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Development of Work Measurement Mobile Application for Industrial Engineering Students Using the ADDIE Model

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A B S T R A C T

To succeed academically in Higher Education, a student pursuing Industrial Engineering must deepen their understanding of core courses. Although the use of mobile applications in the classroom has become popular, challenges linked to limited internet connectivity remain a major concern. This study aims to help students cope with the Work Measurement subject by integrating it into a mobile application. The ADDIE model guided the development of the educational mobile application. Quantitative data were collected from 295 respondents to assess user adoption. Users strongly agreed that the mobile application can be explored anytime (mean = 3.64), the navigation of the mobile application is simple to recall (mean = 3.57), and the mobile application is easy to use on an Android phone (mean = 3.53), resulting in an overall average mean of 3.41 (Agree) for perceived ease of use. In terms of Perceived Usefulness, users agreed strongly on the mobile application gives a greater control over my learning activities (mean = 3.58), the mobile application makes earning easier and simpler (mean = 3.55), and the mobile application is useful in my learning endeavor (mean = 3.52), resulting in an average mean of 3.36. This study revealed that the mobile application is a useful tool for students who prefer flexible and self-paced learning. The positive acceptance implies that mobile applications can improve learner engagement, time management, and students' performance. To foster students' engagement and retention, it is recommended that interactive simulations and self-assessment quizzes be integrated into the mobile application. .

RESUMO

Para ter sucesso acadêmico no Ensino Superior, um aluno que busca Engenharia Industrial deve aprofundar sua compreensão dos cursos básicos. O uso de aplicativos móveis em sala de aula está se tornando uma prática comum no novo normal. No entanto, uma conexão de internet ruim pode causar problemas e deixar os alunos menos motivados para assistir às aulas. Este estudo tem como objetivo ajudar os alunos a lidar com a disciplina de Medição do Trabalho, integrando-a em um aplicativo móvel. A Medição do Trabalho é um curso fundamental em Engenharia Industrial que define um tempo padrão para uma tarefa para maior produtividade. O desenvolvimento do aplicativo móvel educacional foi guiado pelo modelo ADDIE. Há 295 entrevistados inscritos na disciplina Estudo de Trabalho. Os dados revelaram que a avaliação dos entrevistados na adoção do Aplicativo Móvel de Medição de Trabalho em termos de utilidade percebida influenciou a adoção efetiva da tecnologia para operar o sistema, assim, o aplicativo é benéfico para os alunos, pois permite que eles acessem o material instrucional sempre que quiserem, de qualquer local, conforme sua conveniência. A facilidade de uso percebida na adoção da tecnologia é determinada pela facilidade de uso com a facilidade de navegação, o que traz uma sensação prazerosa aos usuários.

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Introduction

For the continuity of education during the pandemic, most universities in Higher Education strive to incorporate technology into their lessons. Programs were offered via online learning, while the smartphone was integrated into the classroom, and students read on their phones while studying. However, a poor internet connection may cause issues in dealing with studies (Bahinting et al., 2022). Using the internet to attend lessons virtually is insufficient due to slow internet connectivity, resulting in less motivated students, which influences the behavior of the students to utilize technology in education (Lapitan et al., 2021). It would be very challenging for the students to study because they feel incompetent due to the lack of interpersonal touch between teachers and students.

The research's theoretical framework is based on the Technology Acceptance Model. It is the reflection of the user's desire to utilize the system, which is supported by the perceived ease of use and perceived usefulness (Christian et al., 2023). The perceived usefulness has an impact on how the user will operate the system. Perceived usefulness is achieved when the user has control of the system in executing commands easily. According to the study of Zhai and Shi (2020), the technology needs to be perceived as useful by the user when it helps individuals do tasks successfully. Meanwhile, perceived ease of use tells how the system can be accessed clearly. This shows the user's response on how easy it is to use the system (Qashou, 2021).

To address these issues, this study developed a Work Measurement Mobile Application for Industrial Engineering students using the ADDIE methodology, a systematic educational architecture divided into five stages: analysis, design, development, implementation, and evaluation. This strategy ensured application was pedagogically solid, learner-centered, and relevant to the course curriculum. The application was created to run on Android smartphones and can be viewed offline, making it especially useful for students who have limited internet connections.

