ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XIV, Issue IX, September 2025

Web Wizards: A Gamified Approach to Mastering Web Development Through Puzzle Challenges

Ronald Fernandez, John Alver Antonio, Valrino Farvin Baring, Joseph Ian Gonzales, Justine Lance Manahan

Universidad de Manila, Philippines

DOI: https://doi.org/10.51583/IJLTEMAS.2025.1409000065

Abstract— This paper discusses *Web Wizards*, a mobile app designed to help users learn web development through gamified, puzzle-based learning. Compared to more traditional methods, the app introduces features like interactive challenges, real-time feedback, and two-player modes (Arcade and Story), either competitive or cooperative, to boost both engagement and understanding. The project followed a developmental research approach using the Agile methodology, with user input gathered throughout the development process. Results showed that learners felt more motivated and were able to apply practical skills more effectively. Overall, *Web Wizards* contributes to the field of educational technology by demonstrating how gamification can make programming concepts less intimidating and more accessible for beginners.

Keywords— Gamification, Web Development, Puzzle Quiz, Mobile Learning, Educational Technology

I. Introduction

In today's fast-paced digital world, technology plays a crucial role in various sectors, including education, business, and healthcare. Knowledge of computer technology and programming in various fields is essential to meet industry demands for expertise in Information and Communications Technology (ICT), such as software programming, databases, software engineering, computer networking, and creative multimedia (Kadar et al., 2021). As technology continues to evolve, many organizations are turning to automated systems to streamline their operations. This capstone project, "Web Wizards: A Gamified Approach to Mastering Web Development Through Puzzle Challenges," addresses specific problems by introducing an engaging technological solution that enhances learning effectiveness and supports better educational outcomes.

The rise of web development as a vital digital skill poses educational challenges to students and beginners through conventional learning techniques. Traditional learning methods that use textbooks and video tutorials fail to deliver interactive coding practice which impedes student ability to implement theoretical coding principles. The students' background knowledge and teaching methods together with their attitudes and social context both contribute to learning difficulties in computer programming, as stated by Kadar et al. (2021). The consequence leads students to experience information retention difficulties and experience decreased motivation and heightened feelings of being overwhelmed by the subject matter. Web development lessons present challenges to educators when they attempt to make their classes engaging and interactive for their students.

Web development learning becomes complex because beginners face confusion and frustration which stems from numerous technologies used in the field. Traditional learning systems offer insufficient instruction for hands-on learning or problem resolution thus driving numerous students to become uninterested. New educational methods need to replace traditional learning approaches because of the increasing requirement for effective student-engaging teaching methods.

The study addresses these obstacles through Web Wizards which provides users with a mobile application-based quiz game for web development education. The research tests how sociodemographic factors (education level and age along with gender) affect the implementation of innovative challenge-based gamification approaches in xMOOC environments and studies their influence on students' final evaluation results (Rincon Flores et al., 2020). The application includes multiple game mode features alongside real-time evaluation functions and achievement-based reward structures to boost users' learning experience. Web Wizards has developed a system which delivers motivating web development instruction through its educational platform targeting students together with beginners, professionals and educators. Through its gaming-infused educational approach the app enables people to develop coding skills while boosting their self-assurance and improving their readiness for professional projects. The process of using game-based elements outside traditional gameplay settings creates computer-human engagement and facilitates desirable learning behaviors according to Khaleel, Ashaari, and Wook (2020). This innovative approach not only supports learners in mastering web development but also offers educators a new tool for delivering engaging lessons.

II. Related Studies

A. Influence of 3D Models and Animations on Students in Natural Subjects

Teplá et al. (2022) explored how dynamic visualizations, such as 3D models and animations, affect students' motivation in science education. The study involved over 565 students in Czech middle and high schools, comparing dynamic visualizations with static visuals. Results indicated that students who learned with 3D models demonstrated higher

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XIV, Issue IX, September 2025

motivation and better learning retention, particularly in Chemistry and Biology compared to those who learned with static visuals.

Relevance to the Study: This supports the use of interactive 3D visualizations in education to make learning more effective and engaging, and the proposed system, Web Wizards builds upon this by incorporating 3D elements into a gamified learning experience for web development learning.

