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Mobile Physics as Innovation to Reinvigorating Active Engagement and Learning Dynamics of Grade 11 Learners on Uniform Accelerated Motion

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ABSTRACT

Physics phenomena are widely viewed in daily life, and the technical nature of physics makes modern life seem to be simpler than it was many years ago. Physics teaching and learning, on the other hand, has not always been done effectively, especially in developing countries. This study aimed measured the effectiveness using mobile physics on students' reinvigorating active engagement and learning dynamics on teaching uniform accelerated motion. The study employed the one-group pretest–posttest design. The design compared the result obtained from researcher – made - pretest and posttest and adapted science engagement scales. The study revealed that mobile physics as innovation had a positive effect on the learning dynamic of the learners, as evidenced by the significantly greater mean in the posttest. The data showed that there is significant difference in the pretest and posttest score of students in the utilization of mobile physics on teaching uniform accelerated motion. It is also evident that learners highly have engagement during the innovation on teaching uniform accelerated motion. Future utilization of this mobile physics as an innovation would raise learners' active engagement and learning dynamics in teaching physics concepts.

Keywords- active engagement, learning dynamics, innovation and mobile physics, uniform accelerated motion**.**

I. INTRODUCTION

Physics is the study of matter and energy, as well as their interactions. It is the most fundamental of sciences. Other sciences, such as chemistry, astronomy, and geology, are built on its foundation. (Santisteban, 2016). Physics principles are used in many other areas of science, and it has greatly contributed to our current understanding of the universe. (Asuncion, et al, 2012).

On the basis of experimental data from another situation, physics may predict how nature would behave in a given situation. Since these predictions put physics at the center of modern technology, they have the potential to have a significant effect on our lives. Rocketry and the advancement of space travel are deeply rooted in Galileo Galilei's (1564-1642) and Isaac Newton's physical laws (1642-1727). In the construction of engines and the design of aerodynamic vehicles, the transportation industry heavily relies on physics. The transistor is responsible for the development of entire electronics and computer industries. Electromagnetic waves, whose presence was predicted by James Clerk Maxwell (1831-1879) in his theory of electricity and magnetism, are heavily used in the telecommunications industry. The medical profession obtains photographs of the interior of the human body using X-ray, ultrasonic, and magnetic resonance methods. The laser has had probably the most widespread influence on modern technology. This incredible unit, which is a direct application of atomic physics concepts, has applications in fields ranging from space exploration to medicine (Cutnell, 2014).

Physics is a part of the spiral progression program in Science Education in the Philippines from Grade 7 to 10, and it is also offered as advanced subjects in senior high school. Physics students gain skills that are transferable to other fields. Thinking logically and analytically, solving problems, building mathematical models, using accurate approximations, and having detailed descriptions are all examples of these skills (Giambattista, et al, 2017).

Despite the fact that physics is unquestionably important to society, the majority of students are unable to take the subject seriously. The very fact that physics is included in the curriculum causes them excessive concern. Students are apprehensive about the course because they feel it will be difficult. Students perceive introductory physics courses to be more challenging than other introductory science courses (Ornek, et al, 2010). This may be due to the fact that success in physics courses necessitates a different methodology, mindset, and outlook than success in other science courses. Physics' reputation as a challenging course stems largely from its dominant problem-solving nature, which uses mathematics more intensively and has much more and deeper internal logical relations and unifying concepts (Ogunleye, 2010).

In order to excel in physics, students must have good math skills. Students find physics challenging, according to Angell, et al (2014) and Redish (1994), since they must deal with numerous representations at the same time, such as experiments, formulas and equations, diagrams, and conceptual descriptions in uniform accelerated motion. Physics necessitates the ability to use

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algebra and geometry, as well as the ability to transition from a particular to a general state. Math alone makes physics challenging for many students. One of the reasons students struggle with physics is a lack of mathematical skill. Physics comprehension necessitates the acquisition of mathematics.

According to Ogunleye (2010), the circle of difficulties that students face in solving physics problems is obstructed by a lack of students' comprehension of the problem and their limited mathematical skills. Students miss the qualitative steps in solving physics problems, according to Harper (2006), since they are unaware of the useful knowledge found in the qualitative representations. According to Ali (2012), students are unable to participate in meaningful learning because they lack a comprehensive understanding of the subject's fundamental concepts. Students use learning methods to assist them in learning and comprehending physics concepts. Time dedication and perseverance are needed for success in physics class. It takes time and patience to learn and master everything. Learners must determine their own learning interests and search out the tools that will best assist them in their studies.