The ADDIE model guided the development of the Work Measurement Mobile Application. Students will now have free access to the learning materials, which they can read offline anytime and anywhere. This study sought to evaluate the respondents' adoption of the Work Measurement Mobile Application based on perceived ease of use and perceived usefulness. The adoption and acceptance of a mobile learning application were evaluated using the Technology Acceptance Model, which was based on perceived ease of use and usefulness. Understanding these perspectives is critical because they influence user behavior and desire to incorporate technology into their learning routines. This study intends to give evidence of the application's efficacy, usefulness, and relevance as a supplementary learning aid in Industrial Engineering education by integrating the ADDIE model in its development and the TAM in its evaluation.

The findings of the study intend to assist educators, mobile developers, and researchers in developing accessible and practical mobile learning solutions that are suitable for students' technological abilities and learning needs.

Due to the gap being discussed in the introduction, the researcher aimed to develop an educational mobile application that would serve as an intervention material for the students of Industrial Engineering. This study specifically addressed the problems below: 1. What are the phases of the ADDIE model that were applied in developing the Work Measurement Mobile Application? 2. What is the user's response in adopting the Work Measurement Mobile Application in terms of perceived ease of use? 3. What is the user's response in adopting the Work Measurement Mobile Application in terms of perceived usefulness?

Review of Related Literature

Mobile Learning is a New Trend in Education

Educational institutions started to provide courses via the Internet in the form of a mobile learning application. The primary challenge in online education is the poor internet connection. Due to limited internet accessibility, students in engineering programs may find it difficult to deal with their subjects during online learning. (Aroonsrimarakot et al., 2023) found that the influence of mobile learning on academic achievement outperformed traditional learning. Mobile learning encourages student interaction (Al-Rahmi et al., 2021). The tremendous advancement in virtual technology-enhanced learning was made possible by the widespread usage of mobile technology (Correia et al., 2024). Even with the difficulties related to internet access, mobile learning highlights its potential as an important tool in industrial engineering education.

Work Measurement- Selected Core Subject of Industrial Engineering

Work measurement is the use of certain methods intended to analyze the content of a task by timing how long it takes to complete it (Gajengrakar, 2024). Work Measurement is a core subject of Industrial Engineering that uses methodologies to determine how long a typical worker takes to finish a particular manufacturing task at a particular degree of quality. These procedures help boost efficiency and productivity by enhancing machine usage, work technique uniformity, and job performance. By incorporating the Work Measurement subject into the mobile application, the researcher hopes to close this learning gap to enhance learning and allow students to access offline learning resources at their own speed.

The ADDIE Model

The ADDIE model is a suitable model for building the design of instructional material (Martatiyana et al., 2023). The ADDIE educational methodology has five phases: analysis,

design, development, implementation, and assessment. (Listiani, 2022). In the analysis phase, the student's needs and technical requirements were identified. The development involves programming the system using the created design as a guide. The process of implementing the design with the real users of the learning resources is known as the implementation phase. The last stage is evaluation, which is carried out to see if the overall function of the application is running perfectly.

Android Operating System

The Android Operating System is covered in this literature because it is an essential prerequisite for the study, particularly in terms of operating systems and software development. The Android operating system is mostly used in smartphones and touchscreen devices and was created by Google. The Android operating system is an open-source system that is free to download. It enables developers to construct managed Java code that runs the gadget using Java libraries created by Google and is swiftly gaining market share. Android's cutting-edge smart apps for wireless, real-time, and mobile provide consumers with a richer, less expensive, and better mobile experience (Ejiyi et al., 2021). The Android operating system is used to provide flexibility in creating managed Java code using Google's Java libraries.

Technology Acceptance Model

User adoption of a technical system is mostly governed by its perceived usefulness and ease of use. This stance is validated by the Technology Acceptance Model, which emphasizes perceived usefulness and ease of use as the main factors of technology adoption. Users' perception of how simple it is to use a mobile application defines its perceived ease of use (Christian et al., 2023). Feedback from users on the system's accessibility reflects its perceived ease of use. The simplicity of the system predicts the user's behavior in using the system (Canca & Perdahçı, 2023).

