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Exploring the Factors in Student's Retention of E-Learning Mathematics: A Case of Grade 12 Senior High School Students at the University of Perpetual Help System- Pueblo de Panay Campus

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Abstract- The study aims to determine the effects of teacher's factors, student attitude, and motivation on student's ability to absorb, recall and maintain the learned concepts. This research measures the effects of the said factors on student's mathematics retention. For this study, the data are collected from 101 STEM students of the University of Perpetual Help System-Pueblo de Panay Campus. The data analysis is done using Paired t-test, Cronbach's Alpha and Pearson r. The results have revealed that teacher's factor, students' attitude and motivation have significant differences. Results indicate that the three factors have statistical effect and significant impact on student's ability to absorb, recall and maintain the learned concepts in Mathematics subject via e-learning platform. Based on the findings, teacher's factor is one of the factors that the school should give much focus on since teacher has the ability to motivate and influence the attitude and performance of the students and they are accountable for the achievements and performance for the students. Furthermore, the study finds out that e-learning does not reduce education, learning process, between students and teacher. Retention rates for online students are much higher than for traditional because it makes every learning material accessible and makes it more likely that a student can increase his productivity by finishing a course or program when physical limitations are removed.

Keywords: emerging methodology, e-learning, retention.

I. Introduction

Mathematics is one of the fundamental subjects that is a part of human life that can solve and understand ourselves and the world we live in (Russell, 2017). Mathematics in education can provide an effective way towards new inventions, solutions and innovation. Through this, people can do a lot of things at ease by the help of its applications. In meeting this convenience, there is a need to find out whether the identified factors have a relationship between student's retention of Mathematics.

As one of the identified factors, teacher's influence towards the learning of a student has a vital role in education (Bombaes, 2017). Teacher's factor contributes to the students' academic performance. Moreover, under this factor, other variables are taken identify the sub-factors that fall under teacher's influence are teacher motivation (Thoonen et al., 2011), punctuality of teachers (Sahito et al., 2016), learners' exercises (Min, 2008), teacher preparedness and teacher teaching aid (Siachifuwe, 2017). This also includes teacher's ability to utilize e-learning platform as a mode of teaching and learning to deliver information and instruction to student. Other factors like attitude (Briz-Ponce et al., 2017) and motivation of students (Augustyniak et al., 2016) can influence and affect their academic performance most specifically in learning mathematics. In this regard, the perceived enjoyment is regarded as one of the components which determines students behavior towards math retention using the e-learning platform (Panay et al., 2019).

In today's generation, education is enhanced by the use of technology integration particularly the e-learning platform and teaching using this platform is regarded as an emerging methodology of teaching and learning. Teaching and learning via e-learning platform brings changes in pedagogical strategies and improves the efficiency of teaching and learning (D. Doculan, 2016). It is regarded as an emerging methodology. This platform bridges the students and teacher relationship to the next level of education. Digital technology has changed the very notion of what being a human means (Borba et al., 2016).

Retention of learned concepts can be defined as having the information stored in long-term memory in such a way that it can be readily retrieved, for example, in response to standard prompts (Karpicke & Roediger, 2007). Retention attempts to describe the ways in which the student and the institution interact with one another. The theoretical principles convey the importance of having knowledge of student attributes that influence retention (READ, 2017).

This paper confirms the relationship between teacher's factors, student attitude, and student motivation where the role of the teacher in on-line education and the degree of student's attitude and motivation are substantiated. To further understand this relationship between these factors towards student 'retention of learned concepts of mathematics, the paper is explained and discussed in different sections as follows.

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II. Research Objectives

With the advanced technological innovation and development, the use of e-learning platform has become very prominent especially during the COVID-19 pandemic period. E-learning has become the primary way of teaching and learning and become a necessary teaching method (Moreno-Guerrero et al., 2020). This study presents contributing factors towards student's retention of mathematics via e-learning as a mode of delivery in teaching. The aims of this study to identify the influences and impacts of teacher's influence, student attitude, and motivation on student's retention of mathematics which can be observed when teaching is delivered and learning is achieved online. The main objective of this study is to identify the factors that influence retention and effectiveness of the e-learning method in student's ability to absorb, recall and maintain the learned concepts about mathematics.

