Leveraging Technology for Teaching and Learning: Developing a Django-based Quiz Application for Education

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ARTICLE INFO	ABSTRACT
	This study presents the development and evaluation of the Rapid Personalized Assessment Platform for Quizzes (RPAP-Quiz), an innovative web-based application designed to enhance assessment practices in educational settings. Utilizing the Python Django web framework, RPAP-Quiz addresses critical challenges such as adaptability to diverse learning needs and secure assessment delivery. The application empowers educators to manage classes, create customizable quizzes, and monitor student performance while incorporating advanced anti-cheating measures to ensure academic integrity. On the student side, features like secure quiz participation, anti-cheating, and a user-friendly interface promote engagement and critical thinking. A descriptive research methodology guided the study, focusing on user perceptions of the platform's acceptability, evaluated through ISO/IEC 25010:2023 quality standards. Sixty respondents, including teachers and students, assessed the application across nine criteria, achieving an overall rating of "Extremely Acceptable." Key strengths identified were functional suitability, ease of interaction, and security, highlighting RPAP-Quiz's capacity to meet the evolving demands of online assessments. Despite these strengths, minor concerns regarding reliability and performance efficiency were noted, attributed to network dependencies and the strict enforcement of anti-cheating protocols. This research stresses the potential of RPAP-Quiz to transform assessment practices, offering an accessible solution that aligns with modern educational objectives. Recommendations include expanding anti-cheating features and enhancing system flexibility to support broader applications. RPAP-Quiz exemplifies the integration of technology in fostering secure, efficient, and equitable educational experiences for teachers and learners alike. **Keywords:** educational application, quality education, quiz application, technology for education, web application.

INTRODUCTION

As the world advances, technology does, too. In education, technology has played a significant role in reshaping its landscape through innovative methodologies, bridging traditional and modern teaching paradigms. Advanced technological tools such as interactive platforms enabled adaptive learning experiences to cater to student's diverse needs [1]. Additionally, the integration of advanced technologies in higher education facilitates improved engagement and interaction, providing students with tailored academic support and access to resources that augment their learning journey [2].

As part of education, assessments play a critical role in measuring learning outcomes, guiding instructional strategies, and fostering student engagement. Assessments are effective when teachers provide valuable feedback to their students, enabling them to identify their strengths, weaknesses, and areas for improvement [3]. Additionally, assessments help shape the curriculum by ensuring instructional practices align with the desired educational goals of the university [4].

During the COVID-19 pandemic, assessments adapted to remote settings highlighted their role in maintaining educational standards and measuring engagement in virtual classrooms [5]. Techniques like blended feedback in language education have demonstrated the effectiveness of integrating real-time, formative assessments with summative evaluations [4]. Moreover, innovative approaches, such as project-based assessments and authentic evaluations, have proven essential in fostering critical thinking and 21st-century skills [6]. Such methodologies emphasize the evolving landscape of assessments, balancing traditional metrics with modern educational needs.

In providing online assessments, existing quizzes and assessment tools face various challenges that limit their effectiveness in educational settings. A primary concern is the lack of adaptability to individual learner needs, often providing a one-size-fits-all experience that fails to accommodate diverse learning styles and capabilities [7]. Another significant limitation lies in content generation, where reliance on pre-designed questions makes it challenging to offer dynamic, context-specific quizzes [8]. Lastly, a major concern on online assessments is cheating, where students can use online resources while taking the quiz without the knowledge of their teacher [9].

With these challenges, the researchers aimed to develop an assessment tool, specifically for delivering quizzes, entitled the "Rapid Personalized Assessment Platform for Quizzes" shortly termed RPAP-Quiz. RPAP-Quiz's main objective is to aid teachers in giving quizzes in their classes, strengthening security and-anti-cheating features that may reduce the worry of educators giving an automated and online quiz. Teachers are also enabled to create classes to customize and limit the students who can see and take the quiz. Lastly, teachers have the right to view and download student grades for easy recording in their class records.

