VODCast as a Tool for Flipped General Physics

Aldrin Inan Ijalo

Article Info

Article History

Received:
22 June 2025

Accepted:
28 October 2025

Keywords

Video-on-demand cast
VODCast
Flipped classroom
General physics 1
STEM education

Abstract

This study aimed to develop electronic instructional tool, Video-on-Demand Cast (VODCast), to address the identified least-mastered competencies in the General Physics 1 of Grade 12-STEM, particularly the competencies of "Measurement errors"; "Addition of Vectors"; and "Uniformly Accelerated Motion". The study engaged 52 Grade 12-STEM students and 5 evaluators: educational technology, information technology (IT), English, curriculum development or instructional materials development, and teacher of General Physics 1. Data collection involved the General Physics Test (GPT) and ASU Generic Instrument for the Review, Evaluation, and Approval for Use of Instructional Materials (GIREAUIM). Findings revealed that while VODCast effectively enhanced students' engagement and skill mastery, challenges and areas for improvement were noted. Expert evaluations highlighted its strong usability, suitability, engagement, and alignment with science content. The acceptability of the VODCast as evaluated by students and experts in general and in terms of contents, format and presentation, efficacy of materials, and performance assessment was rated "Highly Acceptable". Future research should investigate its long-term effects and scalability to maximize its impact as a transformative educational tool. This study affirms the potential of multimedia learning in addressing critical learning gaps and advancing student-centered science education.

Introduction

The Philippine educational system has undergone significant modifications in the past years, particularly in response to the abrupt shift in learning modalities caused by the COVID-19 pandemic (Javier, 2021; Rogayan, Rafanan, & de Guzman, 2021); and climate-related factors, particularly typhoons and extreme heat index (ReliefWeb, 2023; ACAPS, 2024). The COVID-19 pandemic and increasing extreme weather events have disrupted traditional classroom learning in the Philippines, prompting the Department of Education to expand its policies to allow class suspensions due to health and environmental hazards (Philippine Star, 2024). As a result, schools have been encouraged to adopt flexible learning modalities to ensure educational continuity (Hallare, 2020). Modular Distance Learning Modalities (MDLM) became the primary mode of instruction, presenting challenges such as limited student-teacher interaction, insufficient scaffolding, and inadequate visual representation of abstract concepts (Hairulla & Malayao, 2022). These limitations significantly affected students' comprehension, particularly in technical subjects such as General Physics 1, which require a deeper understanding of both theoretical and applied concepts.

Physics, by nature, is a highly conceptual and abstract subject that demands strong analytical and problem-solving skills. According to Redish (2018), traditional Physics instruction often relies heavily on lecture-based approaches that focus on mathematical formulations rather than conceptual understanding. Studies have shown that students struggle with grasping fundamental Physics concepts due to cognitive overload, lack of visualization, and minimal engagement with real-world applications (Singh & Marshman, 2015; Heckler, 2011). Furthermore, the abstract nature of topics like kinematics, dynamics, and measurement errors requires active learning strategies to promote conceptual clarity (McDermott & Redish, 1999). However, the constraints of modular learning, which primarily rely on printed self-learning modules, have exacerbated the challenges in Physics education by restricting students' exposure to interactive, real-time problem-solving activities (Ramos & Dizon, 2021).

The Cognitive Theory of Multimedia Learning (CTML) suggests that students learn more effectively when they are exposed to both visual and auditory information, allowing them to process and integrate knowledge more efficiently (Johan et al., 2018). Given the inadequacies of traditional modular learning, Video-on-Demand Cast or VODCasts (Video Podcasts) have emerged as a promising instructional tool to enhance students' understanding of Physics concepts. Unlike static learning materials, VODCasts provide multimodal content by integrating visual explanations, animations, and auditory narration, which help bridge the gap between abstract theory and real-world applications (Mayer, 2020). This aligns with research indicating that video-based instructional materials improve students' engagement, knowledge retention, and conceptual understanding in STEM education (Zhang, Zhou, Briggs, & Nunamaker, 2006).

The flipped classroom model, in which student accesses VODCast content before attending classroom discussions, presents an innovative solution to the limitations of traditional Physics instruction. In this setup, students build foundational knowledge independently, allowing for more active problem-solving, collaboration, and higher-order thinking activities during in-person sessions (Saira et al., 2021). This approach has been shown to enhance learning outcomes and critical thinking skills, particularly among students who struggle with abstract concepts (Bishop & Verleger, 2013; Hew & Lo, 2018). Additionally, research suggests that digital natives—students who have grown up with digital technology—are more inclined to engage with interactive, multimedia-based learning materials than conventional textbooks (Berkman Klein Center, 2021).

Empirical evidence further supports the effectiveness of Video-on-Demand Cast (VODCasts) as supplementary instructional tools. For instance, a study by Pilkington (2020) found that students who engaged with VODCasts demonstrated higher levels of comprehension and motivation compared to those who solely relied on traditional learning materials. Similarly, Ulla et al. (2022) reported that VODCasts improved students' understanding of complex topics such as vectors and kinematics by providing dynamic visualizations and real-time problem-solving demonstrations. In another quasi-experimental study, Chang and Tseng (2024) found that the integration of authentic video materials in language instruction significantly enhanced students' learning experiences, further supporting the potential of video-based learning tools across disciplines.

Despite the growing body of research on VODCasts, several gaps remain, particularly in the context of Physics education in the Philippines. While existing studies have demonstrated the positive impact of VODCasts on general learning outcomes, there is limited research on their application in Physics instruction within the local educational setting. Most studies on VODCasts have focused on language acquisition (Abdullah et al., 2021; Chang & Tseng, 2024) and general science education (Pye et al., 2020), leaving a gap in understanding how VODCasts can specifically enhance students' comprehension of Physics concepts. Moreover, no local purposive study has been conducted to develop and evaluate Physics VODCasts tailored to the Philippine educational framework. While some modular learning materials in Physics are available through the Department of Education, they often lack the interactivity and multimodal engagement needed to support student learning effectively (Ramos & Dizon, 2021). Attempting to address these challenges, the researcher became interested in developing a Physics Video-on-demand cast (VODCast) as an anchor for flipped classrooms, specifically designed for Grade 12 STEM students in the Philippines. By integrating multimedia learning principles with Physics instruction, this study aims to bridge the gaps in traditional and modular education, fostering a more engaging, flexible, and student-centered learning environment. Ultimately, the development and evaluation of a Physics VODCast contribute to the ongoing efforts to enhance science education and improve student academic performance in the country.

