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COMPUTER AND INTERNET USE: ITS EFFECT ON THE PERFORMANCE OF STUDENTS IN PLANE GEOMETRY

Ma. Theresa F. Pescador
University of Northern Philippines
Vigan City, 2700 Ilocos Sur
mathess26@yahoo.com.ph

Mary Loreen Cayabyab
University of Northern Philippines
Vigan City, 2700 Ilocos Sur
mary_loreen@yahoo.com

ABSTRACT

This study aimed to investigate the effects of computer and Internet usage on the performance of students studying plane geometry. The rapid influx of new technologies and applications has brought advancement that has become an integral part of a person's identity. According to Amponsah (2010), most youth are largely occupied with chatting with friends, browsing Internet sites, and playing online games. This behavior leads to long hours on the Internet, which causes them to sleep in class or miss class altogether. The proper and efficient use of technology can provide many positive benefits; however, technology can prevent many youth from thinking critically, due to the easy access of information. The instruments used in the study are a plane geometry achievement test and a survey on computer and the Internet usage. The study revealed that the performance of the respondents is satisfactory. The respondents indicate "Very Satisfactory" performance along the congruence of line segments, angles, and triangles. It further revealed that the statement "Computers are used to play interactive games like Dota" is significantly related to the level of performance of the respondents in courses on plane geometry.

Keywords: Plane Geometry, Computer and Internet Use

INTRODUCTION

The rapid influx of new technologies and applications has brought advancement that has become essential to a persons' identity. These innovations affect largely how people learn, communicate, teach, and conduct research. A survey conducted by Simon Kemp and We are Social (2016), identified the Philippines as a country in which people spend 5 hours 12 minutes average daily use of the internet via Personal Computer or tablet and 3 hours 14 minutes average via a mobile phone. In the PowerPoint presentation, it shows that the Philippines is ranked second among the top 28 world Internet user countries by accessing through laptops or desktops and ranked seventh by accessing through mobile device.

Use of technology by youth is very evident. Internet-enabled devices like computers, tablets, and smartphones are just a few of the many devices that young people use daily. Most spend their time engaging in reading, researching, or relaxation on these devices. A survey conducted by Child Trends Databank (2015) revealed that the majority of young people use the computer to watch videos, play games, and engage in social networking, while only 10% use a computer and the Internet for reading or looking up health information online. This survey is further validated in the study by Amponsah (2010), which found that most youth are so engrossed in chatting with friends, browsing, and playing online games that they spend long hours on the Internet. Several studies reveal that the majority of students do not mind spending long hours on the Internet and sleeping only few hours because they find excitement or entertainment in what they are doing.

Based on the observations included of the faculty teaching geometry, the students face difficulty with proving statements, specifically in starting the proof. Some teachers have observed that, during classes, students are using their devices for different purposes, which make them less focused or cause them to miss some learning materials. Most often, they rely on the Internet for solutions to their assignments and submit copy-paste research projects. An interview conducted with the Assistant Dean of the College of Teacher Education, based on the record on feedback of their graduates who did not pass the licensure examination in elementary education, revealed that these graduates were not able to answer basic questions about mathematics.

Within this context, the researchers have considered ways to improve or even develop students' proving skill. If the same excitement can be felt toward their study of plane geometry through a more responsible, effective, and efficient use of a computer and the Internet, could there be a possibility that the student's proving skill

could improve? As the students are exposed to technology, will their visual ability increase and help them in their geometry work?

OECD (2015) revealed that, despite the considerable amount of investments in computers and Internet connections for educational use, there is little evidence that computer and Internet use among students leads to better performance in mathematics. There is a belief that students' constant use of technology hinders their ability to persevere and face problem-solving challenges. It has been observed that technology has led to a decline in the abilities and preparedness of students entering tertiary institutions. This could be a hindrance for students to maximize their learning at the tertiary level.

The studies mentioned above contradict the findings of Alday and Panaligan (2013), who found a positive effect from the use of technology, specifically on e-learning, as it improves students' performance. Topics of geometry like circles and parabolas are better taught through diagrams by using animation and visual presentations. This is consistent with the results of Boyraz (2008), who found that the two different methods of instruction using dynamic geometry-based instruction had a significant effect on students' attitudes toward geometry, mathematics, and technology as compared to traditional textbook-based instruction. Likewise, a research project conducted by Means and Olson (1995) mentions that, when students use technology as a tool or support for communicating with others, they are active rather than passive recipients of information and actively make choices on how to generate, obtain, manipulate, or display information.

