ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 4 (April 2026)

Digital-Based Instructional Materials in General Physics 1

Jerlene L. Dacalos
DepEd Rizal - Tanay Senior High School
jerlene.dacalos@deped.gov.ph

Date Submitted:
April 05, 2026

Date Accepted:
April 19, 2026

Date Published:
April 20, 2026

DOI:
10.5281/zenodo.19654156

ABSTRACT

The objective of the study is to determine the level of performance of Grade 12 STEM students before and after exposure to Digital-Based Instructional Materials in General Physics 1. The study used descriptive, developmental and experimental design and was conducted at Tanay Senior High School during the SY. 2023-2024 with 26 student-respondents. Purposive sampling technique was used. The study utilized pretest and posttest found in the MELC with the least mastered skills topics found in the LOA results from 2 consecutive school years 2021-2023. The tests were checked and validated by teacher-experts in the field of science. Weighted mean and T-tests were used in the study. For the level of performance, from 11.53 mean on pre-test with VI of S to 17.77 mean on posttest with VI of O, thus for the significant difference, the obtained p-value of 0.000 does not exceed 0.05 level of significance, the findings implicated that there is an increase in the level of performance of Grade 12 STEM students before and after exposure to the developed Digital-Based Instructional Materials in General Physics 1. Based on the findings, the study concluded that the developed Digital-Based IM in General Physics 1 offered different features such as experiments and activities that increased the interest of students as to increase also their performance. It was recommended for benchmarking in other schools, increased promotion of ICT integration and developed students' mathematical and scientific skills.

Keywords: *Digital-Based Instructional Materials, DBMI, ICT integration and General Physics 1*

INTRODUCTION

Education is one of the important aspects in life and essential way to learn something new in everyday living. Its intention is to benefit the person mentally, physically, emotionally, and spiritually by putting them in a better place they were previously in before. A good quality education is the gateway to greater personal achievement as well as integration of technology that enables individuals to achieve holistic development. Rapid change of technology is now a partner in educational development. Technology enhances the teaching and learning process of different areas of education. According to study, children learn more and can easily understand the lessons with the use of interactive media and software applications. When a student is not interested in the class anymore, changing teaching approach or improving teaching procedures are often recommended. These solutions, in accordance with the law, may be implemented at any time to transform the viewpoint of the students in education. Students will no longer think that studying is a punishment for them, for they will enjoy learning with the help of digital learning. DepEd Order No. 78, s, 2010, DepEd Computerization Program (DCP)With the legal mandate of promoting the right of all

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citizens to take appropriate steps in making education accessible to all, the Department of Education (DepEd) is geared towards the transformation of education through the DepEd Computerization Program (DCP*)* The said program allows schools to improvise teaching-learning process. It allows the students to adopt the learning system of the present generation and maximize the use of technology, as a medium to develop quality and effective learning. As agents of change, teachers provide knowledge and facilitate learning. Teachers who embrace technology in teaching provide meaningful learning experiences to the students. In addition, habitual users of ICT devices look for opportunities to upgrade their ICT knowledge and skills, share their experiences, and create a culture of collaboration to assist each other. One of the examples of integrating ICT in teaching and learning process is through digital platforms such as using computers, tablets and smartphones. From this, lessons can easily be accessed by the students through their handy gadgets. It is the reason that led the researcher to find out that the use of Digital-based instructional materials in teaching will improve the level of performance of the students in General Physics I.

Literature Review

Digital-Based Instructional Materials are instructional materials that integrate technology using gadgets like computer, laptop, tablet or cellphone.It is also considered as Learning Resource Materials that serve as tools for learning. It has an application installed for students' access. It is a type of instructional material that uses applications with lessons presented through PowerPoint presentations and recorded voice lessons and other digital-based activities that are designed to use by students and their teachers. According to Baryak (2019), Digital-Based IM as instructional materials in teaching acid-base lesson in Science and Technology are seemly effective to students which enable them to learn these lessons using interactive animations and simulations. Students can collaborate using learning resource material such as non-print material in the classroom. Students engage with one another to discuss chemical instances presented by technology tools (e.g., animation, simulation, video, etc.) or to define and describe chemistry topics (Laroche et al., 2018). This environment will allow for information interchange and social building (collaborative knowledge construction) among students.

The use of technology in learning process was thought to be of great importance especially for university students. The used technology helped to transform this process from being highly teacher-dominated to a more students-centered one (Hafa, 2021). In context, the purpose of the study was to develop a compiled learning resource materials like digital-based IM to carry out an assessment and analysis of digital tools destined for education. As discussed, and explained in one article, technology bridges the gap between quarantine and teaching. Smartphones have become essential more than just being a luxury. Digital tech during this time is a need for all. They also stated the benefits of technology to learners and teachers, which are the flowing: equips learners for their future careers, personalizes learning and teaching approaches, drives down costs overall, and brings more learning opportunities and boosts teamwork and communication (Child Hope Philippines, 2021).

