

Original Article

Design and Development of Gami-count: A Gamified Solution to Increase Undergraduates' Learning Engagement in the Accounting Subject

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Abstract - Gamification is a commonly used technique by educators and training officers to gamify learning and working processes in a fun and interesting way. This study explored the existing issues concerning the lack of gamification solutions. It developed a prototype software system to enhance learning engagement in the pursuit of ACCA-level accounting studies among undergraduate scholars. A total of 81 participants took part in the survey to identify requirements that the proposed system software should possess. Following the completion of the system development and deployment, participants were given the second survey to provide constructive feedback on the prototype in terms of effectiveness. Results suggested that (A) most undergraduate users find the system a workable and practical approach to improve learning engagement in the pursuit of accounting knowledge at the ACCA level, (B) users also find that possessing a high level of aesthetics and design leads to frequent use of gamification software. Finally, the results are then analyzed and discussed subjectively in terms of the implication for targeted undergraduates' engagement and interest in learning and revising ACCA accounting knowledge and in terms of the construct validity of gamified solutions.

Keywords - ACCA, Accounting game, Gamification, Gamified prototype, User acceptance test.

1. Introduction

For many, a game can be anything labelled as one in common parlance. It is widely deemed that the characteristics of a game depend on the combination of game elements in an activity itself and the involved participants [1]. Games can be categorized into serious or purposive games and recreational games. Serious games are meant to promote learning elements and enhance the problem-solving abilities of the players [2]. They are known for improving the comprehension of certain topics, which helps players retain the experience in difficult and complex competencies [3]. Besides, games have appeared in various fields and reached a wide range of people in education, sports, heritage and health, such as for stroke rehabilitation [4].

Before the age of digital games as the mainstream form of modern gaming and entertainment, games mainly come in various forms [5]. A prime example of a game is Monopoly, which is a trading board game based on real-world properties that players can acquire and develop a top of them to collect rent from players accidentally stumbling upon these properties to make the opponents go bankrupt. Although the game offers players the balance between their skill of resource management and predatory play [6], the underlying

game concept of Monopoly was already being overused when it was introduced. Yet, Monopoly is still enjoyed by many today, and organizers have been hosting competitions across the globe every 4 to 6 years since 1973 [7].

Gamification is the current trend in which gaming mechanisms are used in non-gaming contexts to increase audience motivation or user engagement; it needs a high level of expertise to integrate game components with non-gaming components that are entertainment-oriented [8]. Besides, gamification refers to using recreation format elements in non-game settings [9,15].

According to Werbach et al., the basic composition of gamification consists of elements and techniques from game designs to be integrated into non-game contextual activities [10]. It is a way to make activities more game-like and fun in nature, allowing players to complete tasks or business processes instead of going through the unnecessarily tedious and dull approach such as staff training. Gamification in education aims to increase student motivation and active engagement throughout the teaching and learning process. Highly motivated students will participate actively in the learning process and enhance their experience [11].