The inconsistencies in the abovementioned studies regarding the effect of computer and Internet use in terms of whether it can improve the performance of students in mathematics, specifically in the subject of plane geometry, prompted the researchers to conduct this study. Students' use of the Internet cannot be controlled for, as it plays an important role in their research work. While they use their mobile devices or computers for research, they also find time to play games on the Internet or engage in offline playing. Believeing that this affects their concentration and focus, the researchers considered examining the relationship of online games to students' performance in plane geometry.

OBJECTIVES OF THE STUDY

The researchers observed that the majority if not all students were using Internet-enabled devices, including mobile phones, tablets, laptops, and other gadgets accessible to the network connection. These gadgets had become an integral part of

their daily activities. These observations prompted the researchers to investigate whether computer and Internet usage can help improve the level of performance of the students in plane geometry. As stated by Amoo (2010), if ICT facilities are integrated into junior and senior secondary school, there might be an improved motivation towards the learning of the school subjects which includes Mathematics.

The present study aims to determine the following: 1. The respondents' computer and Internet usage, along with the following: (a) settings that have been used for Internet connection, (b) setting most frequently used for Internet access, (c) websites that are visited, (d) number of hours in using the Internet, (e) number of hours in using the computer for fun/play, (f) number of hours in using the computer for school works, (g) number of hours in playing online interactive combat or adventure games like Dota or Clash of Clans or other interactive games; 2. the respondents' level of performance in the achievement test in Plane geometry; and 3. the relationship between the respondents' computer and Internet usage and the respondents' level of performance in the achievement test in plane geometry.

METHODOLOGY

The researchers used a descriptive method of research that is correlational in nature. The respondents were 131 fourth-year Bachelor of Science in Elementary Education students at the University of Northern Philippines during the school year 2014-2015. Using the G-Power Software (effect size = .3 and $\alpha = .05$), the number of samples determined was 134. However, the researchers made used of total enumeration with a given set of parameters; i.e. the students/respondents had finished plane geometry during the 1st semester of the school year mentioned above.

The researchers used two sets of instruments: the Computer and Internet Usage Inventory and the Plane Geometry Achievement Test. The researcher adopted the Computer and Internet Use Inventory from www.haverford.edu.com. The MIS experts in our university provided information on the latest online games being played, and web sites that are commonly used by students were added to the survey. On the other hand, the Plane Geometry Achievement Test was adopted from the Geometry Practice Test at Geometry Practice II (n.d.)[1]. This was validated by three expert teachers in Mathematics to ensure that it is applied in the Philippine setting. The evaluators were given a set of criteria on which to base their judgment for the sustainability and construction of the achievement test. The experts' evaluation yielded a mean rating of

[1] This is a geometry test retrieved on March 2015 from shendoahmiddle.com/wp-content/uploads/2017/01/geometry-eoc-pratice-test-2.pdf

4.75, which is interpreted as “Very Valid” on the rating scale for the content validity of a questionnaire by Bitonio (2014). There were 5 items which were added to cover the topics included in the course outline, and some items were improved based on the suggestions of the validators.

After the final approval of the questionnaire, it was pilot tested among 27 BSED math students at the University of Northern Philippines who were officially enrolled in plane geometry. After the test administration, the test papers were subjected to item analysis.

In computing the discrimination index, the researchers first scored each student's test and rank ordered the test scores. Next, the 27% of the students scoring at the top and the 27% at the bottom were separated for the analysis. Wiersma and Jurs (1990) stated that "27% is used because it has shown that this value will maximize differences in normal distributions while providing enough cases for analysis." The discrimination index is the number of students in the upper group who answered the item correctly minus the number of students in the lower group who answered the item correctly, divided by the number of students in the larger of the two groups.

The following norms were applied, as suggested by Ebel & Frisbie (1986): .40 and greater are very good items, .30 to .39 are reasonably good but possibly subject to improvement, .20 to .29 are marginal items and need some revision, and below .19 are considered poor items and need major revision or should be eliminated. From the original 45 items tested, 35 items were selected, and these were administered to the 131 Bachelor of Science in Elementary Education students as the respondents of the study.

