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DEVELOPMENT AND EVALUATION OF A WEB-BASED MODULAR LEARNING PROGRAM FOR COMPUTER TECHNOLOGY: BASIS FOR INSTRUCTIONAL INNOVATION

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ABSTRACT: This research developed and evaluated a Web-Based Learning Program (WBLP) for the Computer Technology program at Cebu Technological University–San Francisco Campus as a foundation for instructional innovation. Specifically, it examined the program's technical requirements, assessed its conformity to ISO/IEC 25010 software quality standards, determined its acceptability based on the Unified Theory of Acceptance and Use of Technology (UTAUT), identified the challenges encountered during development, and explored its potential for adoption and diffusion among intended users. The study employed a descriptive-developmental research design guided by the ADDIE instructional design model, which involved analysis, design, development, implementation, and evaluation. A total of 473 respondents participated in the study, comprising 393 students, 75 faculty members, and 5 information technology experts, selected through random sampling. Data were gathered using validated researcher-developed questionnaires and analyzed through frequency, percentage, weighted mean, and standard deviation. The findings indicated that the WBLP met the identified technical requirements, obtaining an overall mean of 3.99, interpreted as "agree." The program also achieved a high level of conformity with the assessed ISO/IEC 25010 software quality criteria, with an overall mean of 3.88. Furthermore, its acceptability was rated highly under the UTAUT framework, with an overall mean of 4.25, interpreted as Strongly Agree. Financial and resource constraints emerged as the principal challenges during development. These findings suggest that the developed WBLP has favorable technical and quality characteristics and is acceptable to its intended users. Its positive evaluation also indicates potential for adoption and wider diffusion, although sustained use and broader implementation require further assessment. The study recommends strengthening institutional support, providing user orientation, improving technical resources, and conducting continued monitoring to support the program's integration into computer technology instruction and promote instructional innovation.

Keywords: Technology Management, Web-Based Learning Program, Computer Technology, Instructional Innovation, ADDIE Model, ISO/IEC 25010, UTAUT, Technology Integration, CTU-Main Campus, Cebu Philippines

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DEFINITION OF TERMS

The following terms are defined conceptually and operationally to clarify their meanings and applications in the study entitled "Development and Evaluation of a Web-Based Modular Learning Program for Computer Technology: Basis for Instructional Innovation."

Adoption. Conceptually, adoption refers to the decision to accept and use an innovation or technology. Operationally, it refers to the potential willingness of instructors and students to use the developed web-based modular learning program in computer technology instruction.

Behavioral Intention. Conceptually, behavioral intention refers to an individual's willingness or plan to perform a particular behavior. Operationally, it refers to the respondents' intention to use the developed program for teaching or learning computer technology.

Computer Technology. Conceptually, computer technology refers to the knowledge and practical skills involved in using, managing, and maintaining computer systems and related technologies. Operationally, it refers to the subject area addressed by the learning modules, practical exercises, and assessment activities integrated into the developed program.

Developmental Research Design. Conceptually, developmental research involves the systematic design, development, and evaluation of an instructional product or intervention. Operationally, it refers to the research approach used to plan, develop, test, and evaluate the web-based modular learning program.

Effort Expectancy. Conceptually, effort expectancy refers to the perceived ease associated with using a technology. Operationally, it refers to the respondents' perceptions of how easy the developed program is to learn, navigate, and operate.

Facilitating Conditions. Conceptually, facilitating conditions refer to the perceived availability of resources and support needed to use a technology. Operationally, they refer to the availability of devices, internet connectivity, technical assistance, and other resources that support the use of the developed program.

Functional Suitability. Conceptually, functional suitability refers to the extent to which a software product provides functions that meet specified needs. Operationally, it refers to the extent to which the program's features support its intended computer technology instructional and assessment tasks.

Instructional Innovation. Conceptually, instructional innovation refers to the introduction or improvement of teaching and learning approaches through new methods, tools, or technologies. Operationally, it refers to the use of the developed web-based modular learning program as an alternative or supplementary approach to delivering computer technology instruction.

ISO/IEC 25010. Conceptually, ISO/IEC 25010 is an international standard that provides a model for specifying and evaluating software product quality. Operationally, it serves as the basis for assessing the selected software quality characteristics of the developed program.

Modular Learning Program. Conceptually, a modular learning program organizes instructional content into separate, structured learning units that address specific topics or competencies. Operationally,

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it refers to the collection of computer technology lessons, demonstrations, exercises, and assessments organized into modules within the developed web-based platform.