Table 1. Eight Gameful Designs

Gameful Element	Description
Points	Points serve as an instrument to measure a player’s extent of success and achievements made thus far. They can be used as in-game rewards, as tools to invest in further progress towards certain goals, or merely as a proxy of one’s status and rank. Points can be in the forms of Experience Points (EXP), Steam Points and some academic environments as Credits.
Levels/ Stages	Points serve as an instrument to measure a player’s extent of success and achievements made thus far. They can be used as in-game rewards, as tools to invest in further progress towards certain goals, or merely as a proxy of one’s status and rank.
Badges	Badges work best in boosting inspiration amongst users to work towards achieving certain goals. A survey on utilizing badges in completing tutorials on educational and social platforms that were performed indicated that more participants think that badges contributed to increasing their learning engagements and motivation to complete tutorials [19].
Leader boards	The primary use case of the leaderboard is to establish a centralized and unified ranking system where players get to check their standings based on other in-game elements such as achievement points, badges, levels etc. Usually, a leaderboard would display the latest current high scorers and overall scores of the top players. Top-ranking players on the leaderboard are usually rewarded with prestigious and rare titles and awards. This helps to give ranked players a sense of achievement and status in the virtual community and unranked players the motivation to work harder in completing more tasks to get listed on the leaderboard, which promotes healthy competition.
Prizes & Rewards	Prizes are a good tool to motivate players, as shown in a study [20]. Multiple small rewards work better than a single big one. Additionally, players’ motivation and engagement are influenced heavily by the timing and scale of rewards as well [21]. Character Upgrades are an example of Prizes & Rewards defined here. It visualizes and allows users to gauge their progress through a virtual avatar. This character will record and resemble the player’s growth in the gamified process and allows others to recognize the effort the player has put into reaching the current level of his character. To effectively utilize this element, the system must be designed to allow players to upgrade their virtual characters occasionally and when they complete a task in the form of character upgrade points, skill points and rewards.
Progress Bars	Progress Bars enhance the gamification of the educational process. This is different to Badges that signify a player’s achievements once they complete a certain goal or level. Progress Bars display the player’s progression before completing a task or goal. It is meant to motivate people to pursue and achieve their educational goals and tasks whilst empowering those lagging behind in their progress.
Storyline	A storyline is a tool for Gameful designers to breathe life into the gamified system by introducing narrative and plots. A positive storyline stimulates users to engage in a positive interest curve where the interest peaks at the start and at the end of the learning process, which keeps them motivated to go through and complete the learning process [22]. In another study, storylines are found to be able to give students the context of learning and problem-solving as well, besides being able to demonstrate how learning concepts can be applied in the real-world environment [22].
Feedback	The more frequent the feedbacks are, gamified system designers or course facilitators can accommodate the necessary and beneficial changes quicker to the system. This helps to boost the learning effectiveness and engagement of the learner. Succinct and immediate feedback is crucial in reaching the flow state, which is the situation of how engaged and immersed the person is in an activity.

According to Werbach et al., they see the 15 components that include avatars, badges, leaderboards, points, and teams, which they are dubbed the “PBL triad” – the action of points, badges, and leaderboards as the primal characteristics of gamified programs [10]. As a game theory, gamification is closely tied with sociology, psychology and many more disciplines. The prime purpose for organizations to gamify business processes is to stimulate and improve employees’ engagement in performing better to reach organizational goals. It is wise to acknowledge that many gamification concepts exist beyond the horizon of academic literature. Hence, it would do those concepts no justice to exclude business literature utilizing the idea as well.

2. Related Work

2.1. Gamification

When the Gam-R – Gamification Reloaded workshops are held, the workshops welcome the discussion on various gamification topics in various contexts, from gamification for varying user groups to the analysis of individual game design elements [12]. It was agreed upon that gamification’s most obvious benefit is the ability to stimulate individual motivation in completing dull and boring activities. Also, gamification can be deemed a workable strategy for creating or encouraging a flow state [13]. In the study, it was found that autotelic experience, which is the intrinsically motivated

experience to perform something, which in this case, is related to playing the gamified system, having clear goals and feedback are more likely to occur for those involved in the game or gamified process. Through gamifying learning activities based on a Mobile Gamification Learning System (MGLS), it was discovered that incorporating the mobile and gamification techniques into a learning process can dramatically better the learning performance and induce a higher degree of study motivation than traditional learning methods [14]. Besides, a study from [39] shows that it is undeniable that gamification can yield positive results when used as a tool to influence many aspects of education.

In another example, users using a gamified version of the AutoCAD software - GamiCAD, were found to have higher subjective engagement levels and managed to perform the testing tasks assigned at a quicker pace and have a higher completion ratio [16]. In the study, users gain a sense of accomplishment while completing tasks and progressing through the levels designed in a structured system. This is often not the case when users learn by reading conventional academic resources and content that are not otherwise interactive designed systems. The specifically designed GamiCAD helps improve the overall learning engagement by assigning guidance tasks to the users that have been gamified, which was done so by designing challenging levels and giving users motivational feedback and assigning encouraging repetitive task completions via score improvements. In science learning, game-based science learning also supplements students' scientific knowledge gains. It is found to be able to greatly improve the gain of knowledge of students from all educational backgrounds as compared to conventional classroom teachings [17]. In the same study, gaming mechanisms, or game elements, stand equivalent to the learning mechanisms influencing the effects of game-based science learning.

