Video Lessons for the Course Introduction to Computing through Online/Offline Mode (ICOM): Its Development and Evaluation

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***Abstract*—Conducting video lessons is a common trend in today's new normal educational setup. Hence, it is crucial to initiate efforts to evaluate this strategy. This developmental research developed and evaluated an online/offline video lesson for the course Introduction to Computing. Selected via cluster sampling, twenty first-year students from a state university, four information technology experts, two curriculum experts, and one language teacher participated in the study. A researcher-made examination and an adapted evaluation form for video materials were utilized in the study. Results showed that the three least achieved computing skills were: (a) logical and critical thinking domains like explaining the different jobs, functions, professions, and careers in the field, identifying computing hardware and others; (b) technical domains like identifying input, output, processing, and storage devices and others; and (c) analytical domains such as text alignment, addition of line breaks and others. The overall evaluation of the acceptability of the video materials was very acceptable (M = 3.69) in terms of content (M = 3.79), instructional quality (M = 3.68), technical quality (M = 3.65), presentation and organization (M = 3.64), accuracy and up-to-datedness of information (M = 3.64), and assessment (M = 3.71). The students who achieved the objectives of the video lessons experienced a more personalized learning journey. Further research on and use of the strategy in various academic settings is recommended.**

***Keywords*—computing skills, developmental research, video lessons, online/offline learning, introduction to computing**

I. Introduction

The rise of digital technology gives a ray of hope that can direct and stimulate change toward holistically achieving all 17 Sustainable Development Goals (SDGs) [1]. The world is currently undergoing a phase of digitalization, where the majority of daily activities depend heavily on advanced digital and computer technology. This transformation notably influences education, as it becomes the primary arena where students initially encounter technology, requiring teachers to adeptly utilize it in the classroom to fully engage and educate learners of this generation [2]. According to the United Nations Educational, Scientific, and Cultural Organization (UNESCO), ICT is the foundation for everything in our modern society. Thus, a greater comprehension of this expansion in knowledge is critical. Furthermore, ICT assists students in acquiring knowledge, improving their talents, fostering social mobility, and allowing people to participate in the global economy, all of which have a big beneficial influence on the educational system [3].

Computing is becoming a mainstream field that is incorporated into the school curriculum and serves as an enabler for a growing number of academic disciplines in higher education [4]. Introduction to Computing is a required course in the information technology education programs—Bachelor of Science in Computer Science (BSCS), Bachelor of Science in Information Systems (BSIS), and Bachelor of Science in Information Technology (BSIT) (CHED Memorandum Order No. 25—Revised BSCS, BSIS, and BSIT Policies, Standards, and Guidelines, 2015). The Commission on Higher Education (CHED) selected BSIT as one of the priority courses (CMO 01, s. 2014—Priority Courses for Academic Years 2014-2015 to 2017-2018, CMO 25, s. 2015). According to the course description, this course educates graduates to meet varied user demands regarding the selection, development, implementation, integration, and administration of computer technologies within an organization.

Furthermore, CMO 25, s. 2015 has been used as a guide to make some of the distinctions of the outcomes of various Information Technology Education (ITE) programs; thus, Information Technology (IT) students are expected to have a diverse set of IT-related skills, backgrounds, and interests, as well as computer programming experience gained through a high school programming course, military training, or on-the-job training. Most students who enter one of the computer majors do not have a clear knowledge of the aims of the various majors or what career routes are involved in information technology education courses [5].

The COVID-19 pandemic has brought about a profound transformation in the higher education system of the Philippines. There has been a notable shift towards online instruction as a strategic measure to curtail the further transmission of the virus [6]. With the radical progress in modern information technology, the academic community can remain well-connected while working from home. Academic administrators are working hard to guarantee that educational achievement, albeit affected, does not cease totally during this crisis moment [7]. Many prestigious schools and universities are attempting to avoid this dilemma by relocating critical instructional tasks to the virtual realm. To that purpose, remote learning options such as online courses, live streaming, virtual teaching, and simulated laboratories are providing an effective alternate method of studying courses with laboratory components from home while remaining safe.

The participating university in Janiuay offers Bachelor of

Science in Information Technology in 2018 under the revised curriculum established by Board of Regent (BOR Resolution No. 56-C (s. 2018), with Introduction to Computing as a course serving as the foundation for all main disciplines in the degree [8]. The course covers an overview of the computing industry and computing profession, including research and applications in various fields; an appreciation of computing in various fields such as Biology, Sociology, Environment, and Gaming; an understanding of ACM requirements; an appreciation of computing history; and knowledge of the key components of computer systems (organization and architecture), malware, computer security, the Internet and internet protocols, HTML 4/5 and CSS (CMO 25, s. 2015).

West visayas state university, similar to most institutions in the world, have also adapted to the new normal. Synchronous video conferences (e.g., Zoom, Google Meet, and Microsoft Teams) and asynchronous videos (henceforth, video; e.g., lecture recordings) are the most common strategies for transitioning to online learning. Systematic reviews have shown that video conferences are satisfactory substitutes for traditional pedagogies, with comparable learning outcomes [9]. Because of its reliance on internet platforms, online learning has successfully transitioned into the twenty-first century. According to Ehlers *et al.* [10], e-learning is defined as the process of combining online platform technologies with the Internet in order to improve learning and provide users with access to online resources. Many users of e-learning platforms recognize that online learning offers ease of management, providing learners with convenient access to both teachers and educational materials [11, 12]. This mode of learning has also proven effective in reducing the effort, travel expenses, and additional costs associated with traditional learning. E-learning has significantly streamlined administrative tasks, preparation, lecture recordings, attendance tracking, and class commutes.