Performance Expectancy. Conceptually, performance expectancy refers to the degree to which an individual believes that using a technology will provide benefits in performing tasks. Operationally, it refers to the respondents' perceptions of how the program may improve access to learning materials, understanding of lessons, and completion of computer technology learning activities.

Portability. Conceptually, portability refers to the ability of a software product to be transferred or adapted for use across different environments. Operationally, it refers to the program's ability to operate in its intended computing environments, browsers, or devices, as assessed in the study.

Reliability. Conceptually, reliability refers to the ability of a software product to perform specified functions under specified conditions for a specified period. Operationally, it refers to the consistency and dependability of the developed program during testing and evaluation.

Security. Conceptually, security refers to the protection of information and systems against unauthorized access and other security threats. Operationally, it refers to the safeguards provided by the program for user accounts, learning records, assessment results, and other information processed by the system.

Software Quality. Conceptually, software quality refers to the degree to which a software product satisfies specified requirements and quality characteristics. Operationally, it refers to the quality of the developed program as assessed using the selected criteria of ISO/IEC 25010.

Social Influence. Conceptually, social influence refers to the extent to which an individual perceives that important people believe they should use a particular technology. Operationally, it refers to the influence of instructors, classmates, administrators, or other relevant individuals on respondents' willingness to use the program.

Technology Acceptance. Conceptually, technology acceptance refers to an individual's willingness to adopt and use a technological system. Operationally, it refers to the respondents' perceptions and intentions regarding the use of the developed program, assessed through relevant constructs of the Unified Theory of Acceptance and Use of Technology (UTAUT).

Thematic Analysis. Conceptually, thematic analysis is a qualitative method used to identify, organize, and interpret patterns of meaning within a dataset. Operationally, it refers to the procedure used to analyze open-ended responses or interview data concerning the challenges encountered during program development.

Unified Theory of Acceptance and Use of Technology (UTAUT). Conceptually, UTAUT is a theoretical framework for explaining technology acceptance and use through constructs such as performance expectancy, effort expectancy, social influence, and facilitating conditions. Operationally, it serves as the framework for evaluating users' acceptability of the developed web-based modular learning program.

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Usability. Conceptually, usability refers to the extent to which intended users can use a software product effectively, efficiently, and satisfactorily in a specified context. Operationally, it refers to how easily respondents can navigate the program, understand its features, and complete learning activities.

Web-Based Modular Learning Program. Conceptually, a web-based modular learning program is a digital instructional system accessed through a web browser that presents organized learning modules and related activities. Operationally, it refers to the system developed in this study to provide computer technology lessons, demonstrations, practical exercises, and assessments through an online platform.

INTRODUCTION

Web-based modular learning has become an important instructional approach because it provides learners with flexible access to educational content and learning activities (UNESCO, 2023). Digital learning environments allow students to review lessons, complete exercises, and assess their understanding beyond scheduled classroom sessions (OECD, 2021). In computer technology, web-based modules can support the development of technical knowledge through organized lessons, demonstrations, practical activities, and assessments (UNESCO, 2023). The integration of digital instructional resources can also encourage independent learning and help students manage their learning progress (OECD, 2021). Therefore, developing a structured and accessible web-based modular learning program is a relevant approach to strengthening instructional delivery at Cebu Technological University–San Francisco Campus.

This research focused on the development and evaluation of a web-based modular learning program for computer technology at Cebu Technological University–San Francisco Campus. It involved designing and developing a digital learning platform that organized instructional materials into manageable modules to support flexible, accessible, and self-paced learning. The study determined the program's level of conformity with ISO/IEC 25010 software quality standards and assessed its acceptability using the Unified Theory of Acceptance and Use of Technology (UTAUT). It also identified the challenges and difficulties encountered during the program's development and examined its potential for adoption and diffusion among intended users. These objectives aligned with the broader emphasis on improving the quality, accessibility, and effectiveness of technology-supported education (UNESCO, 2023; OECD, 2021).