Dunn (1984) defines learning style as "the manner in which each person absorbs and retains knowledge and/or skills." Learning methods such as small group, cooperative work, case studies, simulation, conversation, problem-solving, and journal writing, according to Meyers and Jones (1993), are a factor in successful learning. Students must make a time commitment to their education in order to be successful in school. Cramming is minimized and tension is reduced by keeping to a routine devoted to studying and completing assignments ahead of schedule.

Physics success is an indicator of a student's experience, abilities, and understanding of the subject. Since physics is viewed as a challenging course, a passing grade is regarded as a significant achievement, whereas a failing grade is recognized as natural. Any students who failed the course could have passed it if they had been more diligent in their studies. Many students do not put in the extra work necessary to get a good grade in physics.

According to a study conducted by Cadorna et al (2013), the students performed poorly in physics. The students did well in forces and function, energy and strength, and vectors and scalars, but did poorly in vectors and scalars. The students performed well in terms of expertise, but poorly in terms of comprehension and application skills. Alegre (2012) discovered that physics was a source of great dissatisfaction for students, who reported that their physics achievement was strongly influenced by their attitudes and anxiety.

Learning media, including both print and digital media, has increased in popularity over time. Digital learning refers to the use of digital media in the classroom. When digital learning is applied, it becomes a structured source of knowledge information (Balichenko M. et al, 2017). Mobile learning is carried out by digital learning (Yanga & Yenb, 2017). Learners' learning processes can be supported by mobile learning because of its simplicity and portability (Joo et al, 2014; Pegrum M, et al, 2013). Since it is interactive, mobile learning can improve learning enthusiasm, minimize myths, and speed up the learning process (Tabor, 2016).

Computers in education have changed significantly in recent years, from computer-assisted learning to web-based learning to mobile learning (Vavoula & Karagiannidis, 2015). According to Caudill (2017) and Keegan (2012), mobile learning, also known as mLearning, has raised the goal of customized, virtually universal, and permanent learning for the new educational demands. Because of these conditions, students will actively engage in the development of their own virtual learning environment. Students' interest in mobile technology, on the other hand, can be used as a powerful tool to reinforce active involvement in classrooms (Markett et al, 2016) and to increase their interest in learning and interaction (Liu et al, 2013). Other features of mobile devices, such as their collection of built-in sensors, such as accelerometer, gyroscope, magnetic sensor, or light detector, may be used by physics teachers to enhance students' learning: the increasing capabilities of modern mobile devices, smartphones, and tablets, as well as their set of built-in sensors, such as accelerometer, gyroscope, magnetic sensor, or light detector, allow for the design of low-cost real experiments. Students and teachers can use them as measuring instruments in learning labs as well as in a variety of everyday tasks where they can put what they have learned in class into practice (Falco et al. 2010; Kuhn et. al, 2011).

Mobile Physics Learning (Saputra & Kuswanto, 2019; Yáez, Okada, & Palau, 2015) is a learning medium that was previously developed by merging Android and Physics subjects. It is used as a new learning technique and offers an interesting transition experience. Students' involvement in the use of technology, especially mobile learning in critical thinking processes, can support higher learning through the use of mobile learning (Android) in the learning process. Furthermore, Mobile Physics Learning aids students' comprehension of the difficulty of physics content in the classroom by including animation, simulation, and learning images. Students may use physics mobile learning to practice and improve their abilities to actively interact and learn creatively, including diagram representation and critical thinking (Saputra& Kuswanto, 2019).In this study, researcher tried to find out the effectiveness of using mobile physics on students' reinvigorating active engagement and learning dynamics on teaching uniform acceleration motion.

II. STATEMENT OF THE PROBLEMS

This study aims to determines the effectiveness using mobile physics on students' reinvigorating active engagement and learning dynamics on teaching uniform accelerated motion.

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Specifically, it sought to answer the following questions:

1. What is the learning dynamic of the learners based on the pre-test and post-test results using mobile physics on teaching uniform accelerated motion?
2. Is there a significant difference that exists between the pre-test and post-test results of using mobile physics s on teaching uniform accelerated motion?
3. How does the student's active engagement during the implementation of mobile physics on teaching uniform accelerated motion as described in the following?

a) Cognitive Engagement
b) Behavioral Engagement
c) Emotional Engagement
d) Social Engagement