The e-learning framework is increasingly being used as a flexible platform for teaching and learning activities [13]. Both educators and students acknowledge that online learning methods facilitate the pursuit of lessons from any location, particularly during challenging circumstances that may hinder physical attendance at universities and schools. This approach fosters self-directed learning, allowing students to engage in lessons both synchronously and asynchronously at their convenience [14]. Moreover, self-regulated learning constitutes a fundamental aspect of the student-centered learning paradigm. This approach motivates students to actively engage in the learning process, organize their efforts, identify their strengths, and proactively determine the most effective path to achieve the learning objectives [15].

Despite the benefits it offers, online learning presents several drawbacks, one of which includes unreliable internet connections. Through a comparison of the present global ICT environment with the current situation in the Philippines, Salac [16] illustrate that the Philippines' internet infrastructure falls behind that of contemporary growing Asian nations, particularly in terms of internet connection. Furthermore, A study conducted by Aung and Khaing [17] identified several challenges that developing countries, including the Philippines, encounter when implementing e-learning. These challenges encompass poor internet connectivity, a lack of knowledge regarding the effective utilization of information and communication technology, and inadequacies in content development.

As a consequence, the researchers concluded that offline video courses may be used as a substitute so that students could continue to learn even if they were unable to participate in the synchronous sessions. According to Sagge and Segura's study [18], more students were able to access the video courses since they were kept on an external device that could be put into any compatible device, like a mobile phone, and could be viewed whenever there was no internet connection. They are free to learn the lessons at their own convenient time and location. As a final point, Antonio [19] noted in his research that offline video lectures have been shown to be more successful than modules at improving students' academic performance in Mathematics. Because of its pause-and-play functionality, it provides the pupils more time to comprehend the lecture. When a teacher is unable to lecture students face-to-face, offline videos are crucial for explaining mathematical ideas and procedures. It eliminates the digital barrier that prevents Modular Distance Learning (MDL) in educating the students. Finally, Nabayra [20] mentioned in his study that technology-enhanced instructional tools like videos and other learning media are useful learning resources in this new pandemic-induced education system for optimizing learning results.

In the classroom, although students can potentially study anything online or offline, learning may not be optimal, particularly in classes that need direct interaction and face-to-face contact [21]. Face-to-face training is being used by first-year IT students on campus. It should be emphasized that Introduction to Computing as a topic needs laboratory and hands-on activities to compensate for the lectures; however, the laboratory class schedule was cut short due to inadequate computer laboratories and PCs. Another issue is a bad internet connection. In the Introduction to Computing course, synchronous learning is not possible, and teaching courses with laboratory components is extremely difficult.

According to Darbinyan [22], computer-based materials in the form of video lessons are being used to provide off-campus students with some interactive learning activities in the absence of laboratory classes, and some computer simulation programs can serve to partially replace laboratory exercises in this time of pandemic in remote learning. Furthermore, Boateng *et al.* [23] stated that video is one of the most diverse and different virtual learning media that collect and display information as well as provide a sensory learning environment, allowing learners to better absorb and remember knowledge.

The prevalence of video-based learning is increasing in higher education settings, driven by the rapid expansion of self-paced asynchronous courses [24]. This surge in video-based learning within higher education is credited to its user-friendly nature and adaptability. In the educational landscape, instructors find it convenient to convey both auditory and visual information through videos. Students, particularly those frequently off campus, benefit from unrestricted access to video content, transcending limitations of time and geography [25].

Additionally, numerous studies have explored the use and effectiveness of video materials [26–29]. The effectiveness of videos is notably heightened when employed for instructing practical skills rather than theoretical concepts [26]. Videos present substantial benefits for both teachers and students, contributing to improved academic performance in diverse contexts. They positively influence student motivation, confidence, and attitudes [27]. Demonstrating their utility, video tutorials have proven advantageous for students grappling with the understanding of course materials. Furthermore, observations suggest that the incorporation of videos enhances interaction between students and teachers [28]. Undoubtedly, video stands out as a powerful and efficient tool for fostering comprehensive learning [29].

Moreover, video-based learning stands out as a powerful tool for enhancing the teaching and learning process. As highlighted by Yousef *et al.* [30], educational videos efficiently boost motivation, engage learners, and cater to diverse learning styles. The authors emphasize the unique ability of videos to convey complex ideas, especially procedural knowledge, that may be challenging to express in text. Supported by various studies, they demonstrate how videos not only enhance learning outcomes but also contribute to increased student satisfaction, interaction, and communication [30].

Furthermore, videos play a pivotal role in traditional instructional methods and students' learning habits, potentially replacing other forms of media in online education [31, 32]. The evolving landscape of video creation and the availability of user-friendly, scalable distribution platforms [33] further underscore the substantial impact of videos on education.

In a study by Manley *et al.* [34], the focus was on video-based instruction for introductory computer programming within a comprehensive CS0 course. Students' perceptions of learning activities were found to be more positive and their interactions with the instructor to be more meaningful in the video-based instruction section when two sections were compared, one of which used video-based instruction and the other not.

Additionally, an analysis of student performance data suggested a potential positive influence of video instruction on student learning outcomes.

Insorio *et al.*'s [35] study delved into the positive impact of video lessons, created by teachers, on the academic performance of students in mathematics. The evident difference in average scores on initial and final assessments highlights the effectiveness of these video lessons as additional educational tools, particularly beneficial for students facing difficulties. This indicates that students encountering challenges demonstrated improved understanding of the math content, achieved performance task standards, and independently gained knowledge through the utilization of video lessons accessible on platforms like Google Classroom.