III. Method of Investigation

a) Research Design and Method

The study is a quantitative research developed is quantitative. A case study has been designed to measure the teacher's factor, students' attitude, and students' motivation towards student's retention of learned concepts in mathematics. The delivery of teaching and learning was done through the use of e-learning as an emerging methodology. To assess the said factors, the study was done through correlational research. The total number of population consisted of 101 grade 12 STEM students has been covered, for it serves the purpose of the study. To find out the relationship and significant difference of the variables of the study, a self-made questionnaire was used gather the needed data. The questionnaire was made by the researchers in accordance with the current study.

b) Instrumentation

The study took place at the University of Perpetual Help System – Pueblo de Panay, Roxas City, Capiz, Philippines. All STEM students of Grade 12 were covered to gather the information. The questionnaire has only one part which measures the student's retention in terms of teacher factor, student's attitude and student's motivation towards student's retention of learned concepts using five-point Likert Scale.

c) Sample Design

For statistical analysis the data were collected from Grade 12 STEM students, all are active users of e-learning platform of the university. There were 101 participants and they were given a structured questionnaire to identify and perform the relationship of every variable using correlation analysis. Cronbach's Alpha was used to determine the reliability of each item from the questionnaire. This study is quantitative with the support of SPSS.

d) Pilot Testing

The number of participants was identified based on the 15% of total Grade-12 STEM students and it was conducted in Grade-11 STEM students first in order to test the applicability and objectivity of the research tool.

e) Data Analysis and Results

i. *Data Analysis and Results*

Pearson r correlation analysis is utilized for measuring the model that consists of validity test. All factors are tested to be greater than 0.5. In the reliability test, Cronbach's Alpha value is determined and found to be higher than 0.8. This is a manifestation that questions under each construct are significantly valid and reliable with Sig.(2-tailed) = 0.000 < p = 0.05 and r(x,y) ≥ 0.5 > r = 0.195 in order to measure the teacher's factor, students' attitude and perceived enjoyment towards students' retention in mathematics using e-learning platform.

Table 1.0: Teacher's factor items correlation

Correlations

		TOTAL (TEACHER FACTOR)
Q1	Pearson Correlation	.738**
	Sig. (2-tailed)	.000
	N	101
Q2	Pearson Correlation	.728**
	Sig. (2-tailed)	.000
	N	101
Q3	Pearson Correlation	.694**
	Sig. (2-tailed)	.000
	N	99

Q4	Pearson Correlation	.809**
	Sig. (2-tailed)	.000
	N	101
Q5	Pearson Correlation	.770**
	Sig. (2-tailed)	.000
	N	101
Q6	Pearson Correlation	.663**
	Sig. (2-tailed)	.000
	N	101
Q7	Pearson Correlation	.582**
	Sig. (2-tailed)	.000
	N	101
Q8	Pearson Correlation	.592**
	Sig. (2-tailed)	.000
	N	101
Q9	Pearson Correlation	.786**
	Sig. (2-tailed)	.000
	N	101
Q10	Pearson Correlation	.760**
	Sig. (2-tailed)	.000
	N	101
TOTAL TEACHER FACTOR	Pearson Correlation	1
	Sig. (2-tailed)	
	N	101

***. Correlation is significant at the 0.01 level (2-tailed).*

**. Correlation is significant at the 0.05 level (2-tailed).*

Table 1.1: Students' attitude item correlation

Correlations

		TOTAL (STUDENTS ATTITUDE)
Q1A	Pearson Correlation	.600**
	Sig. (2-tailed)	.000
	N	101
Q2A	Pearson Correlation	.635**
	Sig. (2-tailed)	.000
	N	100
Q3A	Pearson Correlation	.803**
	Sig. (2-tailed)	.000
	N	98
Q4A	Pearson Correlation	.784**
	Sig. (2-tailed)	.000
	N	100
Q6A	Pearson Correlation	.738**
	Sig. (2-tailed)	.000
	N	100

