Mobile-based PhilNITS reviewer design: Its functionality, reliability, usability and efficiency

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A B S T R A C T

The examination is used to determine the strengths and limitations of certain individuals. In the fast-growing Information Technology (IT) business, IT workers who have certifications on their resumes are more likely to be employed, earn higher salaries, develop their professions, and have more opportunities for new jobs. As mobile devices have become more essential, the need for new applications that can assist teaching and learn on mobile platforms has grown. In the 21st century, mobile learning has a significant impact on education. Incorporating the most recent development technology in review materials proved to be beneficial especially for examinees. Hence, the researchers were immensely motivated to design a mobile-based PhilNITS reviewer. The development of this application can help students broaden their knowledge and evaluate their readiness to take the examination. The development method was adopted as the research design of the study. The developed mobile application is user-friendly and can be accessed offline. Quality in the use model ISO/IEC 25010:2011 was utilized to establish the five evaluation criteria. Results revealed that the mobile-based PhilNITS reviewer is usable and meets its expected functions in terms of functional suitability, performance efficiency, usability, maintainability, and portability. This application will widen the knowledge and examine the individual skills in the field of information technology, especially in mobile development. For further improvement, the researcher recommends that future studies incorporate a top score module with multiple levels to assess and improve the user's understanding of different Information Technology terminology.

INTRODUCTION

Examinations have long been an essential part of a students' life. It is a tool that determines if students possess the right skills and knowledge in this digital world. A guiding light to assess a program's quality by taking into account how well it does in certain exams. It is a good indicator of program excellence if the first-time pass rate is high (Dela Fuente, 2021). These tests are used to identify a person's strengths and limitations to get a rough idea of his potential. One of the ultimate challenges a candidate must overcome in the licensing process is to pass the examination.

To ensure that only the certified IT experts are hired examination is vital in the choice of an employer. Passing IT exam increases one's competitiveness as it indicates possibility of employment, salary increase salary and promotion in the IT industry. It does not only brings prestige to IT professionals but also job opportunities. The Philippine National Information Technology Standard (PhillNITS) exam and certification for IT engineers were established in 2002. It is a certification that is recognized not only by the Philippines and Japan but other Asian countries that are members of Information Technology Professionals Examination Council-ITPEC (JITCO, 2009). PhilNITS exam is taken by individual that seeks certification in the field of IT. Employers finds it challenging to identify people with the appropriate skills and knowledge in a fast-expanding IT industry. Thus, IT professionals with certifications are more likely to be hired.

Mobile learning is the most recent advancement in online education. Mobile phones are often recognized as the most promising mobile learning terminal equipment, with mobile learning resources for mobile phones beginning to appear (Guoxin, 2012). Mobile gadgets have been the most popular and indispensable expedient for human needs in recent years due to their utility, user-friendliness, and accessibility (Malavolta et al., 2015). In the context of education, these mobile devices enable people in academic and non-academic settings with a variety of learning alternatives, such as mobility, social involvement, context-sensitivity, connectedness, individualism, and affordance (Crompton, 2013). The need for building applications that can assist teaching and learning on mobile platforms has grown. Mobile phones are not only communication devices but also portable and private technical instruments that provides users direct access to website that act stand-alone software and collect data from device hardware (Joorabchi, Mesbah, & Kruchten, 2013). Mobile technological advancements have enabled the development of a wide range of applications that people may utilize on the go (Harrison et al., 2013). Mobile learning (m-learning) is a new paradigm that builds on e-learning by encouraging independent and active learning and transforming educational institutions into 24/7, no-barrier learning centers (Kuimova et al.,2018).

Individualized learning, flexibility in terms of time and place, engagement with peers and teachers in both formal and informal settings, and the availability and interactivity of mobile devices are all advantages of mobile learning. (Gangaiamaran, 2017; Klimova, 2019). According to (Klimova, 2018) research shows that mobile applications aid in developing all language abilities, particularly the retention of new vocabulary, and that their use also boosts students' willingness to study. The influence of mobile phone technology on learning is portability, collaboration, and motivation, which benefits students, parents, and teachers (Barker, Krull, and Mallinson, 2009). The essential characteristics of mobile learning are accessibility, immediacy, and interactivity (Bachore, 2015). Furthermore, mobile devices enable learners to interact and engage in learning activities regardless of location or time (Ghasia, Mohamed, 2019).

