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DESIGN AND DEVELOPMENT OF AN INTERACTIVE WEB-BASED LEARNING PLATFORM FOR BIM USING THE ADDIE MODEL

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ABSTRACT

Building Information Modelling (BIM) adoption in Malaysian construction sector still faces issues, that includes low awareness of the need to shift toward BIM, limited understanding and a lack of access to suitable learning resources. The main problem is the absence of a digital platform that is simple to access, open to everyone for free, interactive and capable of supporting self-learning at home. This study develops an integrated website accessible to all. The website is based on the ADDIE Model, which encompasses five phases: Analysis, Design, Development, Implementation and Evaluation. The main objective is to provide a comprehensive digital learning platform that enhances users' understanding and interest BIM in a systematic manner. A provider based on requirements and costs, domain and hosting services was selected, designing the layout, adding interactive multimedia features, and testing the site's functionality and accessibility on different devices. Finally, the website is able to help users understand basic BIM topics more clearly with step-by-step content, visual and multimedia elements, interactive exercises and a user-friendly navigation structure. Suggestions for improvement include adding a discussion forum and self-assessment features to enhance the learning experience. This shows a systematic approach through ADDIE Model suit the needs of BIM users.

1. Introduction

The use of BIM and the three-dimensional (3D) model in projects are increasingly frequent for supporting design tasks (Charef, Alaka, & Emmitt, 2018). Sanchez and Rodriguez-Paz (2021) stated that BIM is an ICT technology with the potential to be used as a didactic approach to improve e-learning outcomes. According to Tanko and Mbugua (2021), digital applications and BIM have been introduced into the construction industry to develop a smart construction ecosystem. However, full adoption of BIM has yet to be realised in the

industry, and the use of BIM applications in higher education institutions has not been thoroughly explored. Nonetheless, the level of BIM proficiency among some stakeholders remains unsatisfactory. One of the main contributing factors is the lack of systematic and interactive learning materials. Most teaching and learning processes involving BIM still rely on traditional approaches that are less effective in supporting technical understanding. In addition, there are challenges such as time constraints, software access, and the shortage of competent and skilled instructors. These issues affect the overall effectiveness of the teaching and learning process, ultimately limiting users' potential to master the skills required by the industry. Conventional teaching methods are also becoming increasingly irrelevant to the needs of today's learners, who are more inclined towards digital technology and interactive visual content.

Digital learning has become a viable alternative that is significantly reshaping the knowledge delivery system in today's context. Online learning not only supports self-directed learning but also provides flexibility in terms of time and location. According to Cortez-Lara and Sanchez (2024), advancements in digital technologies in the construction industry have made e-learning a crucial component in civil engineering courses. Innovations such as Building Information Modelling (BIM) have revived interest in its application across various related courses. Today, BIM is a widely used digital technology in the Architecture, Engineering and Construction (AEC) industry. BIM is the process of creating, using, and sharing three-dimensional models through digital technologies that carry various forms of information needed by multiple parties, such as architects, engineers, quantity surveyors, and others. All information in BIM can be accessed and used collaboratively by project stakeholders to meet objectives throughout the construction project phases. Mastery of BIM software and technology is essential, particularly for stakeholders, to meet the increasingly complex and competitive demands of the construction industry. Therefore, the development of a systematic and interactive digital learning medium is crucial to help users understand BIM concepts more effectively and holistically. This interactive website has been developed as an educational innovation to support self-directed and visual learning on BIM-related topics.

2. Methodology

E-learning is a communication technology that enhances learning results. Educational institutions and training programmes often utilise e-learning to improve learning experiences. E-learning seeks to enhance instructional quality by resolving challenges related to location and accessibility (Wahyudin, Darmawan, & Suharti, 2022). This website's design and development adhere to the five principal phases of the ADDIE Model: analysis, design, development, implementation, and evaluation. We implement this structure consistently during the entire development of the interactive web portal and user interface. Branson introduced the ADDIE instructional model in 1975. It was created at the Centre for Educational Technology at Florida State University. Conceived by Dick and Cary in 1978 and enhanced by Russell Watson in 1981, Dick and Cary's ADDIE model is regarded as essential for the formulation of training and instructional tactics (Hannum, 2005). Figure 1 illustrates the stages of the ADDIE Model.