In a pilot study, eight gameful design elements that were most significant and heavily used in the learning and educational context were identified. The elements consist of: Points, Levels/ Stages, Badges, Leaderboards, Prizes & Rewards, Progress Bars, Storyline, and Feedback [18]. The intricacies of each gameful element are further highlighted in Table 1.

A study was made on the famous gamified eLearning platform Kahoot on its overall efficacy in creating learning engagement in the classroom [23]. Gamified eLearning tools such as Kahoot inject positive energy and exploration concept and bring the element of fun to the mundane learning environment in the classroom, which constitutes the increased comprehension and motivation of the students in their learning. Gamification of learning also boosts student engagement by appealing to all students, even the meekest and introverted of them all, thus tying together the cooperative, fast-paced learning environment and friendly

competition among peers [24]. Looking into the intricate workings of human behavior, companies get to leverage Gamification concepts in ways of Usability, Motivation and Trust [25]. Wherein Usability refers to the constant increment in-game difficulty that helps users to learn more about the features and grow in the knowledge base. Motivation refers to users' intrinsic willpower and interest to put more effort into learning more about the game and developing new ways to play. Finally, Trust can be defined as badges or achievements users receive for solving a task that creates a sense of achievement and shared ownership. This allows users to trade or gift virtual assets to others to increase social networking, ultimately forming a community-trusted environment. To have a clear and concise concept of game design to work on, companies will need to rely on a framework that considers three aspects: Game mechanics, Dynamics, and Aesthetics [25].

While researching how specific game elements affect the satisfaction level of psychological needs, Michael et al. discovered that using ranked and scored-based mechanics such as leaderboards, badges and performance illustrations greatly affects the satisfaction of competence needs and positively increases the perceived task meaningfulness. Additionally, game design and concepts such as avatars, plots and in-game teammates affect participants' social relatedness [26]. Landers introduced and developed a psychological theory on gamified learning that argues that gamification resembles the use of game attributes defined by the Bedwell taxonomy, outside the context of a game aimed at affecting learning-related behaviors [27]. Gamification processes affect learning-related behaviors, with one of the processes moderating the association between instructional quality and learning and the other that mediates the relationship between learning and game elements and concepts. He argues that the behaviors of an intermediary learner or attitude must be altered accordingly for gamification to work as intended. In another study, a set of psychological theories that support Gamified Learning was discussed, and applied examples were stated. The point is that individual game elements must relate to certain motivational, behavioral, and attitudinal outcomes for the Gamification process to be effective and successful in achieving its objectives [28].

In the learning curve and process of studying accounting, it is mandatory that students understand the theoretical, conceptual, and technical resources before they can ultimately be applied accurately and correctly in real-life case accounting and bookkeeping scenarios. The key issue is that they will suffer during a discussion related to the technical applications of the accounting resources if they lack possess a strong foundation of the accounting concepts and necessary critical thinking skills [29]. This is crucial to point out as it becomes one such barrier to mastering or excelling in learning to account. In recent years many studies and

research are revolving around the use of gamification in the accounting and finance education sector. Models and prototype systems gamifying the learning process of accounting have largely been a hot topic amongst scholars due to their efficacy in improving users’ learning engagement and interest and motivation in attaining knowledge without going through the mundane, conventional way. In a study, student’s motivation and interest to learn accounting and marketing can be greatly increased with games [30].