Institutions in the Philippines such as the non-stock, non-profit, non-government organization Japan IT Standards Examination Philippines PhilNITS, were formed in response to rising labor demand in Japan. It was established in 2002 using Japanese capital and knowledge in order to sustain an examination system for Filipino employees seeking work in Japan. (JITCO, 2009). A standardized exam is given to students under standardized or controlled conditions that dictate where, when, how, and how long they can react to questions or prompts (Goodwin and Driscoll, 1980). Review materials have evolved from traditional textbook to electronic that can be attributed through technological advancement. For instructional development many applications have been

created (Demuynck & Laureys, 2002). Variety of software has been developed to incorporate the recent technology in review materials. E-learning is a learning process aided by digital tools and m-learning is an e-learning aided by mobile devices. M-learning works by combining hardware and software technologies in multimedia apps to assist instructional content such as quizzes or games (Pinkwart, 2003). Mobile learning is successful in enhancing educational results as it increases access to education and promotes individualize, collaborative and ubiquitous learning (Alexander, 2004; Chen, 2013). Users found mobile application to be accessible, appealing, and pedagogically beneficial but the main problems includes optimization, development time, technical and organizational issues, academic workload and production expenses. Utilizing the applications increases vocabulary learning, confidence, class involvement and students has a positive attitude of multimedia in education (Rezaei et al., 2018).

Review materials review centers are found to be an essential tools in in an examination by providing access to updated and best materials for review. However, last academic year 2018-2019 less than 5% of IT graduates passed the PhilNITS exam. The most prevalent issue students have when taking the certification is lack of accessible and free review materials and centers. Students are oblige to purchase review materials like textbooks to those who can afford. On mobile devices, PhilNITS reviewer for IT students is an android-based mobile application that runs on tablets, smartphones, and other mobile devices. It was created for reviewers who wanted to pass the PhilNITS exam but don't have resources as to what topics would be include. It contains set of questions that evaluate participants' who wish to use a free and offline digital reviewer. The application will include lectures in the discipline of information technology to help students broaden their knowledge and decide whether or not they are prepared to take the exam. The mobile app will provide drills in the form of questions. It will evaluate the students' readiness to take the exam. Reviewers will be able to review on the go as all they need is an android-compatible handset. The inconvenience of bringing in review materials will be reduced making the PhilNITS exam more worthwhile.

OBJECTIVES

The project's goal is part of the educational institution's efforts to provide free and convenient offline digital reviewers to IT students. Thus, a mobile-based app reviewer was designed/developed a review materials for those preparing to take the PhilNITS exam. Specifically, this study aimed to:

1. Design PhilNITS reviewer that is accessible, user-friendly, handy and available offline.
2. Develop a mobile application that contains questions that covers the PhilNITS examination.
3. Determine the level of satisfaction of the end-users based on ISO/IEC 25010:2011 quality model.
4. Evaluate the developed application in terms of functionality, reliability, usability, and efficiency based on McCall's software quality model.