METHODS

Research Design

The study used developmental, descriptive and experimental design. It utilized developmental research to describe how the Digital-based IM developed. According to Klaassen et a., (2020), developmental research aims to understand in detail how and why a teaching-learning sequence works or fails to work. It seeks to understand whether the teaching-learning process proceeds as hypothesized. In addition, this study also used descriptive method of research to collect relevant data and information using a questionnaire checklist. A one-shot experimental design utilizing one group of respondents was also used to determine the performance of the student respondents in the developed Digital-based instructional materials.

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Research Locale

The study was conducted at Tanay Senior High School located in Sitio Dalawang Kawayan, Brgy. Tadang Kutyo, Tanay, Rizal. At present, it has a total population of 330 students, 13 teachers, and 4 non-teaching personnel. The school usually initiated programs and projects that helped improve the performance of the students. To achieve this, teachers were encouraged to use instructional materials that promote self-sufficiency like enhancement materials and digital-based materials.

Participants and Sampling Technique

The respondents of the study were twenty-six (26) Grade - 12 students from Science, Technology, Engineering and Mathematics strand section Poseidon of School Year 2023-2024 at Tanay Senior High School. Purposive sampling technique was used since the study used one group of respondents which is the advisory class of the teacher–researcher. Purposive sampling is a form of non-probability sampling in which researchers rely on their judgment when choosing members of the population to participate in their surveys (Alchemer, 2021).

Research Instrument

The study used 20-item test questions. These test questions were used to determine the performance of the students. These reliable items were used as the pretest. The same items were reshuffled and used as the post-test. To determine the level of performance of Grade 12 STEM students to the developed Digital-Based Instructional Materials in General Physics 1, the 5-point Likert's scale was used.

Scale	Range	Verbal Interpretation
5	4.20 – 5.00	Outstanding
4	3.40 – 4.19	Very Satisfactory
3	2.60 – 3.39	Satisfactory
2	1.80 – 2.59	Unsatisfactory
1	1.00 – 1.79	Poor

Data Gathering

The researcher utilized the pretest and the post-test with emphasis on the topics wherein students found difficulty during the previous school Year of 2021 – 2023 based on the Learning Outcome Assessment (LOA) results and the Least Mastered Skills (LMS) from the Test Results in General Physics The table of specification constructed includes 4 Most Essential Learning Competencies (MELC) under Physics 1 (1st quarter – weeks 7-8) and lessons from Momentum, Center of Mass, Impulse, and Momentum-Impulse Theorem. The objectives of each lesson were based on the MELCs. Initially, 20-item test questions were developed (5 each MELC). They were subjected to item analysis and were used as the pretest and post-test. They were also checked and validated by the teachers from Tanay Senior High and Tanay-Sampaloc Integrated National High School (Senior High Dept.).

Data Analysis

The following were the statistical tools used in the study: To determine how the Digital-based Instructional Materials in General Physics I developed, the qualitative description was used. To determine the level of performance of the students before and after exposure to the developed Digital-Based Instructional Materials in General Physics I, the weighted mean was used. To determine the significant difference in the level of performance of the students as revealed in their pretest and post-test, a t-test was used.

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Ethical Consideration

Permission to conduct the study was pursued to Tanay Sub-Office specifically addressed to the Public School's District Supervisors before conducting the study. Also, letters were given to the principal of the participating schools for their approval. And lastly, informed consent was sought from the student-participants. The data and information were treated confidentially and secured according to the Data Privacy Act of 2012.

RESULTS AND DISCUSSION

Development of Digital-based Instructional Materials in Physics

The LMS and LOA given in the MELC's in General Physics I and the level of performance of grade 12 STEM learners were considered as the basis for developing Digital-Based Instructional Materials in General Physics I which are composed of the first quarter (1st quarter) lessons, week 7-8. The main goal of the developed Digital-Based Instructional Materials in General Physics 1 was to provide opportunities for the grade 12 learners to enjoy Physics subject. It was also created as an additional instructional material not just for the learners as well as for the teachers engaged in the teaching-learning process.

Level of Performance of the Students before and after Exposure to the Developed Digital-Based Instructional Materials in General Physics I in terms of the Following Most Essential Learning Competencies

Table 1 presents the level of performance of the students before and after exposure to the developed Digital-Based Instructional Materials in general Physics I in terms of the following most essential learning competencies. It can be grasped from the table below that the grade 12 learners have a satisfactory performance in the first three given MELCs and unsatisfactory performance in the latter part before they were exposed to the developed Digital-Based Instructional Materials in General Physics I. Meanwhile, after exposure, it was noted that the level of performance in terms of different competencies has increased, from satisfactory to outstanding performance respectively.