Method

This study aimed to develop an electronic instructional material as an anchor for the flipped classroom. Specifically, it sought to answer the following questions: (1) What are the least mastered competencies of Grade 12 STEM students in General Physics 1? (2) What electronic instructional material can be developed to address the least mastered competencies of Grade 12 STEM students in General Physics 1? (3) What is the level of acceptability of the developed electronic instructional material as an anchor for the flipped classroom in terms of (a) Content; (b) Format and Presentation; (c) Efficacy of Materials; and (d) Performance Assessment; as evaluated by the students and experts? The theoretical framework included Anchored Instruction (Bransford et al., 1990), which highlighted the importance of contextual learning anchored by a central element like a video. The Cognitive Theory of Multimedia Learning (Mayer, 2014) supported the incorporation of visual and auditory components to alleviate cognitive overload and bolster retention. The Successive Approximation Model (Allen & Sites, 2012) offered a flexible, iterative approach for creating and enhancing e-learning resources. The research question bridges a gap between instructional design theory and classroom practice in a flipped learning. The study utilized design research following a cyclical process of IPO Model, this study developed and evaluated a VODCast for flipped classroom through five key phases:

Input

Analysis Phase

The researcher aimed to analyze the least mastered competencies of Grade 12- STEM students in General Physics 1. Before administering the General Physics Test (GPT), the researcher asked permission from the Dean of the College of Teacher Education (CTE) and the Principal of Laboratory High School (LHS) through a letter.

The General Physics Test (GPT) was administered to 58 students who took General Physics 1 in the first semester of AY 2022-2023. These students are from Aklan State University-Laboratory High School (ASU-LHS) After administering the test, each student's response was recorded item by item, with a score of one (1) indicating a correct answer and zero (0) for an incorrect answer. The total number of correct responses was then calculated for each item to determine its frequency. These test items were grouped according to the competencies they were intended to assess, with each group consisting of three to four items corresponding to a specific competency. To evaluate student performance per competency, the average frequency of correct responses within each group was computed. This average served as an indicator of how well the students mastered each competency. Following this, the competencies were ranked in ascending order based on their average frequencies—from the lowest to the highest. The four competencies with the lowest average scores among the first 13 Most Essential Learning Competencies (MELCs) in General Physics 1 were identified as the least mastered competencies by the Grade 12-STEM students. This instrument was subjected to validation by experts and has an internal consistency reliability of 0.721 in Cronbach's Alpha.

Process

Design Phase

The outline and format of the VODCast were created. This outline is based on the gathered data from the analysis stage and the curriculum guide for General Physics 1. It served as a guide for the development of the VODCast because it encapsulated the least mastered competencies in General Physics 1, the parts of the VODCast, and its distinct features. Furthermore, the format of the VODCast contained these important parts: Title and Learning Competency, Stimulating Recall, Present Information, Lesson Proper, Providing Guidance (Summary), Elicit Performance, Assess Performance, Key to Corrections, and References. Worksheets were answered by the students in the classroom and the answer key was provided.

Development Phase

The researcher developed the physics VODCast based on the outline and format constructed in the Design Stage. The content of the VODCast was derived from the information gathered in the Input Phase (Analysis Stage) through a General Physics Test (GPT), which identified the least mastered competencies in General Physics 1. The video lesson script is crafted in this stage. This video lesson script is checked by two physics experts. The VODCast was created using Wondershare Filmora X and further enhanced through the Canva application for additional video editing features. The VODCast undergone production (shooting), post-production (editing), initial validation of experts for revisions, and pilot-testing with Grade 12-STEM students and a teacher-implementor with observations.

Evaluation Phase

Two Physics teachers, three experts (Curriculum/IT/EdTech), and 52 Grade 12-STEM students assessed the VODCast using the adopted Generic Instrument for the Review, Evaluation, and Approval for Use of

Instructional Materials (GIREAUIM) (Legaspi et al., 2020). Data were analyzed using mean and standard deviation for the overall acceptability and in terms of its content, format and presentation, efficacy of material, and performance assessment.

Revision Phase

Initial validation by three experts ensured early improvements. Adjustments were made based on evaluations to enhance clarity, engagement, and effectiveness. This study exemplified how design research specifically developmental studies contribute to both educational innovation and practical classroom enhancements (McKenney & Reeves, 2012) ensuring alignment between the research objectives and methodological approach.

Output

After the evaluation of the five experts on the acceptability of the physics VODCAST and considering comments, suggestions, and recommendations, the Physics VODCAST was the product of this study that was used as an instructional tool in the flipped General Physics classroom.

Results

Least Mastered Competencies in General Physics 1

In this study, a General Physics Test (GPT) was administered to 58 Grade 12-Science, Technology, Engineering, and Mathematics (STEM) strand students from Aklan State University- Laboratory High School. The least mastered competencies in General Physics 1 were then determined based on the competencies with the least number of students who answered the items correctly. Four (4) least mastered competencies of the first 13 learning competencies in the subject General Physics 1 were identified.

Table 1 shows the ranking of the least mastered competencies in General Physics 1 based on analysis students' performance, revealed that out of the 13 identified learning competencies, the our (4) were categorized as the least mastered competencies. These four competencies garnered the least average frequency count of the correct responses in the General Physics Test (GPT). For the first topic which is Measurement, two least mastered competencies were accounted: (1) "differentiate random errors from systematic errors" (M=45.25 out of 58), indicating that many students were unable to distinguish between types of measurement errors. Similarly, "Estimate errors from multiple measurements of a physical quantity using a variance" (M=44.75 out of 58) reflecting difficulty in applying statistical tools to analyze experimental data. For the second topic, one least mastered competency was accounted; (3) "Perform the addition of vectors" (M=43.75 out of 58) correct responses suggesting challenges in combining vectors graphically or analytically. For the third topic on Kinematics: Motion Along a Straight Line, (4) "Solve for unknown quantities in equations involving one-dimensional uniformly accelerated motion" (M=44.25 out of 58) showing students' difficulty in using kinematic equations to find variables related to motion.