B. Mobile Game Application for Student Knowledge Practice Developed with An Architecture Using Distributed Web Systems

Ileana & Popgeorgiev (2020) explored the impact of mobile and tailored game-based learning in higher education by developing a mobile learning app called "Quiz Time!", an application designed to improve students' C# programming skills through a fuzzy logic-based learning model and personalized recommendations. Results showed that integrating mobile games into education enhanced engagement and knowledge retention, emphasizing the need for more research into game-based learning environments.

Relevance to the Study: Web Wizards builds on this concept by offering a personalized, mobile first learning platform that combines puzzle challenges with web development concepts in a gamified format.

C. *Game-Based Digital Quiz as a Tool for Improving Students' Engagement and Learning in Online Lectures*

Nuci et al. (2021) examined the impact of game-based quizzes like Kahoot! on student engagement in online education. Their study showed that students who engaged with gamified quizzes showed a 73% improvement in their learning curve compared to 57.5% in traditional online classes. Elements like competition and rewards played a big part in keeping students motivated, reinforcing the benefits of game-based learning in higher education.

Relevance to the Study: Web Wizards uses a similar approach by integrating real-time quizzes and puzzles to keep learners engaged, especially in a virtual environment.

D. Gamification in English Online Learning: A Phenomenological Study

Pandi-Ruedas, J. & Pacatang, H. (2024) conducted a phenomenological study to explore how gamification influences the motivation and engagement of senior high school students in an English online learning environment. The research focused on the students' lived experiences, uncovering that game elements such as points, rewards, levels, and challenges significantly improved learners' interest, motivation, and participation. Students also expressed that gamified learning environments made lessons more interactive and enjoyable, helping them overcome the monotony of traditional online classes.

Relevance to the Study: This emphasizes the motivational impact of gamification in education, reinforcing the integration of game-based features in Web Wizards to foster student engagement in learning web development.

E. A Gamified Educational Learning Module for Core Subjects in an Elementary Level

Blancaflor, E., Camaongay, K., Chua, J., & Echanes, G. (2022) developed Astro Academy, a 2D puzzle-based educational game designed to increase motivation and learning among elementary students, particularly during the COVID-19 pandemic. The study emphasized the integration of educational content with interactive mini-games to enhance cognitive skills such as reading, math, and critical thinking. Through user acceptance and unit testing, involving students and a teacher, findings revealed that gamified elements like challenges, story-driven tasks, and colorful interfaces boosted student engagement and interest in learning. The majority of student testers responded positively to the game's usability and expressed interest in continued use.

Relevance to the Study: This supports the use of gamified educational platforms in increasing student motivation and cognitive development, which aligns with Web Wizards' objective of combining interactive storytelling and game mechanics to create an engaging web development learning experience.

III. Methodology

A. Research Design

A developmental research design guides the creation of Web Wizards mobile application that advances web development learning through quiz-based gameplay between students. The application's effectiveness and usability together with user engagement receive quantitative and experimental analysis for a systematic and data-driven evaluation

1) Descriptive Developmental Research Approach: Web Wizards is designed to help students learn web development through an interactive quiz-based mobile game. It includes features like Arcade Mode, Story Mode, and live feedback to make learning more engaging.

During the development phase, user feedback is gathered by conducting surveys, and usability testing. This assists the developers to get to know how the users feel concerning the app and what aspects need improvement. The idea is to

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XIV, Issue IX, September 2025

describe the way the application is constructed as well as what can be done to make it better in accordance with the user input.

This approach does not involve experiments or comparisons. Instead, it focuses on describing the development steps and using user feedback to make the app more effective for learning.

2) System Development Model: The Agile Methodology was selected because its flexible iterative approach demonstrates ideal suitability for developing the interactive learning platform Web Wizards. The methodology responds to user feedback by maintaining ongoing development focus which enables continuous improvement of the dynamic gamified system.

Fig. 1: System Development Model

B. Phases of Development

1) Planning: Planning means figuring out the project's big picture and deciding what's most important to do first. This creates a list of tasks to guide the work step by step. For Web Wizards, planning meant deciding to make a fun mobile app to learn web development. Choose the best features, like game modes and instant feedback, and planned short work periods to build the main parts little by little.