Accordingly, on the student's end of RPAP-Quiz, class codes for joining a class are only available via their teacher, ensuring that only the students from that specific class can join. Students are given scheduled and timed quizzes for them to think critically with a time-limit pressure set by the teacher. Lastly, anti-cheating features are added to the application, ensuring that students will avoid cheating on their online quizzes.

The study's main objective is to develop a web quiz application, "Rapid Personalized Assessment Platform for Quizzes," or RPAP-Quiz, which utilizes Python Django Web Framework. This aims to provide technological solutions for giving assessments to students. Additionally, this study focuses on the following specific objectives: (1) To design and develop the web application for teachers with the following features: Class Management, Quiz Creation, and Result Tracking and Reporting; (2) To design and develop the web application for students with the following features: Class Joining, Taking Quizzes, and Scores and Results Viewing; and (3) To evaluate the acceptability of the web application by intended end-users using the ISO/IEC 25010:2023.

METHODS

A. Research and Software Development Methodologies

To conduct the research, the researchers implemented a descriptive research method. In descriptive research, it investigates a phenomenon as it exists. This study aimed at developing the RPAP-Quiz, an online quiz platform, and determining the acceptability of the application as perceived by the intended audience. This describes the perceptions of the end-users on the developed application.

In terms of the software methodology, the researchers implemented the Rapid Application Model (RAD). In RAD, it prioritizes quick prototyping in delivering an application or a system. RAD is being implemented with continuous iterations until the expected product is built. This approach was implemented in the development of RPAP-Quiz to achieve the desired application before being released for evaluation by intended end-users. Figure 1 presents the RAD model.
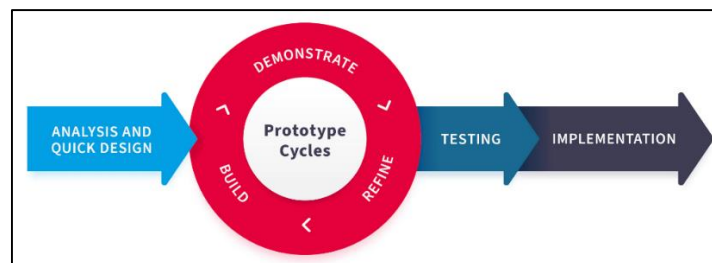

Figure 1: Phases of the Rapid Application Development Methodology

Each phase presented in Figure 1 was followed. However, the model was only implemented until the testing phase, allowing end-users to evaluate the application. The application's actual deployment was yet to be conducted as the study only focused on its development and evaluation.

B. Respondents of the Study and Research Instrument

The study's respondents are targeted as the intended end-users of the system as the instrument used was to determine their acceptance of the developed technology. Table 1 presents the intended end-user respondent types and their corresponding frequencies.

Table 1: Respondents of the study

Respondents	Frequency	Percentage
Teachers across disciplines	10	16.67%
Students across disciplines	50	83.33%
Total	**60**	**100.00%**

As the study focused on measuring user-ended perceptions, the targeted respondents are the web application's end users. 10 teachers and 50 students, for a total of 60 respondents, were asked to evaluate RPAP-Quiz using the ISO/IEC 25010:2023 questionnaire.

To evaluate the web application, the ISO/IEC 25010:2023 was used, utilizing its nine (9) criteria to determine a software product's quality. The ISO/IEC 25010:2023 was made into a questionnaire consisting of the nine criteria: (1) functional suitability, (2) performance efficiency, (3) interaction capability, (4) safety, (5) reliability, (6) maintainability, (7) compatibility, (8) security, and (9) flexibility.

C. Data Gathering Procedure and Statistical Treatment

To gather data from the intended users, an in-class, live demonstration was part of the demonstration of how the application works. Additionally, a recorded video of the same was made and attached to an online form for evaluators to see how the application works. A paper-based form was used during face-to-face demonstrations to gather responses from the intended audience. For others, an online form was used and shared to answer questions. These forms consisted of demographic information and the ISO/IEC 25010:2023 questionnaire.

To analyze and interpret the responses from the participants, a five-point Likert scale was used as a reference to the responses. Table 2 presents the five-point Likert scale used in the study.