Q7A	Pearson Correlation	.695**
	Sig. (2-tailed)	.000
	N	100
Q8A	Pearson Correlation	.685**
	Sig. (2-tailed)	.000
	N	100
TOTAL STUDENTS ATTITUDE	Pearson Correlation	1
	Sig. (2-tailed)	
	N	101

***. Correlation is significant at the 0.01 level (2-tailed).*

**. Correlation is significant at the 0.05 level (2-tailed).*

Table 1.2: Perceived enjoyment items correlation

Correlations

		TOTAL (PERCEIVED ENJOYMENT)
Q1B	Pearson Correlation	.889**
	Sig. (2-tailed)	.000
	N	100
Q2B	Pearson Correlation	.910**
	Sig. (2-tailed)	.000
	N	100
Q3B	Pearson Correlation	.718**
	Sig. (2-tailed)	.000
	N	100
Q4B	Pearson Correlation	.855**
	Sig. (2-tailed)	.000
	N	100
TOTAL PERCEIVED ENJOYMENT	Pearson Correlation	1
	Sig. (2-tailed)	
	N	101

***. Correlation is significant at the 0.01 level (2-tailed).*

Table 2.0: Teacher factor Reliability Statistics

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No. of Items
.887	.894	10

Table 2.1: Teacher factor Inter-Item Correlation Matrix

Inter-Item Correlation Matrix

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Q1	1.000	.743	.605	.282	.443	.526	.585	.489	.443	.307
Q2	.743	1.000	.626	.324	.458	.330	.351	.402	.458	.216
Q3	.605	.626	1.000	.465	.415	.527	.444	.308	.732	.507
Q4	.282	.324	.465	1.000	.681	.368	.563	.537	.341	.393
Q5	.443	.458	.415	.681	1.000	.637	.325	.592	.304	.371
Q6	.526	.330	.527	.368	.637	1.000	.510	.228	.386	.557
Q7	.585	.351	.444	.563	.325	.510	1.000	.570	.325	.579
Q8	.489	.402	.308	.537	.592	.228	.570	1.000	.408	.325
Q9	.443	.458	.732	.341	.304	.386	.325	.408	1.000	.639
Q10	.307	.216	.507	.393	.371	.557	.579	.325	.639	1.000

Table 3.0: Student attitude Reliability Statistics

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No. of Items
.850	.864	7

Table 3.1: Student attitude Inter-Item Correlation Matrix

Inter-Item Correlation Matrix

	Q1	Q2	Q3	Q4	Q9	Q10	Q11
Q1	1.000	.433	.218	.400	.284	.218	.319
Q2	.433	1.000	.285	.717	.256	.285	.368
Q3	.218	.285	1.000	.591	.653	.473	.593
Q4	.400	.717	.591	1.000	.675	.591	.563
Q9	.284	.256	.653	.675	1.000	.760	.725
Q10	.218	.285	.473	.591	.760	1.000	.593
Q11	.319	.368	.593	.563	.725	.593	1.000

Table 4.0: Perceived enjoyment Reliability Statistics

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No. of Items
.893	.892	4

Table 4.1: Perceived enjoyment Inter-Item Correlation Matrix

Inter-Item Correlation Matrix

	Q5	Q6	Q7	Q8
Q5	1.000	.837	.515	.746
Q6	.837	1.000	.500	.943
Q7	.515	.500	1.000	.503
Q8	.746	.943	.503	1.000

**Therefore, the result in Table 1.0 – table 1.2 shows validity of the items in each factor and table 2.0 – table 4.1 shows the reliability of the items in each factor.*

Table 5.0: Statistics (Teacher Factor, Student Attitude and Perceived Enjoyment)

	Mean	N	Std. Deviation	Std. Error Mean
Teacher Factor	4.4072	101	.51276	.05102
Perceived Enjoyment	3.8430	101	.64014	.06370
Student Attitude	3.2896	101	.80291	.07989

Table 5.1: Paired Correlations (Teacher Factor, Student Attitude and Perceived Enjoyment)

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Teacher Factor & Perceived Enjoyment	101	.565	.000
Pair 2	Teacher Factor & Student Attitude	101	.308	.002
Pair 3	Perceived Enjoyment & Student Attitude	101	.714	.000