However, there is a gap in research concerning the development of video lessons specifically tailored for the Introduction to Computing course. While related studies have extensively explored video-based instruction in fields like mathematics, sciences, and other subjects, its application in computing courses is relatively underexplored. The subsequent studies presented below substantiate the significant benefits of incorporating video materials in teaching and learning.

Along these lines, the rapid growth of online education has resulted in increased interest in academic research on learning with instructional video as an aid to provide meaningful teaching and learning processes; thus, the development of video materials for the course Introduction to Computing is regarded as an urgent need to maximize the learning process and translate the subject's competency requirements.

The findings and results of this research may be useful for teachers and facilitators of courses such as Introduction to Computing. It allows access to empirical data about the use of video lessons in teaching the specific course. It does not only provide such information but also serves as groundwork for the development and use of this strategy in other related areas of ICT and computing. Curriculum developers and designers may also utilize the findings of this study to revisit, review and possibly revise current curricula for the said course.

The purpose of this research was to create and assess video lessons for Introduction to Computing in Online/Offline Mode (ICOM). It tried to answer the following questions in particular:

1) What are the least achieved computing skills in terms of (a) logical and critical thinking domain, (b) technical domain, and (c) analytical domain?
2) What instructional material and its features can be developed to address the least-achieved computing skills of first-year BS Information Technology students?
3) What is the evaluators' evaluation of the level of acceptability of the instructional material as to (a) content, (b) instructional quality, (c) technical quality (d) presentation and organization, (e) accuracy and up-to-datedness of information, and (f) assessment?

The paper's organization is outlined as follows: The methodology section offers insights into critical elements, including details on research participants, ethical considerations, and the instruments used for data collection. The research procedure is expounded, with a focus on the input-process-output framework. Subsequently, the results and discussion section is presented, leading to the conclusion.

II. Methodology

In order to create research-based instructional video lessons for the Introduction to Computing course, this study used a developmental research technique. As described by Ibrahim [36], Developmental research refers to the systematic study of creating, implementing, and assessing educational programs, processes, and products that must fulfill internal consistency and effectiveness requirements. Furthermore, Klaassen [37] characterized developmental research as a cyclical process of small-scale in-depth construction and assessment of example teaching-learning sequences at a content-specific level. It seeks to generate an empirically backed justification of the inner workings of such a sequence, which is said to be a significant contribution to the competence of teachers, curriculum planners, and educational researchers.

This research falls with the realm of Type 1 developmental research. According to Richey and Klein [38], Type 1 developmental studies concentrate on a specific educational product, program, technique, or instrument. This type of study addresses not just design and development but also assessment. Similarly, the purpose of this study was to create, test, and improve a computer skill-based instructional video lesson that may be used as enrichment and evaluation material for teaching and learning the course Introduction to Computer.

Furthermore, the IPO (Input-Process-Output) model served as the foundation for the processes in this study (See Fig. 1). The input phase accepts data, information, and knowledge in response to the factors defined in the learning context. The process phase looks for methods to inspire creative and diverse thinking through the use of processes to interpret, explain, arrange, and present different approaches to events that are expected to occur in the learning area. The process outcomes are delivered in the output phase by openly expressing ways of knowing that are converted into ways of acting [39].

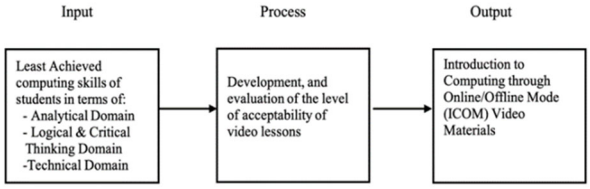

Fig. 1. The diagram of the development and evaluation of the video lessons.

A. Research Participants

Respondents. The participants were twenty first-year BS Information Technology students enrolled in Introduction to Computing (CC 201) during the second semester of the academic year 2022–2023 at West Visayas State University Janiuay Campus. They were requested to complete a researcher-created test to assess the least-obtained computing abilities in terms of analytical, logical, and critical thinking, as well as technical domain, which served as the foundation for the video lectures.

The sample selected was calculated using cluster sampling, as described in previous sections. Following that, a random sample was drawn from these clusters, and all of them were incorporated into the final sample [40]. The fishbowl method was used to choose the cluster. A, B, C, D, and E were assigned to each cluster. The letters were then carefully combined before being placed in a basin. The researchers then chose only one letter without looking. Letter A was chosen from the bowl as the study's sample.

Evaluators. A faculty member, responsible for teaching the CC 201 subject across various campuses, collaborated with IT faculty members and curriculum experts to validate the video lessons. Not only did they fulfill the role of validators, but they also served as evaluators, assessing the acceptability of the video lessons. In addition to this core team, two IT experts, two curriculum experts, and one language expert were specifically selected based on their expertise to contribute as evaluators. Their insights, comments, and suggestions played a pivotal role in the iterative process of designing, developing, and enhancing the video lessons.

The selection of these faculty members was purposeful, considering their proficiency in the subject matter. Consequently, their feedback was deemed crucial in refining the video lessons. Furthermore, the evaluators employed an adapted questionnaire, utilizing specific criteria to assess the video lessons. The individual evaluations of the experts were consolidated, creating a comprehensive overview of the video lessons' acceptability. This collaborative approach ensured a well-rounded and informed perspective, contributing significantly to the overall improvement of the video lessons.