2) Analysis: Analysis is about gathering all the details and making sure everyone knows what the project needs to do. It helps the team understand exactly what to build. The Web Wizards research looked at what makes learning web development hard, like not being exciting enough. Made sure the app would have the right difficulty levels and clear learning paths to fix these problems.

3) Design: Design means creating simple and flexible plans that can change easily as the project moves forward. It includes making the app look good and work well for users. The app's design was set up to have two game modes with easy-to-use mobile screens. Fun elements like badges were added to keep learners interested, and a system to track progress was planned.

4) Implementation: Implementation is the process of writing code in short bursts, constantly testing and adding new features. Developers build the app piece by piece. We built the app one step at a time, starting with basic quizzes and adding instant feedback. The app was made for Android phones, and the team used tools to manage the code together.

5) Testing: Testing involves regularly checking the app to make sure it works well and is easy to use. Feedback is gathered to make improvements. Web Wizards had quizzes and feedback systems tested. Students and teachers tried the app to find any problems and suggest improvements, ensuring the app was fun and helpful.

6) Deployment: Deployment means releasing the app to users in stages and watching how it performs to make future updates. Web Wizards was released on Android so learners could easily access it. We tracked how people used the app and planned updates to make it even better and improve user experience.

C. Respondent Selection and Evaluation Approach

Web Wizards were assessed using a purposive sample of individuals who were students, professors, and IT professionals. These groups were selected to give a balanced view: students were the main users and learners of web development, professors guaranteed the pedagogical sanity of the platform, and IT professionals were able to give the industry perspective. This combination of respondents enabled the study to evaluate the effectiveness of the system in both educational and real-world aspects.

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XIV, Issue IX, September 2025

The ISO/IEC 25010 quality model was used to evaluate the application, and it consists of the following criteria, functional suitability, usability, performance efficiency, reliability, security, maintainability, portability, and compatibility. All sub-criteria were rated using a five-point Likert scale, which allowed respondents to identify strengths and weaknesses in a similar manner. Responses were analyzed using descriptive statistics (mean and standard deviation) with an emphasis on patterns and trends instead of inference comparisons because the study was exploratory.

D. Conceptual Framework

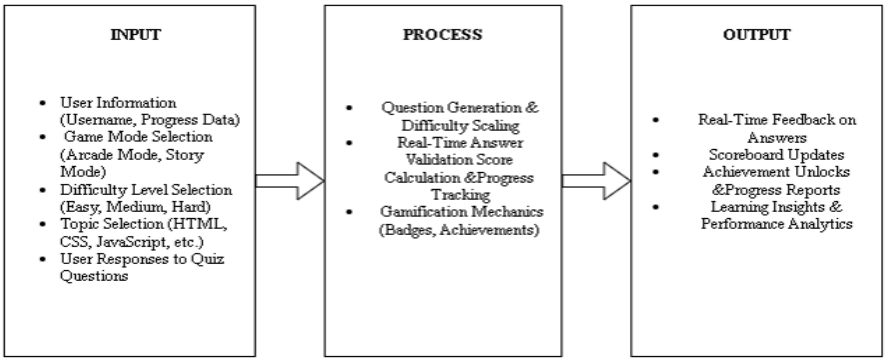

Fig. 2: Conceptual Framework

I. PROTOTYPE

Fig. 3: Title Screen – The main entry screen of Web Wizards, displaying the title and navigation options (Play, Options, Exit).

The title screen which the user sees upon opening the app. Includes the title of the game, multiple buttons play, options and exit.

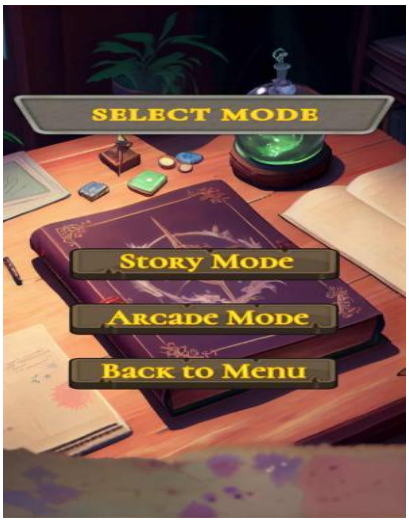

Fig. 4: Mode Selection Page – The interface allowing users to choose between Story Mode (progressive learning) and Arcade Mode (casual practice).