Table 2: Five-point Likert scale

Scale	Range	Descriptive Rating
5	4.50 – 5.00	Extremely Acceptable
4	3.50 – 4.49	Very Acceptable
3	2.50 – 3.49	Acceptable
2	1.50 – 2.49	Fairly Acceptable
1	1.00 – 1.49	Poorly Acceptable

The Likert scale used was focused on acceptability to determine if the item from a criterion is acceptable as perceived by the end-users of the system as the target respondents of the study. This provided ease in interpreting the result based on determining the acceptability of the end-users to the developed web application.

In terms of the statistical treatment, the mean was used to present quantitative results from the respondents' ratings. Mean presents the average results of the responses, while the standard deviation presents the scatteredness of the frequency of responses based on the Likert scale.

RESULTS AND DISCUSSION

A. Development of the Web Application for Teachers' Assessment Management

Figures 2-6 present the features of the teacher's account to the RPAP-Quiz web application. The teacher can view insights through a dashboard, manage classes and quizzes, and manage the data bank of questions.

As presented in Figure 2, insights from the teacher's overall application content were presented in their dashboard. The teacher's dashboard presented analytical data regarding their classes and quizzes. A calendar is also included in the teacher's schedule. Upcoming quizzes are also presented so the teacher can prepare relating to the upcoming quiz. As Kuznetsova [10] mentioned, dashboards provide solutions to analyze complex data visually through graphs,

charts, and numbers. Providing a dashboard as part of the teacher's account enables teachers to visualize and summarize their classes and quizzes in an overall manner.
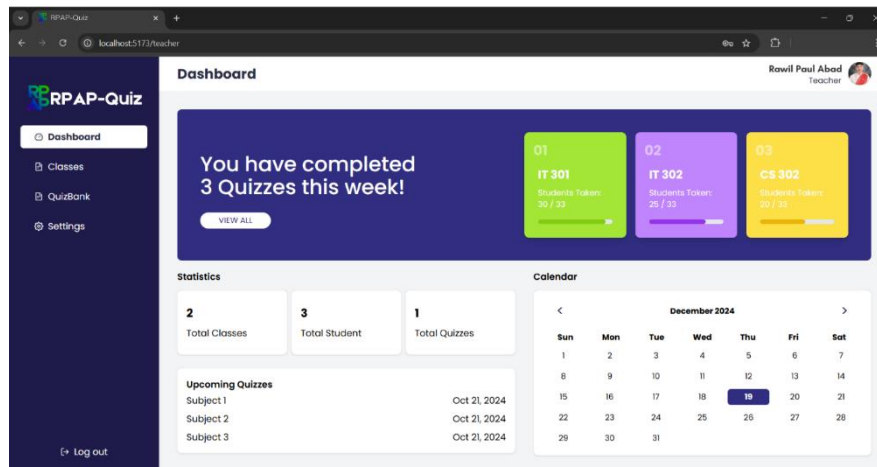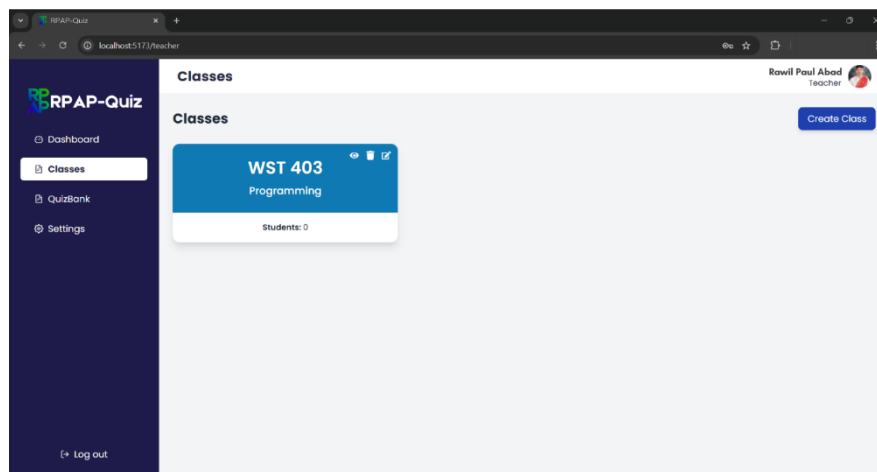

Figure 2: Teacher's dashboard

Figure 3: Teacher's class management

Before the teacher can create quizzes, they must create a class first. Figure 3 shows the class management page of the teachers. These classes are created to manage each class they are handling for easier quiz distribution. With each class, a teacher can invite students by adding them manually or by sharing a class code with their students. Upon creating the classes, only then that the teacher create a quiz within the class. Figures 4-5 present the quiz management of the teachers.