Conceptual Framework of the Study

The framework of the study employed by the researcher to develop a Mobile-Based PhilNITS Reviewer for 4th-year Information Technology students is depicted in Figure 1.
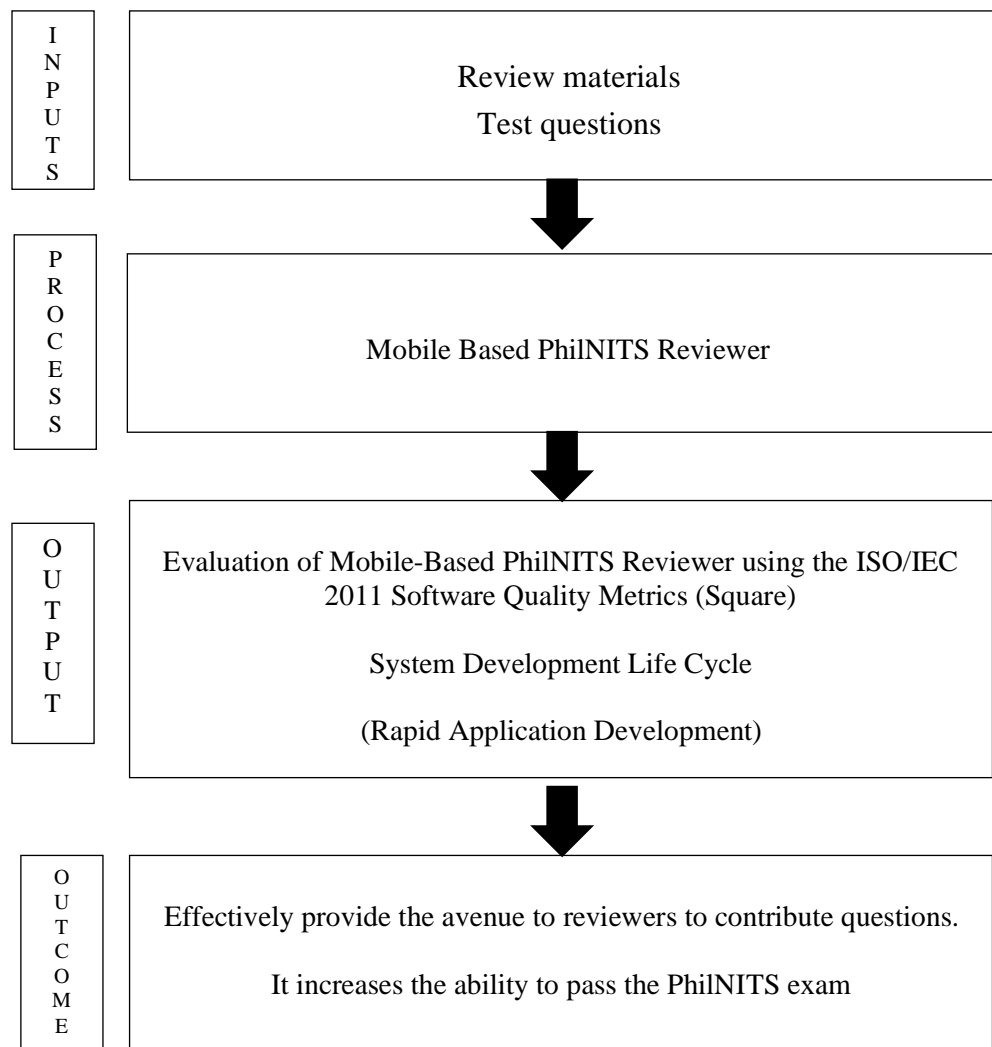
INPUTS	Review materials Test questions

PROCESS	Mobile Based PhilNITS Reviewer

OUTPUT	Evaluation of Mobile-Based PhilNITS Reviewer using the ISO/IEC 2011 Software Quality Metrics (Square) System Development Life Cycle (Rapid Application Development)

OUTCOME	Effectively provide the avenue to reviewers to contribute questions. It increases the ability to pass the PhilNITS exam

Figure 1. Conceptual framework of the mobile-based PhilNITS reviewer

METHODS

Research Design

In this study, the researchers used the developmental research method. The respondents were chosen using a technique known as the convenient purposive sampling technique. The researchers concentrated on specific population characteristics that caught their attention and would best answer the research questions. This study included 161 participants, these participants were BSIT 4th-year students of the College of Information and Communications Technology and Engineering (CICTE) during the First Semester, AY 2021 – 2022.

Instrument

Before being given to the actual respondents, the study instrument was subjected to adequate validity and reliability tests. The proponents used convenient purposive sampling to identify 30 respondents for the reliability and validity test, ensuring that the evaluators could deliver a more reliable evaluation result. CICTE instructors and BSIT students were among the respondents. They used the app several times, testing all of its

features and ensuring that it worked properly. The evaluation questionnaire utilized was adapted from ISO/IEC 25010:2011 software quality standards. Table 1 shows that the proponents used a five-point Likert scale, with five (5) highest and one (1) lowest. The Mobile Based PhilNITS Reviewer was evaluated using a survey instrument by the researchers. The evaluation questionnaire was created using ISO/IEC 25010:2011 software quality standards. This software evaluation tool is a criteria-based questionnaire that assesses the functional suitability, performance efficiency, usability, maintainability, and portability of software.