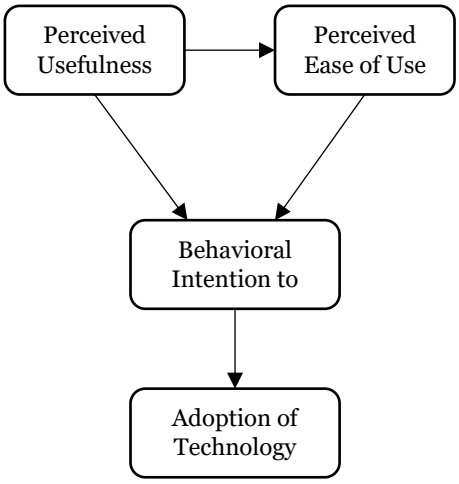
In this study, mobile learning is thought to be a promising way to close the learning gap in Work Measurement. The researcher developed a mobile application that would let students access offline materials at their own pace and engage with the learning more successfully.

Theoretical Framework

The theoretical foundation of this study, as seen in Figure 1, is based on the Technology Acceptance Model (TAM), which describes how the user accepts and adopts technology (Alfadda & Mahdi, 2021). Users rate the mobile application based on how readily they navigate its features, which demonstrates how they feel about the system's usability. The perceived usefulness influences the attitude and intention of the user to accept the system.

Figure 1.

Technology Acceptance Model



Methodology

This study utilized a developmental research methodology to develop and evaluate a mobile application suitable for Industrial Engineering students, specifically in the area of Work Measurement. The methodology is divided into two parts: (1) developing the mobile application using the ADDIE model that focuses on the application's systematic design and development, and (2) The second part focused on assessing how users accepted the application through investigating their assessments of its usability and utility using the Technology Acceptance Model (TAM) principles.

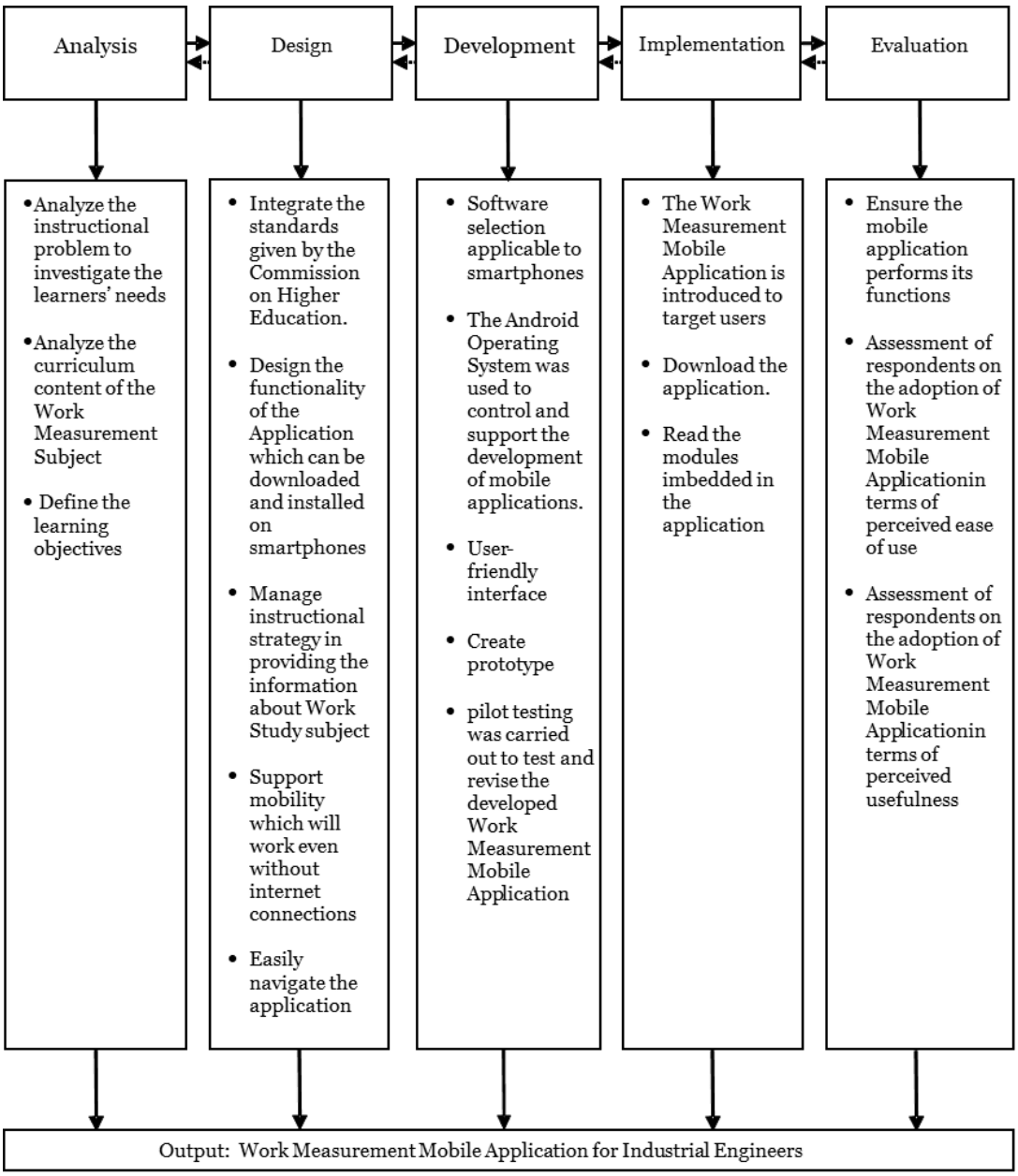
1. Development of Work Measurement Mobile Application Using the ADDIE Model