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XIV, Issue IX, September 2025

The page where the user is offered a choice between two different modes: Story Mode and Arcade Mode which has varying gameplays, or just go back to the title page.

Fig. 5: Story Mode and Arcade Mode Page – Story Mode emphasizes sequential topic progression, while Arcade Mode offers varying difficulty levels (Easy, Medium, Hard).

Story Mode is where the gameplay is more specific. This game mode is more on a step by step progression where users can track their progress for a specific section or language.

Arcade Mode is where the user can play casually between different difficulties: Easy, Medium, and Hard.

Fig. 6: Section Select – A menu enabling users to choose specific sections of web development topics for focused learning in Story Mode.

Section Select is what appears next after the user clicks play in the Story Mode page. Here, the user can choose which specific section of web development topics they want to learn or play.

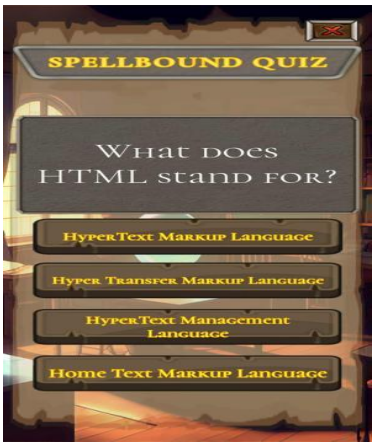

Fig. 7: Quiz Sample Gameplay – A multiple-choice coding puzzle designed to test user knowledge, with real-time feedback to reinforce learning.

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XIV, Issue IX, September 2025

Quiz is one of the sample gameplays that the user might expect when walkthrough the game. It's one of the most effective ways to test and assess the user's knowledge.

Fig. 8: Web View Simulation Page – A split-screen coding environment where users write HTML, CSS, or JavaScript and view results instantly for interactive practice.

Web view simulation page is where the user can write code on one side of the screen while instantly seeing the output on the other. It acts like a built-in playground, letting users test HTML, CSS, or JavaScript in real time without switching tabs or using external tools. This setup helps beginners understand cause and effect faster, making the learning process more interactive and efficient.

IV. Results and Discussion

This section summarizes and discusses the evaluation results obtained from the ISO/IEC 25010-based questionnaire distributed to chosen respondents. The study focused on the Web Wizards application's major quality features, such as functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability. Each sub-criterion was scored on a five-point Likert scale, allowing users to identify both strengths and weaknesses based on their perceptions and interactions with the system.

The findings are presented not only mathematically, but also in relation to the system's intended purpose as a gamified learning tool for web development. Trends, repeated feedback, and significant score changes across criteria are reviewed to identify which components of Web Wizards meet acceptable standards and which may require more modification. This interpretation connects raw data to practical changes, laying a solid foundation for future system enhancements. Responses from the Likert scale were analyzed using descriptive statistics, including mean and standard deviation per ISO/IEC 25010 sub-characteristic. Given the exploratory nature of the study and sample size, inferential statistics were not emphasized; instead, the focus was on identifying trends and consistency across respondent groups.

A. Department/Role

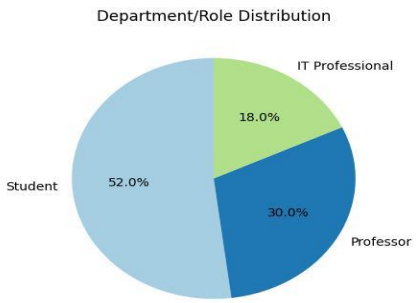

Fig. 9: Department/Role Pie Graph

Respondents were limited to students, professors, and IT professionals. This mix enabled the evaluation to include opinions from both academic users and active practitioners in the technology field. Having input from learners, educators, and industry professionals allows us to evaluate not just how engaging and clear the system is, but also how useful and applicable it is in real-

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XIV, Issue IX, September 2025

world learning or training settings. Students were chosen as the target learners of the platform, professors ensured pedagogical validity, and IT professionals contributed industry-relevant perspectives, ensuring a balanced evaluation.