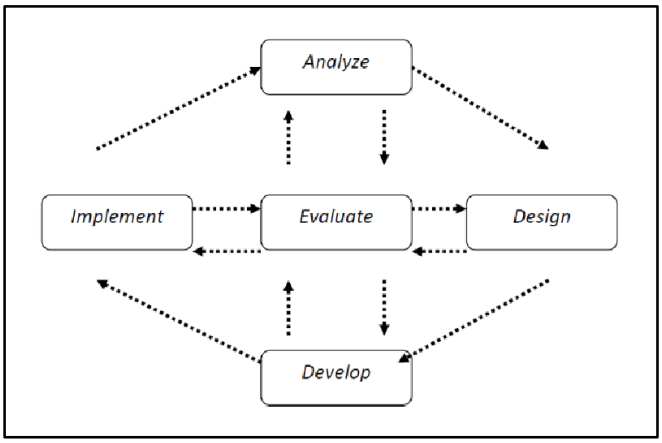

Figure 1. Five structured phases of the ADDIE model.

2.1 Analysis Phase

The initial phase of the methodology is the analysis phase. A preliminary investigation was carried out on available BIM-related educational content across various websites. This initial examination highlighted the necessity for a learning platform that delivers BIM information in a structured, visual, and easily accessible manner. Additionally, during this phase, the domain and hosting service were selected and registered with a user-friendly provider that offers robust support for the platform.

2.2 Design Phase

In the design phase, the structure of the website was organised using an information mapping technique. Essential components such as the layout of the homepage, arrangement of the menu, user navigation paths, and types of multimedia content were identified and outlined using a simple wireframe. The design prioritised simplicity, incorporating consistent visual elements, a professional colour scheme, and appropriate typography for technical education.

2.3 Development Phase

The development phase involved using a Content Management System (CMS) platform, which allowed for responsive theme customisation, educational plugins, and the integration of interactive media. The website was built with various components, including a homepage, learning modules, videos, hyperlinks, a contact page, and more.

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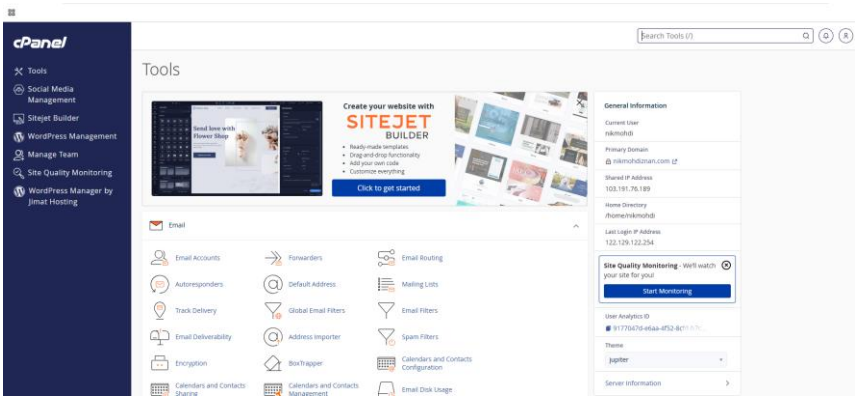

Figure 2. C-panel interface during the website development phase

2.4 Implementation Phase

Following the completion of development, the website was launched during the implementation phase, making it available to users. The entire content was reviewed for technical functionality, relevance, and compliance with digital learning design standards. Final modifications were made based on internal testing prior to the official launch of the website.