Table 1. Five-point Likert Scale with the mean range interpretation

Mean Score	Verbal Interpretation
4.21 – 5.00	Excellent
3.41 – 4.20	Very Good
2.61 – 3.40	Good
1.81 – 2.60	Fair
1.00 – 1.80	Poor

Data Gathering Procedure

The researchers conducted a survey in the College of Information and Communications Technology and engineering department in collecting data. Interviews and distribution of questionnaires to the Students of the said Department were done to collect relevant data needed in the development of the project. In the second stage of the data collection process, the researchers directly distributed and administered surveys to the respondents via Google Forms. The survey respondents were given ample time to complete it. The researchers then personally collected the completed surveys, which were tabulated and analyzed.

Figure 2. Google forms containing the evaluation criteria based on ISO/IEC 25010:2011

Data Analysis

In terms of functional suitability, performance efficiency, usability, maintainability, and portability, the researchers used the mean to assess and evaluate the Mobile-Based PhilNITS Reviewer. The researchers used statistical tools. It includes a scaling system used by the researchers as a technique to encode the assessment rating and calculate the mean. The researchers analyzed all data, information, and user requirements. This phase also helps the researchers have an idea on how to build and create the application and help conceptualize how the proposed application would be beneficial and if it is the solution to the needs of the respondents.

Software Development Life Cycle (SDLC)

Rapid Application Development (RAD) is a concept that developed from a discontent with the waterfall software design approach, which usually resulted in outdated or inefficient solutions by the time they were released. James Martin coined the term RAD in the early 1990s. (Rouse, 2016). Figure 2 shows the software development that the researchers use for the development of the application. It depicts the several procedures that researchers must follow in order to improve the application.
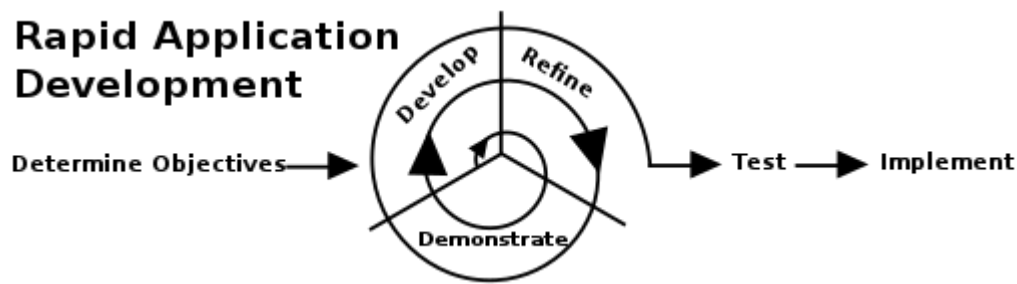

Figure 2. Source (Beao, 2012)

Analysis and Quick Design

During Analysis and Quick Design phase, the researchers interviewed the respondents where the study was conducted. The respondents were given the privilege to suggest and request how the application will be designed and developed. After data gathering, the researchers made an initial design for the proposed application.

System Design

The researchers developed the proposed application. It involves the style or layout of how the app will seem based on the user's needs. Researchers/programmers also add unique designs to make the application more interactive and user-friendly.

Prototype Cycle

This stage includes building, demonstration, and refinement from the information that was gathered and analyzed. The researchers first made the prototype of the application that was demonstrated to the client. In the building stage, the researchers collected all the data gathered to build the prototype. After creating the prototype, it is shown to the client the application's function, the flow on how it works, and the functions of the features included in the application. The last stage is refinement. In this stage, the researchers refined the application by the client's additional needs. It has changed in features, flow, and functions based on the clients' requirements.