In the determination of the reliability of the instrument, the researchers used the KR20 reliability analysis. The formula used was

$$\rho_{KR20} = \frac{k}{k-1}\left(1 - \frac{\sum_{j=1}^{k} p_j q_j}{\sigma^2}\right)$$

where:

k = number of questions

p_j = number of people in the sample who answered question j correctly

q_j = number of people in the sample who didn’t answer question j correctly

σ^2 = variance of the total scores of all the people taking the test = VARP (R1)

where R1 = array containing the total scores of all the people taking the test.

The result showed that the plane geometry Achievement test had a reliability coefficient of .77, which means that the instrument used in the research is reliable.

The researchers followed the guidelines on interpreting the level of performance in the achievement test based on the following criterion-referenced interpretations:

Range of Scores	Interpretation
28-35	Outstanding
21-27	Very Satisfactory
14-20	Satisfactory
7-13	Poor
0-6	Very Poor

The researchers made use of the following statistical tools: frequency and percentage present the distribution and profile of the student respondents, mean determines the respondents' level of performance in the achievement test in plane geometry, ranking describes the respondents' computers and Internet usage, and Pearson's Product-Moment Method of Correlation determines the relationship between the independent variables and dependent variable in this study. The variable "exposure to computer and the Internet" was correlated with "plane geometry performance per content area" to determine if there exists a significant relationship between them.

RESULTS AND DISCUSSION

Profile of the Respondents in Computer and Internet Usage

It can be seen from Table 1 that most of the respondents make use of the computer connected to the Internet at home, which ranks first. This finding could mean that most of the students have computers in their home and are connected to the Internet. The same finding was reported by the Child Trends Databank (2015) in the study of Home Computer Access and Internet Use in 2013, that almost six out of ten children used the Internet at home; this is nearly six times as many as in 1997. Due to their class schedule, the respondents did not have time to connect to the Internet while they were at the university. Moreover, the item "Use of Internet at public library" was ranked last. Perhaps some libraries do not yet have access to the Internet. Other respondents make use of Cybercafes or another settings, such as a friend's home or at school or work.

Table 1 Settings on the Use of Computer

Settings	Mode Used to Connect the Internet		Most Frequently Used Mode to Access the Internet	
	Frequency	Rank	Frequency	Rank
Cybercafé or another setting open to the public	32	3	20	2
Mobile Connection	65	2	65	1
Public Library	8	6	5	6
At home	72	1	15	4
At a Friend's home	19	5	8	5
At school or work	28	4	18	3

Table 1 presents the respondents' most frequently used mode of connecting to the Internet. The use of mobile connection was ranked first. This is not surprising, because most smartphones have Wi-Fi capability, and it is the most accessible way of connecting to the Internet. Furthermore, the local Internet providers offer bundle promos and reduced prices for Wi-Fi accessibility. Rainie and Cohn (2014) have documented in their study that wired computers are less preferred as a mode of connecting online compared to smartphones. On the other hand, the item "Public Library" was ranked 6th. This result may show that the Internet of public libraries is for management only.

Table 2 Type of Web Sites Visited

Items	Frequency	Rank
Social Networking	108	2
Search Engine	120	1
Third Party Downloading sites	18	7
Retail Sales	11	8
Educational/School	83	3
Games	48	5
Music/Film/Celebrity	79	4
News	41	6
Religion	9	9.5
Sports	9	9.5

Along the variable on the sorts of websites visited by the respondents in the last month, Table 2 reflects that search engines ranked 1st. These findings imply that

respondents use the Internet to fulfill academic research purposes that may address their educational needs, to find relevant news, or to access decision-making information. The items "Religion" and "Sports" sites were ranked 9.5, which means that this is the least-visited type of website. This may imply that the respondents are not interested in religion and sports. The result of the study supports the assertions by Head and Eisenberg (2011), as mentioned in his report, that the majority of students visit websites to purchase something, but those looking for spiritual information were least visited.

Table 3 reveals that there are eight respondents who gave no answer. This result may mean that these respondents do not use a computer and the Internet for any purpose or some of the respondents do not have a computer and access to the Internet at all. This is not surprising to note because there are high-tech companies in US territories, but some locals do not own computers of any kind. In Palo Alto, California, in the heart of Silicon Valley and home to Stanford University, at least 4% of households do not own any type of computer. In Cambridge, Massachusetts, the location of Harvard and M.I.T., at least 8% of households are computer-free. However, less than half of the respondents use a computer and the Internet for 1-4 hours a week. The result contradicts the survey conducted by the Web of Trust website (2009), in which 50% of the respondents reported spending 9-12 hours on the computer per day. The table further dictates that almost all of the respondents use a computer and the Internet.