In Figure 4, teachers can manage all quizzes available in their selected class. All quizzes available in the selected class are visible on this page. Teachers can also see their students who took the quizzes given in the class. Teachers can download score reports after the students answer the quiz. This will help the teachers to record the student's grades in their class records. Lastly, the "Create a quiz" button is available on this page should the teacher wish to create a new quiz for the class.

In Figure 5, teachers can add a new quiz after clicking the "Create a quiz" button. Teachers can set up a duration for the quiz, a timer on how long the students can take it, instructions for the students to follow, an option to enable students to see the correct answers after submitting the quiz, and the questions added for the quiz. The teacher has options to add different types of questions such as multiple choice, true or false, and short answer questions. Teachers can also add questions from their question bank should they wish to reuse old questions from other quizzes they created.
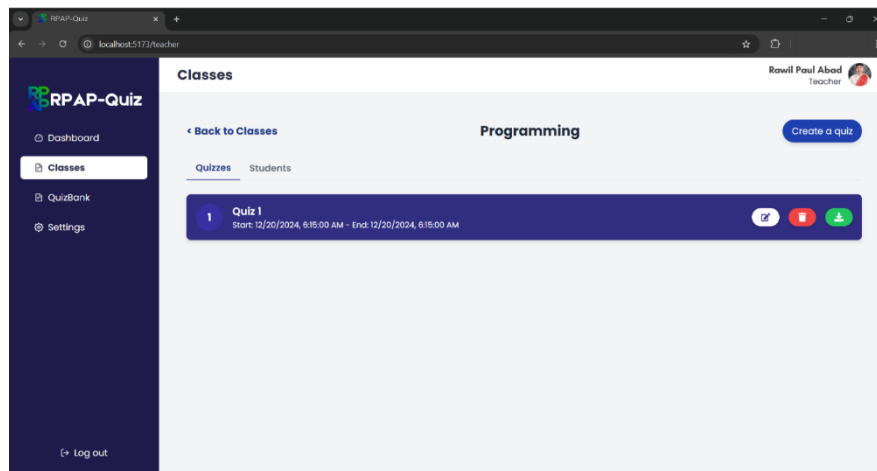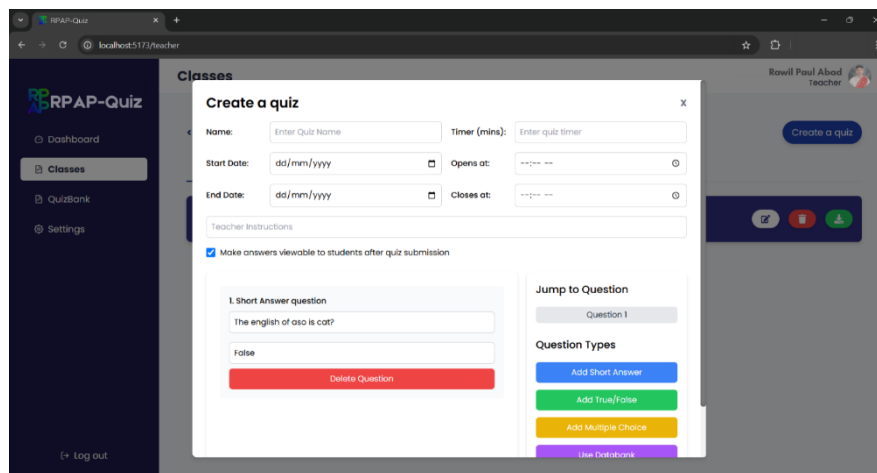
Figure 4: Teacher's quiz management