The ADDIE Model, The ADDIE model guarantees the production of effective educational materials by offering a framework that facilitates a methodical approach to producing instruction (Muhammad & Akhsani, 2021). As depicted in Figure 2, was utilized to help conceptualize the development of the Work Measurement Mobile Application. It is divided into five stages: analysis, design, development, implementation, and evaluation (Li et al., 2024)

The first stage of the ADDIE model is the analysis phase, which corresponds with the investigation to identify the particular needs of industrial engineering students. Identifying the fundamental topics that will be integrated into the program requires analyzing the course curriculum content of the Work Measurement subject to align the instructional material based on the memorandum ordered by the Commission on Higher Education.

Figure 2.

ADDIE Model



The development phase is the third phase in which the information gathered from the analysis and design phases is used during the development of the Work Measurement Mobile Application. The Android operating system made the development of mobile applications easier. To ascertain what must be changed and fixed, pilot testing was conducted. During the development process, a prototype was made to determine the functionality and design of the product as well as to observe how the user interacts with and reacts to the overall concept. Included in the development phase is the portability of the mobile application and the hardware requirements to make it compatible with smartphones after installation.

The fourth phase is the implementation phase. Students can read more about the topic and use the application to access it. Students have the chance to complete the exercises and assess their understanding of the subject matter by verifying that they have provided the right response. While reading the application, the user can adjust the screen by scrolling from side to side or by zooming in or out, depending on the size of their screen.

The evaluation phase is the last stage. The respondents utilized the created mobile application as an extra resource in reviewing their lessons in the Work Measurement subject. The mobile application developer verifies that the designated function operates according to its specifications and makes sure the program can aid students in comprehending the idea of learning.

2. Assessment of the User's Response in Adopting the Work Measurement Mobile Application

The developed Work Measurement Mobile Application's performance and user adoption were evaluated using the Technology Acceptance Model (TAM). This approach focuses on two main variables: Perceived Ease of utilize (PEOU) and Perceived Usefulness (PU), which serve as essential determinants for satisfaction with utilizing a technology-based system. The assessment process gathered feedback from Industrial Engineering students who interacted with the mobile application to better understand their experience and satisfaction with the tool as a supplementary learning resource. The data received from the users revealed how the application supported their learning process and how willing they were to continue using it.

Participants of the Study

This study comprised Industrial Engineering students from Quezon City University, specifically those enrolled in the Work Study and Measurement course during the second semester of Academic Year 2021-2022. The study had a total of 295 respondents. Data about students' experiences, insights, ideas, and suggestions was gathered and shall be kept confidential.