B. Functional Suitability

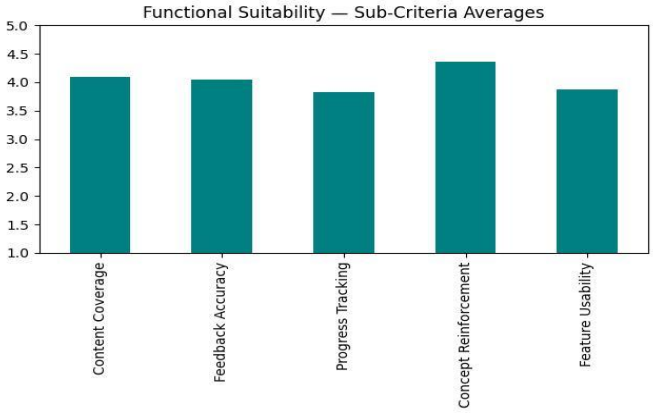

Fig. 10: Functional Suitability

The Functional Suitability category received consistently high ratings, averaging above 4.0. Respondents particularly valued Content Coverage and Concept Reinforcement, showing that the system effectively provides relevant learning materials and reinforces web development concepts. Feedback Accuracy and Progress Tracking also scored well, though with slightly more variation, suggesting opportunities to refine assessment feedback and tracking features.

C. Performance Efficiency

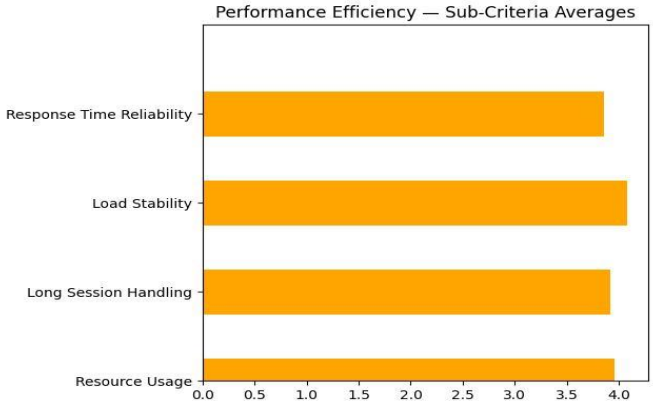

Fig. 11: Performance Efficiency

Performance Efficiency scored strongly, with most sub-criteria averaging around 4.2. Responsiveness and Response Time Reliability received the highest marks, indicating that the system loads lessons and quizzes quickly. Resource Usage and Long Session Handling also performed well, meaning the application runs smoothly even on extended use. Load Stability showed slightly lower values but still remained positive.

D. Compatibility

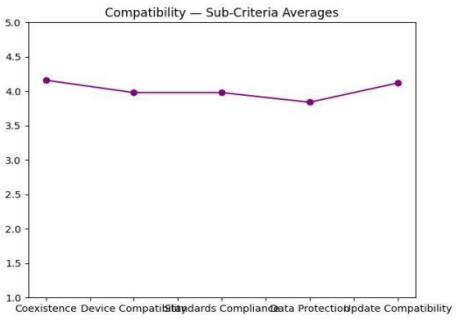

Fig. 12: Compatibility

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XIV, Issue IX, September 2025

Compatibility results were favorable, averaging above 4.0. Respondents agreed that the system functions across devices and complies with necessary standards. Device Compatibility and Standards Compliance scored highest, showing adaptability to different environments. Update Compatibility received slightly lower ratings, suggesting that improvements could be made in handling OS updates more seamlessly.