Figure 5: Teacher's quiz creation

As Figure 6 presents, teachers can manage their questions using the quiz question bank. Question banking can be done by manually adding questions directly from the quiz question bank page. By default, if a teacher creates a quiz, all questions added to the quiz are automatically saved to the question bank. This ensures that all questions created by the teacher are saved and stored for future use.
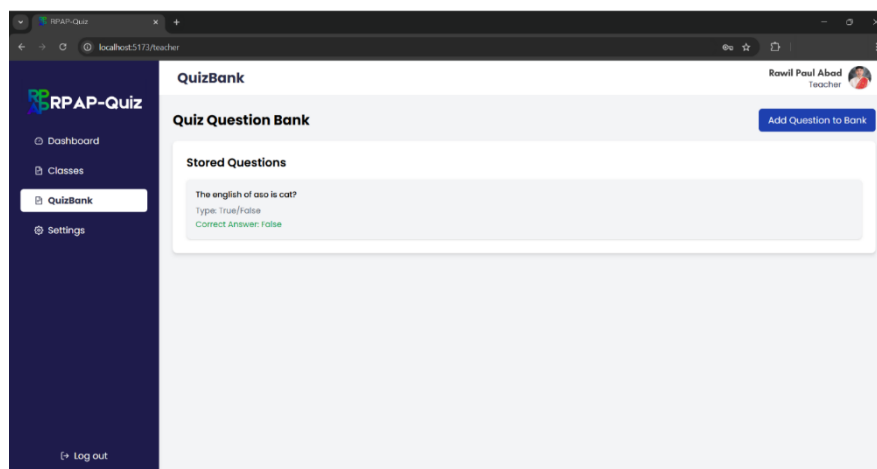

Figure 6: Teacher's question bank

B. Development of the Web Application for Student's Account

Figures 7-11 present the features of the student's account to the RPAP-Quiz web application. As a student has fewer features than a teacher, students can only join classes, and take quizzes given to the class they are joined with.
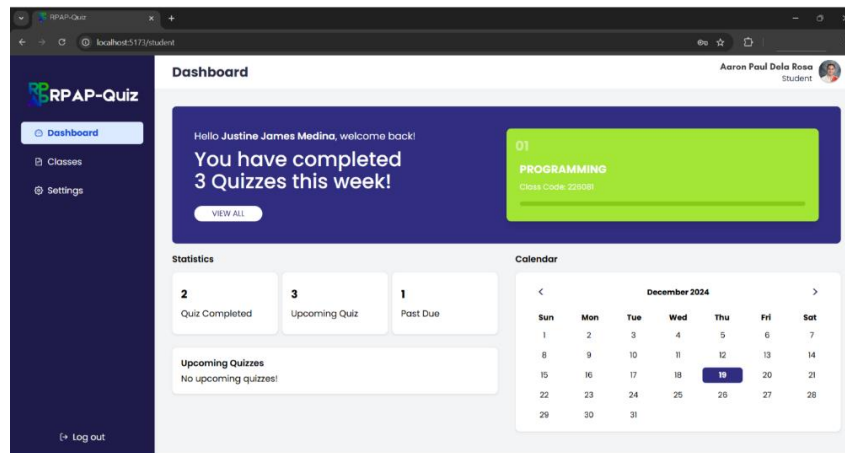

Figure 7: Student's dashboard

The student's dashboard appears after a successful login by the student. As shown in Figure 7, the student's dashboard contains information regarding their completed, upcoming, and past quizzes. This gives them ideas and reminders to review for their quizzes in their respective classes. In Figure 8, students can view and manage their classes.