Research Instruments

The test assessed two key constructs: perceived ease of use and perceived usefulness through a Likert-scale item ranging from 1 (Strongly Disagree) to 4 (Strongly Agree). The research instrument of this study is an adopted modified survey instrument. A Likert scale was utilized, ranging from 4 to 1, with a verbal interpretation of strongly disagree to strongly disagree, respectively.

Scale	Range	Verbal Interpretation
4	3.5 - 4.00	Strongly Agree
3	2.5 - 3.49	Agree
2	1.5 - 2.49	Disagree
1	1.0 - 1.49	Strongly Disagree

Validation

The survey questionnaire was expertly validated to verify its content's accuracy and significance. Professionals in areas of industrial engineering education were asked to assess the questionnaire's structure, language, and alignment with the TAM framework. In addition, a pilot test was conducted to check the survey instrument's reliability.

Data Gathering Procedure

Before taking the survey, the respondents were given access to the Work Measurement Mobile Application and instructed to use it as a supplement to their educational tasks for the final term period of the second semester. During this period, the respondents explored the application's features, such as the learning modules, charts, examples, and activities. Participation in the survey was entirely voluntary, and responses were gathered anonymously to encourage open and unbiased evaluation.

Limitations of the Study

This study primarily deals with developing the Work Measurement Mobile Application using the ADDIE model and then evaluating user acceptance based on perceived ease of use and perceived usefulness within the framework of the Technology Acceptance Model (TAM). Furthermore, responders were limited to Industrial Engineering students enrolled in the second semester of the school year 2021-2022.

Results and Discussions

1. Phases of the ADDIE Model that were Applied in Developing the Work Measurement Mobile Application

The ADDIE Model, a well-known educational architecture model comprising the following phases: analysis, design, development, implementation, and evaluation, guided the development process. Each phase was executed systematically to guarantee that the educational application met the learning objectives of Industrial Engineering students, particularly in Work Measurement.

Analysis

The analysis involves determining the gap and identifying the needs of the learners to come up with the Work Measurement Mobile Application. A deeper analysis experience by the students in attending online classes was conducted. The scope of the Work Measurement Mobile Application was established following the course philosophy, objectives, course requirements, anticipated learning outcomes, teaching methodologies, and academic infrastructures. The instructional analysis on the Work Study subject was applied to align the course syllabus to the Commission on Higher Education Memorandum Order (CMO) as well as to identify the subject contents.

Figure 3.