Table 1. Least Mastered Competencies in General Physics 1

Most Essential Learning Competencies	*Number of Items*	*Average Frequency Count of Correct Responses (N=58)*	*Rank*
1. Solve measurement problems involving conversion of units and measurement expression in scientific notation.	3	52.00	11
2. Differentiate accuracy from precision.	4	50.00	9
3. differentiate random errors from systematic errors.	4	45.25	4
4. Estimate errors from multiple measurements of a physical quantity using a variance.	4	44.75	3
5. Differentiate vector and scalar quantities.	4	49.25	7
6. Perform the addition of vectors	4	43.75	1
7. Rewrite a vector in component form.	4	52.50	12
8. Convert a verbal description of a physical situation involving uniform acceleration in one dimension into a mathematical description.	4	47.00	5.5
9. Interpret displacement and velocity, respectively, as areas under velocity vs time and acceleration vs time curves.	4	47.00	5.5
10. Interpret displacement and velocity, respectively, as slopes of position vs time and velocity vs time curves.	3	49.30	8
11. Construct velocity vs time and acceleration vs time graphs, respectively, corresponding to a given position vs time graph and velocity vs time graph and vice versa.	4	56.00	13
12. Solve for unknown quantities in equations involving one-dimensional uniformly accelerated motion.	4	44.25	2
13. Solve problems involving one-dimensional motion with constant acceleration in contexts such as, but not limited to, the “tail-gating phenomenon”, pursuit, rocket launch, and free-fall problems.	4	50.75	10

Developed Video-On-Demand Cast (VODCast) in General Physics 1

Table 2a. Topics per VODCast Episode

Title	Topic / Competency	*Duration*
VODCast in General Physics 1		
Episode 1. Measurement (I):	Differentiate random errors from systematic errors	24 mins & 18 s
Episode 2: Measurement (II):	Estimate errors from multiple measurements of a physical quantity using variance	25 mins & 54 s
Episode 3: Vectors:	Perform addition of vectors	43 mins & 39 s
Episode 4: Kinematics:	Solve for unknown quantities in equations involving one-dimensional uniformly accelerated motion	29 mins & 30 s

Episode 1: Measurement (I). Differentiate Random Errors from Systematic Errors

In this episode (duration: 24 mins and 18s), the key differences between random errors and systematic errors in measurement were explored. To deepen students' understanding, various learning activities were conducted. The host began with a concept demonstration, using real-life scenarios such as measuring the temperature of boiling water with different thermometers to illustrate both error types. This was followed by a hands-on experiment, where students used rulers, weighing scales, and thermometers to take multiple measurements, analyze discrepancies, and classify errors as either random or systematic. Additionally, an error analysis exercise allowed students to evaluate pre-prepared data sets with intentional errors to determine their nature and impact. To reinforce critical thinking, students engaged in a discussion and reflection, where they examined the implications of measurement errors in scientific research and brainstormed strategies to minimize them. Finally, they participated in an application challenge, designing their own experiment while incorporating techniques to reduce errors, thus enhancing their understanding of precision, accuracy, and reliability. Through these structured activities, students strengthened their analytical skills in identifying and addressing errors, thereby improving a least-mastered competency in scientific experimentation.

Episode 2: Measurement (II). Estimate Errors from Multiple Measurements of a Physical Quantity Using a Variance

This episode (duration- 25 mins and 54s), students explored error estimation in measurements using variance. By analyzing multiple measurements of a physical quantity, they assessed data reliability and accuracy. Calculating variance helped them evaluate deviations from the mean, reinforcing their understanding of measurement consistency. To deepen their learning, students engaged in various activities. They conducted a hands-on measurement experiment, recording multiple readings of a given physical quantity using different instruments. They then performed a variance calculation exercise, computing the mean and variance of their data sets to assess measurement consistency. An error analysis discussion followed, where students compared their results, identified sources of deviation, and discussed their implications. Additionally, students learned and applied systematic steps in problem-solving, following a structured approach to analyzing errors and improving measurement accuracy. To connect theory with practice, they participated in a real-world application task, analyzing experimental data from real-life scenarios, such as temperature fluctuations or weight measurements. Through these activities, students strengthened their skills in data analysis, error evaluation, and systematic problem-solving, addressing a least-mastered competency in scientific experimentation.

Episode 3: Vectors. Perform the Addition of Vectors

This episode (duration-43 mins and 39s), students explored vector addition using graphical and analytical methods, including the head-to-tail, parallelogram, and component methods. To reinforce these concepts, they engaged in a guided demonstration, a vector drawing exercise on graph paper, and calculation-based problem-solving using trigonometry and algebra. A real-world application discussion connected vector addition to navigation, forces, and motion, followed by a collaborative challenge where students solved complex vector problems. Through these activities, students enhanced their problem-solving skills, spatial reasoning, and understanding of vector operations, addressing a least-mastered competency in physics and engineering.

Episode 4: Kinematics. Solve for Unknown Quantities in Equations Involving One-Dimensional Uniformly Accelerated Motion

This episode (duration-29 mins and 30s), students explored solving equations related to one-dimensional uniformly accelerated motion. They applied kinematic equations to determine displacement, velocity, acceleration, and time in various scenarios. To reinforce these concepts, students engaged in several problem-solving activities. They began with a guided computation exercise, where the instructor demonstrated step-by-step solutions to sample problems. This was followed by individual problem sets, where students independently applied kinematic equations to solve for unknown motion variables. A motion graph analysis task required students to interpret velocity-time and position-time graphs to extract key motion parameters. Lastly, a real-world application discussion connected their computations to practical situations like vehicle acceleration, sports physics, and free-fall motion. Through these structured problem-solving activities, students strengthened their analytical skills and conceptual understanding, addressing a least-mastered competency in motion analysis.

Table 2b. Outline of the VODCast

II. Parts of the VODCast		
I.	Title and Learning Competency	
II.	Stimulating Recall	
III.	Present Information	
IV.	Lesson Proper	
V.	Providing Guidance (Summary)	*(related Gagne's Nine Events of Experience)*
VI.	Elicit Performance	
VII.	Assess Performance	
VIII.	Key to Corrections	
IX.	References	

Students' and Experts' Acceptability Evaluation of the VODCast

Overall Acceptability.

As to the overall acceptability of the VODCast, it has an overall rating of "Highly Acceptable" (M= 4.84, SD= 0.08). This shows that the VODCast has excellently met the standards and no revisions needed. In particular, the students have rated the content part as the highest with mean (M=4.91 and SD of 0.03). In addition, for experts, the content as well obtained the highest rating (M= 4.96, SD=0.02). In terms of the average mean, the highest rating was attributed from the content (M= 4.94, SD= 0.04) but the lowest rating was accounted from performance assessment (M=4.75, SD=0.02) yet both were highly acceptable. The Performance Assessment received the lowest rating as it involves continuous tracking, pre/post-assessments, and detailed feedback, making it more demanding. Additionally, measuring engagement through real-world performance tasks adds complexity, as it requires clear criteria and consistency. Despite this, its high rating reflects strong acceptance.