Rui et. Al discovered that motivation and attitude play statistically significant roles in Perceived Learning of Accounting with gamified apps [31]. Of ‘Motivation’ refers to student engagement in pursuing academic achievement. Varying in orientation and magnitude, motivation, regardless of whether it is intrinsic or extrinsic, is often chosen as a variable of measurement to decipher various behaviors in different contexts and environments. Simply put, a motivated student or player will want to improve his or her knowledge bank and therefore opens himself or herself to more opportunities that allow him/ her to engage in more tasks and bear more risks. As for ‘Attitude’, the study uses the Theory of Planned Behavior (TPB) that aids in understanding human behaviors in various environments and contexts. A Gamification technique encompassing the use of “Accounting on the Block” (AOTB) was used in conducting research to educate Diploma level accounting students the Published Financial Statements [32]. The study reviewed that the participating students are highly motivated and satisfied with using the AOTB board game method in their learning of the accounting subject.

Table 2 shows a myriad of other similar existing applications and systems. The available features and gamification elements are compared with the proposed system.

2.2. Problem and Research Objectives

With the features found in the proposed application system, undergraduates will be able to form the intrinsic motivation to learn accounting in a stress-free and positive environment.

Table 3 shows the problem statements that this project aims to mediate. One of the key issues pertaining to the application of gamification today is the poor design of the gaming concept. True enough, gamification includes the use of game elements such as points, leaderboards, badges, narrative etc. Positively affect learning outcomes. However, merely gamifying the process without context for the sake of gamification will not result in the most effective outcomes, as opposed to when gamification is used in line with instructional design principles [33].

For gamification to work, the technique must supplement what the system or process intended. Another issue is the ethical issues that stem from the inappropriate use of gamification. Kevin and Tae Wan highlighted the ethical issues pertaining to the use of gamification [34]. The ethical issues that arise from the inappropriate use of gamification are compiled in Table 4.

In terms of worker exploitation and manipulation, they are primarily from the relationship between the gamified software providers and their players. The moral status of any complications fails to be determined by only investigating if the player is worse off.

If the provider shares an imbalanced relationship with the player in the real world, to an extent where providers can take advantage of the player’s unique weaknesses, it is exploitation. When gamified service providers create an in-game environment in a way that players do not have the ability to make autonomous decisions, it is an issue of manipulation. Gamification that potentially inflicts or conjures intentional or unintentional harm to workers and related parties when the gamified process leads to physical or mental injuries is considered harmful. Players acting against fundamental human values to meet a game’s objectives form the issue of fall of character morals. Naturally, ethical issues contribute most to causing social issues; hence, gamified systems must not induce or encourage the abandonment of ethics while attempting to improve the learning engagement of the intended audience further. Based on the problems and ethical issues that arise, the research objectives are formulated in Table 5.

Table 2. Comparison of similar systems

Gamification Elements	Red Flags	Accounting Missiles	Accounting for Empires Game	Gami-count
Character Personalization	No	No	No	Yes
Rankings/ Leaderboard	Yes	No	Yes	Yes
Badges & Achievements	No	No	Yes	Yes
Storyline/ Plot	No	No	No	Yes
Targeted Audience	Pre-U	General	CPA Students	Undergraduates
Time Limit	Yes	Yes	No	No
Micro Interactions	No	No	No	Yes
Incentives/ Prizes/ Rewards	No	No	Yes	Yes
Interaction Model	Single-Player	Single Player	Multiplayer	Mixed

Table 3. Problem statements

1. Poor Gamification Concept.
2. Ethical Issues with Inappropriate Use of Gamification

Table 4. Ethical issues with inappropriate use of gamification

- Worker Exploitation,
- Autonomy Infringement,
- Manipulation of workers and customers,
- Intentional or unintentional harm to workers or other related parties,
- Negative effects on the moral characters of involved parties.

Table 5. Research objectives

- RO1. To identify the strengths and weaknesses of currently available solutions to the gamified learning process of the accounting subject in the market
- RO2. To assess the risks associated with gamifying the process of learning to account among university students
- RO3. To gather user feedback and identify the crucial functionalities and features in making the gamification process a success
- RO4. To develop a gamified system solution that is effective in enhancing the learning experience of accounting amongst undergraduates.

