most of them support the use of computer technology in the process of learning especially in mathematics. 236(62%) students were only able to answer at most 7 questions correctly. This means that students were having problems with the topic given. Most of the students commented that they could not visualize the image of the combinations of the transformation. The other problems listed by the students were: confused with the transformation and difficult to find the image of the transformation. The result of the study also showed that the technical school and the urban school performed better than rural school. The students from the technical school have a course on technical drawing while the urban school has the best computer lab in the area.

The findings of this study will be used to help the authors to develop a courseware on the transformation and combinations of geometric transformation that will help students overcome some of the problems through the development of the right Instructional Design (ID) model. The courseware will be developed using Microsoft Director and Flash. It is also hoped that with such needs analysis done at the early analysis stage of the software

development will help ensure that the final courseware product can make mathematics more interesting and meaningful for students.

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