

Instructional Module in Computer Programming as a Psychological Strategy to Ensure Continuity of Learning amidst the Pandemic

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Abstract

This study aimed to design, develop, and evaluate an instructional module in computer programming to ensure continuity of learning despite the challenges posed by the Covid-19 pandemic. The study aimed to create an interactive supplemental learning material that supports independent learning and covers the essential concepts and skills in computer programming fundamentals. It also aimed to evaluate the module's acceptability as to format, language, content and activities/assessment. The instructional module was developed using the Analysis-Design-Development-Implementation-Evaluation (ADDIE) methodology. The resulting text-based module with reinforcement of the course website included topics such as two-part Introduction to Programming, Getting to Know the Programming Environment, Programming Fundamentals, Control Structures and Arrays which were presented in an engaging and interactive manner. The language used was English while a variety of assessment and activities were embedded to regularly evaluate the students' knowledge and skills. Fifty- two purposively chosen Bachelor of Science in Information Technology students enrolled in computer programming course of Iloilo State College of Fisheries –San Enrique Campus served as the respondents of the study. Each student was given a copy of the printed module. Then on the last day of the class for 1st Semester AY 2022-2023, a questionnaire-checklist was administered to gather data on their acceptability of the developed module. Results showed that as to format, language, and activities/assessment, the instructional module got 4.41, 4.35, and 4.34 respectively which were described as "Very Satisfied". The module's content got a mean score of 4.19 which was described as "Satisfied". Overall, the module got a grand mean of 4.32 which was described as "Very Satisfied". It was recommended to review the content of the instructional module for its improvement. This study was conducted on April 2021 to December 2022.

Index Terms— computer programming, instructional module, learning continuity, pandemic

I. INTRODUCTION

As a result of the Covid-19 pandemic, typical classroom learning has been interrupted, causing difficulties for educational institutions and students everywhere. As a result, a lot of colleges and universities such as the Iloilo State College of Fisheries (ISCOF) have started using a blend of online and module-based education as a substitute for conventional classroom training. This change hasn't been without challenges, either, since both students and teachers have had to become used to new ways of learning.

Instructional modules have become a feasible method for guaranteeing learning continuity in response to these difficulties. Self-contained chunks of training known as instructional modules can be used to augment or take the place of traditional classroom instruction. They can be made to cover key ideas and abilities in a given subject area and facilitate autonomous study. Several educational contexts have employed instructional modules, and have been shown to be effective in supporting learning outcomes.

Instructional modules can improve students' knowledge acquisition and retention in a variety of academic areas, according to earlier studies. For instance, Bakla et al(2018) .'s study discovered that using instructional modules to teach science enhanced students' performance and attitudes about the topic. In a similar vein, Qayyum et al(2017) .'s research revealed that instructional modules were successful in enhancing students' learning results in mathematics.

Instructional modules have also been utilized to facilitate independent learning and supplement conventional classroom training in the field of computer programming. An instructional module was created, for instance, in a study by Bote-Lorenzo et al. (2007) to facilitate self-directed learning in computer programming. The module, which was created to cover fundamental programming concepts and abilities, was successful in enhancing students' knowledge acquisition and retention.

Given how well instructional modules support learning objectives, the goal of this study was to design, implement, and assess a computer programming instructional module to maintain learning continuity despite the constraints given by the Covid-19 epidemic. The instructional module was created using the Analyze-Design, Develop, Implement, and Evaluate (ADDIE) approach, and its acceptability was assessed in terms of its format, language, content, activities, and assessment.

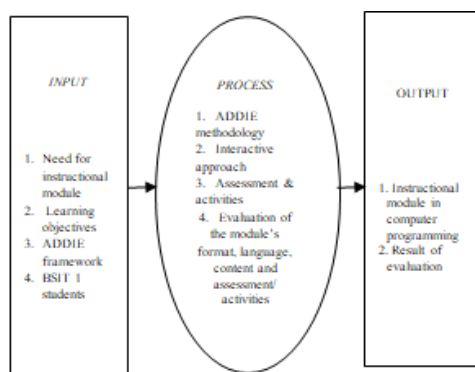
II. METHODOLOGY

A. Theoretical Framework

This study can be grounded in constructivist learning theory, which places emphasis on how important it is for students to actively develop their own knowledge via their experiences, which is in line with the usage of instructional modules in computer programming that encourage independent learning (Jonassen, 1999). The instructional module can inspire students to take an active role in their learning and create their own understanding of the ideas and abilities in computer programming by offering an interactive and engaging learning experience. The core of the constructivist perspective, according to Jonassen (1999), is the production of meaning by learners and the social context in which this takes place (p. 215). Giving students the chance to reflect on their own learning and actively create new knowledge, evaluation, and activities integrated into the instructional module further enhances the constructivist approach. Additionally, the constructivist approach's primary principle of learner-centered instruction can be supported by the usage of instructional modules as supplemental learning materials (Kumar & Bhatia, 2020).