Main Menu of Work Measurement Mobile Application

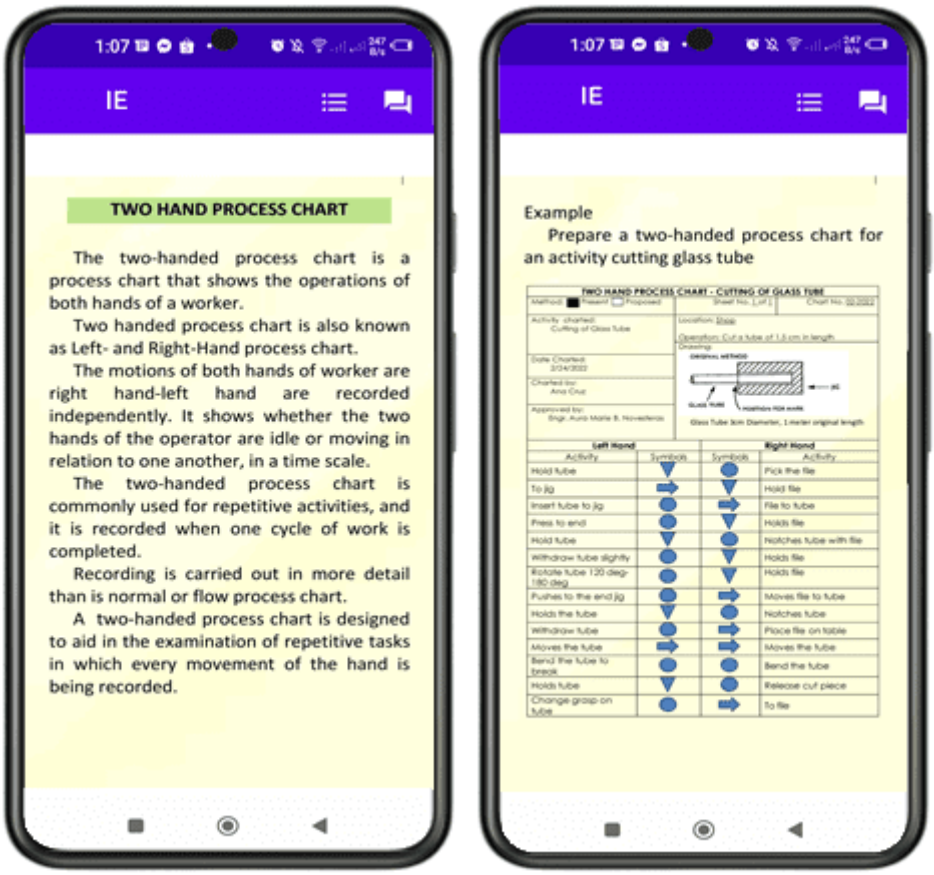
Design

The design phase includes the identification of learning objectives for the Work Study subject, which was integrated into an educational mobile application following the Commission on Higher Education (CHED) design curriculum, as shown in Figure 3. Students can effortlessly navigate the application by simply clicking on the course program and selecting an engaging topic to read. The course syllabus for Work Measurement was revisited to examine the learning objectives, instructional delivery design, and assessment tasks. The

design of the Work Study Mobile Application includes course materials comprised of texts, different charts, and images of the corresponding topic as written in the syllabus.

Figure 4.

Discussion and Example of Charts



Development

The third stage is the development process, where the Work Measurement Mobile Application was developed using the data collected from the analysis and design stages. This was assisted by the Android operating system. Pilot testing was done to determine what must be corrected and modified. A prototype was created during the development process to establish the product design and to see how the user interacts with the overall design. The system consists of a brief overview of the topic, a step-by-step method, an example with an explanation, and an exercise with the right answer.

Implementation

The implementation stage is the point at which the target users can access the mobile application. The Application can be downloaded and installed to provide a study tool that is

ready for use. Students have access to the application and can read more about the subject. They have the chance to complete the exercises and assess their understanding of the subject through the given exercises.

Evaluation

The final step is evaluation, where the developer verifies during testing that the designated function performs as defined by its specifications and that the application may assist students in comprehending the concept of learning. The respondents utilized the developed Work Measurement Mobile Application, and the respondents' adoption of the Work Measurement Mobile Application was evaluated according to ease of use of the application and its effectiveness.

The Work Measurement Mobile Application was developed using the ADDIE Model, with a clear focus on instructional alignment, learner engagement, and usability. Identifying learner needs to evaluate user experience, ensured that the mobile application was both pedagogically and technically effective. The educational application provides Industrial Engineering students with a portable and readily accessible resource to assist independent study, particularly in areas with limited internet availability. By combining course-aligned information with intuitive design and offline accessibility, the mobile application offers a practical addition that adheres to both educational best practices and user-centered design.

1. Phases of the ADDIE model that were applied in developing the Work Measurement Mobile Application

The study's objective is to develop instructional material on Industrial Engineering using the ADDIE Model. The analysis stage involves figuring out the learners' needs. When conducting an analysis, one must determine whether the user's needs will be met by the mobile app's quality. When downloaded and installed on Android phones, it allows unlimited mobility, with the ability to function without an internet connection. When the user has easy command execution of the system, perceived utility is attained while completing the tasks.

The design stage of the Work Measurement Mobile Application includes identifying learning objectives following the CMO design curriculum. The course syllabus was revisited to examine the course learning outcome, instructional delivery design, assessment tasks, and course requirements. The application runs on smartphones via the Android operating system. Favorable to the study of Ejiyi et al. (2021), Android's advanced application offers consumers a more advanced mobile experience.

The Development Stage includes smartphone-compatible software selection. The Android OS was employed to manage the creation of mobile applications. Its user-friendly UI

works with any mobile device. To create a more user-friendly program, a revision of work was done on the interface, text, color, and image interaction to make it more attractive to the user.