As presented in Figure 8, students can manage their classes. Using this page, they can join a class by clicking the "Join Class" button and providing the class code given by their teacher. Should a teacher invite the students to join their class, a notification on this page will appear and the student may accept or decline the invitation.
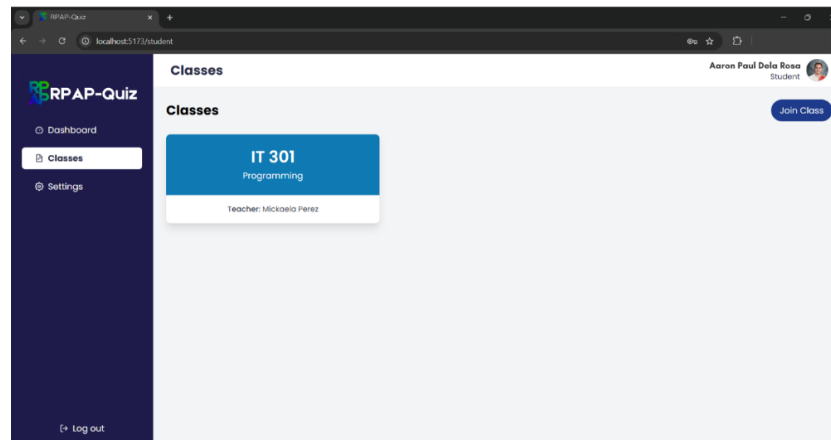

Figure 8: Student's classes

The succeeding figures, Figures 9-11, present the quiz management, taking quizzes, and viewing of answers by the student. In Figure 9, students can see all their quizzes categorized as upcoming, past due, and completed. Here, the quizzes available displayed are for a specific class alone. Students must select a class to view the quizzes posted by their teacher.

Figures 10-11 present how a student takes a quiz and how will they be able to see the answers. In Figure 10, once the student starts taking the quiz, the screen will automatically be set to full screen. This is part of the anti-cheating feature of the application to limit the students from visiting other tabs. Additionally, another anti-cheating feature prevents the student from using the Alt+Tab key combination to avoid visiting other windows opened on their laptop or computer. These anti-cheating features, once violated by the students, will automatically submit their quiz. Students will see a timer set by their teacher on how long the exam should be taken. Once the time lapsed, the quiz will automatically be submitted as well. In Figure 11, if it was enabled by the teacher, students can see the correct

answers to the quiz. This is being controlled by the teacher to prevent the students from sharing the answers with others who have yet to take the quiz. These features make the quiz app more secure and allow teachers to have more control over the quiz [11].
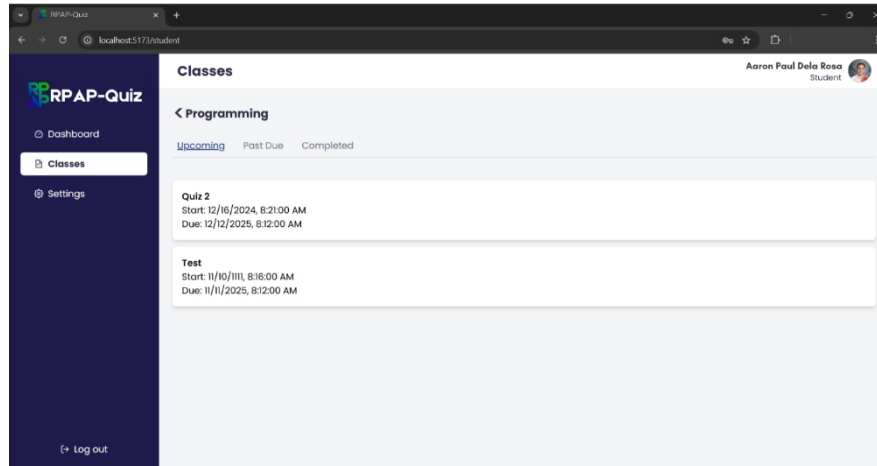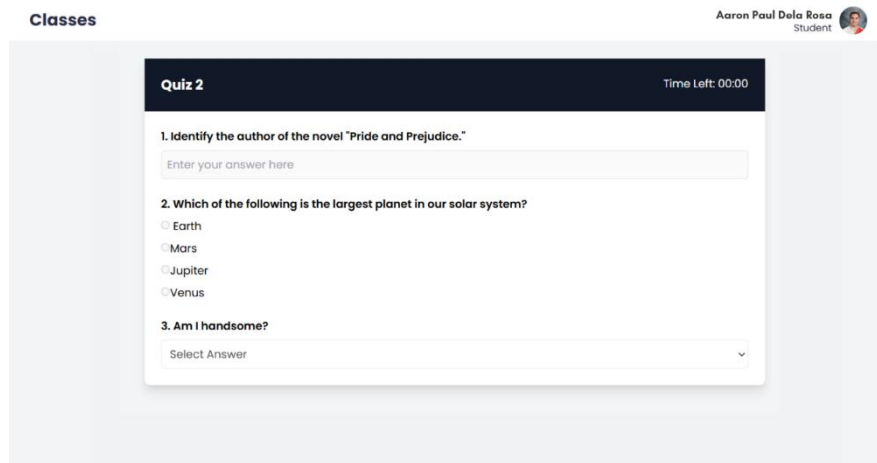