B. Conceptual Framework

The study makes use of the concept of Input-Process-Output as reflected in Fig. 1. The identified inputs are the (a) need for supplemental learning material in computer programming due to challenges posed by the Covid-19 pandemic; (b) analysis of learning objectives and target audience; (c) ADDIE methodology as a framework for instructional module development; and (d) Bachelor of Science in Information Technology 1 students as the target audience. Whereas, the process includes (a) the design and development of an interactive instructional module in computer programming using the ADDIE methodology; (b) the incorporation of essential concepts and skills in computer programming fundamentals; (c) the use of an engaging and interactive approach to encourage active learning and constructivist approach; (d) embedding of assessment and activities to evaluate knowledge and skills regularly; and (e) evaluation of the module's acceptability as to format, language, content, and activities/assessment through a questionnaire-checklist administered to the students. The outputs are (a) an instructional module in computer programming as a supplemental learning material for Bachelor of Science in Information Technology 1 students; and (b) results of the evaluation as a basis for module improvement.



C. Research Design

This study made use of descriptive-developmental research design as it focused on the development and evaluation of instructional modules in computer programming to ensure continuity of learning despite the challenges posed by the Covid-19 pandemic.

D. The ADDIE Model

By following the ADDIE methodology in the development of the instructional module in computer programming, the researcher/designer can ensure that the module is effective, efficient, and engaging for the learners. The specific activities performed in each phase of ADDIE are discussed in the following:

Analysis. During this phase, the learning objectives for the instructional module were identified making sure that they aligned with the course and program's intended outcomes of information technology. Then, an interview was conducted with the target audience to determine their level of knowledge and skills in computer programming. Finally, constraints, resources available, and appropriate platforms for instruction delivery were identified

Design. In this phase, instructional strategies that will be used to achieve the learning objectives such as discussion, demonstration, and hands-on activities were selected. Then, assessment methods that will be used to evaluate the learner's knowledge and skills in computer programming such as quizzes, activities, assignments, and laboratory exercises were developed. Different media and materials to be used during the delivery of instruction such as online videos, course website, chat groups, avatars, and online classroom codes and links were embedded in the text-based module. Finally, the instructional flow and structure of the module, including the order of topics, the pacing of instruction, and the interaction between learners and the instructional materials were designed.

Development. Using the prototype created in the design phase as the blueprint, the instructional module was developed. The sections and structure were based on the approved institutional format while the content was based on the syllabus reviewed and approved by the committee. The text-based module was developed using a word processor and a portable document format (pdf) version was produced. Other elements in the module such as badges, certificates, logos and cliparts were developed using online graphic designing tools. The course website was developed using a templated website builder and was passcode-protected.

Implementation. During this phase, the developed instructional module was presented to the faculty of the ISUFST/ISCOF system for critiquing. Also, the module was pilot-tested to BSIT students from other campuses. The materials were revised based on the suggestions and comments from the learners and stakeholders.

Evaluation. In this phase, summative evaluations to measure the effectiveness of the instructional module in achieving the learning objectives were conducted. Also, the instructional module was submitted to the external evaluation committee, one unit every two weeks for detailed evaluation. Written comments and feedback were reflected in the evaluation form. Proper revisions were made based on the evaluation results before the module is printed or uploaded for distribution. Appropriate revisions to the course website were also made.

E. Locale of the Study

This study was conducted at Iloilo State University of Fisheries Science and Technology previously known as Iloilo State College of Fisheries, San Enrique Campus, San Enrique, Iloilo, Philippines.

F. Respondents

The respondents of the study were the fifty-two (52) first-year students taking the Bachelor of Science in Information Technology program who were enrolled in the first semester of the Academic Year 2022-2023.

G. Sample Size and Sampling Technique

Using the Slovin formula, 52 was derived as the sample size from the population of 60 students. These students were determined using the electronic draw lots.

H. Research Instrument

The 20-item questionnaire on the “Evaluation of Developed Learning Material” (Anzures & Locara, 2022) was used to determine the acceptability of the instructional module as to its format, the language used, content, and activities and assessment.