Table 6. Data collection method

Research Dimension	Explanatory Sequential Design
Research Methodology	Mixed Mode
Research Methods	Survey

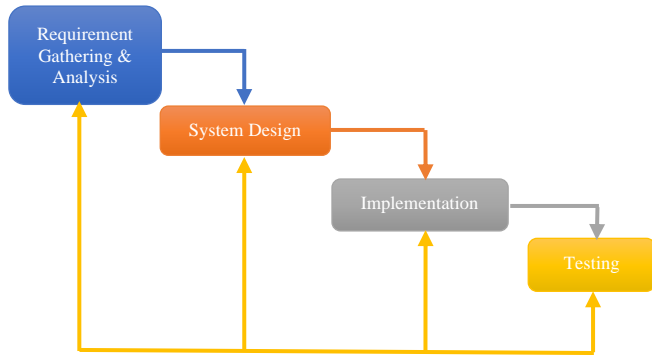


Fig. 1 Modified Waterfall SDLC

3. Methods

This study employed a mixed research method model combining quantitative and qualitative research methodologies to obtain and illustrate data more insightfully. Initially, a requirements survey will be distributed to the targeted audience, and the data will be processed using the following research methodology. Table 6 shows the data collection methods in this study.

Regarding the development of the system, the Modified Waterfall Software Development Life Cycle method is used due to its high flexibility and larger error margin, as shown in Fig. 1. Any errors can be corrected and mediated without largely affecting the operations of the system [35-38].

Before the system design stage, a survey that collects user requirements for the system is distributed to the target user group. Results from the initial survey are then analysed to produce prominent and appropriate requirements. The basic

GUI design of the system is crafted, followed by successful implementation. Finally, tests on the system are made, consisting of Unit Tests, Integration Tests and User Acceptance Testing (UAT).

4. Results and Discussion

This section discusses the results of the survey that has been conducted.

4.1. Survey Results

Fig. 2 shows the result regarding student motivation towards gamification. In the question to confirm if respondents think that the poor application of gamification may lead to students losing interest and motivation over sustenance to lifelong learning of accounting using the software, results show that 41.1% (n=30) of the respondents strongly agree with the statement. 39.7% (n=29) agree, 9.6% (n=7) disagree, and only 1.4% (n=1) strongly disagree. 8.2% (n=6) remained a neutral stance.