UNESCO (2023) emphasized that educational technology can support access, inclusion, instructional delivery, and educational management when its use responds to learners' needs and appropriate pedagogical objectives. The OECD (2021) explained that digital technologies can support personalized learning, help teachers improve instructional practices, and provide opportunities to respond to differences in students' learning needs. Xue et al. (2024) found that UTAUT had been widely applied in higher education research to examine technology acceptance, with performance expectancy emerging as an important factor influencing behavioral intention. ISO/IEC 25010:2023 provides a software product

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quality model that can guide the specification, measurement, and evaluation of software quality characteristics (International Organization for Standardization [ISO], 2023). These perspectives support the development of a web-based modular learning program that considers instructional needs, software quality, and users' acceptance of educational technology (ISO, 2023; UNESCO, 2023).

Although digital technology offers opportunities to improve educational delivery, its effectiveness depends on appropriate implementation, accessibility, and alignment with learning objectives (UNESCO, 2023). The OECD (2021) also identified continuing challenges in maximizing the benefits of digital technologies while addressing equity, inclusion, and implementation concerns. However, the general literature does not establish whether a dedicated web-based modular learning program for computer technology at Cebu Technological University–San Francisco Campus has been developed and evaluated according to ISO/IEC 25010 and UTAUT. The application of software quality standards and technology acceptance measures to this specific program therefore requires contextual investigation, particularly regarding software conformity, user acceptability, and the difficulties encountered during development (ISO, 2023; Xue et al., 2024). This study addressed that context-specific gap by developing and evaluating the program and examining its potential for adoption and diffusion among intended users.

The research was significant because it provided a basis for improving computer technology instruction through an organized and accessible web-based modular learning program. Its evaluation against ISO/IEC 25010 provided a structured approach to examining software quality, while UTAUT offered a framework for understanding users' acceptance of the technology (ISO, 2023; Xue et al., 2024). The program could support students by providing organized learning materials and opportunities to review lessons at their pace, consistent with the potential of digital technology to support more responsive learning experiences (OECD, 2021). It could also assist instructors in supplementing classroom instruction with digital modules, learning activities, and assessments (UNESCO, 2023). Ultimately, the findings could guide the institution in making informed decisions about instructional innovation, program improvement, and the possible wider adoption of web-based modular learning.

REVIEW LITERATURE

Constructivist Learning Theory

Constructivist learning emphasizes that learners actively construct knowledge through experience, exploration, reflection, and interaction with their learning environment, which can be supported by technology-enhanced instructional activities (UNESCO, 2023). Vygotsky’s sociocultural perspective, as applied in contemporary educational research, highlights the importance of social interaction, scaffolding, and teacher guidance in developing learners’ understanding (UNESCO, 2023). In a web-based modular learning program, students can develop their understanding by studying digital lessons, completing interactive exercises, exploring examples, and applying concepts to practical computer technology tasks (OECD, 2021). Learner-centered digital environments can provide

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opportunities for independent study and collaborative activities while allowing teachers to guide students who encounter learning difficulties (OECD, 2021). This theory is relevant to the present study because the developed program is intended to organize instructional materials into modules that support active participation, self-paced learning, and the application of technical knowledge (UNESCO, 2023).

Cognitive Theory of Multimedia Learning

Mayer's Cognitive Theory of Multimedia Learning explains how learners process information presented through words and visual representations, providing a foundation for designing multimedia instructional materials (Mayer, 2021). Contemporary multimedia learning research emphasizes that the design and presentation of instructional content influence how learners select, organize, and integrate information (Mayer, 2021). In a web-based modular learning program, computer technology lessons can incorporate diagrams, screenshots, instructional videos, demonstrations, and concise explanations to clarify technical concepts and procedures (UNESCO, 2023). Carefully organized digital materials can help learners engage with complex information while reducing unnecessary demands on their cognitive processing (Mayer, 2021). This theory is relevant to the study because the quality and organization of multimedia resources can influence how effectively students understand technical concepts and connect theoretical knowledge with practical computer technology applications (Mayer, 2021).

Technology Acceptance Model (TAM)

The Technology Acceptance Model explains technology acceptance through perceived usefulness and perceived ease of use, which influence users' attitudes and intentions toward using a technological system (Granić, 2022). In higher education, technology acceptance frameworks have been widely applied to examine how students and educators respond to digital learning tools and instructional technologies (Xue et al., 2024). Perceived usefulness concerns whether users believe a system improves their learning or instructional performance, while perceived ease of use concerns how easily they can operate the system (Granić, 2022). In the present study, students and teachers can evaluate whether the web-based modular learning program helps them access lessons, complete activities, review learning materials, and support instructional delivery (Xue et al., 2024). The theory is relevant because the successful use of the developed program depends not only on its technical features but also on whether intended users consider it useful and easy to use (Granić, 2022).