Testing

According to Gao et al. (2014), mobile software testing is a set of mobile app activities that use specific software test techniques and tools to confirm functionality, performance, and QoS quality. Mobility, usability, interoperability, connectivity, security, and privacy are just a few of the advantages. The proponents did alpha testing to make the application more functional and bug-free. This type of testing refines the mobile application before it is deployed. The College's Information Technology teachers carried out alpha testing. The application was ready for evaluation after several design and functionality issues were resolved.

Implementation

This phase discusses the implementation of the proposed application wherein the Three (3) Experts evaluate the proposed application. This phase also addressed if the recommended functions and suggestions of the respondents were met.

RESULTS AND DISCUSSION

A. System Interface

The Graphical User Interface (GUI) was created to meet the project's requirements, as indicated below.

Figure 3. Topic page

Figure 4. Content page

When a user clicks on the tab 'Technology", topic contents will be displayed.

When a user clicks the tab 'Select topic' found on the welcome page, the four categories display.
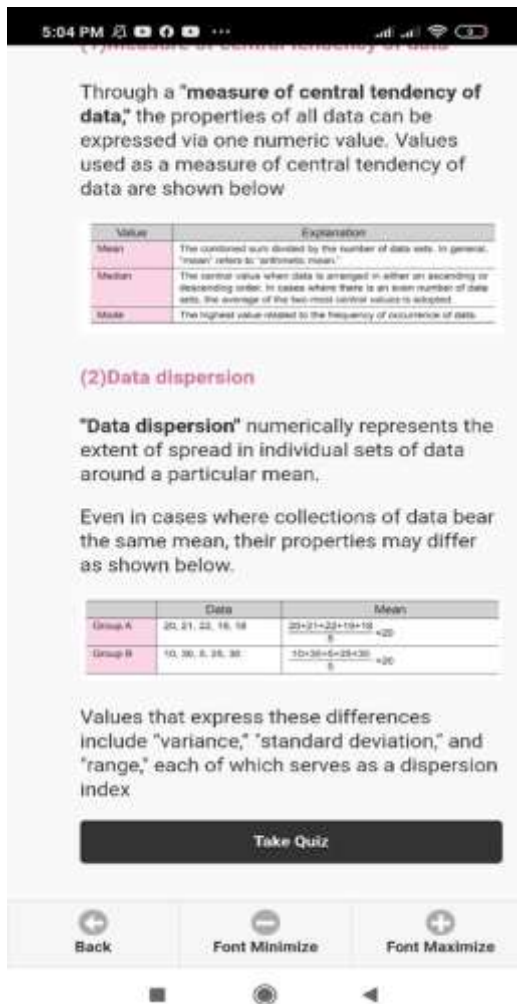
Figure 5. Start quiz