Ethical considerations. When conducting this study, ethical norms such as privacy and confidentiality were followed. That is, the volunteers in this study must not be harmed.

The researchers followed the following ethical principles in the conduct of the study: (1) permission to conduct the study among the BS Information Technology first-year students was obtained from the campus administrator and school director; (2) the researchers informed the participants that no harm would come to them as a result of the study; (3) if the participants felt uncomfortable in answering the questions or did not answer them, the researchers respected his/her right. Assent and consent forms were also obtained and facilitated. Maintaining the confidentiality of information gathered from the participants is one of the most important elements of research ethics. Participants in the study provided valuable and often sensitive information to the researchers on the premise that their identities remained intact and concealed.

B. Data Gathering Instruments

In order to develop the instructional video lessons based on the computing skills of first-year BS Information Technology students, the following instruments were used in this study:

Researcher-made exam. Before creating the exam items, a table of specifications was created to assess the first-year BS Information Technology students' least-attained computer skills in terms of analytical, logical and critical thinking, and technical skills. To measure the students 'computing skills, the 60-item multiple choice test (https://bit.ly/3H4ALrl) was based on five chapters of Introduction to Computing, namely: Industry in the Profession, Key Components of a Computer System, Computer Security, Networks, Internet and Internet Protocol, and Introduction to HTML and Cascading Style Sheets.

The exam consisted of twenty objective-type test items per domain, allowing for item analysis. The exam items were subjected to face and content validation by university specialists. To determine the reliability of the test, pilot testing was conducted last January 23, 2023, to one intact group of first-year BS Information Technology students in a University in Pototan who had taken the subject Introduction to Computing during the first semester of the AY 2022-2023. This group was excluded from the actual assessment of least-achieved computing skills.

After pilot testing, the researcher-made test was trimmed down to 45 items where the three (3) domains had fifteen items each. This happened because some items in each competency did not meet the set discriminant coefficient which is 0.20 or better. Furthermore, high internal

consistency tests include elements that have generally favorable connections with the entire test result. Because of the different forms of the item and total score distributions, values of the discrimination index seldom surpass 0.50 in practice. Item discrimination is classified as good if the index is greater than 0.30, fair if it is between 0.10 and 0.30, and poor if it is less than 0.10 [41].

The test's reliability was investigated using Kuder-Richardson 20 or KR 20 and indicated an alpha level of 0.83 reliability coefficient, indicating that the test was reliable.

Evaluation form. The Instructional Material (IM) evaluators used the West Visayas State University's adapted evaluation form for non-printed instructional lessons, document number WVSU-IQA-SOI-05-F02, to determine the acceptability of the video lessons in terms of content, instructional quality, technical quality, presentation and organization, and assessment. This instrument has also undergone a validation process.

The evaluation form includes the evaluators' names, directions, and indicators for each criterion. The evaluators might choose whether or not to write their names. The instructions for completing the evaluation form are provided in the instruction section. The major section of the evaluation form is where the evaluators analyze the video courses in terms of content, instructional quality, technical quality, presentation and organization, correctness and up-to-date information, and assessment. The grading system was as follows: Very Acceptable (VA), "4", Acceptable (A), "3"- Moderately Acceptable (MA), "2"- Barely Acceptable (BA), and "1"- Not Acceptable (NA).

C. Research Procedure

Before data gathering, permission from the campus administrator and the school director of the School of Information and Communications Technology (SICT) was sought to conduct the study among the first-year BS Information Technology students of the campus. Since this study adapted the IPO framework in the development of introduction to computing online/offline mode video lessons integrated into the developmental research method, the process was run through in detail as revealed in the explanations below:

Input Stage. Upon securing permission from the campus administrator, the dean of instruction, and the director of the School of Information and Communications Technology, the researchers set the schedule and venue in consultation with the subject instructor to expedite the gathering of data that would serve as the benchmark in the process of developing the online/offline mode video lessons. Concurrently, the researcher-made exam underwent scrutiny from expert validators to ensure both face and content validity.

During the conduct of the exam, one section out of five BS Information Technology first-year students were randomly chosen to be the respondents of the study. These students underwent a 20-minute orientation as to the proceedings of the conduct of the exam along with the protocols to be observed and followed. The conduct of the exam was done at the most convenient time for a maximum of 90 minutes. The respondents were properly oriented, carefully observed, and meticulously supervised. The researchers facilitated and conducted the exam with the help of the subject instructor.

Fig. 2 shows the highlights of the implementation of data gathering in the input stage.

Fig. 2. The video lessons prototype for the introduction to computing.

In this stage, the key priority was identifying what students needed based on the least-achieved computer skills in terms of analytical, logical, and critical thinking, as well as technical areas. Hence, vital to the development of instructional material is the analysis and evaluation of computing skills that served as the benchmark in the development of the video lessons.

The results of the study were statistically treated and analyzed using rank and mean for descriptive statistics. Interpretation of the needs assessment results provided baseline data that determined the learning gaps and was used as inputs in the selection and design of appropriate video material.

Meanwhile, the CC 201 syllabus was reviewed as to its content coverage and outcomes-based teaching and learning strategies as addressed in the stipulations of CMO 25, s. 2015. IT faculty developed the syllabus during the syllabi-making workshop organized by the Office of the Director of Instruction and Quality Assurance (DIQA) last April 2018. It was enhanced and finalized during the IT courses syllabi-making spearheaded by the College of Information and Communications Technology held at Bearland Resort in Tigbauan, Iloilo last May 2018. This syllabus was first implemented in the first of semester, school year 2018–2019.

