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Effectiveness of Validated Teaching-Learning Package in Projectile Motion for Grade 9 Science

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Abstract: This study tested the validity and effectiveness of the developed Teaching-Learning Package in Projectile Motion for Grade 9 Science. A Teacher's Guide, a Learner's Module, and a Computer- Aided Instructional (CAI) tool comprised the package. The CAI tool composed of interactive simulations was developed using Adobe Flash Professional CC 2015 software and Small Basic and utilized the Microsoft PowerPoint 2016 as the overall platform. Research and Development design was employed in the study. The assessment of the package was done in five categories: (1) objectives, (2) contents of the Teacher's Guide and Learner's Module; (3) content quality, (4) instructional quality, and (5) technical quality of CAI tool by the five Physics and two ICT teachers. General average ratings of 3.58 and 4.41 were obtained from the assessment of the modules and CAI tool, respectively. Thus, teaching materials possess very good qualities. It is observed that the improvement of students who learned with the use of Teaching- Learning Package is greater than the traditional approach using a textbook. It is recommended that the developed Teaching- Learning Package should be used in teaching Projectile Motion for Grade 9 Science in the K- 12 curriculum.

Keywords: CAI tool; innovation; interactive learning; kinematics; K to 12 curriculum; projectile motion; teaching Physics

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Introduction

High school students often struggle with many difficulties during solving quantitative physics tasks [1]. Bevins [2] clarified in their study that while students have particularly strong inclinations and interest in science, the way science is taught in school depreciates their enthusiasm because the problems and concepts given are not directly related to what they encounter in their daily lives.

Science instructors have recognized that despite the great effort students put in their study, there are still huge gaps in their understanding of important physics problems [3]. In a lesson on projectile motion, when asked to choose the correct trajectory for a ball rolling off a track, 85% of 77 students correctly chose the parabolic path [4]. However, further questioning revealed that many students held misconceptions about fired objects. Therefore, it is incumbent upon educators to seek a way of eliminating or reducing the effect of these misconceptions. Hence, this puts- on the challenge to educators in teaching the correct concepts since keeping students' interests in science, particularly Physics, at a high level is important not only for the continuity of scientific endeavors but also to ensure scientific literacy of future generation [5].

Alegre [6] claimed that proofs are better when students can interact with the figure. Thus, projectile motion can be better understood when students can see their concepts in dimensional views. With the world moving rapidly into digital media and information, ICT's role in education is becoming more important, and this importance will continue to grow

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and develop in the 21st century [7].

Furthermore, the researcher has observed that despite the increasing use of ICT- integrated simulations in teaching kinematics to enhance student learning, limited instructional materials using Computer-Aided Instruction (CAI) suitable for Filipino students have been developed. Thus, the researcher is motivated to develop a Teaching-Learning package in Projectile Motion for Grade 9 Science that anchors on learning competencies of the Department of Education's K to 12 curriculum for better understanding and meaningful learning.

Method

This study tested the effectiveness of the Developed Package in Projectile Motion for Grade 9 Science. Specifically, it did the following:

1. Preparation of a Teaching-Learning Package in Projectile Motion composed of the following:
   1.1. Teacher's Guide
   1.2. Learner's Module
   1.3. Computer-Aided Instructional (CAI) tool
2. Assessment of the Teacher's Guide and Learner's Module in terms of:
   2.1 Learning Objectives
      2.1.1. Attainability
      2.1.2. Clarity
      2.1.3. Relevance
   2.2 Contents
      2.2.1. Appropriateness
      2.2.2. Appeal
      2.2.3. Conformity with Standards
      2.2.4. Innovativeness
3. Assessment of the CAI tool in terms of:
   3.1 Content Quality
   3.2 Instructional Quality
   3.3 Technical Quality

Testing the Teaching-Learning Package's effectiveness in teaching Projectile Motion for Grade 9 students based on the pretest and posttest scores of the experimental (Interactive Approach using the Teaching-Learning package) and control (Lecture Approach—teacher's dialogue with DepEd textbook).

The researcher believes that academic achievement, specifically science achievement, will be improved more by using the modern teaching strategy, which is the interactive learning using the developed Teaching- Learning Package

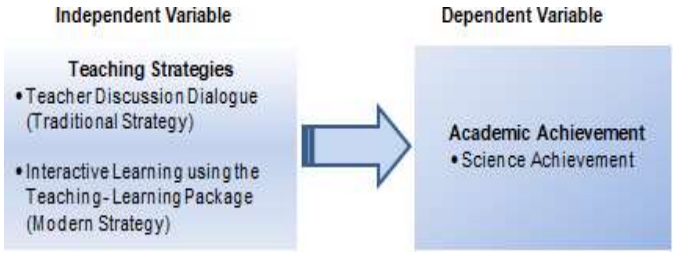

Figure 1. Conceptual framework.

Research and Development (R & D) design was employed to develop and assess the Teaching-Learning Package. The researcher used the following statistical methods: 1) Calculated the mean in the pre and posttest; 2) Calculated the Z-test to examine the difference between the performance of control and experimental groups.