Figure 6. Quiz page

This tab is found below at the very end of each topic.
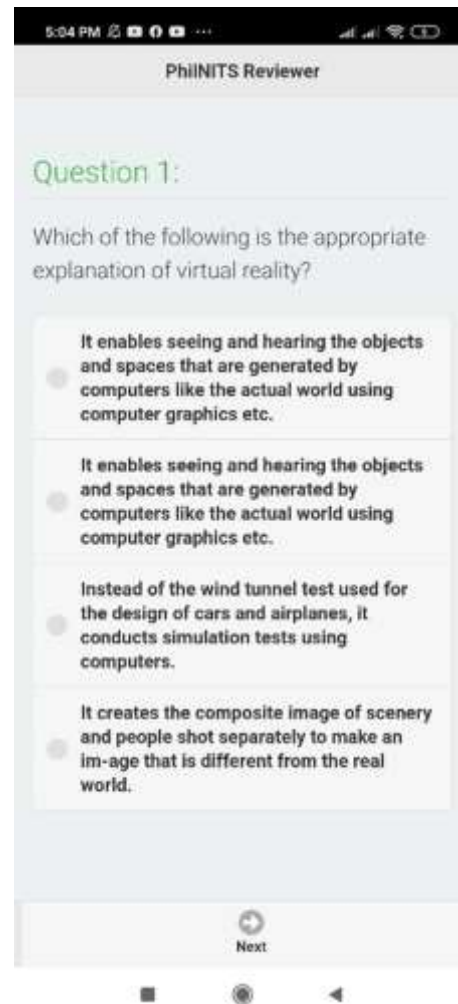
Upon clicking the Start Quiz tab, questions will be displayed.
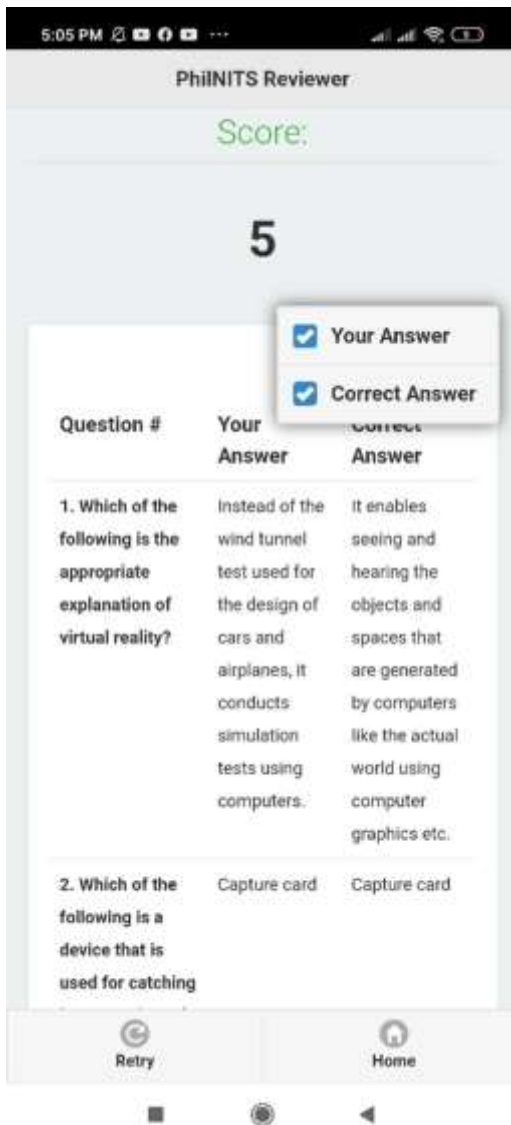
Figure 7. *Result page*

This page displays the user examination score and answers key to each question.
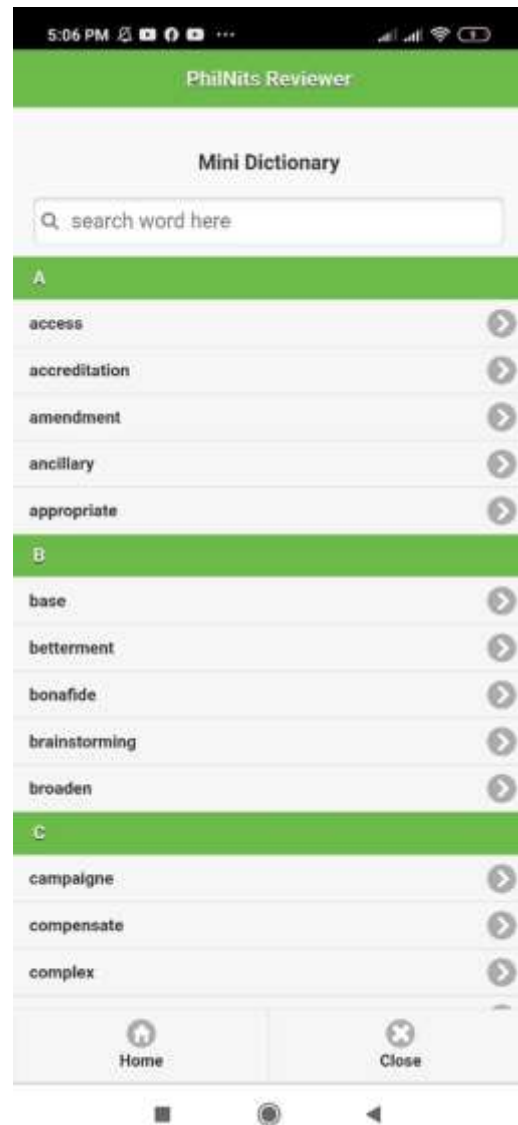
Figure 8. *Dictionary page*

This page displays the search engine dictionary. It includes definitions for computer-related terms and abbreviations.