Table 3 Number of Hours a Week the Respondents Used the Computer and the Internet

Items	No. of hours a week in using the computer and the internet	
	Frequency	%
Less than 1 hour/week	7	5.34
1-4 hours/week	40	30.53
5-6 hours/week	21	16.03
7-9 hours/week	9	6.87
10-20 hours/week	12	9.16
21-40 hours/week	16	13.74
Over 40 hours/week	18	12.21
No Answer	8	13.74
Total	131	100

Table 4 Number of Hours a Week the Respondents Used the Computer and the Internet According to Purpose

Items	No. of hours used According to Purpose					
	For Fun/Games		For School Works		For Playing Online Interactive Combat or Adventure Games	
	Frequency	%	Frequency	%	Frequency	%
Less than 1 hour	38	29.00	5	3.82	76	58.02
1-5 hours	38	29.00	48	36.64	22	16.79
6-10 hours	19	14.50	30	22.90	11	8.40
11-20 hours	14	10.69	31	23.66	7	5.34
21-40 hours	7	5.34	8	6.11	10	7.63
Over 40 hours	5	3.82	1	0.76	5	3.82
No Answer	10	7.63	8	6.11	0	0
Total	131	100.00	131	100.00	131	100.00

Table 4 shows that 10 (7.63%) of the respondents gave no answer. This finding may mean that they do not have a computer at home, or they do not prioritize the use of the Internet for fun or game purposes. However, more than half of the respondents use a computer and the Internet for fun or game for less than one hour to and one to five hours a week. This study agreed with Rideout et al. (2010) when he mentioned that young people are most likely to use a computer and the Internet for social networking, playing games, and watching videos.

In addition to using the computer for schoolwork, there are eight (or 6.11%) who do not use a computer and the Internet. This may be because some of the respondents do not have computers at home, and they prefer using other printed and available materials for schoolwork. On the other hand, almost all of the respondents use a computer for schoolwork, and 48 of the respondents, or 36.64%, spend 1-5 hours a week for this purpose. Monahan (2014) reports that, with the present trend of education, one needs a computer and Internet access to fulfill all school requirements well. Access to a computer and the Internet provides access to knowledge and information that are part of education in the 21st century.

The same table indicates that all of the respondents spend hours playing interactive combat or adventure games; this contradicts the previous finding that there are a few respondents who do not use the computer for fun/games. More than half of the respondents (76 or 58.02%) spend less than an hour playing daily. This implies

that most of the respondents use a computer and the Internet for playing interactive or adventure games, but they have not played for a very long time.

Regarding the Frequency Distribution on Playing Interactive or Adventure Games on Computer, more than half of the respondents, specifically 85 or 64.89%, said that they play interactive or adventure games like Dota or Clash of Clans, and only 38 or 29% have not played these games. The result in this table agrees with the result in Table 4, which indicates that more than half of the respondents use the Internet to play interactive or adventure games.

Level of Performance

Table 5 shows that, as a whole, the performance of the respondents has a mean of 48.18, which is described as "Satisfactory." In light of the performance of the respondents by content area, the topic of congruence of line segments, angles, and triangles has the highest mean, with a descriptive rating of "VS." The result may imply that the respondents have good logical reasoning and a good background in numerical and algebraic applications. On the other hand, the respondents demonstrated the lowest mean along the content area of geometric inequality. This result may mean that the respondents have difficulty in formulating geometric relationships. The level of performance of the respondents in all the other content area is "Satisfactory."

Table 5 Level of Performance of the Respondents in Plane Geometry Per Content Area

Topics	$\overline{x}$	Descriptive Level
Basic concepts in Plane Geometry	40.25	S
Proving Statements	49.00	S
Congruence of Line segments, Angles and Triangles	60.67	VS
Congruence based on Triangles	50.25	S
Geometric Inequalities	30.25	P
Parallel Lines	49.60	S
Quadrilaterals	53.33	S
Ratio, Proportion and Similarity	52.08	S
As a Whole	48.18	S

60.00 -79.99 Very Satisfactory; 40.00 - 59.99 Satisfactory; 21.00 - 39.99 Poor

This conforms the findings of Saelim (1995), which revealed that the performance of the BSCE III students in mathematics, such as calculus, is "Fair." Furthermore, in the study of Nolasco (2010) he also found out that the overall performance of the students in Mathematics is described as "Satisfactory." His findings revealed that the students are found to be weak in all content areas considered in his study.