In general, the overall rating of the students in terms of the overall acceptability was "highly acceptable" (M=4.84, SD= 0.06) and similar overall rating of "highly acceptable" was found out from the experts (M=4.83, SD=0.11).

Table 3. Overall Acceptability of the VODCast

Indicators	Students *(N=52)*		Experts *(N=5)*		*SD*	*Mean*	Description
	M	*SD*	*M*	*SD*			
Content	4.91	0.03	4.96	0.02	0.04	4.94	Highly Acceptable
Format and Presentation	4.83	0.07	4.74	0.15	0.06	4.79	Highly Acceptable
Efficacy of Material	4.87	0.04	4.89	0.10	0.02	4.88	Highly Acceptable
Performance Assessment	4.76	0.05	4.74	0.13	0.02	4.75	Highly Acceptable
Overall Rating	***4.84***	***0.06***	***4.83***	***0.11***	***0.08***	***4.84***	***Highly Acceptable***

Note: Description is based on the following scale. 4.51-5.00 (Highly Acceptable), 3.51-4.50 (Acceptable), 2.51-3.50 (Moderately Acceptable), 1.51-2.50 (Faily Acceptable), 1.00-1. 50 (Not Acceptable).

Content

The content of the VODCast has an overall rating of "highly acceptable" (M=4.94, SD= 0.04). Such rating means that the VODCast has excellently met the standards and no revisions needed. In particular, the students rated "Engaged students in higher-order thinking skills through its activities, exercises, and tasks" (M=4.94, SD=0.24) and "Included accurate, valid, truthful, and reliable information" (M=4.94, SD=0.24) as the highest with equal means (M=4.94 and SD= 0.24). In addition, for the experts, all indicators of the content attained a comparable rating (M=5.00, SD=0.00). In terms of the average mean, the highest rating was attributed from the statement "Engaged students in higher-order thinking skills through its activities, exercises, and tasks" and "Included accurate, valid, truthful, and reliable information" (M=4.97, SD= 0.04). As a whole, the overall rating of the students was "highly acceptable" (M=4.91, SD=0.03) and the same overall rating of "highly acceptable" was found out from the experts (M=5.00, SD=0.00).

Table 3a. Acceptability of the VODCast in Terms of its Content

CONTENT INDICATORS	Students (N=52)		Experts (N=5)		SD	Mean	Description
	M	SD	M	SD			
1. Adhered to the learning competencies, general, and specific outcomes of the curriculum guide/syllabus.	4.92	0.27	5.00	0.00	0.05	4.96	Highly Acceptable
2. Met the learning needs of individual learners from various skills and maturity level.	4.87	0.44	5.00	0.00	0.10	4.93	Highly Acceptable
3. Engaged students in higher-order thinking skills through its activities, exercises, and tasks.	4.94	0.24	5.00	0.00	0.04	4.97	Highly Acceptable
4. Eliminated biases, culturally unacceptable texts and images, unfounded information, and claims without citations.	4.88	0.38	5.00	0.00	0.08	4.94	Highly Acceptable
5. Included accurate, valid, truthful, and reliable information.	4.94	0.24	5.00	0.00	0.04	4.97	Highly Acceptable
Overall Rating	***4.91***	***0.03***	**5.00**	**0.00**	***0.02***	***4.96***	***Highly Acceptable***

Note: Description is based on the following scale. 4.51-5.00 (Highly Acceptable), 3.51-4.50 (Acceptable), 2.51-3.50 (Moderately Acceptable), 1.51-2.50 (Faily Acceptable), 1.00-1.50 (Not Acceptable).

Format and Presentation

The format and presentation of the VODCast has an overall rating of "highly acceptable" (M=4.74, SD= 0.15). This indicates that the VODCast has excellently met the standards and no revision is needed. In particular, the students have evaluated "Directions and instructions for activities and exercises are clear and understandable" as the highest with a mean (M=4.90 and SD = 0.36). In addition, for the experts, the same indicator, "Directions and instructions for activities and exercises are clear and understandable" obtained the same rating as "highly acceptable" (M=5.00, SD=0.00). In terms of the average mean, the highest rating was accounted for from the statement "Directions and instructions for activities and exercises are clear and understandable" (M=4.95, SD= 0.07). As a whole, the overall rating of the students was "highly acceptable" (M=4.83, SD= 0.07) and an analogous rating of "highly acceptable" was deciphered from the experts (M= 4.64, SD= 0.26).

Table 3b. Acceptability of the VODCast in Terms of Format and Presentation

FORMAT AND PRESENTATION INDICATORS	Students (N=52)		Experts (N=5)		SD	Mean	Description
	M	SD	M	SD			
1. Appropriate format for the subject matter.	4.81	0.49	4.80	0.45	0.01	4.80	Highly Acceptable
2. Recent and updated reference materials were used to flesh out the topics.	4.87	0.34	4.60	0.55	0.19	4.73	Highly Acceptable
3. Appropriate images, graphics, and format for the references.	4.85	0.41	4.40	0.55	0.32	4.62	Highly Acceptable
4. Directions and instructions for activities and exercises are clear and understandable	4.90	0.36	5.00	0.00	0.07	4.95	Highly Acceptable
5. Easy to navigate through as it provides interactivity and high-quality sensory experiences for all users.	4.73	0.56	4.40	0.55	0.23	4.57	Highly Acceptable
Overall Rating	***4.83***	***0.07***	***4.64***	***0.26***	***0.15***	***4.74***	**Highly Acceptable**

Note: Description is based on the following scale. 4.51-5.00 (Highly Acceptable), 3.51-4.50 (Acceptable), 2.51-3.50 (Moderately Acceptable), 1.51-2.50 (Faily Acceptable), 1.00-1.50 (Not Acceptable).

Efficacy of Material

The efficacy of the material which is the VODCast has an overall rating of "highly acceptable" (M= 4.89, SD= 0.10). This evokes that the VODCast has excellently met the standards and no revisions needed. In particular, the students have evaluated "Work properly without purchase of additional components" as the highest with a mean (M=4.92 and SD= 0.27. In addition, for the experts, all indicators of the efficacy of material attained the same rating (M=5.00, SD=0.00) except for the "Used by all students without extensive supervision or special assistance" (M=4.60, SD= 0.55). In terms of the average mean, the highest rating was accounted for from the same statement with the highest rating as evaluated by students (M=4.96, SD= 0.05). As a whole, the overall rating of the students was "highly acceptable" (M= 4.87, SD= 0.04) and a comparable overall rating of "highly acceptable" was ascertained from the experts (M= 4.92, SD= 0.18).