Table 5.2: Paired Test (Teacher Factor, Student Attitude and Perceived Enjoyment)

Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1 Teacher Factor - Perceived Enjoyment	.56415	.54950	.05468	.45567	.67263	10.318	100	.000
Pair 2 Teacher Factor - Student Attitude	1.11755	.80887	.08049	.95787	1.27723	13.885	100	.000
Pair 3 Perceived Enjoyment - Student Attitude	.55339	.56630	.05635	.44160	.66519	9.821	100	.000

ii. *Result and Hypothesis Testing*

After signifying the validity of the measurement model, the next step was to hypothesize the significant difference and relationship using paired T-test and person r. The results based on the structural model support that all proposed hypotheses were supported by the data.

Teacher Factor (mean = 4.4072, SD = .51276) is higher than *Perceived Enjoyment* (mean = 3.8430, SD = .64014) in terms of mean which signifies that teacher factor has higher effect than perceived enjoyment on student's retention. Based on the result, there is a high significant difference between teacher factor and perceived enjoyment with t = 10.318, df = 100 and sig.

(2 tailed) = .000. Also, the correlation value of teacher factor and perceived enjoyment is equal to .51276 which indicates that there is a positive or direct relationship between these two variables.

Teacher Factor (mean = 4.4072, SD = .51276) is higher than *Student attitude* (mean = 3.2896, SD = .80291) in terms of mean which signifies that teacher factor has higher effect than student's attitude on student's retention. Based on the result, there is a high significant difference between teacher factor and student attitude with t = 13.885, df = 100 and sig. (2 tailed) = .000. Also, the correlation value of teacher factor and student attitude is equal to .308 which indicates that there is a positive or direct relationship between these two variables.

Perceived Enjoyment (mean = 3.8430, SD = .64014) is higher than *Student attitude* (mean = 3.2896, SD = .80291) in terms of mean which signifies that perceived enjoyment has higher effect than student's attitude on student's retention. Based on the result, there is a high significant difference between teacher factor and student attitude with t = 9.821, df = 100 and sig. (2 tailed) = .000. Also, the correlation value of perceived enjoyment and student attitude is equal to .714 which indicates that there is a positive or direct relationship between these two variables.

IV. Discussion and Conclusion

This study examines the influence and impact of teacher's factor, student's motivation, and student's on student's ability to absorb, recall, and maintain the learned concepts in Mathematics of Grade 12 STEM students of the University of Perpetual Help System-Pueblo de Panay Campus, Roxas City, Philippines. The results of this study assemble by t-test and Pearson r which indicate that teacher factor, student attitude and student motivation towards students' retention. These findings support that these factors are significant and have a positive impact on the findings generated with the use of Paired t-test analysis.

As part of the investigation, it reveals that based on 101 respondents who participated in the data collection; Teacher Factor has the highest influence on student's ability to absorb, recall and maintain the knowledge she or he learned. With the help of e-learning the students along with teacher factors, teacher was able to successfully and effectively deliver his lessons thus contributing to the success of teaching and learning. The findings show that teacher preparedness and ability to deliver his lesson through e-learning platform, teacher motivation, marking of learner's exercises, punctuality of teacher and teaching aid which fall under teacher factor should be considered in teaching mathematics. Teachers who are successful in establishing an online learning community encourage student participation and discourage lurking behavior. This was followed by the student motivation and student attitude have the least effect on student's retention.

Based on the findings, the study recommends that, teachers should enrich better the teacher factor such as teacher preparedness, teacher motivation, marking of learner's exercises, teaching aid, together with student motivation and student attitude for these contribute to student's retention of learned concepts and knowledge in Mathematics. In order to make learning appears more profound, teachers should engage students in a more challenging online environment by making the lessons more interactive and the e-learning platform fun since students find it enjoyable to use.

Furthermore, the study finds out that e-learning does not reduce education, learning process, between students and teacher. This only proves that retention rates for online students are much higher than for traditional, in-person students, for online learning increases access and makes it more likely that a student can finish a course or program.

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