B. Application Evaluation Result

The overall result was 4.45, which was assessed as very good based on the data gathered. It indicates that the app was functional, usable, efficient, maintained, and portable. Table 2 elaborates this further.

Table 2. T*he findings of the respondents' assessments using the ISO/IEC 9126-1:25010
Software Quality Model Characteristics are shown in Table 2.0.*

| Areas	Mean	Verbal Interpretation
Functionality suitability	4.33	Very Good
Performance Efficiency	4.51	Very Good
Usability	4.52	Very Good
Maintainability	4.46	Very Good
Portability	4.45	Very Good
Overall	4.45	Very Good

Functional suitability with an average mean of 4.33, interpreted as "very good," shows that the application functions are appropriate and needed. The application has earned a lot of good feedback. The software works well on mobile phones, particularly Android devices, and it automatically adapts to the user's device compatibility. Performance efficiency with an average mean of 4.51 "very good" indicates that the application is responsive in real-time. The results demonstrated that the app is effective in terms of time management and resource efficiency when carrying out its activities, yielding a highly favorable outcome. Usability with an average mean of 4.52 "very good" means that the application is easy to operate, pleasing, and satisfying for the user. With a simple user interface and uncomplicated methodology, the software is easy to use and install. According to the survey, the app received a high rating. Maintainability with an average mean of 4.46 "very good" indicates that the application applies to students. Because of its primary methodology, the software can be updated, altered, and deployed on time. The app can be recreated in a matter of minutes, and an update for Android devices may be downloaded. It earned the software a high rating. Portability with an average mean of 4.45, interpreted as "very good." The app received a high rating. It is because Android apps are packaged as APKs (android packages), and with the arrival of file-sharing apps, files may be transferred from one device to another without the need for the internet.

Expert Testing

Expert testing was also done to make sure that the application complied with the Software Quality Requirements. The app received a perfect score from three IT professionals. The experts' assessment of the Mobile-Based PhilNITS Reviewer using McCall's Software Quality Model was summarized in Table 3.

Table 3. *McCall's Software Evaluation Criteria for Software Quality Model evaluated
the Mobile-Based PhilNITS ReviewerServices by IT Experts.*

Criteria	Mean	Verbal Interpretation
Auditability	4.65	Very Good
Accuracy	4.41	Very Good
Completeness	4.67	Very Good
Communication Commonality	5.0	Very Good
Conciseness	4.34	Very Good
Consistency	4.56	Very Good
Operability	4.67	Very Good
Security	3.65	Very Good
Documentation	4.68	Very Good
Simplicity	5.0	Very Good
Software System Independence	4.34	Very Good
Traceability	4.69	Very Good
Training	5.0	Very Good

Controllability	4.67	Very Good
Data Commonality	4.40	Very Good
Error Tolerance	4.44	Very Good
Execution Efficiency	4.67	Very Good
Expandability	5.0	Very Good
Hardware Independence	5.0	Very Good
Instrumentation	4.43	Very Good
Modularity	4.42	Very Good
Total Mean	4.60	Very Good

Table 3 shows that experts rated the developed application a 4.65 score, indicating that in terms of auditability (the ease with which standards can be checked) interpreted as very good. The experts scored of 4.41 for accuracy, which referred to the precision of calculations and power. The application's completeness, or the amount to which all key functionalities have been implemented, received a 4.67, which is regarded excellent. The program obtained a 5.0 rating, meaning that it is very good in terms of communication commonality, or how well standard interfaces and protocols are understood. The system's conciseness, or the program's compactness in terms of lines of code, obtained a very good average score of 4.34. The consistency of application, or the adoption of standardized design and documentation methodologies in the software development project, received a 4.56 rating, which is very good. In terms of the application's security or the availability of the application's measures that monitor or safeguard the programs and data, the established system obtained a mean of 3.65, which is considered good. In the application's self-documentation, a mean of 4.68 was reached, which was considered very good. The derived mean for the ease with which the program can be understood or the software's simplicity was 5.0, rated as very good. For software application independence, or the degree to which the program is independent of nonstandard programming language features, operating system characteristics, and other environmental limitations, the experts rated it a mean score of 4.34, or very good. Experts give a 4.69 rating to the ability to track a design representation or actual software component back to requirements, or the application's traceability.