Table 3c. Acceptability of the VODCast in Terms of its Efficacy of Material

EFFICACY OF MATERIAL INDICATOR	Students		Experts		*SD*	*Mean*	Description
	M	*SD*	*M*	*SD*			
1. Durable, easily stored, transported, cost effective, and accessible.	4.85	0.41	5.00	0.00	0.11	4.92	Highly Acceptable
2. Updated and adaptable to match the resources of the school.	4.83	0.43	5.00	0.00	0.12	4.91	Highly Acceptable
3. Work properly without purchase of additional components.	4.92	0.27	5.00	0.00	0.05	4.96	Highly Acceptable
4. Used by all students without extensive supervision or special assistance.	4.85	0.36	4.60	0.55	0.17	4.72	Highly Acceptable
5. Met the requirements of the school and accepted technical standards.	4.88	0.32	5.00	0.00	0.08	4.94	Highly Acceptable
Overall Rating	***4.87***	***0.04***	***4.92***	***0.18***	***0.10***	***4.89***	***Highly Acceptable***

Note: Description is based on the following scale. 4.51-5.0 (Highly Acceptable), 3.51-4.50 (Acceptable), 2.51-3.50 (Moderately Acceptable), 1.51-2.50 (Faily Acceptable), 1.00-1.50 (Not Acceptable).

Performance Assessment

The performance assessment part of the VODCast has an overall rating of "highly acceptable" (M=4.74, SD= 0.13). This shows that the VODCast has excellently met the standards and no revision is needed. In particular, the students have rated two indicators namely, "The materials keep an on-going record of students' progress and allow the professor/subject teacher full access to individual student monitoring of activities, assignments, assessments, and grades" and "There are pre and post assessments, including constructive feedback and prescriptive guides for remediation" as the highest with a mean (M=4.81, SD= 0.40 and M=4.81, SD= 0.49). In addition, for experts, two indicators of the performance assessment acquired the highest rating (M=5.00, SD= 0.00) and these are "Assessment methods are suited to the objectives of the subject" and "Assessment methods are suited to the student's ability". In terms of the average mean, the highest rating was attributed to "Assessment methods are suited to the student's ability" as evaluated by students and experts (M=4.88, and SD=0.16). In general, the overall rating of the students was "highly acceptable" (M=4.76, SD= 0.05) and a similar overall rating of "highly acceptable" was found out from the experts (M=4.72, and SD= 0.30).

Table 3d. Acceptability of the VODCast in Terms of its Performance Assessment.

PERFORMANCE ASSESSMENT INDICATORS	Students (N=52)		Experts (N=5)		SD	Mean	Description
	M	*SD*	*M*	*SD*			
1. Observable performance that is relevant to real world experience can be used to measure student engagement.	4.73	0.63	4.80	0.45	0.05	4.77	Highly Acceptable
2. Assessment methods are suited to the objectives of the subject.	4.69	0.61	5.00	0.00	0.22	4.85	Highly Acceptable
3. Assessment methods are suited to the student's ability.	4.77	0.47	5.00	0.00	0.16	4.88	Highly Acceptable
4. The materials keep an on-going record of students' progress and allow the professor/subject teacher full access to individual student monitoring of activities, assignments, assessments, and grades.	4.81	0.40	4.40	0.55	0.29	4.60	Highly Acceptable
5. There are pre and post assessments, including constructive feedback and prescriptive guides for remediation.	4.81	0.49	4.40	0.55	0.29	4.60	Highly Acceptable
Overall Rating	***4.76***	***0.05***	***4.72***	***0.30***	***0.13***	***4.74***	***Highly Acceptable***

Note: Description is based on the following scale. 4.51-5.00 (Highly Acceptable), 3.51-4.50 (Acceptable), 2.51-3.50 (Moderately Acceptable), 1.51-2.50 (Faily Acceptable), 1.00-1.50 (Not Acceptable).

Discussion

Least Mastered Competencies in General Physics 1

The General Physics Test (GPT) revealed that out of the 13 identified learning competencies, four (4) were categorized as the least mastered.

(1) *"Differentiate Random Errors from Systematic Errors"* (M=45.25 out of 58), indicating that many students were unable to distinguish between types of measurement errors. This aligns with the findings of Etkina et al. (2006), who reported that students often struggle with understanding the nature and sources of measurement errors due to inadequate exposure to authentic experimental analysis in JHS.

(2) "*Estimate Errors from Multiple Measurements of a Physical Quantity Using a Variance*" (M=44.75 out of 58), reflecting difficulty in applying statistical tools to analyze experimental data. Similar challenges were observed by Buffler, Allie, and Lubben (2001), who underscored that high school students often lack conceptual understanding variance due to inadequate emphasis on data analysis in outmoded physics education.

(3) "*Perform Addition of Vectors*" (M=43.75 out of 58) suggesting challenges in combining vectors graphically or analytically. This is consistent with the work of Nguyen and Meltzer (2003), which found that students frequently misunderstand vector direction and magnitude, particularly when moving between graphical and analytical representations.

(4) "*Solve for Unknown Quantities in Equations Involving One-Dimensional Uniformly Accelerated*

Motion" (M=44.25 out of 58), shows students' difficulty in using kinematic equations to find variables related to motion. This is supported by the study of Trowbridge and McDermott (1980), which found that many learners have persistent misconceptions about acceleration and motion, often failing to properly apply kinematic relationships even after instruction.

Developed Video-On-Demand Cast (VODCast) in General Physics 1

Four (4) VODCast Episodes were produced, each focusing on key concepts: Episode 1: Measurement (I) (24 mins,18s). Episode 2: Measurement (II) (25 mins, 54s). Episode 3: Vectors (43 mins, 39s). Episode 4: Kinematics (Duration: 29 mins, 30s). Each of this episode targets least mastered competencies through a structured and engaging learning activities.

Title and Learning Competency set objectives, ensuring students understand the lesson's purpose which, as Mayer (2009) explained in his CTML, improved retention and understanding.

Stimulating Recall connects prior knowledge with new concepts, reinforcing connections between old and new concepts (Bransford et al., 2000).