Alignment with the study: Since Objective 3 specifies UTAUT, UTAUT should be the primary framework for measuring acceptability, while TAM may be retained as a supporting theory if justified in the conceptual framework (Xue et al., 2024).

Republic Act No. 10173 — Data Privacy Act of 2012

Republic Act No. 10173 establishes safeguards for personal information collected, stored, and processed by public and private organizations, making data protection an important consideration in educational technology systems (National Privacy Commission, 2023). The law is relevant to the web-based modular learning program because the platform may process student accounts, assessment results,

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learning records, and other personal information. Educational institutions should apply appropriate organizational, physical, and technical safeguards when processing personal data, consistent with the principles of transparency, legitimate purpose, and proportionality (National Privacy Commission, 2023). Accordingly, the program should incorporate appropriate access controls, privacy notices, and security measures to protect user information and support responsible information management.

Republic Act No. 8792 — Electronic Commerce Act of 2000

Republic Act No. 8792 provides legal recognition for electronic data messages, electronic documents, and electronic transactions under the conditions established by law (Republic Act No. 8792, 2000). Its policy provisions recognize the role of information and communications technology in national development and support the use of electronic means for handling information and transactions (Republic Act No. 8792, 2000). The law is relevant to the web-based modular learning program because the system may distribute digital learning materials, receive online submissions, and facilitate electronic communication between students and instructors. The program should therefore handle electronic records responsibly and observe applicable legal and institutional requirements when processing and maintaining digital information.

Republic Act No. 10929 — Free Internet Access in Public Places Act

Republic Act No. 10929 established a program for providing free internet access in designated public places, including specified areas in state universities and colleges and other covered institutions (Republic Act No. 10929, 2017). The law is relevant to the proposed program because internet connectivity is necessary for users to access online modules, instructional resources, assessments, and communication features. Access to available public internet facilities may help eligible students and instructors use the platform, although actual access depends on the availability and implementation of the service at the institution (Republic Act No. 10929, 2017). The law supports the broader goal of improving internet accessibility but does not itself require an institution to develop a particular web-based learning platform.

Objectives

1. To develop a web-based modular learning program for computer technology.
2. To determine the level of conformity of the developed program with ISO/IEC 25010 software quality standards.
3. To determine the level of acceptability of the developed web-based modular learning program.
4. To identify the challenges and difficulties encountered during the development of the web-based modular learning program.
5. To determine the potential for adoption and diffusion of the developed technology among intended users.

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MATERIALS AND METHODS

Design

This research employed a developmental research design to develop and evaluate a web-based modular learning program for computer technology, consistent with educational design research approaches that connect the development of interventions with systematic evaluation in authentic educational contexts (Jacobsen & McKenney, 2024). The developmental component focused on planning, designing, developing, and testing the program, while the evaluative component determined its conformity with ISO/IEC 25010 software quality standards and its acceptability based on the Unified Theory of Acceptance and Use of Technology (UTAUT) (International Organization for Standardization [ISO], 2023; Xue et al., 2024). The study also identified the challenges and difficulties encountered during program development and examined the program's potential for adoption and diffusion among intended users, consistent with the need to align educational technology research methods with research questions and practical outcomes (Jacobsen & McKenney, 2024).

Environment

The research was conducted at Cebu Technological University–San Francisco Campus, where the web-based modular learning program for computer technology was developed and evaluated within its intended educational context. The selection of an educational setting was consistent with educational design research, which emphasizes examining instructional interventions in relation to the contexts in which they are intended to be used (Jacobsen & McKenney, 2024). The research environment was considered in terms of the availability of computer facilities, internet connectivity, and instructional resources because access to technological infrastructure is relevant to the implementation and use of digital learning systems (UNESCO, 2023).

Materials and Development Tools

The development of the web-based modular learning program utilized computer hardware, software development tools, internet connectivity, and instructional materials to support the design, programming, testing, and implementation of the system (Jacobsen & McKenney, 2024). The materials included computers or laptops, a web browser, a code editor, a database management system, web development technologies, and a suitable hosting environment, selected according to the system's requirements and intended functions (ISO, 2023). The instructional materials consisted of computer technology learning modules, text-based lessons, illustrations, demonstrations, practical exercises, and assessment activities designed to support the organization and delivery of learning content (UNESCO, 2023). The technologies and software were selected according to the program's functional requirements, accessibility, compatibility, and intended quality characteristics, consistent with the software product quality evaluation framework established in ISO/IEC 25010:2023 (ISO, 2023).