Process Stage. The researchers assessed the respondents' least-achieved computer abilities (analytical, logical and critical thinking, and technical domain) after obtaining data in the input stage. The researchers provided potential activities that would address the learning gaps while also outlining the subjects or lessons in accordance with the course objectives and learning outcomes that were clearly defined and described in the syllabus. Merrill's [42] four-phase education approach served to guide in establishing the sequencing and presentation of themes in the building of the instructional video lesson template.

The first step in this stage was to develop the instructional content. Based on the findings of the computer skills study, the framework and format of the video lessons package were designed and sketched out during this step. These outcomes functioned as a checkpoint against the process of creating the video courses.

Merrill's four prescriptive instructional concepts that improve the quality of learning in all contexts guided the design of the video lessons for the course Introduction to Computing [43]. While sequencing is dependent on many

variables, including content, learner, and outcome, many instructional models suggest that the most effective learning products or environments are problem-centered and include four phases of instruction: activation of prior experience, demonstration of skills, application of skills, and integration of these skills into real-world activities.

The highlights of these principles were encapsulated in the storyboard of the video material, while as to the physical aspects, the outline, format, and layout of the video lessons were designed and sketched out using multimedia software such as Microsoft PowerPoint and Canva.

The lesson title was delivered first, followed by the learning outcomes that were required of the students at the end of the class, so that they could focus on their learning efforts aimed at achieving the goals. Then, based on the four stages of the instruction model, the following learning and teaching activities were implemented through the introduction of the various sections of the course workbook:

i) Activation. When teaching stimulates prior knowledge, it promotes learning. This is done when past knowledge is activated based on the learners' schema. This is the section of the lesson that seeks to grab readers' attention before getting into the meat of the issue. Each class began with a preview that introduced students to the subjects to be covered. It also instructed students to recall prior knowledge and link it with existing information and relevant experience that may serve as a basis for new knowledge.

ii) Demonstration. When education involves a demonstration, learning is enhanced. Various real-life examples were used to explain the ideas, principles, skills phase, techniques, tasks, and applications, which were given using visuals such as graphics, screen casting/recording, drawing, animation, and simulation.

iii) Application. When education includes chances for application, learning is enhanced. Learners apply skills through interactive tasks incorporated in video classes, allowing them to practice and reinforce what they saw in the presentation. This is developed in the quiz and tasks area, where students learn to participate by answering questions following the talk.

iv) Integration. When education facilitates integration into the actual world, learning is fostered. Learners are given the opportunity to integrate what they have learned and experiment with new applications. The class concluded with a summary of the subjects covered and a connection to the topics to be addressed in the following lesson. They then investigated the connection between the themes and human cognition. This is shown in the phase where they go through evaluation or enrichment tasks, and lastly, they ask students to reflect and write down what they learnt from the session.

Concerning the technical design of the instructional video, the researchers sought advice from a video editor on the design concept, icons and graphical presentation, audio/music and narration, and physical layout/format of the video lessons, while keeping the technical quality criteria in mind. As a result, multimedia experts first evaluated the design, layout, and structure. The style and arrangement of the video lessons were revised.

The development of the video tutorials is the design's high point. The videos were created at this stage based on the outline and format created during the design stage. The videos ranged in duration from 20 to 30 minutes. Furthermore, the films were prepared with video editing software Sony Vegas Pro 14 and Canva. During this period, the design was constantly evaluated and revised.

The major aspects and format of the films generated in this study are consistent with the cognitive paradigm of multimedia learning [44]. This is a key basis for creating excellent video materials. Students are engaged in learning that is offered in a variety of formats, such as videos, audio, and other technologies meant to pique students' attention and allow for quick answers [45]. It also agrees with the findings that material quality is an important variable because of its beneficial influence on student satisfaction [46].

Output Stage. The main goal of this stage was the final packaging of the video lessons incorporating the comments and suggestions from expert evaluators. The capstone of this stage was the evaluation of video lessons for the course Introduction to Computing to be carried out by a panel of experts using the evaluation questionnaire. The results of the evaluation were analyzed and interpreted using descriptive statistics to determine the acceptability of the video lessons. (*https://www.youtube.com/@paulinetorion7695/featured*) The prototype of the video lessons for the course Introduction to Computing is as follows.

The timeline for video materials development comprises three crucial stages, spanning a total of six months. During the initial Input Stage, lasting two months, tasks include exam preparation, pilot testing, ensuring exam validity and reliability, conducting exams, and subsequent data analysis. Following this, the Process Stage unfolds over the next two months and involves developing instructional content, designing video materials, video production/shooting, and comprehensive video editing. The final Output Stage, also spanning two months, includes evaluating video materials, conducting meticulous data analysis of evaluation results, integrating comments and suggestions from expert evaluators, and ultimately packaging the video materials. This well-organized timeline ensures a systematic and thorough approach to creating and refining educational video content.

III. Results and Discussion

A. The Least-Achieved Computing Skills in Introduction to Computing

To determine students' least-achieved computing skills in Introduction to Computing, percentages and rank were used. Based on the results, three of the computing skills in each domain were identified as the bottom-line computing skills falling under analytical, logical and critical thinking, and technical domains, respectively.