The following scale with its corresponding description was used to interpret the scores:

Mean Scores	Description
4.20 - 5.00	Very Satisfied
3.40 – 4.19	Satisfied
2.60 – 3.39	Moderately Satisfied
1.80 – 2.59	Dissatisfied
1.00 – 1.79	Very Dissatisfied

I. Data Analysis Procedure

The data generated from the acceptability of the developed instructional module was statistically analyzed using the frequency and mean. Frequency was used to determine the profile of the respondents while mean was used to determine the level of acceptability of the developed module as to its format, language used, content, and activities/assessment as perceived by the respondents.

III. RESULTS AND DISCUSSIONS

The Instructional Module in Computer Programming was developed to address the need to continue the teaching-learning endeavors of the college despite the challenges posed by Covid-19. Students were immersed in a new normal environment where limited face-to-face classes were conducted. The module was carefully developed based on ADDIE methodology and it was subjected to user acceptability.

A. The Developed Instructional Module

1. The Cover Page. The Cover Page reflected in Fig.2 features a blurred image of a student coding from her personal computer, while prominently displaying the institutional logos of the five campuses of ISCOF namely Main Tiwi, Barotac Nuevo, Dingle, Dumangas, and San Enrique.



Fig. 2. The Cover Page



Fig. 3. The Letter to the Students

2. The Letter to the Students Page. This welcoming page shown in Fig. 3 sets the tone and expectations of the students who will be using the module. It provides an overview of the course as well as what they should expect to learn from the course. The letter was written to establish a connection between the instructor and students, even in a remote or asynchronous learning environment.

3. The Preliminary Pages. The preliminary is composed of pages for the Vision-Mission-Goals-Objectives of the College, the BSIT program and Computer Programming course intended learning outcomes, the course description and requirements, the course outline, and descriptions of activity icons, badges, and tokens. These pages provide important context, structure, and guidance for students as they engage with the instructional module. They can help the students understand the relevance and importance of the module, set clear expectations for what they need to do and learn and stay organized and engaged throughout the computer programming learning process. The selected Preliminary Pages are shown in Fig 4a. and Fig. 4b.



Fig.4a. Preliminary Page(a) Fig.4a.Preliminary Page(b)

4. The Unit Introduction Page. This page as shown in Fig.5 serves several purposes in the instructional module. Firstly, it features a quote from a well-known programmer, which may help to inspire and engage learners. Additionally, it provides a brief overview of the topics that will be covered in the unit. The learning objectives for the unit are also presented on this page, helping students to understand what they should expect to learn and achieve. Finally, a motivational activity is included, which might take the form of a brain teaser or puzzle related to computer programming or information and communication technology (ICT) in general. This activity aims to stimulate learners' curiosity and interest, encouraging them to actively engage with the material.



Fig.5. Unit Introduction Page Fig.6. Learning Content

5. The Learning Content Section. The Learning Content section of the module which is shown in Fig.6 contains a comprehensive discussion of each topic. To enhance the learning experience, an avatar, which serves as a teaching assistant or learning companion, occasionally appears to provide additional information. The avatar may point out supplemental material such as a video or downloadable resource that can be accessed from the course website.

6. The Activities Section. The activities section as reflected in Fig.7a and Fig.7b provides opportunities for learners to apply and reinforce the concepts and skills they have learned. These activities may include exercises, quizzes, and practical tasks that simulate real-world scenarios in computer programming. The activities are designed to be engaging and interactive, with the goal of promoting independent learning and critical thinking among the learners.

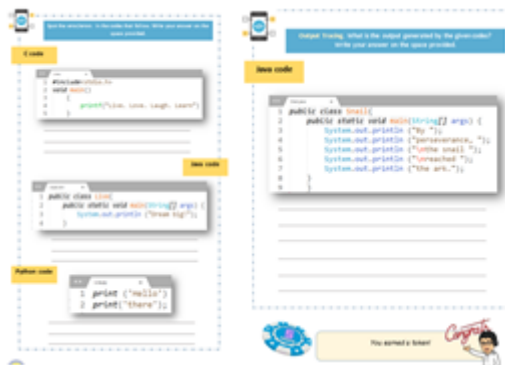


Fig.7a. Activities Section Fig.7b. Activities Section

7. The Assessment Section. The Assessment section as shown in Fig.9 provides a summative evaluation of the students' knowledge and skills related to the topics covered in the particular unit. The assessments were designed so that it aligns with the learning objectives and the content of the unit and gauges the students' progress and determine if they have achieved the intended learning outcomes. The results of the assessments help the instructor to identify areas of improvement and adjust the instruction accordingly. Additionally, assessments motivate students to study and review the content more thoroughly.