Figure 9: Student's quizzes

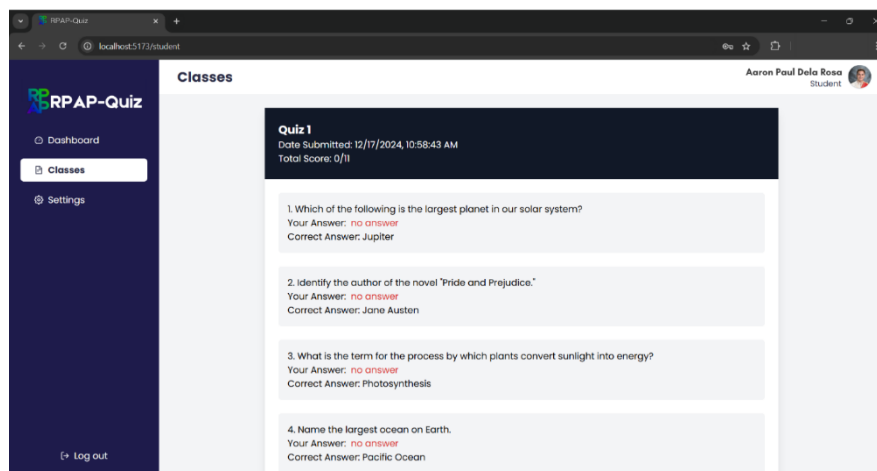
Figure 10: Student taking a quiz in full-screen view

Figure 11: Student's result from a quiz

Referencing the study of Noorbehbahani et al. [12], mitigating online cheating is a challenging process. As tools in mitigating and preventing cheating advance, other forms of online cheating emerge. However, it is always better to have existing mitigating features to online cheating rather than letting the students freely do online cheating. This

idea was implemented by integrating anti-cheating features into RPAP-Quiz. Additionally, teachers can utilize the application during their in-person classes to provide proctoring while the students are taking the quiz using the app. This ensures an additional way of reducing cheating in a class.

C. Evaluation of the Web Application by the End-Users Using Standard Software Quality Evaluation Criteria

In evaluating the acceptability of the end-users of the RPAP-Quiz, the standard software quality evaluation criteria of the ISO/IEC 25010:2023 were used. The nine (9) criteria of ISO/IEC 2010:2023 were made into a questionnaire and shared with the respondents. Table 3 presents the summary of the respondents' ratings of the RPAP-Quiz.

Table 3. Summary of the respondents' ratings of the RPAP-Quiz.

Criterion	Teachers		Students	
	Mean	Descriptive Interpretation	Mean	Descriptive Interpretation
Functional Suitability	4.70	Extremely Acceptable	4.69	Extremely Acceptable
Performance Efficiency	4.50	Extremely Acceptable	4.68	Extremely Acceptable
Interaction Capability	4.70	Extremely Acceptable	4.75	Extremely Acceptable
Safety	4.65	Extremely Acceptable	4.70	Extremely Acceptable
Reliability	4.55	Extremely Acceptable	4.59	Extremely Acceptable
Maintainability	4.58	Extremely Acceptable	4.71	Extremely Acceptable
Compatibility	4.60	Extremely Acceptable	4.74	Extremely Acceptable
Security	4.60	Extremely Acceptable	4.66	Extremely Acceptable
Flexibility	4.58	Extremely Acceptable	4.64	Extremely Acceptable
Overall Mean	**4.61**	**Extremely Acceptable**	**4.68**	**Extremely Acceptable**