Development Procedure

The development of the web-based modular learning program followed a systematic process aligned with educational design research, which connects the identification of educational needs,

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development of an intervention, and evaluation of its effectiveness and suitability (Jacobsen & McKenney, 2024).

1. Requirements Analysis. The researcher identified the instructional needs, intended users, learning competencies, and system requirements relevant to computer technology, following the principle that educational design should respond to clearly defined problems and contextual needs (Jacobsen & McKenney, 2024).

2. System Design. The researcher prepared the program architecture, interface layouts, database structure, navigation, and learning-module organization, considering the software quality characteristics and evaluation criteria identified in ISO/IEC 25010:2023 (ISO, 2023).

3. Program Development. The researcher developed the web-based platform and integrated the instructional modules, learning activities, assessment features, and other necessary functions in accordance with the identified system requirements and intended learning outcomes (Jacobsen & McKenney, 2024).

4. Testing and Refinement. The program underwent functional testing to identify errors, usability concerns, compatibility issues, and other technical problems, consistent with the use of software quality models to establish testing objectives and evaluate product quality (ISO, 2023).

5. Evaluation. The completed program was evaluated by qualified evaluators and intended users to determine its conformity with ISO/IEC 25010 and its acceptability based on UTAUT, which has been applied in higher education research to examine technology acceptance and use (ISO, 2023; Xue et al., 2024).

Respondents and Sampling Procedure

The respondents were selected to provide relevant evaluations of the developed web-based modular learning program for computer technology, particularly its technical quality, instructional suitability, and usability (Jacobsen & McKenney, 2024). A total of 428 respondents participated in the study, consisting of 35 faculty/IT experts (8.18%) and 393 students (91.82%), as presented in Table 1. Purposive sampling was employed to select participants based on their relevance to the study's objectives and their capacity to assess the program's features and potential use (Campbell et al., 2020). The inclusion of both faculty/IT experts and students provided perspectives from technical evaluators and intended users of the developed learning program.

Table 1. Distribution of Respondents

N=428

Respondents	Sample N	Percentage (%)
Faculty/IT Expert	35	8.18
Students	393	91.82
Total	**428**	**100**

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Instrument

The research utilized evaluation questionnaires and a researcher-developed checklist to collect data on the program's software quality, user acceptability, and development challenges, consistent with the use of survey instruments in educational technology acceptance research (Xue et al., 2024).

The ISO/IEC 25010-based evaluation questionnaire assessed the program's software quality using selected characteristics of the adopted standard, which provides a reference model for specifying, measuring, and evaluating software product quality (ISO, 2023). The selected characteristics included functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability, with the final set aligned with the ISO/IEC 25010 edition used in the study (ISO, 2023).

The UTAUT-based acceptability questionnaire assessed users' perceptions through performance expectancy, effort expectancy, social influence, and facilitating conditions, which are central constructs of the Unified Theory of Acceptance and Use of Technology (Xue et al., 2024). Behavioral intention and actual use were also considered when appropriate to the study's objectives and data-collection procedures, as research on UTAUT in higher education examines technology acceptance and use through surveys and related measures (Xue et al., 2024).

A development challenges checklist or interview guide was used to identify difficulties encountered during requirements analysis, system design, programming, content integration, testing, and implementation, consistent with educational design research approaches that examine both the development process and the practical challenges of educational interventions (Jacobsen & McKenney, 2024). The instruments were reviewed by qualified experts to assess their relevance, clarity, and alignment with the research objectives, while pilot testing and reliability analysis were conducted when these procedures formed part of the approved study protocol (Jacobsen & McKenney, 2024).

Data-Gathering Procedure

Before data collection, the researcher secured the necessary institutional permissions and obtained informed consent from participants in accordance with established ethical principles for research involving human participants (Council for International Organizations of Medical Sciences [CIOMS], 2016). The developed program was presented to the evaluators and intended users, who received instructions on how to access and use its features so that they could evaluate the system in relation to its intended functions and user requirements (ISO, 2023). After examining or using the program, participants completed the appropriate evaluation questionnaires, following the survey-based approach commonly used in studies of technology acceptance in higher education (Xue et al., 2024). The researcher also documented development issues and collected additional information through the checklist or interview guide to identify recurring challenges encountered throughout the development process (Jacobsen & McKenney, 2024). The completed instruments were checked for completeness, and the responses were organized for analysis in accordance with the planned data-analysis procedures (Creswell & Creswell,

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2023). Participant confidentiality and the security of collected data were maintained in accordance with applicable research ethics principles and personal data protection requirements (CIOMS, 2016; Republic Act No. 10173, 2012).