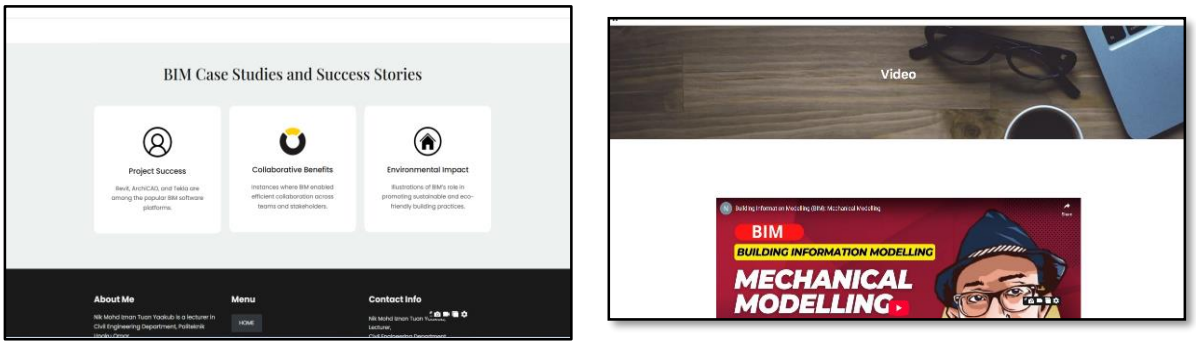

Figure 3. Front page display of the developed website

2.5 Evaluation Phase

During the evaluation phase, the researcher evaluated usability, technical functionality, and design consistency using a self-assessment checklist created in accordance with educational web design principles. This evaluation considered factors such as page load speed, readability of text, navigation design, and the effectiveness of visuals in conveying information.

3. Results

In the 21st century, educators are utilising emerging technologies to develop not only knowledge of graduates, but also their soft skills in order to enhance competencies parallel with employer's requirements. Collaborative learning has been proven in promoting soft skills development (Razali & Shahbodin, 2015). The development of the interactive website for BIM education has been successfully finalized in accordance with the five phases outlined in the ADDIE Model. The outcomes demonstrate that this methodical approach offers considerable benefits by ensuring the website is not only content-rich but also stable, user-friendly, and responsive to contemporary digital learning requirements.

A key finding is the efficiency gained from utilizing a Content Management System (CMS) as the development platform. This choice allows for flexible uploading, management, and updating of content. The development process was streamlined through the implementation of responsive themes and educational plugins, such as Elementor, which enhance interactive learning through features like text displays, slideshows, and explanatory videos on BIM concepts. Observations from early users indicate that the integration of multimedia elements significantly enriches students' comprehension during self-review sessions.