Result and Discussion

The development of Teaching-Learning Package in Projectile Motion for Grade 9 Science is composed of the following instructional tools:

1. Teacher's Manual
   1.1. Semi- Detailed Lesson Plans
      1.1.1 Constant Horizontal Motion
      1.1.2 Accelerated Motion
      1.1.3 Free- Fall Motion
      1.1.4 Two- Dimensional Motion
      1.1.5 Projectile Motion
2. Learner's Module
   1.1. Learning Objectives
   1.2. Contents
3. Computer-Aided Instructional (CAI) tool
   3.1 PowerPoint Lecture Presentations
      3.1.1. Lesson 1: Uniform Motion
      3.1.2. Lesson 2: Accelerated Motion
      3.1.3. Lesson 3: Free- Fall Motion
      3.1.4. Lesson 4: Two- Dimensional Motion
      3.1.5. Lesson 5: Projectile Motion
   3.2 Interactive Simulations
      3.2.1. Arrow Simulation
      3.2.2. Lazy Car Simulation for Speed (d versus t)
      3.2.3. Lazy Car Simulation for Acceleration (d versus t)
      3.2.4. Lazy Car Simulation for Acceleration (v versus t)
      3.2.5. Basketball Simulation
   3.3 Graphic Interchange Format (GIF) files
      3.3.1. Tricycle GIF
      3.3.2. Walking Stickmen GIF
      3.3.3. Bicycle GIF
      3.3.4. Green Car GIF

3.3.5. Skinny Bicy GIF
3.3.6. Airplane GIF
3.3.7. Free- Falling Apple GIF
3.3.8. Free- Falling Watermelon GIF
3.3.9. Free- Falling Penny GIF
3.3.10. Free- Falling Feather GIF
3.3.11. Types of Projectile GIF
3.3.12. Two dimensional GIF

Assessment of Teaching- Learning Package

The tables that follow show the results of the assessment made by the Science Teachers and ICT teachers on the manner on how the objectives were formulated, and the contents of the Teacher's Guide and Learner's Module; and content quality, instructional quality, and technical quality of the CAI tool.

Table 1: Teachers' Assessment Rating on the Objectives of the Teacher's Guide and Learner's Module (N=5)

Area	Mean Rating	Qualitative Description
Attainability	3.28	Highly Attainable
Clarity	3.76	Very Clear
Relevance	3.92	Very Relevant

Table 2: Teachers' Assessment Rating on the Contents of the Teacher's Guide and Learner's Module (N=5)

Area	Mean Rating	Qualitative Description
Appropriateness	3.6	Very Appropriate
Appeal	3.7	Very Appealing
Conformity with Standards	3.4	Strongly Conforms
Innovativeness	3.4	Very Innovative

Table 3: Overall Mean Responses on Content Quality, Instructional Quality, and Technical Quality of the CAI Tool (N=5)

Component	Mean Rating	Qualitative Description
Content Quality	4.4	Very Good Quality
Instructional Quality	3.4	Very Good Quality
Technical	3.5	Very Good Quality

Tabel 4: Comparison Between the Results of the Pretest and Posttest for the Control and Experimental Group

Group	N	Pretest Mean	z	Pretest Mean	Pretest Mean
Control	46	3.413	0.0805	7.043	7.2434
Experimental	46	3.457		10.804	

Effectiveness of the Teaching-Learning Package

After applying the experiment, the researcher conducted a post-academic achievement test and then analyzed the study outcomes to determine the effectiveness of using the Teaching-Learning Package in teaching Projectile Motion for Grade 9 Science *(See Table 4).*

Table 1 shows the mean rating of five respondents on assessing the objectives of the Teacher's Guide and Learner's Module. As the evaluators perceived, the objectives provided students with clear direction on what they would expect and what they would accomplish. Moreover, it can be said that the objectives were formulated within the intellectual capabilities of the intended users.

The ratings given by the evaluators indicate that the contents of the Teacher's Guide and Learner's module were appropriate for the lesson and for the intended end-users, as shown in Table 2. The results also show that the author has considered the students' interests as one of the factors in choosing the contents of the learning modules. In choosing the subject matter, the students' interest must be considered since this is one of the many important factors that would keep students read the learning module. Furthermore, evaluators found out that the learning competencies prescribed by the Department of Education were met. That is, the learning module includes all the essential elements –the concepts, principles, graphs, and tables. The materials agree with acceptable norms and standards in science education. Further, the results indicate that the writer has developed a unique way of presenting concepts and adopted a simplified approach in presenting solutions to problems that may help students understand the concepts without so much difficulty.

As shown in Table 3, the overall responses of all the respondents rated the content quality, instructional quality, and technical quality as very good with mean ratings of 4.37, 4.37, and 4.48, respectively. Thus, the respondents generally rated the CAI tool as a very good instrument in terms of the content, technical, and instructional qualities. This means that the relevance of the subject matter covered by the CAI tool to learning objectives and the educational value, appropriateness of the instructional material to the curriculum, and the CAI tool's overall technical operation is very good for physics instruction.

Conclusion

Considering the findings of this study, the researcher concludes that 1) The package is a very good supplement in teaching Projectile Motion for Grade 9 Science under the K to 12 curriculum; 2) The objectives of the module are perceived to be very attainable, very clear, and very relevant; 3) The contents of the module are very appropriate, very appealing, strongly conforms with acceptable standards, and very innovative; 4) The Computer-

Aided Instructional tool is found to be very good in terms of content, instructional, and technical qualities; 5) The Teaching-Learning Package is effective in teaching Projectile Motion for Grade 9 Science. It is observed that the development of the academic achievement is greater with the use of Teaching-Learning Package than the traditional approach using a textbook; 6) The Teaching-Learning Package that was developed should be used in teaching Projectile Motion in Grade 9 Science

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