Table 1. *Level of Performance of the Students before and after Exposure to the Developed E-Based Instructional Materials In General Physics I in terms of the Following Most Essential Learning Competencies*

	Pretest			Posttest		
	Mean	Sd.	VI	Mean	Sd.	VI
Differentiate the center of mass and geometric center	3.07	.868	Satisfactory	4.57	.626	Outstanding
Relate the motion of the center of mass of a system to the momentum and net external force acting on the system	2.93	.944	Satisfactory	4.53	.681	Outstanding
Relate the momentum, impulse, force, and time of contact in a system	2.97	.765	Satisfactory	4.40	.724	Outstanding
Solve problems involving center of mass, impulse, and momentum in contexts such as, but not limited to, rocket motion, vehicle collisions, and ping-pong.	2.57	1.040	Unsatisfactory	4.27	.828	Outstanding
Total	11.53	2.300	Satisfactory	17.77	2.176	Outstanding

The table reveals that there was an increase in the level of performance of grade 12 learners after they were exposed to the developed Digital-Based Instructional Materials in General Physics I. It also implies that using the developed Digital-Based Instructional Materials in General Physics I helped the grade

ISSN: 3116-3475
International Journal
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12 learners to increase their level of performance in different lessons from satisfactory to outstanding performance it's because they found the materials content-friendly, and the activities and experiments were challenging.

This is supported by the study of Tambongco (2021) entitled "Development and Validation 0f Enhancement Activities for Grade 7 Science that he states that the use of enrichment and enhancement instructional materials stimulates the physical, mental and social skills as well. They are helpful tools in facilitating the teaching-learning process, thus, facilitate effective learning. Students were set to focus as they used the material as it guides them through the enhancement activities which is found to be related to the present study. This also confirms the study of Morphew (2021) that the developed instructional material in teaching Physics to high school students helped the students understand and enjoy the abstract nature of Physics and at the same tie increased the level of their performance.

Significant differences in the level of performance of the respondents as revealed in the pretest and post-test

Table 2 below presents the significant difference in the level of performance of the respondents as revealed in the pretest and post-test using the developed Digital-Based Instructional Materials in General Physics I.

Table 2. *The Significant Difference In The Level Of Performance Of The Respondents As Revealed In The Pretest And Post-test*

		Mean	Sd.	Mean Diff.	t	df	Sig.	H_O	VI
Differentiate the center of the mass and geometric center	Pretest	3.07	.868	1.500	11.238	29	.000	R	S
	Posttest	4.57	.626						
Relate the motion of the center of mass of a system to the momentum and net external force acting on the system	Pretest	2.93	.944	1.600	12.105	29	.000	R	S
	Posttest	4.53	.681						
Relate the momentum, impulse, force, and time of contact in a system	Pretest	2.97	.765	1.433	15.577	29	.000	R	S
	Posttest	4.40	.724						
Solve problems involving center of mass, impulse, and momentum in contexts such as, but not limited to, rocket motion, vehicle collisions, and ping-pong.	Pretest	2.57	1.040	1.700	10.172	29	.000	R	S
	Posttest	4.27	.828						
Total	Pretest	11.53	2.300	6.233	23.097	29	.000	R	S
	Posttest	17.77	2.176						

Legend: *R – reject* *S – significant*

It can be gleaned from the table that there is a significant difference in the level of performance of grade 12 learners before and after exposure to the developed Digital-Based Instructional Materials in General Physics I since the obtained p-value of 0.000 which does not exceed 0.05 level of significance. The findings implicated that there is an increase in the level of performance of grade 12 learners as revealed in the result before and after the exposure to the developed Digital-Based Instructional Materials in General Physics I. It is because of the different features offered by the developed material, the content, experiments and activities. As one of the students comment as he used the developed Digital-based material, he said that he really enjoyed using this material aside from full package, it is also handy.

This also implies that the developed Digital-Based Instructional Materials in General Physics I is a tool to increase the performance level in General Physics I. It suggests also that other teachers may adapt

the developed materials and used them in their school. The result supports the study of Taboada (2019) who recommended that teachers may be encouraged to develop enhancement activities in their respective disciplines to sustain the atmosphere of effective teaching-learning processes.

This is also supported by the study of Resita et al., (2018) in their study that aims to develop electronic module design based on Learning Content Development System (LCDS) supports this study, that foster students' multi representation skills in physics subject material. Based on the data, 95% of the students only use one form of representation in solving physics problems. Representation which tends to be used by students is symbolic representation. Students are considered to understand the concept of physics if they can change from one form to the other forms of representation which is related to the present study that also develop a material/strategy to develop the particular skills of the students.

CONCLUSION

The developed Digital-Based Instructional Materials served as an additional instructional material to learners and teachers as they engaged in the teaching-learning process. The material was also an effective tool as it helped increase the level of performance of students in different lessons as they found the materials content-friendly, and the activities and experiments challenging. And lastly, it is valid instructional material for teaching General Physics 1 to grade 12 learners.

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