8. The Unit Accomplishment Page. This page as shown in Fig.10 serves as a congratulatory section for the learners who have successfully completed the lessons, activities, and assessments. An avatar provides the congratulatory message, and the learners are awarded badges and certificates for their achievements. Furthermore, this page provides a brain teaser or a puzzle that the learners must solve to unlock the next unit, adding an element of fun and engagement to the learning process.



Fig. 9. Assessment Page



Fig.10. Accomplishment Page

B. The Computer Programming 1 Course Site

1. The Home Page. The Home Page of the course site as shown in Fig.11 contains a welcome message from the subject teacher. It also contains a photo of the faculty and staff of ISCOF and some random photos of the faculty and students of the College of Computer Studies. Tabs for Lessons, Downloads, and References were created to facilitate ease of navigation.

2. The Lessons Page. Reflected in Fig.12 is the Lessons Page that outlines the topics included in the course. Each topic links to its dedicated page.



Fig.11. The Home Page

Fig.12. The Lessons Page

3. The Topics Page. The Topics Page shown in Fig.13 simply reinforces the discussions found in the text-based instructional module. It mainly contains embedded lessons presented in a video format. The video lessons embedded were taken from video-sharing sites which were evaluated by the subject teacher and found to be appropriate and relevant to the topic.

4. The Downloads Page. One of the most essential aspects of teaching computer programming is the availability of tools such as installers of code editors, compilers, assemblers, and integrated programming development (IDE). For convenience on the part of the students, these tools are made available for download through the course site as presented in Fig.14.



Fig.13.The Topics Page

Fig.14. The Downloads Page

C. Evaluation of the Developed Instructional Module

Table I shows the result of the evaluation of the developed learning module. Based on the results of the evaluation, the respondents have a high level of satisfaction with the module, as evidenced by the mean score of 4.32, which is closer to the maximum score of 5. The respondents' satisfaction is also high for the different aspects of the module. They were "Very Satisfied" with the module's Format, Language Used, and Activities/Assessment, as indicated by their mean scores of 4.41, 4.35, and 4.34, respectively.

However, the respondents were only "Satisfied" with the module's Content, as indicated by their mean score of 4.19. This suggests that while the respondents generally found the module's content acceptable, there may be some areas where the module could be improved to increase satisfaction.

Overall, the evaluation results suggest that the module is generally well-received by the respondents and that it is effective in meeting their expectations in terms of format, language, and activities/assessment. The module's content may require further refinement to improve overall satisfaction, but the satisfaction level is still relatively high.

Table I. Result of the Evaluation of the Developed Instructional Module

Instructional Module	Mean	Interpretation
A. As a whole	4.32	Very Satisfied

B. Format	4.41	Very Satisfied
C. Language Used	4.35	Very Satisfied
D. Content	4.19	Satisfied
E.Activities/Assessment	4.34	Very Satisfied

IV. CONCLUSION

Based on the results of the evaluation, it can be concluded that the instructional module in computer programming that was developed using the ADDIE methodology was effective in ensuring continuity of learning despite the challenges posed by the Covid-19 pandemic. The high level of satisfaction expressed by the Bachelor of Science in Information Technology 1 students in terms of the module's format, language used, and activities/assessment suggests that the instructional module was well-structured, engaging, and effective in supporting independent learning.

While the slightly lower mean score for content suggests that there may be some areas for improvement, the overall high level of satisfaction expressed by the students suggests that the module was successful in achieving its goals. The instructional module could serve as a model for the development of other supplemental learning materials for other subject areas or for use in other educational settings, particularly in situations where traditional classroom learning is disrupted.

V. RECOMMENDATIONS

Based on the results of the study, the following recommendations are advanced:

1. The content of the instructional module may be reviewed and revised as necessary to ensure that it fully meets the needs of the target audience and covers all the essential concepts and skills in computer programming fundamentals.
2. The use of instructional modules and other technology-based tools and resources should be encouraged in other subject areas and educational settings, particularly in situations where traditional classroom learning is disrupted.
3. Further research could be conducted to evaluate the effectiveness of instructional modules and other technology-based tools and resources in supporting independent learning and ensuring continuity of learning during times of crisis or disruption.
4. Teachers and educators should be provided with adequate training and support in the development and implementation of instructional modules and other technology-based tools and resources to ensure that they are used effectively and to their full potential.

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AUTHOR'S PROFILE



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