Present Information introduces topics with step-by-step explanations and multimedia, catering to different learning styles.

Lesson Proper deepens comprehension through real-world applications and interactive discussions, addressing learning gaps.

Providing Guidance summarizes key points for better retention. Lesson proper and summary delivered structured content and reinforced key points, aligning with effective instructional design principles (Gagné et al., 2005).

Elicit Performance offers guided practice.

Assess Performance evaluates understanding through assessment, providing feedback. These two sections engaged learners actively, which Chickering and Gamson (1987) identified as key to effective education.

Key to Corrections clarifies mistakes, reinforcing problem-solving skills.

References support independent learning, helping students strengthen their grasp of complex topics. This ensures that the VODCast enhances content mastery and promotes key competencies in K to 12 and STEM frameworks especially in the flipped classroom model.

The findings of this study align with that of Sezer (2017), who reported that a technology-enhanced flipped classroom model not only improved student learning outcomes but also increased motivation; student engagement and performance (Kapur et al, 2022) by facilitating greater differentiation of instruction

Students' and Experts' Acceptability Evaluation of the VODCast

Overall Acceptability

As to the overall acceptability of the VODCast, it has an overall rating of "Highly Acceptable" (M=4.84, SD=0.08). This shows that the VODCast has excellently met the standards and no revisions needed. In particular, the students (M=4.91, SD=0.03) and experts (M= 4.96, SD=0.02) have rated the Content with highest score and the lowest rating was accounted for from performance assessment (M=4.75, SD=0.02) yet both were highly acceptable. The Performance Assessment received the lowest rating as it involves continuous tracking and detailed feedback, making it more demanding. Despite this, its high rating reflects strong acceptance. Based on the result, the respondents agreed that the VODCast is highly acceptable in terms of content, format and presentation, efficacy of material, performance assessment, and in terms of overall rating. This implies that the developed VODCast is worthy and can serve as an instructional material in a flipped classroom model that will help students learn at their own pace.

This finding aligns with Robles' (2009) study, which indicated that the learning package development was reliable, as shown by the high percentage of responses in the "strongly agree" category. The study also confirmed that the developed CALP was valid in terms of its objectives, content, presentation, and usefulness, making it a suitable alternative instructional material for both enrichment and remediation.

The findings of this study align with previous research demonstrating the effectiveness of vodcasts as instructional tools in physics education. For instance, Celestino-Salcedo et al. (2024) developed a vodcast embedded with Physics Education Technology (PhET) simulations to supplement learning materials for Grade 9 science students. Their study concluded that the vodcast was a very good material for classroom implementation, receiving an overall expert rating (M=4.78 out of 5.00), and was perceived as very useful by both students and teacher-observers.

Similarly, Ulla et al. (2022) created a teacher-produced vodcast embedded with simulations to teach light propagation, refraction, and reflection. The vodcast was rated as very satisfactory by content and ICT experts, and students' achievement levels improved from 'did not meet expectations' to 'fairly satisfactory' after its implementation. Students also perceived the vodcast as very useful.

Furthermore, Dimaro et al. (2023) developed and implemented a vodcast for teaching light to Grade 8 students, following the ADDIE framework. The vodcast received a very satisfactory rating from experts and was found to be a very effective vehicle for meaningful delivery of science lessons, supporting high learner motivation. These studies collectively suggest that well-designed vodcasts can enhance students' understanding of physics concepts and serve as effective instructional materials.

Content.

Students rated “Engaged students in higher-order thinking skills through its activities, exercises, and tasks” and “Included accurate, valid, truthful, and reliable information” as the highest with equal means (M=4.94, SD=0.24). Both rated Highly Acceptable”. Experts, all indicators of the content attained a comparable rating (M=5.00, SD=0.00). These results aligned with Putman and Kingsley (2009) and Ulla et al. (2022) were vodcasts enhanced students' understanding of science vocabulary due to the clarity of content, making it straightforward.

Format and Presentation.

Students evaluated “Directions and instructions for activities and exercises are clear and understandable” as the highest with a mean (M=4.90, SD=0.36. Experts, the same indicator, obtained the same rating as “highly acceptable” (M=5.00, SD=0.00). Both rated Highly Acceptable”. These findings reinforce prior research on the benefits of well-designed multimedia in physics education. Morphew et al. (2020) found that clear visuals and engaging narration improved assessment outcomes, while Celorico (2017) showed that visually stimulating simulations enhanced student achievement. Caracta et al. (2018) further emphasized the impact of well-structured video lessons on learning.

Efficacy of Material.

Student evaluated “Work properly without purchase of additional components” as the highest with a mean (M=4.92, SD= 0.27. Experts, all indicators attained the same rating (M=5.00, SD=0.00) except for “Used by all students without extensive supervision or special assistance” (M=4.60, SD=0.55). Both rated Highly Acceptable”. These findings confirm that a VODCast must also fit easily into classroom routines. Ulla et al. (2022) found that a VODCast with embedded simulations was both highly effective and required minimal specialized equipment. Likewise, Celestino-Salcedo et al. (2024) showed that a vodcast for projectile motion was well-received thanks to its durability, adaptability, and easy compatibility with school technology.

Performance Assessment.

Students have rated two indicators namely, “The materials keep an on-going record of students' progress and allow the professor/subject teacher full access to individual student monitoring of activities, assignments, assessments, and grades” and “There are pre and post assessments, including constructive feedback and prescriptive guides for remediation” as the highest with a mean (M=4.81, SD=0.40 and M=4.81, SD=0.49). For experts, two indicators acquired the highest rating (M=5.00, SD=0.00) and these are “Assessment methods are suited to the objectives of the subject” and “Assessment methods are suited to the student's ability”. All were rated “Highly Acceptable”. Based on the findings of this study, performance assessment is a key element of the VODCast. This conclusion is supported by Loh and Chandra (2023), who stress that well-designed performance-based assessments provide teachers with vital information for revising and refining instructional materials.

Conclusions

On the basis of findings, the following conclusions were drawn: Some students still struggle in General Physics 1, as evidenced by their least mastered competencies, due to gaps in their foundational knowledge from Junior High School (JHS), as well as poor retention of previously acquired concepts. The lack of reinforcement and long-term retention of fundamental physics principles may have contributed to difficulties in applying them to more advanced topics.