Table 1 shows the ranking of the computing skills in the logical and critical thinking domain of Introduction to Computing. The computing skills are ranked from highest to lowest based on how many percent of the participants answered the questions correctly under a particular computing skill. The results show that the participants are knowledgeable enough and have good computing skills in cybersecurity, vulnerabilities, attacks, and the impact of security breaches. 35% of the participants answered the questions correctly followed by classifying different

malicious software and anti-malware tools to use at 30%. The three items in rank three to five are considered the three least-achieved computing skills in the logical and critical thinking domain. First among the least achieved skills is—identifying computing hardware, software development, and IT services industries wherein only 10% of the participants got the correct answer. Second least achieved is explaining the different jobs, functions, professions, and careers in the field which had a result of 15%. Third least achieved is applying a code of ethics for ICT professionals at 20%.

Table 1. The least-achieved computing skills in introduction to computing in the logical and critical thinking domain

Logical and Critical Thinking Domain	%	RANK
1. Explaining cybersecurity, vulnerabilities, attacks, and impact of security breaches.	35%	1
2. Classifying different malicious software and anti-malware tools to use.	30%	2
3. Applying code of ethics for ICT Professionals	20%	3
4. Explaining the different jobs, functions, professions, and careers in the field.	15%	4
5. Identifying computing hardware, software development and IT services industries.	10%	5

Table 2 presents the ranking of the computing skills in the technical domain. The computing skills are ranked from highest to lowest based on how many percent of the participants answered the questions correctly under a particular computing skill. The results show that the participants are knowledgeable enough and have good computing skills on discussing internet protocols since 60% of the participants answered the questions correctly, followed by explaining computer networks and internet at 50% and assembling and disassembling personal computer unit at 35%.

The three items in rank four to six are considered the three least-achieved computing skills in technical domain. First among the least achieved is explaining the components of computer system wherein only 15% of the participants got the correct answer. Second is evaluating the different types of software which had a result of 25%. Third is identifying the different input, output, processing and storage devices‖ at 30%.

Table 2. The least-achieved computing skills in introduction to technical domain

Technical Domain	%	RANK
1. Discussing Internet Protocols	60%	1
2. Explaining Computer Networks and Internet	50%	2
3. Assembling and disassembling personal computer unit	35%	3
4. Identifying the different input, output, processing and storage devices	30%	4
5. Evaluating the different types of software	25%	5
6. Explaining the components of computer system	15%	6

Table 3 presents the ranking of the computing skills in analytical domain. The computing skills are ranked from highest to lowest based on how many percent of the participants answered the questions correctly under a particular computing skill. The results show that the participants are knowledgeable enough and have good computing skill on creating table in a webpage in which 60% of the participants answered the questions correctly followed by identifying the structure of a tag and outline algorithm at 55% and creating, saving and viewing HTML document at 45%.

The three items in rank five to seven are considered the three least-achieved computing skills in analytical domain. First among the least achieved is inserting graphics into a Webpage‖ wherein only 15% of the participants got the correct answer. Second is building a link from one page to another and link to a page on a different website‖ which had a result of 20%. And, third is applying aligning of text, adding line break and horizontal rule and creating list at 25%.

Table 3. The least-achieved computing skills in introduction to computing in analytical domain

Analytical Domain	%	RANK
1. Creating a table in a webpage.	60%	1
2. Identifying the structure of a tag and outline algorithm.	55%	2
3. Creating, saving and viewing HTML document.	45%	3
4. Applying background and highlight.	40%	4
5. Applying aligning of text, adding line break and horizontal rule and creating list.	25%	5
6. Building a link from one page to another and linking to a page on a different website.	20%	6
7. Inserting graphics into a Webpage.	15%	7

The test results reveal that in relation to the least-achieved computing skills in the areas of logical and critical thinking, technical, and analytical domains, even students who have already taken the course Introduction to Computing still possess skills that are not yet fully developed. The participants' learning may be impeded by poor memory retention. Furthermore, because the researchers encountered pauses and changes in the mode of learning, learners may struggle to recall all of the necessary abilities that are required in the topic. They specifically created online/offline mode video lessons for Introduction to Computing to assist BS Information Technology students in developing the least-obtained computing skills for the course Introduction to Computing. The findings are significantly corroborated by the study of Almarbheh *et al.* [47], which stated that exposure to digital films promotes analytical thinking and problem-solving abilities, allowing for an effective method of synthesizing, analyzing, and evaluating knowledge and/or information.

B. Video Lessons for the Course Introduction to Computing

The video lessons for the course Introduction to Computing were created as an alternative classroom teaching and learning strategy popularly used in today's educational environments. It is a contextualized additional learning resource based on the least-obtained computer abilities of first-year BS Information Technology students in terms of analytical, logical, and critical thinking, as well as technical domains. It is advised that learners use contextualized instructional resources to help them grasp important learning abilities [48, 49].

The data gathered during the analysis stage was used to design and develop the Introduction to Computing

online/offline mode video lessons, which integrated the three domains of computing skills through learning content and formative assessments. For video recording, the researchers tapped the expertise of a cameraman fully rigged with equipment (video camera, tripod, lighting, and microphone). The video lessons were produced using a condenser microphone for audio recording, along with video editing software programs such as Sony Vegas Pro 14 and Canva.

Use of video lessons to achieve instructional objectives seeks to increase students' capacity for self-directed learning as well as develop their positive attitude throughout the course Introduction to Computing. Instructional materials must be self-directed so that students may finish them without the help of an instructor [50, 51]. This may also be used as an intervention tool for students struggling with the said course.

The researchers hoped that by using these video lessons to study Introduction to Computing, the students would acquire the following computing skills in terms of analytical domain such as (a) apply aligning of text; add line break and horizontal rule and create list; (b) build a link from one page to another and link to a page on a different website; and (c) insert graphics into a webpage, in terms of logical. For critical thinking domain, the following skills are: (a) apply code of ethics for ICT Professionals; (b) explain the different jobs, functions, professions and careers in the field; and (c) identify computing hardware, software development and IT services industries; in terms of technical domain (a) identify the different input, output, processing and storage devices; (b) evaluate the different types of software; and (c) explain the components of computer system.