Note. No. of teachers=10, no. of students=50, total N=60

Positively, based on the end-user's ratings of the RPAP-Quiz, Functional Suitability, and Interaction Capability received the highest rating with a mean of 4.70 and a descriptive interpretation of "Extremely Acceptable" for teachers. Interaction Capability received the highest rating of 4.75 for the students with an interpretation of "Extremely Acceptable." For the teachers' insights, RPAP-Quiz provided the functionalities needed for an online quiz maker. Additionally, they found it useful as RPAP-Quiz provided a beneficial feature for the teachers which was the anti-cheating feature. Both teachers and students rated Interaction Capability the highest, which shows that using RPAP-Quiz is simple and easy to navigate as the criterion focuses on how the user interacts with the application. RPAP-Quiz provided proper labeling and navigation for easy access to several features. Additionally, teachers and students can use the application with little guidance as RPAP-Quiz provides self-descriptive functionalities. As Carson [13] mentioned in an article in Medium, allowing users to interact and use applications easily gives them the satisfaction of using an application multiple times. It gives them the capacity to finish things quickly with less hassle in learning and operating the application.

However, as one system cannot solve anything, so does RPAP-Quiz. Based on the ratings of the respondents, Performance Efficiency received the lowest mean of 4.50, interpreted as "Extremely Acceptable" for teachers. The students have rated Reliability with a mean of 4.59 and an interpretation of "Extremely Acceptable." Though the means present high numbers, among all the criteria from the ISO/IEC 25010:2023, they received the lowest means. This indicates that, from the perspective of the end-users, RPAP-Quiz provides quality performance on delivering the needed output as needed but users may encounter delays in outputs depending on their internet connectivity. This may cause poor performance which some teachers consider as a probable issue in detecting students' activities while using the application [14]. Additionally, students have concerns about the reliability of the application as it automatically submits the quizzes once they have violated any of the anti-cheating features. Their concerns are the recording of their grade once the quiz was automatically submitted. As one of the respondents commented during the evaluation, "I was not able to submit my quiz since I violated an anti-cheating feature. I am not aware of what was submitted to my teacher or if some of my answers were recorded." Students were rest assured that any answered items would be recorded and even the activity that violated the anti-cheating feature was recorded on the teacher's end [15]. As Taşkın [9] mentioned in the book "Teaching and Assessment in the Era of Education 5.0," several concerns were raised in the utilization of online assessments, and one of these is online cheating, which requires an

urgent solution. As a strategy to combat this academic dishonesty, the integration of anti-cheating features is necessary for online assessment applications, such as RPAP-Quiz has in its features.

Considering the evaluation, the overall means are 4.61 and 4.68 for teachers and students, respectively, with descriptive interpretations of "Extremely Acceptable." This shows that the users' perceptions of using the application are that the system is acceptable, providing that it does what it is meant to deliver. Additionally, teachers have commended the integration of several anti-cheating features which the teachers find as the best feature of RPAP-Quiz and comparable to other existing exam makers that do not provide even a basic anti-cheating feature.

CONCLUSIONS

In summary, RPAP-Quiz was successfully developed in terms of its features necessary for teachers and students. Features for the teachers such as class management, quiz management and creation, and question banking were successfully integrated into RPAP-Quiz to help teachers manage their classes and quizzes given and shared with the students. Class joining, taking quizzes, and viewing of scores were successfully integrated as features for the students. Developing anti-cheating features was the highlight of the application in preventing cheating by the students. As perceived by both teachers and students, RPAP-Quiz is "Extremely Acceptable" and usable in terms of giving assessments and quizzes in classes. Upon successful implementation of RPAP-Quiz in classes, cheating in online assessments will be reduced and teachers will have a more secure way of providing online assessments.

With the findings of the study, the following are the recommendations: (1) integrate other anti-cheating features such as limiting the number of screens the students use, and (2) allow the students to search for existing classes to join in to reduce the workload of invitations by the teachers.

ACKNOWLEDGEMENTS

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