Data Analysis

The quantitative data were analyzed using descriptive statistical techniques to summarize participant characteristics and evaluate the developed program, consistent with established approaches to presenting and interpreting quantitative research findings (Creswell & Creswell, 2023).

- Frequency and percentage were used to summarize participant profiles and categorical responses, consistent with descriptive statistical procedures for organizing quantitative data (Creswell & Creswell, 2023).
- Weighted mean was used to determine the levels of conformity with ISO/IEC 25010 and acceptability based on UTAUT by summarizing participants' ratings across the selected evaluation indicators (Creswell & Creswell, 2023; Xue et al., 2024).
- Standard deviation was used to describe the variability of evaluation responses and indicate the extent to which participants' ratings differed from the mean (Creswell & Creswell, 2023).
- Thematic analysis was applied to open-ended responses or interview data to identify recurring patterns and themes related to the challenges and difficulties encountered during program development, following established guidance for qualitative data analysis (Braun & Clarke, 2021).

The interpretation of mean scores followed the rating scale established in the research instrument, while the software quality findings were interpreted according to the selected quality characteristics of ISO/IEC 25010:2023 (ISO, 2023). Findings on adoption and diffusion were interpreted according to the evidence collected, with UTAUT providing a framework for understanding users' acceptance and use of technology (Xue et al., 2024). Actual diffusion was not claimed unless supported by evidence of implementation, adoption, or use beyond the initial evaluation stage (Jacobsen & McKenney, 2024).

Ethical Considerations

The researcher observed ethical principles throughout the study, including voluntary participation, informed consent, respect for participants, and appropriate protection of collected information (CIOMS, 2016). Participants were informed about the study's purpose, their involvement, and their rights before taking part in the evaluation process (CIOMS, 2016). Personal information and evaluation responses were handled confidentially and used only for legitimate research purposes in accordance with the Data Privacy Act of 2012 (Republic Act No. 10173, 2012). The program was also reviewed for appropriate access controls and data protection measures, particularly in relation to user accounts, learning records, and assessment results, consistent with the need to protect personal data processed by digital systems (National Privacy Commission, 2023).

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RESULTS AND DISCUSSIONS

The conceptual model implies that the development and evaluation of a web-based modular learning program for computer technology should follow a systematic process that integrates learners' needs, instructional objectives, curriculum standards, and technical requirements. The use of the ADDIE instructional design model provides an organized framework for analysis, design, development, implementation, and evaluation, ensuring that instructional materials and technological features are aligned with learning objectives. The model further emphasizes the importance of assessing technical requirements, software quality, and user acceptability before promoting wider implementation. These components are consistent with the principles of instructional design and technology-supported education, which emphasize purposeful planning, usability, and continuous improvement (Branch, 2009; UNESCO, 2023).

The evaluation component of the conceptual model is also supported by the ISO/IEC 25010 software quality framework and the UTAUT technology acceptance model. ISO/IEC 25010 provides criteria for evaluating software product quality, while UTAUT explains technology acceptance through factors such as performance expectancy, effort expectancy, social influence, and facilitating conditions. These frameworks help determine whether the developed program meets technical expectations and is acceptable to its intended users. The UNESCO (2023) Global Education Monitoring Report further emphasizes that educational technology should be assessed according to its educational value, accessibility, and suitability for the learning context rather than assuming that technology alone improves learning.

Thus, the conceptual model establishes a logical connection between needs assessment, systematic program development, quality evaluation, user acceptance, and the potential adoption and diffusion of the web-based modular learning program as a basis for instructional innovation.

Table 1 shows that the study involved 428 respondents, comprising 393 students (91.82%) and 35 faculty/IT experts (8.18%). The predominance of student respondents indicated that the evaluation primarily reflected the perspectives of the intended users of the web-based modular learning program, while the faculty/IT experts provided complementary perspectives on its technical quality and instructional suitability. This distribution implied that the program's usability, accessibility, and potential usefulness for learning were important considerations in evaluating its acceptability. Xue et al. (2024) emphasized the relevance of technology acceptance factors in understanding the adoption and use of educational technology in higher education. Similarly, ISO (2023) provided a software product quality framework that supports the systematic evaluation of software characteristics relevant to user needs and intended functions. Therefore, including both students and faculty/IT experts offered complementary perspectives for assessing the developed program, although the larger student representation meant that the overall findings were more heavily influenced by student evaluations.