The researchers shared the video lessons via Share-it, a mobile application, so that students can watch them offline. Also, the researchers uploaded the video lessons in her YouTube channel for those students who have internet connection so that they can watch them online. When using video lessons, learners are encouraged to use laptops, mobile phones and tablets. Since the video can be uploaded to different media platform in this time of pandemic and during face-to-face modality, students can save the video in their USB flash drive or in their mobile phone gadget which they can review even after class.

Furthermore, Merrill's [42] four-phase teaching approach served as a guide in framing the sequencing and presentation of themes in the building of the instructional video lesson template. While sequencing is dependent on many variables, including content, learner, and outcome, many instructional models suggest that the most effective learning products or environments are problem-centered and include four phases of instruction: activation of prior experience, demonstration of skills, application of skills, and integration of these skills into real-world activities.

It is also vital to highlight that no infringement of intellectual property rights is intended in these video tutorials. The author does not own the photos, graphics, or music used in the video tutorials, since they are the rightful owners' property. The owner's and/or organization's names, as well as the internet address from where it was taken, were identified and put in the reference list. The video courses created are non-profit tools solely intended for educational purposes.

Table 4 shows the outline of the computing skills, topics, and necessary parts of the video lessons for the course Introduction to Computing. The least-achieved computing skills were addressed in the different topics of the video lessons. In the domain of logical and critical thinking domain, three video lessons were developed, each focusing on one computing skill that was least achieved. These lessons cover Unit 1: Industry in the Profession and are divided into three separate video sessions. In the technical domain, there were two video lessons. Video Lesson 4 incorporated computing skills that were least-achieved, while Video Lesson 5 addressed one such skill. These lessons pertain to Unit 2: Components of computer and are divided into two distinct video sessions. In the analytical domain, there was one video lesson encompassing the three least-achieved computing skills. This lesson relates to Unit 3: Hypertext Markup Language and is presented in a single video session.

Table 4. The outline of the computing skills, topics, and necessary parts of the developed video lessons for introduction to computing through online/offline mode

	Units and Lessons	Topics	Computing Skills
Logical and Critical Thinking Domain	Unit 1:	Industry in the Profession	
	Lesson 1:	Computer and Information Technology Industries	Identify computing hardware, software development and IT services industries Explain the different jobs, functions, professions and careers in the field
	Lesson 2:	IT Professions and Career	Apply code of ethics for ICT Professionals
	Lesson 3:	Code of Ethics for ICT Professionals	
Technical Domain	Unit 2:	Components of Computer System	Explain the components of computer system
			Identify the different input, output, processing and storage devices
			Evaluate the different types of software
			Apply aligning of text, add line break and horizontal rule and create list
	Lesson 1:	Elements of the Computer System	
	Lesson 2:	Software and Operating Systems	Build a link from one page to another and link to a page on a different website
Analytical Domain	Unit 3:	Hypertext Mark-up Language	Insert graphics into a Webpage
	Lesson 1:	HTML Basics	
	Parts of Video lessons	a. Introduction	e. Content
		b. Topics of the Video lessons	f. Activation
		c. Author's Note	g. Demonstration
		d. Learning Outcomes	h. Application
			i. Integration
			j. References

The suggestions and comments of the experts were integrated in all six video lessons. Thus, a video material for the course Introduction to Computing was developed. The outstanding pedagogical features of the video material were designed to help students with no background in computing to clearly understand the concepts and their applications in real-life situations.

C. The Evaluation of the Acceptability of the Video lessons for the Course Introduction to Computing

This section addresses the acceptability of video lessons in general and in terms of content, instructional quality, technological quality, presentation and arrangement, information correctness and up-to-datedness, and evaluation. The mean and standard deviation were used to calculate the evaluator's opinion of the degree of acceptability of the created video lessons. Table 5 shows the evaluator's overall and detailed evaluation of the acceptability of the video lessons.

Table 5. The overall evaluation of the level of acceptability of video lessons

Category	SD	M	Description
1. Content	0.26	3.79	Very acceptable
2. Constructional Quality	0.02	3.68	Very acceptable
3. Overall Technical Quality	0.15	3.65	Very acceptable
4. Presentation and Organization	0.22	3.64	Very acceptable
5.Accuracy and Up-To-Datedness of Information	0.08	3.64	Very acceptable
6. Assessment	0.07	3.71	Very acceptable
Overall Rating	0.10	3.69	Very acceptable

Note. n = 7. Interpretation is based on the following scale/criteria: 1.00–1.50 = Barely Acceptable, 1.51–2.50 = Moderately Acceptable, 2.51–3.50 = Acceptable, 3.51–4.00 = Very acceptable.

The results show that, as an entire group, the evaluator's evaluation of the level of acceptability of the video lessons was very acceptable (M = 3.69, SD = 0.10). In terms of content, it was very acceptable (M = 3.79, SD = 0.26), which was rated the highest, while the instructional quality was also evaluated as very acceptable (M = 3.68, SD = 0.02). Moreover, the evaluator's evaluation of the level of acceptability of the video lessons in terms of overall technical quality was very acceptable (M = 3.65, SD = 0.215), whereas the presentation and organization were similarly rated very acceptable (M = 3.64, SD = 0.22). Lastly, evaluator's evaluation of the accuracy and up-to-datedness of information was very acceptable (M = 3.64, SD = 0.08), even though it was rated the lowest among other categories, and the assessment was also very acceptable (M = 3.71, SD = 0.07). This means that the video lessons met expectations. The very acceptable rating in terms of content, instructional quality, technical quality, presentation and organization, information accuracy and up-to-datedness, and assessment of the video lessons suggests that it can serve as an effective instructional material in learning for the course Introduction to Computing.