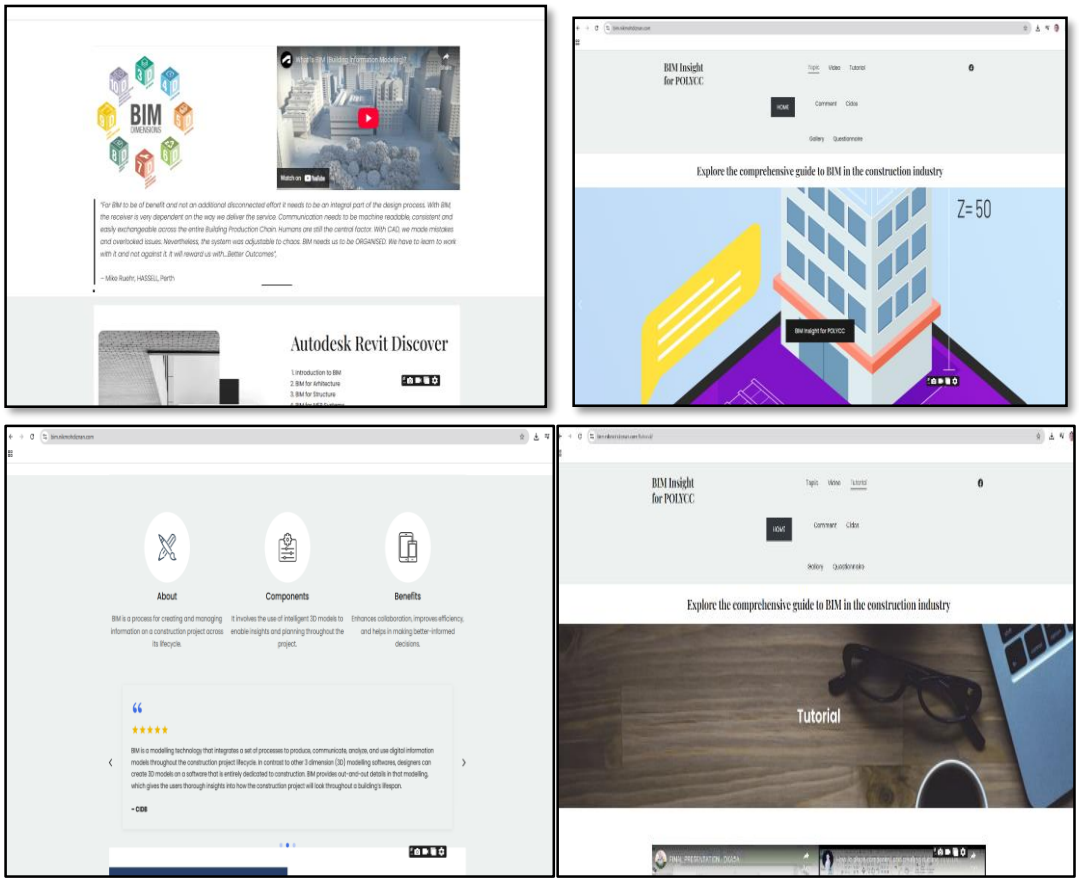

Figure 4. Other displays of the developed BIM website.

Additionally, the well-structured site layout, which encompasses an introduction, learning modules, a video gallery, supplementary resources, and a feedback section, promotes systematic navigation for users. The findings also reveal that the incorporation of visual graphics, including BIM infographics and technical diagrams, effectively elucidates challenging concepts that users often struggle to grasp.

4. Discussion

Educators are utilising emerging technologies to develop not only knowledge of graduates, but also their soft skills in order to enhance competencies parallel with employer's requirements. Collaborative learning has been proven in promoting soft skills development. Teaching is a highly complex occupation, which needs to adapt to a great deal of variety in context, subject matter and learners. (Razali & Shahbodin, 2015). The BIM website is developed using the ADDIE Model (Analysis, Design, Development, Implementation, Evaluation), a widely recognized instructional design framework. This systematic approach begins with assessing user needs and ends with evaluating the product's effectiveness. The website integrates various learning components, such as videos, interactive quizzes, visual notes, and links to additional resources, all aimed at enhancing user experience and engagement. This initiative seeks to significantly improve the application of educational technology within BIM, aligning with national goals for the digitalization of higher education.

Enhancing educational quality demands continuous innovation, particularly in areas such as curriculum design, instructional strategies, learning media, and teaching resources. (Aprianto & Wahyudi, 2023). From a technical standpoint, the website has been tested on multiple devices—including laptops, tablets, and smartphones—demonstrating reliable performance without major issues. It is optimized for fast access and includes essential security measures like SSL implementation. In terms of accessibility, the website adheres to best practices, featuring appropriate color contrasts, user-friendly font sizes, and a responsive layout to ensure usability across all devices. Overall, the findings of this study demonstrate that developing a website based on the ADDIE model not only results in a high-quality digital product but also provides a conducive, flexible, and high-impact learning environment. This BIM website has the potential to serve as a learning resource as well as a reference model for the development of other technical education websites in the future.

5. Conclusion

Internet technology has become an integral part of social production and development, and the use of dynamic networks has expanded internet applications (Wang, 2025). This website was successfully developed from the planning stage all the way to its online publication. More than just a platform for delivering information about BIM, it also serves as a valuable learning tool that enhances students' understanding through interactive content and effective visualizations. The capabilities of the Content Management System (CMS) were fully leveraged to create a stable, accessible, and easily updatable site that works well across various devices. As a conclusion, this study contributes a practical model of best practices in the development of

digital learning materials especially within the context of Technical and Vocational Education and Training (TVET). It is hoped that the website will continue to benefit users, particularly by improving students' comprehension and interest in BIM technology, which is becoming increasingly vital in today's construction industry landscape. In the future, the platform can be further enhanced by integrating assessment systems, student progress tracking, and expanding its content towards micro-credentialing in the field of BIM.

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