Students demonstrated notable difficulties in several key competencies in General Physics 1. In differentiating random errors from systematic errors, their struggles suggest weak foundational knowledge in measurement and experimental uncertainty, likely due to limited exposure during junior high school (JHS). Similarly, estimating errors using variance proved challenging, indicating a lack of familiarity with statistical analysis in physics, which may stem from minimal hands-on experimentation in earlier years. In performing the addition of vectors, students showed difficulty likely rooted in weak spatial reasoning, inconsistent instruction in JHS, and limited practice with both graphical and mathematical vector operations. Lastly, solving for unknown quantities in equations involving one-dimensional uniformly accelerated motion posed a challenge due to weaknesses in algebra, difficulty interpreting word problems, and incomplete understanding of motion concepts carried over from JHS. The abstract nature of kinematics and limited experience in structured problem-solving further contributed to these learning gaps.

Overall, inconsistencies in curriculum coverage, variations in teaching methodologies, limited hands-on laboratory experiences, and insufficient problem-solving practice in JHS may have collectively contributed to students' challenges in General Physics 1. Addressing these gaps through targeted interventions, reinforcement activities, and improved instructional strategies may help enhance students' understanding and mastery of fundamental physics concepts.

Moreso, the VODCast has excellently met the standards and no major revisions are needed as reflected in the evaluation by the experts and the students. The contents, format and presentation, efficacy of materials, and performance assessment were adequate, sufficient, and appropriate for the intended users. Thus, the developed VODCast is fitted to help the students learn the concepts in the subject General Physics 1 easily.

Furthermore, the VODCast has proven to be a highly adaptable resource, particularly as an anchor in a flipped classroom setup. By allowing students to engage with course materials at their own pace before class, the VODCast fosters a more interactive and student-centered learning experience. This flexibility supports 21st-century learners by offering a technology-enhanced instructional tool that is innovative, engaging, and aligns with the flipped classroom model, where students come to class prepared, ready to apply their knowledge in discussions and activities.

Recommendations

More in-depth research may focus on investigating the impact of VODCast engagement on long-term retention, to determine if the use of video-based learning materials not only improves immediate academic performance but also enhances memory retention over time compared to traditional teaching methods. Additionally, a comparison of VODCast with traditional instructional methods in various learning environments (e.g., urban vs. rural schools, online vs. in-person learning, or well-resourced vs. under-resourced schools) may be valuable in assessing the scalability and adaptability of VODCast across different contexts.

Another area for further study may involve examining how VODCast affects student motivation and engagement, with particular attention to changes in students' attitudes toward learning, their interest in the subject matter, and their overall involvement in the learning process. Future research on VODCast should explore its support for diverse learning styles (visual, auditory, kinesthetic), the role of teacher feedback in its effectiveness, its impact on critical thinking and problem-solving skills, and how it fosters collaborative learning through peer interactions and group projects.

Acknowledgements

I am profoundly grateful to the Department of Science and Technology – Science Education Institute (DOST-SEI), the funding agency of this study, under the leadership of Dr. Jayeel S. Cornelio and Dr. Josette Biyo (former Director), for granting me a scholarship through the National Consortium in Graduate Science and Mathematics Education (NCGSME) Capacity Building Program in Science and Mathematics Education (CBPSME). I also extend my heartfelt thanks to the Department of Science and Technology (DOST), led by Sec. Renato U. Solidum Jr. and Dr. Fortunato Dela Peña (former Secretary), for their continued commitment to advancing science education in the country. Their generous support was instrumental in enabling me to complete both my Master's degree and this research in a timely manner.

References

Abdullah, M. Y., Husin, N., Ishak, N. M., & Nawi, N. M. (2021). The effectiveness of vodcast as a technology-based learning tool in English as a second language (ESL) learning: A systematic literature review. *Journal of Physics: Conference Series, 1988*(1), Article 012050. https://doi.org/10.1088/1742-6596/1988/1/012050

ACAPS. (2024). *Philippines: Typhoon and heatwave impacts*. https://www.acaps.org

Berkman Klein Center for Internet & Society. (2021). *Digital natives and the future of learning*. Harvard University. https://cyber.harvard.edu/publication

Bishop, J. L., & Verleger, M. A. (2013). The flipped classroom: A survey of the research. In *ASEE national conference proceedings* (Vol. 23, No. 1, pp. 1–18).

Bransford, J. D., Brown, A. L., & Cocking, R. R. (2000). *How people learn: Brain, mind, experience, and school*. National Academy Press. https://doi.org/10.17226/9853

Buffler, A., Allie, S., & Lubben, F. (2001). The development of first-year physics students' ideas about measurement in terms of point and set paradigms. *International Journal of Science Education, 23*(11), 1137–1156. https://doi.org/10.1080/09500690110039567

Caracta, R. J., Malanum, K. R., & Albay, J. R. (2018). Effectiveness of video lessons in teaching selected topics in physics. *International Journal of Scientific and Technology Research, 7*(4), 27–30.

Celestino-Salcedo, L., Ballesteros, J. R., & Acosta, J. R. (2024). Development and validation of vodcast materials in teaching projectile motion using PhET simulation. *International Journal of Educational Technology in Higher Education, 21*(1), Article 7. https://doi.org/10.1186/s41239-024-00497-0

Celorico, C. P. (2017). Development and validation of learning objects in physics using PhET simulations. *Asia Pacific Journal of Multidisciplinary Research, 5*(1), 118–126.

Chang, M. M., & Tseng, Y. F. (2024). Enhancing language learning through authentic video materials: A quasi-experimental study. *Education and Information Technologies, 29*(1), 131–149.

Chickering, A. W., & Gamson, Z. F. (1987). Seven principles for good practice in undergraduate education. *AAHE Bulletin, 39*(7), 3–7.

Dimaro, S. V., Reyes, A. J., & Dimalanta, I. S. (2023). Development and implementation of a vodcast in teaching light for grade 8 students. *Journal of Science Education and Technology, 32*(2), 221–235. https://doi.org/10.1007/s10956-023-10019-2

Etkina, E., Van Heuvelen, A., White-Brahmia, S., Brookes, D. T., Gentile, M., Murthy, S., Rosengrant, D., & Warren, A. (2006). Scientific abilities and their assessment. *Physical Review Special Topics–Physics Education Research, 2*(2), Article 020103. https://doi.org/10.1103/PhysRevSTPER.2.020103

Gagné, R. M., Wager, W. W., Golas, K. C., & Keller, J. M. (2005). *Principles of instructional design* (5th ed.). Wadsworth/Thomson Learning.