E. Usability

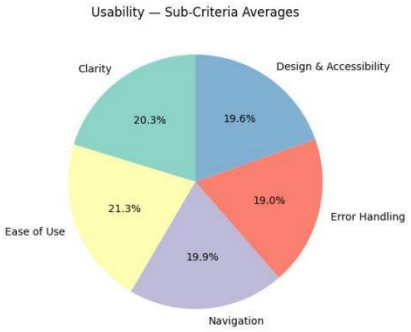

Fig. 13: Usability

Usability was one of the highest-rated categories, averaging around 4.5. Respondents highlighted Clarity and Ease of Use as standout strengths, reflecting that the system is intuitive even for beginners. Navigation and Design & Accessibility were also praised, showing that the layout supports inclusive learning. Error Handling received slightly less emphasis but still rated positively. One student respondent noted, the layout is simple and easy to follow, which makes learning less overwhelming.' Another respondent shared, 'The story mode helps me track progress better than just reading tutorials.

F. Reliability

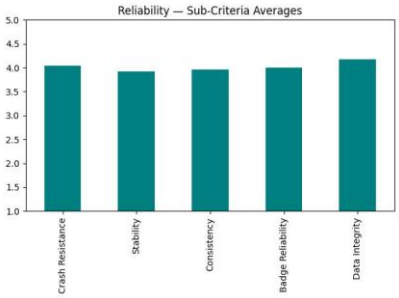

Fig. 14: Reliability

Reliability ratings were consistently high, with averages around 4.3. Stability and Consistency were highlighted as the strongest areas, demonstrating that activities and feedback remain dependable. Crash Resistance and Badge Reliability also received strong approval. Data Integrity was rated positively, confirming that no data loss occurs during normal use. An IT professional commented, 'The system runs smoothly without crashing, which is important for continuous learning. A professor remarked, 'Its consistency makes it reliable enough to be integrated into classroom activities.

G. Security

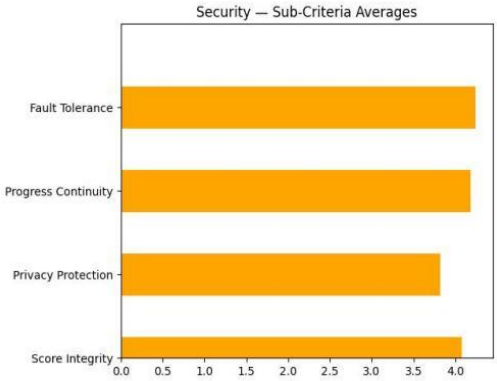

Fig. 15: Security

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XIV, Issue IX, September 2025

Security was another highly rated category, averaging about 4.2. Respondents emphasized Privacy Protection and Data Protection as strong points, ensuring that user information is safeguarded. Score Integrity and Progress Continuity also scored well, showing that achievements are reliably stored. Fault Tolerance was slightly lower but still acceptable, reflecting resilience even during network interruptions.

H. Maintainability

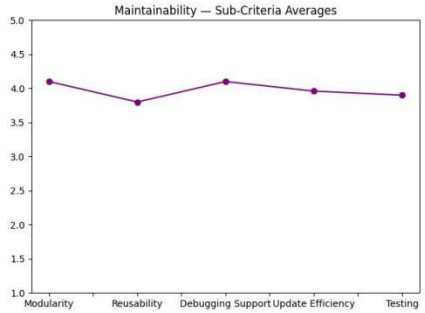

Fig. 16: Maintainability

Maintainability results averaged above 4.0. Modularity and Reusability scored the highest, showing that features can be updated and reused effectively. Update Efficiency and Testing were also rated positively, though they revealed some opportunities for optimization to make updates less disruptive. Debugging Support was the lowest within this category, indicating room for improvement in providing clearer error logs.

I. Portability

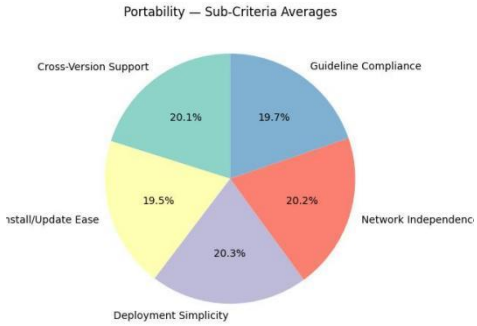

Fig. 17: Portability

Portability was rated positively, averaging around 4.1. Cross-Version Support and Install/Update Ease scored highest, showing that the system runs well on different versions of devices and is easy to set up. Deployment Simplicity and Guideline Compliance also scored well, while Network Independence received slightly lower values, indicating potential for improvement in offline usability.