It can be observed from Table 6 that only the variable "Use of computer for interactive or adventure games" has a significant relationship with the level of performance of the students. The computed statistical power is 0.946, which is considered to be statistically powerful (Skrivanek, 2009). This implies that, when students use the computer for interactive or adventure games, they might demonstrate better performance in plane geometry. This may mean that their analytical level of thinking regarding plane geometry problems could be enhanced. This contradicts the claim by Dewar (2013) that time spent playing is linked with low school competence but only in the case of violent video games. Kids who played educational games did not suffer academically. However, this finding supports the work by De Bell and Chapman (2003), as mentioned by Kim and Chang (2010), in which 56% of students played computer games. Along with the popularity among students, computer games have received much attention from educators as a potential way to provide learners with effective and fun learning experiences. Moreover, Gambari et al. (2014) mentioned that the students who were taught geometry using computer animation performed significantly better in the posttest and retention test than their counterparts, who were taught geometry using an instructional model and a conventional method. The length of time they spend using the Internet or a computer did not affect their level of performance.

Table 6 The Relationship between the Profile of the Respondents and their Level of Performance in Plane Geometry

Variables	r	Decision
a. Settings ever made used connected to the internet	0.019	Do not reject Ho
b. Setting most frequently used to access the internet	-0.051	Do not reject Ho
c. Web Sites frequently visited	0.089	Do not reject Ho
d. Number of Hours spent in using the internet	0.141	Do not reject Ho
e. Number of Hours spent on the computer for fun/game	0.036	Do not reject Ho
f. Number of Hours used in doing school works	0.065	Do not reject Ho
g. Use of computer to play interactive or adventure games	0.199*	Reject Ho
h. Number of hours spent in playing interactive games	0.057	Do not reject Ho

*Significant at 0.05

CONCLUSIONS AND RECOMMENDATIONS

This study reveals that most of the respondents use a computer connected to the Internet at home. Computers have already become a basic facility in most homes. Many of the respondents frequently access the Internet using their mobile phones. The search engine is the most visited website by a great percentage of the respondents. A marked percentage of the respondents use a computer and the Internet 1-4 hours every week. Regarding the time spent using a computer and the Internet, more than half of respondents are playing interactive or adventure games for less than an hour every week, less than half use it for schoolwork for 1-5 hours each week, and some use it for less than an hour or 1-5 hours weekly for fun/games.

In addition, the level of performance in plane geometry of the respondents is "Satisfactory." The respondents demonstrate "Very Satisfactory" performance along the variable congruence of line segments, angles, and triangles, and demonstrate "Poor" performance regarding geometric inequalities. It appears in the study that "Use of a computer for online interactive or adventure games" is found to be significantly related to the student's level of performance in plane geometry.

Although it is clear that computer and Internet usage for interactive or adventure games may be an effective tool for improving the performance of students in plane geometry, Curriculum planners must establish a multi-level approach on the use of computer and the Internet which would include professional development and acquisition of instructional resources needed for its integration into the curriculum. Research studies may be conducted to determine the effectiveness of technology integration into the curriculum in ways that learning process is enhanced, the use of technology is routine and when it supports curricular goals.

IT faculty may develop a model ICT teacher professional development program that focused on the innovative use of computer and Internet for teaching and learning. Many people believe that integration of technology on student projects allow the students to acquire and improve their analytical thinking and problem-solving skills in processing information they find online. In addition, administrators of universities may increase its investment in ICT equipment and facilities in order that majority of the students and teachers can readily access the Internet. The Internet is now one of the major sources of information for students and teachers on any topic or in any subject. Mathematics faculty should be motivated to recognize the relevance of teacher training on the proper usage of computer and the Internet. A continuing development of teachers' ICT-related skills through regular access to a functioning and relevant ICT equipment is encouraged. Mathematics faculty is encouraged to

introduce strategy games that can enhance the visual ability of students which they can use, not only in their study of Geometry but other allied fields.

Other researchers are encouraged to conduct a replication of the study to other group of students of larger sample to further validate the findings of this study. It is also recommended that a study using quantitative-qualitative design should be done using interactive learning in plane geometry and other fields of Mathematics.

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