During the Work Measurement Mobile Application's implementation stage, students were instructed to download and install the application on their mobile and utilize the application as an extra study aid in reviewing their lessons, which they can use during their most available time. The last stage is evaluation to verify the performance of the mobile application in understanding the topics of Work Measurements. Incorporating the Work Measurement subject can help students gain an understanding by enhancing work measurement techniques.

2. Response of the User in Adopting the Work Measurement Mobile Application in terms of Perceived Ease of Use

Table 1 uncovered that respondents generally believed that the Work Measurement Mobile Application is simple to use, with an overall average mean of 3.41. The highest-rated item was "The mobile application can be explored anytime" (M = 3.64), followed by the ease of use on Android phones (M = 3.53) and simple navigation (M = 3.57), all of which were interpreted as "Strongly Agree." Meanwhile, the features related to accomplishing more work than the desktop (M = 2.98) and quick access to the learning menu (M = 3.34) were slightly lower but still within the "Agree" range. These findings show that, while the application performs well in terms of usability, there is an opportunity for improvement in the capabilities, features, and interface design.

Table 1.
Respondents' Assessment in Terms of Perceived Ease of Use

Perceived Ease of Use	***Mean***	***Interpretation***
1. The mobile application can be explored anytime	*3.64*	*Strongly Agree*
2. The mobile application is easy to use on an Android phone	*3.53*	*Strongly Agree*
3. The navigation of the mobile application is simple to recall.	*3.57*	*Strongly Agree*
4. The mobile application helps accomplish more work than the desktop	*2.98*	*Agree*
5. Quick Access to the Learning Menu	*3.34*	*Agree*
Average Mean	*3.41*	*Agree*

The findings correspond with the Technology Acceptance Model (TAM), which holds that comfort of using the system influences a user's behavioral intention to adopt a technology (Christian et al., 2023; Canca & Perdahçı, 2023). The respondents' agreement that the application is simple to use and can be used anytime demonstrates that accessibility and a simple user interface contribute to the acceptance of technology. This corresponds with the

findings of Al-Rahmi et al. (2021), who claim that mobile learning promotes student involvement, and Aroonsrimarakot et al. (2023), who discovered that mobile platforms could outperform traditional techniques under specific conditions. Moreover, because the mobile application is Android-compatible, it takes advantage of the OS's versatility and extensive use (Ejiyi et al., 2021). The mobile application's functional layout capability enhances the learning experience for Industrial Engineering students. As a result, designing educational tools with user-friendliness increases student independence in studying. Finally, a well-designed mobile application can be a useful supplement to traditional learning, particularly when it is tailored to students' preferences and learning requirements.

3. Response of the User in Adopting the Work Measurement Mobile Application in terms of Perceived Usefulness

According to Table 2, Industrial Engineering students evaluated the perceived usefulness of the Work Measurement Mobile Application with a 3.36 overall mean, revealing an interpretation of "Agree." The highly rated indicator was "The mobile application gives me greater control over my learning activities" (M = 3.58), followed by the statement "The mobile application makes my learning easier and simpler" (M = 3.55), both of which received a "Strongly Agree" interaction. Meanwhile, the alignment with learning preferences (M = 2.98) and contribution to performance (M = 3.37) were slightly lower but still positive. These findings indicate that engineering students considered the mobile application useful in promoting flexible and independent learning, especially for those pursuing higher education, and having part-time work while studying.

Table 2.
Respondents' Assessment in Terms of Perceived Usefulness

Perceived Usefulness	***Mean***	***Interpretation***
1. The mobile application is useful in my learning endeavor	3.52	Strongly Agree
2. The mobile application meets the learning needs and preferences	2.98	Agree
3. The mobile application makes my learning easier and simpler	3.55	Strongly Agree
4. The mobile application contributes positively to my performance	3.37	Agree
5. The mobile application gives me greater control over my learning activities	3.58	Strongly Agree
Average Mean	3.36	Agree

These findings support perceived usability as a key driver of user adoption (Zhai & Shi, 2020). When students believe that a system will help them complete work more efficiently, they are more inclined to use it. This finding coincides with the research of Qashou (2021),

which found that mobile applications are more inclined to be accepted when they fit the user's educational requirements. The app's relevance and instructional value were further strengthened by the incorporation of Curriculum Content from the Commission on Higher Education (CHED). The usage of mobile learning is also in favor with the findings of Al-Rahmi et al. (2021) and Correia et al. (2024), whose work discovered how mobile application improves learner engagement and academic achievement even when internet connection is limited. This suggests that creating curriculum-aligned, user-centered applications for smartphones can be an effective approach to enhancing accessibility and achievement in higher education. Furthermore, students rated the Work Measurement Mobile Application as beneficial, emphasizing the necessity of developing mobile learning tools that foster independence and alignment with students' educational objectives.