III. METHODOLOGY

The study employs one-group pretest–posttest design to determine the effect of a treatment or innovation on a given sample. This design was characterized as used in a single group of subjects with the same characteristics which are purposively selected based on the criteria that those learners have a difficulties in learning uniform accelerated motion, then the researcher gave the same treatments, assessments, and innovations. In addition, it has linear ordering that requires the assessment of a dependent variable before and after a treatment is implemented. From this design, the effect of innovation is determined by calculating the difference between the pretest and posttest. If the pretest and posttest scores differ significantly, then the difference may be attributed to the independent variable. The study involves 40 Grade 11 learners from Accountancy, Business and Management of Senior High School from Graceville National High School. The data gathering instrument that utilized was a researcher -made- pretest -posttest which are validated by physics experts in the academe. Each item in the pretest -posttest was carefully checked and the whole content then, submitted to the physics experts to establish its reliability and validity, it will be piloted to 30 respondents and run in the computation program for test reliability and validity. Based on the test-retest reliability revealed it was acceptable with computed value of .703. On the other hand, the researcher adapted the science engagement scales from the study of Wang et. al (2016) which measured the learners' active engagement during science classes.

In analyzing the data, descriptive and inferential statistics will be employed, weighted mean used to determine the learning dynamics of pre-posttest and learners' active engagement. The t-test will be employed to determine if there is a significant difference between the pretest-posttest before and after the implementation of mobile physics on teaching uniform accelerated motion.

IV. RESULTS AND DISCUSSION

This part present both tabular and textual manner the data gathered from the results of the attitude survey and pretest-posttest of students. The data were treated with appropriate statistical test and were analyzed and interpreted to determine the answers to the questions posed in the study.

Table 1: Learning Dynamic of the Learners

	Pretest Score	Posttest Score	Gained Score
Mean	**80.73**	**86.88**	**32**

Looking at the Table 1, were the learners' learning dynamic before and after the utilization of mobile physics.

Considering the data provided on the table, it ind icates that before the utilization of innovation learners' learning dynamic in pretest were 80.73, then in posttest were 86.88. Hence, the learners' gain the score of 32%. More so, it can be concluded that innovation mobile physics had a positive effect on the learning dynamic of the learners, as evidenced by the significantly greater mean in the posttest than in the pretest. It was also supported by Shanmugapriya (2012), Dekhan, et al, (2015) and Shabrina, & Kuswanto (2018) that android mobile learning strengthened the teaching and learning process by concentrating on students' development of knowledge and creating opportunities for students to develop their thinking skills and problem-solving abilities.

Table 2: Test of Difference on the Pretest and Posttest results of using mobile physics s on teaching uniform accelerated motion.

t- test computed value	Degree of freedom	t-test critical value	Probability Level	Decision	Interpretation
8.96	**39**	**2.02**	**< 0.05**	**H_o is rejected**	**Significant**

Upon computing the data, it appeared that the t-value is 8.96 was exceeds in the t- critical value of 2.02 at the degree of freedom of 39. The result is significant at p < 0.05. Therefore, the null hypothesis is thereby, rejected. Thus, there is significant difference in the pretest and posttest score of students in the utilization of mobile

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physics on teaching uniform accelerated motion. The claim is also supported with the study of Saputra & Kuswanto (2019), Physics Mobile Learning Media can be used by teachers to introduce learning through technology-based media structured to enhance students' Higher Order Thinking Skills (HOTS).

Table 3: Learner's Active Engagement during the implementation of mobile physics on teaching uniform accelerated motion.

Type of Engagements	Mean Scores	Verbal Interpretation
Cognitive Engagement	3.56	Highly Engaged
Behavioral Engagement	3.67	Highly Engaged
Emotional Engagement	3.45	Highly Engaged
Social Engagement	3.76	Highly Engaged
Overall Mean	3.61	Highly Engaged

Table 3 showed that all the four indicators of learners' active engagement resulted to highly engaged(3.61) during the implementation of mobile physics on teaching uniform accelerated motion as described mean scores in the cognitive engagement (3.56), behavioral engagement (3.67), emotional engagement (3.45) and social engagement (3.76). More so, González et al. (2014) confirmed that the use of these applications has been shown to have a significant positive impact on student participation.

V. CONCLUSION

In the light of the findings of the study, the following conclusions were drawn:

1. It is evident that innovation mobile physics had a positive effect on the learning dynamic of the learners, as evidenced by the significantly greater mean in the posttest.
2. There is significant difference in the pretest and posttest score of students in the utilization of mobile physics on teaching uniform accelerated motion.
3. The learners' active engagement was highly engaged during the innovation mobile physics on teaching uniform accelerated motion as described in the four indicators of learners 'engagement.

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