J. Summary

The ISO/IEC 25010-based evaluation of Web Wizards produced consistently high ratings for all quality characteristics, with overall averages ranging from 4.0 to 4.5. Usability emerged as the most important factor, notably in terms of clarity, navigation, and simplicity of use, followed by functional suitability, which respondents complimented for its relation to content and concept reinforcement. Performance efficiency and reliability were also well welcomed, showing that the system operated smoothly and remained stable over time. Security, compatibility, maintainability, and portability received somewhat lower but still positive scores, with minor suggestions for smoother update processing, greater debugging tools, and increased offline accessibility. Feedback from students, professors, and IT professionals indicated that Web Wizards is not only engaging but also useful for both academic and training situations, supporting its success as a game-based learning tool for web development.

V. Conclusion

Web Wizards effectively illustrates how teaching web development using game-based learning may be fruitful. The system fills the gap between conventional teaching and real-world application by combining interactive challenges, structured advancement, and real-world coding ideas. From system design and implementation to testing and assessment, the development process demonstrates that the platform is both pedagogically sound and in line with the demands of modern digital learning. Its popularity among academic and professional users confirms its value as an additional resource for technical upskilling, classroom integration, or self-paced learning. To accommodate a larger spectrum of learners, the system can be extended in the future with more

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XIV, Issue IX, September 2025

modules, collaborative tools, and variable difficulty. All things considered, Web Wizards demonstrates that instructional games are more than just amusement but also are viable and scalable solutions for modern programming education.

References

1. Teplá, M., Teplý, P., & Šmejkal, P., (2022). Influence of 3D models and animations on students in natural subjects. IJ STEM Education, 9(65). https://doi.org/10.1186/s40594-022-00382-8
2. Ileana, M., & Popgeorgiev, I., (2020). Mobile game application for student knowledge practice with a distributed web systems architecture. Proceedings of University of Ruse–2020. https://www.academia.edu/128353694/Mobile_Game_Application_for_Student_Knowledge_Practice_with_a_Distributed_Web_Systems_Architecture
3. Pireva Nuci, K., Tahir, R., Wang, A. I., & Imran, A. S., (2021). Game-based digital quiz as a tool for improving students' engagement and learning in online lectures. IEEE Access, PP(99), 1–1. https://doi.org/10.1109/ACCESS.2021.3088583
4. Pandi-Ruedas, J., & Pacatang, H., (2024). Gamification in English online learning: A phenomenological study. Proceedings of the ICCEPH Conference. https://icceph.com/wp-content/uploads/2024/04/GAMIFICATION-IN-ENGLISH-ONLINE-LEARNING-A-PHENOMENOLOGICAL-STUDY.pdf
5. Blancaflor, E., Camaongay, K., Chua, J., & Echanes, G. (2022). A gamified educational learning module for core subjects in an elementary level. International Journal of Information and Education Technology, 12(1), 1751-CS2020. https://www.ijiet.org/vol12/1751-CS2020.pdf
6. Kadar, M., Kamaruzaman, M. F., Kamsin, A., & Halim, N. D. A., (2021). Students' challenges in learning computer programming: A review. Journal of Engineering Science and Technology, 16(1), 6–28.
7. Rincón-Flores, E. G., Ramírez-Montoya, M. S., & García-Peñalvo, F. J., (2020). Gamification in xMOOC learning: Effects of challenge-based dynamics. International Journal of Interactive Multimedia and Artificial Intelligence, 6(2), 23–31. https://doi.org/10.9781/ijimai.2020.02.004
8. Khaleel, F. L., Ashaari, N. S., & Wook, T. S. M., (2020). The impact of gamification on students' learning engagement. International Journal of Electrical and Computer Engineering, 10(5), 4965–4972. https://doi.org/10.11591/ijece.v10i5.pp4965-4972