In terms of training or the degree to which the application supports new users in using the strategy, the app obtained a grade of 5.0, which means very good. Controllability, or the ability to readily manage and manipulate the system in terms of execution, program structure, and design, received a score of 4.67, or very good, from the experts. The application's data commonality, or the program's use of standard data structures and formats, scored a 4.40, which is very good. The experts accorded the established software a score of 4.44, which translates to "very good" when it comes to error tolerance or the amount of harm that occurs when a program has an error. The developed software obtained a rating of 4.67 for its run-time output or execution efficiency, which is considered very good. The developed program obtained a 5.0 score for the degree to which architectural, data, or procedural design can be expanded and the application's expandability. For the degree to which the program is detached from the hardware on which it operates, or the application's hardware independence, the software achieved a 5.0 or very good rating. Experts assigned a mean score of 4.43, which translates to "very good," for device instrumentation, or the degree to which the software tracks its operation and identifies any defects that do occur. Finally, the software received a 4.42 average score, indicating that it is "very good" in terms of device modularity and functional independence of program components. Based on the experts' system evaluation results, the Mobile Based PhilNITS Reviewer received a total mean of 4.60, which is very good.

CONCLUSIONS AND RECOMMENDATIONS

The project was developed primarily to assist students in their examination preparation. The project was created significantly to aid IT students in their preparation for the PhilNITS exam. Because the program is installed on the user's phone, the materials can be accessed from anywhere and at any time. In terms of mobility, the use of Android and the Web is quite beneficial to the reviewer because it simply requires an Android-enabled mobile

phone or a desktop computer. The resources utilized have been reduced. This program can be used on devices that support Android, the consumption of resources will be minimal. As a result, no paper and pencil tests will be used. Because it provides review material through Android-enabled technology, this application will most likely give review centers a competitive advantage. The quality of their reviews will improve due to their effective use of this program, as will the standard of their services. According to the findings, the proposed mobile-based application for IT students effectively establishes the usability of a mobile application reviewer in preparation for the PhilNITS examination. It provides free learning materials that can be accessed anywhere and at any time and serve as a training ground and assist students in their exam preparation.

Based on the ISO/IEC 9126-1:25010 evaluation result, the system, Mobile-Based PhilNITS Reviewer, is usable and has met its expected functions. The mobile application is beneficial, especially to those taking up the examination. The students can access the learning materials from anywhere since it only needs an android supported mobile phone. It can deliver quick results on review quizzes using modern techniques like the smartphone-based reviewer app. Students will find on-the-go learning to be quite beneficial. The researchers suggest that future such studies include a top score module that comprises numerous levels to test and improve the user's knowledge of various Information Technology terminology. Another feature is the ability for a user to challenge a friend to a quiz.

Furthermore, the researchers propose that other researchers use the planned study as a foundation for designing their own version of the program and developing a similar application for review materials that run on mobile devices. Thus, researchers should consider platforms and device compatibility, screen size, user interaction, screen density, phone function integration, and resource management before building a mobile application. On the other hand, future researchers will benefit from the proposed study since it will serve as a guide for building a similar program for reviewing materials on mobile devices. Finally, the researchers advised that programmers should keep backup data in case of problems when developing a mobile application.

LIMITATIONS

This research focused on the design and development of a mobile-based reviewer application for NONESCOST BSIT students. The proposed mobile-based application is portable to many users that they can bring anytime and anywhere. The said application contained lessons in the primary subjects of Information Technology to enrich users' knowledge and to prepare test takers for the upcoming examination. Moreover, it was designed to work in an offline setting. This study, on the other hand, was limited to NONESCOST fourth-year BSIT students. The mock examination is a hundred-item multiple-choice test with topics focused on technology, management, and strategy. After taking the mock examination, users will be able to view their test scores and finally view the answer key afterward. This mobile application can only be used on a smartphone or tablet. The app is a mobile-based application that is only compatible with Android smartphones.

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