The findings above agree with the research conducted by Bacio and Sagge [2, 52], underscoring the importance of instructional materials being suitable for their intended users, contingent upon acceptable aims, content, activities, and evaluation. This concurrence further strengthens the outcomes established by Embajador's study [53], emphasizing that a high level of evaluation indicates instructional materials being optimally utilized by instructors to enhance student learning.

Additionally, the study findings resonate with the assertions made by Almarbheh *et al.* [47], who asserted that video lessons endowed with distinctive features, such as round-the-clock availability, accessibility from any location, formally curated content, and up-to-date lessons, contribute significantly to student and teacher benefits, notably improving engagement in classroom activities.

These outcomes find robust support in the positive and insightful comments from validators and evaluators, exemplified by statements such as: (a) "The meticulous preparation of these films, coupled with the quality of voice and incorporation of processing questions in the discussion, is commendable. The adaptability for both synchronous and asynchronous learning is evident. The learning outcomes are clearly defined from the outset, elucidating the purpose of the films, with essential references appropriately listed;" (b) "The video's relevance and engaging activities are noteworthy, fostering the development of thinking skills with a diverse range of assessments;" (c) "The video lessons stand out for their natural delivery of topics and simple yet effective video editing;" and (d) "Congratulations on crafting video lessons that captivate learners, perfectly tailored to their needs."

The researchers also took into consideration some suggestions and insights after the video lessons had undergone evaluation. Their suggestions include as follows: (a) The learning outcomes must be in line with the task; (b) Proper capitalization of words in the caption should be observed, and there is a question posed on the first video asking for the students' learning tools utilized during the conduct of the lesson proper. There are also times that the discussion and explanation of the lesson seem to be delivered rather fast. The target audience was not stated as well in the video, so I assumed that this is for first-year ICT students since it is about introduction to computing; (c) Some tasks require sufficient reading time; thus extra time may be provided; (d) When there is no text presented it will be better to focus the speaker towards the middle of the screen; (e) When there is activity like listing down, enough time should be given to the audience; and (f) The volume should be audible enough throughout the lesson.

IV. Conclusion

The findings on the least-achieved computing skills (i.e., analytical, logical, and critical thinking domains) show that completion of the course introduction to computing does not necessarily mean that the skills are fully acquired. It's conceivable that the student's learning is being impeded by poor retention.

Based on the findings of the study, the video lessons created for the course Introduction to Computing can be considered as an appropriate learning material for online/offline modalities especially for instruction during the pandemic period when physical classroom interaction is limited or disallowed. The videos are also uploaded to the researcher's YouTube account, so students with internet access can watch them online. Students may just listen to and watch the snippets, then answer the questions addressed after the completion of each subtopic promoting comprehension. They could pause and resume the videos whenever and wherever they feel they want to, making them more adaptable.

The findings also demonstrated that the evaluators' assessment of the degree of acceptance of video courses was quite favorable. This signifies that the generated video

lessons fulfilled the instructional development standards and were aligned with the students' interests and course requirements. Moreover, this indicates that the generated video lectures may be utilized by both professors and students for the course Introduction to Computing. In general, expert opinions and comments on the prepared video courses were good. It simply implies that this material can be used not just by students within the university system, but also by students from other institutions enlisting a BS Information Technology course.

Conducting video lessons provides a means for teachers to reach students who may not be able to attend in-person classes, while keeping them practically engaged and motivated to go through the lessons. It also allows teachers to explain concepts in a visual way, which can be especially helpful for students who learn best through visual means. Video lessons can be recorded and replayed, allowing unlimited access for students to review the materials. This can be especially helpful for students who need extra help understanding concepts. Overall, the video lessons can provide a more personalized learning experience, as teachers can tailor-fit the content to the individual needs of their students.

The findings of this study are expected to contribute knowledge and insights to the field of research and extension work, learning and instruction, and future research. The utilization of video lessons in education has been extensively researched in the past. However, this paper introduces a fresh collection of empirical data regarding the effectiveness of video lessons in the less conventional course of Introduction to Computing. The participants' inclusion in the study was limited in a specific set of characteristics and requirements. This study involved students enrolled in a BSIT program, encompassing diverse demographics and various learning preferences and styles. Moreover, video lessons were used and applied in this study amidst a newer education setup. The array of variables, pertinent to the objective of this study, provide groundwork for future research that has potential to expand into other areas, digging into more specific variables involved, and even in integrating this strategy in other areas of education.

Furthermore, conducting similar and related studies can possibly derive insights and ideas about the development and usage of video lessons in education; particularly, in teaching. Therefore, they may use the data and results of this study as a guide and basis for their research undertaking; considering the research design, participants and samples, instruments, and data gathering procedures. Finally, the video lessons can serve as a valuable intervention in both experimental and comparative studies, enabling the assessment of their impact and efficiency. Additionally, the incorporation of qualitative analysis can further enhance the scope for comprehensive evaluation."

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

Torion, designed, conducted the research, and developed the paper; Bacio contributed by providing advice and suggestions for the improvement of the study, checking the manuscript, proofreading the article, and finalizing the format. All authors approved the final version.

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