The comparative analysis of user responses reveals that perceived ease of use was somewhat higher than the average mean for perceived usefulness, still demonstrating that each of the variables was favorable. Students deemed the mobile application to be more user-friendly and effective in improving their learning outcomes. This shows that the application's user interface and navigation were simple and accessible, which is following Christian et al. (2023) and Canca & Perdahçı (2023), who underlined that user-friendly systems are more likely to be accepted. Nevertheless, the modestly lesser perceived usefulness rating shows that the capabilities of the application may be better aligned with specific learning goals and outcomes. According to Zhai and Shi (2020), usefulness is most visible when a system significantly enhances the completion of work. This necessitates constant improvement of the applications' content relevancy, interaction, and connection with course objectives.

Conclusions

This study demonstrated the successful development of a Work Measurement Mobile Application that utilized the ADDIE model as a systematic framework for instructional design. Integrating technology into the learning process, particularly in engineering education, is more important, especially in meeting students' needs for adaptability, accessibility, and independent learning. The mobile application provided a practical learning resource that Industrial Engineering students could access at any time and from any location, which was especially significant given the limits of internet connectivity and remote learning environments.

Similarly, ease of use of the system significantly influenced the desire to use the system. When students find the program simple, usable, and accessible without technical difficulty, they are more likely to engage with the material and use it regularly. This demonstrates that a user-friendly interface and clear instructional design help to improve user experiences and enhance acceptance of educational applications.

The findings of the user assessment proved that engineering students are generally motivated by technological devices, especially when they are seen to be beneficial and simple to use. According to the Technology Acceptance Model (TAM), the perceived usefulness of the mobile application had a substantial impact on students' willingness to use it as a learning resource. Students noted that the application made it easier for them to complete learning assignments and improved their comprehension of work measurement concepts.

The development process of educational mobile applications emphasized the need to integrate material with academic educational objectives and educational requirements, to guarantee the mobile application functions as both an additional aid and an essential academic resource.

In conclusion, mobile learning applications can be a beneficial tool in higher learning, particularly when driven by strong approaches to instructional design and assessed according to recognized mathematical models. Future development should focus on improving the user experience, broadening access (for example, iOS compatibility), and including factors such as interactive quizzes or gamification to engage learners even more.

Recommendations

To promote user satisfaction and adoption, subsequent application development ought to concentrate on boosting visual design, accessible navigation, and responsiveness. Features like as visual support, gamification, and feedback in real time may improve retention and involvement outcomes.

The application for mobile devices should provide easy access to features such as customizable font sizes, voiceovers, and offline text-to-speech capability to accommodate students with varying learning needs and competencies. This promotes a more diverse educational tool for every student.

Additional versions of the application need to be available with iOS, web-based devices, and Android in order to expand its scope of use and application. This guarantees that students who use different devices have equal access to the application.

The university might think about creating organizational rules or regulations to encourage mobile education integration in the university's curriculum. This policy should establish guidelines for the creation of applications, assessment, and instructional implementation across every program.

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Ethical considerations

This study strictly followed ethical research guidelines to maintain all participants' confidentiality. Before the data collection, every participant provided informed consent. Participants were informed of the goal of the research, that their participation was voluntary, and that they were able to cancel at any time. All responses were kept anonymous and confidential throughout the study.

Compliance with Ethical Standards

The Quezon City University Research Ethics Board approved the research protocol, which included obtaining informed consent, allowing respondents to withdraw from the study at any time, maintaining respondents' anonymity, ensuring no conflict of interest existed in the study's conduct, avoiding bias in the interpretation of the findings, and using the results solely for research purposes.

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