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Table 2 presents the technical requirements of the developed web-based modular learning program, which obtained an overall mean of 3.99 and an overall percentage of 54.23%, interpreted as "developed." Among the criteria, interactive and multimedia resources recorded the highest mean of 4.60, indicating the importance of incorporating engaging learning materials into the program. Ergonomics and data privacy followed with a mean of 4.16, while interactive learning tools and communication and collaboration both obtained 4.06. Module navigation registered a mean of 3.95, followed by design and features at 3.89. User training and orientation received the lowest mean of 3.74, suggesting the need to strengthen user guidance and technical assistance. These findings imply that the program should maintain its interactive learning resources while improving user orientation and accessibility. UNESCO (2023) emphasized the importance of ensuring that educational technology supports meaningful learning and responds to learners' needs. Similarly, ISO/IEC 25010:2023 provides a framework for evaluating software quality characteristics relevant to functionality, usability, security, and overall product quality (International Organization for Standardization [ISO], 2023). Therefore, the results highlight the value of combining engaging instructional resources with user support and appropriate software quality measures when developing web-based learning programs.

Table 3 presents the level of conformity of the developed web-based modular learning program based on seven software quality criteria, with an overall mean of 3.88, interpreted as “High Conformity.” Portability obtained the highest mean of 3.97, followed by efficiency at 3.95 and usability at 3.92, indicating that the program demonstrated favorable performance in operating across intended environments, utilizing system resources, and supporting user interaction. Security obtained a mean of 3.91, while functionality and maintainability recorded means of 3.89 and 3.81, respectively. Reliability received the lowest mean of 3.74, although it remained within the high-conformity category. These findings implied that the developed program generally conformed to the selected software quality criteria, although reliability and maintainability could be further improved. The International Organization for Standardization (ISO, 2023) established ISO/IEC 25010:2023 as a software product quality model that supports systematic evaluation of software quality characteristics. Similarly, UNESCO (2023) emphasized that educational technology should be assessed in terms of its educational relevance, accessibility, and capacity to support meaningful learning. Therefore, the results supported the continued refinement of the program to strengthen its technical quality, reliability, and suitability for computer technology instruction.

Table 4 presents the acceptability of the developed web-based modular learning program among 428 respondents, with an overall mean of 4.25, interpreted as “Strongly Acceptable.” Performance expectancy obtained the highest mean of 4.33, indicating that respondents strongly perceived the program as beneficial to computer technology teaching and learning. Effort expectancy followed with a mean of 4.26, suggesting that the program was perceived as easy to learn and use. Facilitating conditions received a mean of 4.24, indicating that available resources and technical support were considered important for its

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effective use. Social influence obtained the lowest mean of 4.16, interpreted as "Acceptable," suggesting that encouragement and support from instructors, classmates, and the institution could further promote its use. These findings imply that the program was generally well received and had potential for integration into computer technology instruction. Venkatesh et al. (2003) explained through the Unified Theory of Acceptance and Use of Technology (UTAUT) that performance expectancy, effort expectancy, social influence, and facilitating conditions influence technology acceptance and use. Similarly, UNESCO (2023) emphasized that educational technology should respond to learners' needs and contribute meaningfully to teaching and learning. Therefore, the results supported the potential use of the developed program while highlighting the importance of improving institutional support and encouraging wider user engagement.

Thematic Statement

The challenges and difficulties encountered during the development of the web-based modular learning program were categorized into key themes, including technical issues, instructional content development, system usability and navigation, internet connectivity and accessibility, data security and privacy, and user training and orientation.