Hairulla, B. M., & Malayao, A. A. B. (2022). Students' learning experience on the implementation of modular distance learning modality. *Journal of Education, Management and Development Studies, 2*(2), 36–42. https://doi.org/10.52631/jemds.v2i2.91

Hallare, K. (2020). DepEd eyes blended learning as the "new normal" in education. *Philippine Daily Inquirer*. https://newsinfo.inquirer.net

Heckler, A. F. (2011). The role of automatic and reflective processes in students' physics problem solving. *Physical Review Special Topics–Physics Education Research, 7*(1), Article 010107.

Hew, K. F., & Lo, C. K. (2018). Flipped classroom improves student learning in health professions education: A meta-analysis. *BMC Medical Education, 18*, Article 38. https://doi.org/10.1186/s12909-018-1144-z

Javier, M. C. (2021). Online learning experiences of senior high school students during COVID-19 pandemic in the Philippines. *International Journal of Multidisciplinary: Applied Business and Education Research, 2*(10), 854–861. https://doi.org/10.11594/ijmaber.02.10.02

Johan, S. A. M., Shaharom, M. S. N., & Omar, N. A. M. (2018). Cognitive theory of multimedia learning (CTML) principles in teaching and learning. *International Journal of Academic Research in Business and Social Sciences, 8*(8), 457–465. https://doi.org/10.6007/IJARBSS/v8-i8/4625

Kapur, R., Chaturvedi, A., Ramesh, A., & Sharma, S. (2022). The flipped classroom in higher education: A systematic review. *Education and Information Technologies, 27*, 7633–7661. https://doi.org/10.1007/s10639-022-10987-0

Legaspi, C., Lariosa, D., Jamiliarin, P., & Villaruz, J. (2020). *University policy and guidelines manual for the preparation, evaluation, and approval for utilization of instructional materials*. Aklan State University.

Loh, A., & Chandra, V. (2023). Performance-based assessment in digital learning environments: Opportunities and challenges. *Educational Technology Research and Development, 71*(3), 895–914. https://doi.org/10.1007/s11423-023-10248-8

Mayer, R. E. (2009). *Multimedia learning* (2nd ed.). Cambridge University Press. https://doi.org/10.1017/CBO9780511811678

Mayer, R. E. (2020). *Multimedia learning* (3rd ed.). Cambridge University Press.

McDermott, L. C., & Redish, E. F. (1999). Resource letter: PER-1: Physics education research. *American Journal of Physics, 67*(9), 755–767. https://doi.org/10.1119/1.19122

Morphew, J. W., Jackson, M. A., & Shilling, E. A. (2020). Design principles for effective educational videos. *Educational Psychology Review, 32*(2), 667–685. https://doi.org/10.1007/s10648-019-09518-y

Nguyen, N.-L., & Meltzer, D. E. (2003). Initial understanding of vector concepts among students in introductory physics courses. *American Journal of Physics, 71*(6), 630–638. https://doi.org/10.1119/1.1565117

Philippine Star. (2024, April 12). *DepEd to allow class suspensions due to extreme heat*. https://www.philstar.com/headlines/2024/04/12

Pilkington, R. (2020). Exploring the pedagogic value of vodcasts: Student experiences and perceptions in higher education. *Education and Information Technologies, 25*(1), 291–306.

Putman, S. M., & Kingsley, T. (2009). Investigating the effect of technology-enhanced instruction on the reading comprehension of second-grade students. *Journal of Research on Technology in Education, 42*(3), 203–217. https://doi.org/10.1080/15391523.2009.10782532

Pye, E., Holt, M., Salzmann, L., Bellucci, L., & Lombardi, L. (2020). The effectiveness of vodcasts for learning in higher education: A systematic review and meta-analysis. *Computers & Education, 144*, Article 103708. https://doi.org/10.1016/j.compedu.2019.103708

Ramos, R. G., & Dizon, J. B. (2021). Lived experiences of senior high school physics teachers in the use of modular distance learning during COVID-19 pandemic. *International Journal of Advance Research and Innovative Ideas in Education, 7*(4), 1264–1271.

Redish, E. F. (2018). *Teaching physics: With the physics suite*. Wiley.

ReliefWeb. (2023). *Philippines: Humanitarian needs overview*. https://reliefweb.int

Robles, A. P. (2009). Development and validation of computer-assisted learning package in chemistry for high school students. *Philippine Journal of Science Education, 1*(1), 55–70.

Rogayan, D. V., Rafanan, R. N., & de Guzman, A. B. (2021). Exploring Filipino teachers' experiences and coping strategies during COVID-19 pandemic. *Asia Pacific Education Review, 22*(2), 307–316. https://doi.org/10.1007/s12564-021-09692-8

Saira, T., Syed, M. A., Noreen, S., & Hussain, S. (2021). Impact of flipped classroom model on academic performance of undergraduate students. *Journal of Educational Technology Systems, 50*(1), 111–129. https://doi.org/10.1177/0047239521993572

Sezer, B. (2017). The effectiveness of flipped learning on students' academic achievement, attitudes and self-directed learning skills in an EFL course. *Journal of Educational Technology & Society, 20*(1), 46–58.

Singh, C., & Marshman, E. (2015). *Conceptual understanding of physics*. Morgan & Claypool.

Trowbridge, D. E., & McDermott, L. C. (1980). Investigation of student understanding of the concept of velocity in one dimension. *American Journal of Physics, 48*(12), 1020–1028.

Ulla, M. B., Basilio, M. A. P., & Mapatac, L. P. (2022). The use of vodcasts in teaching physics: An analysis of effectiveness in improving students' learning outcomes. *Asia-Pacific Science Education, 8*, Article 11. https://doi.org/10.1186/s41029-022-00101-8

Ulla, M. B., Madriaga, L. C., & Oracion, E. G. (2022). Teachers' use of self-produced vodcasts as supplementary teaching tools in science classes: Opportunities and challenges. *Asia Pacific Education Review, 23*(1), 135–147. https://doi.org/10.1007/s12564-021-09740-7

Zhang, D., Zhou, L., Briggs, R. O., & Nunamaker, J. F. (2006). Instructional video in e-learning: Assessing the impact of interactive video on learning effectiveness. *Information & Management, 43*(1), 15–27.

https://doi.org/10.1016/j.im.2005.01.004

Author Information

Aldrin Inan Ijalo, LPT, MAED

https://orcid.org/0009-0001-8072-1590

Baybay-Alibagon Integrated School

Baybay, Makato, Aklan

Philippines

Contact e-mail: *aldrin.ijalo@deped.gov.ph*