FIGURES

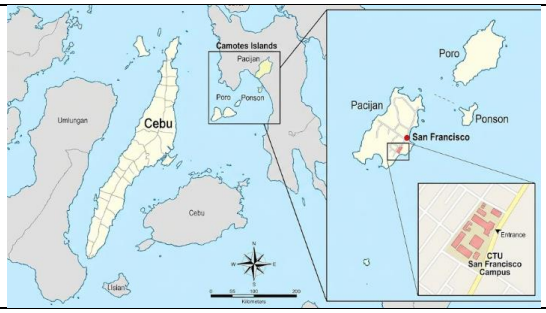

Figure 1. Location Map of the Research Environment

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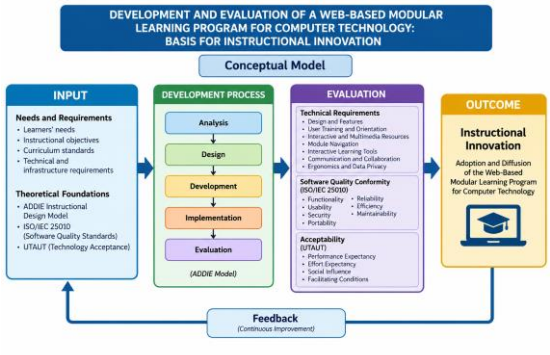

Figure 2. Conceptual Model

TABLES

Table 2. Technical Requirements

N=428

Criteria	Percentage (%)	Mean	Interpretation
Design and Features	52.9	3.89	Developed
User Training and Orientation	50.9	3.74	Developed
Interactive and Multimedia Resources	55.2	4.60	Developed
Module Navigation	53.7	3.95	Developed
Interactive Learning Tools	55.2	4.06	Developed
Communication and Collaboration	55.2	4.06	Developed
Ergonomics and Data Privacy	56.5	4.16	Developed
Overall Mean	**54.23**	**3.99**	**Developed**

Table 3. Level of Conformity

N=428

Criteria	Percentage (%)	Mean	Interpretation
Functionality	46.3	3.89	Highly Conformity
Reliability	40.5	3.74	Highly Conformity
Usability	46.8	3.92	Highly Conformity
Efficiency	47.3	3.95	Highly Conformity

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Security	46.6	3.91	Highly Conformity
Maintainability	43.5	3.81	Highly Conformity
Portability	47.6	3.97	Highly Conformity
Average	**45.51**	**3.88**	**Highly Conformity**

Table 4. Acceptability of the Web-Based Modular Learning Program
N=428

Criteria	Percentage (%)	Mean	Description
Performance Expectancy (PE)	51.9	4.33	Strongly Acceptable
Effort Expectancy (EE)	51.1	4.26	Strongly Acceptable
Social Influence (SI)	49.9	4.16	Acceptable
Facilitating Conditions (FC)	50.9	4.24	Strongly Acceptable
Average	**50.95**	**4.25**	**Strongly Acceptable**

CONCLUSION

The developed web-based modular learning program for computer technology demonstrated potential for adoption and diffusion among its intended users. Its overall acceptability mean of 4.25, interpreted as Strongly Acceptable, indicated favorable perceptions of the program. Performance expectancy obtained the highest mean of 4.33, suggesting that users recognized its potential to support learning and instructional activities. However, social influence received the lowest mean of 4.16, indicating the importance of strengthening institutional encouragement, peer support, and stakeholder participation. These findings suggested that the program could be considered for broader implementation, provided that adequate technical support, user orientation, accessibility, and continuous improvement were ensured. Since actual widespread adoption and diffusion were not yet established by the acceptability results alone, further implementation and monitoring would be necessary to confirm sustained use.

RECOMMENDATIONS

Based on the findings, the following recommendations are proposed:

1. Conduct pilot implementation. The developed web-based modular learning program should be piloted among selected computer technology classes at Cebu Technological University–San Francisco Campus to assess its practical application in actual teaching and learning.

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2. Strengthen institutional support. Campus administrators, faculty members, and information technology personnel should encourage the use of the program through appropriate policies, technical assistance, and integration into instructional activities.

3. Provide user training and orientation. Faculty members and students should receive training on accessing modules, navigating the platform, using interactive learning resources, and addressing common technical difficulties.

4. Improve social influence and stakeholder participation. Faculty champions, peer demonstrations, and collaborative learning activities should be encouraged to promote confidence and willingness to adopt the technology.

5. Ensure accessibility and technical reliability. The program should be regularly evaluated and improved to address connectivity limitations, navigation concerns, device compatibility, data privacy, and system reliability.

6. Monitor adoption and diffusion. Future evaluation should examine actual usage frequency, user participation, continued intention to use, and adoption across additional classes or programs. These indicators can help determine whether the technology is being sustained and disseminated beyond the initial group of intended users.

7. Conduct further research. Future researchers may investigate the relationship between software quality, user acceptability, and actual adoption, using follow-up assessments and appropriate statistical analyses to establish stronger evidence of the program's effectiveness and diffusion potential.

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