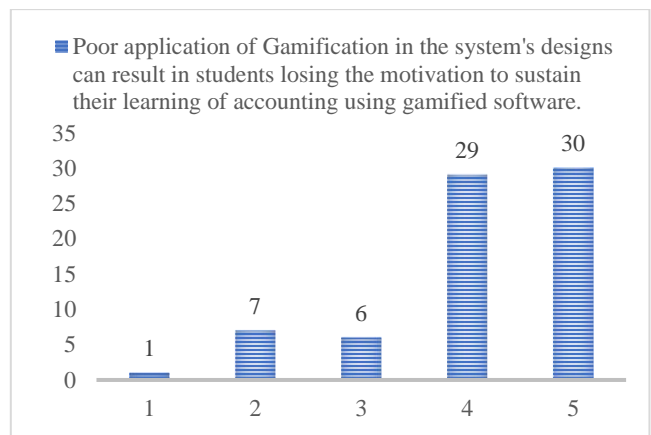


Fig. 2 Students losing motivation to learn due to poor gamification

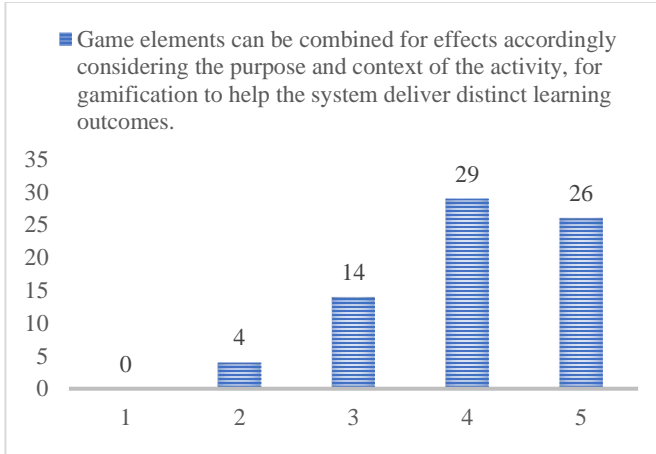


Fig. 3 Game elements can be combined accordingly, considering the purpose and context of the activity.

For the gamified system to be able to deliver the learning outcomes successfully, game elements can be combined for effects accordingly, considering the purpose and context of the activity. Fig. 3 shows that the majority can be seen to agree with the statement, with 45.2% (n = 33) of them agreeing and 28.8% (n = 21) who strongly agree. 21.9% (n = 16) remained neutral, whilst only 4.1% (n = 3) of them disagree.

Based on Fig. 4, the majority of the respondents agree with the statement, as seen from the results indicating that 28.8% (n = 21) of the respondents strongly agree, 45.2% (n = 33) agree, followed by 21.9% (n = 16) who remain neutral, and 4.1% (n = 3) disagree.

Generally, it is believed that system designers should understand the strengths and weaknesses of gamification beforehand as it helps them to design better and implement the end product. However, in Fig.5 portrayed through the results here, 5.5% (n = 4) of the respondents disagree so, and 1.4% (n = 1) strongly disagree.

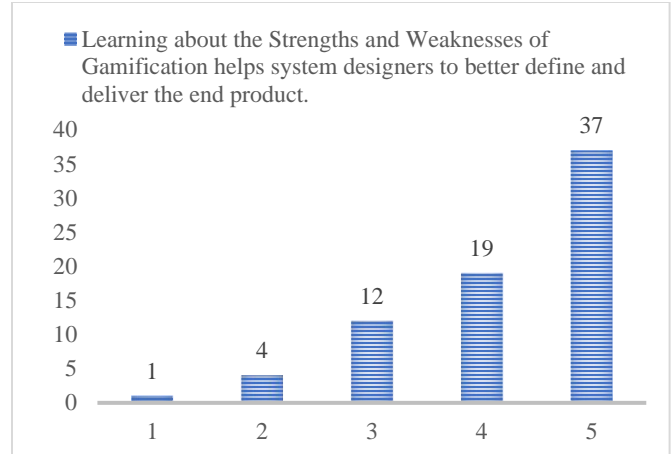


Fig. 5 Importance of identifying strengths and weaknesses of gamification to system designs of the end product

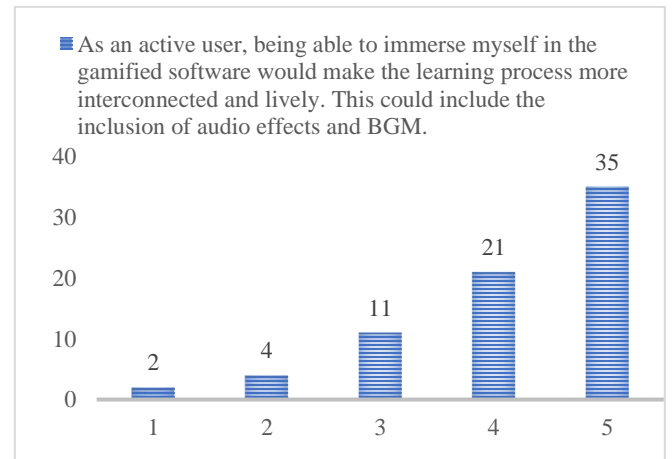


Fig. 6 Audio and BGM inclusion

Fig. 6 shows a positive sentiment amongst respondents regarding the statement that active users would be able to immerse themselves in the gamified system more so if audio effects and BGM are included and set up with consideration.

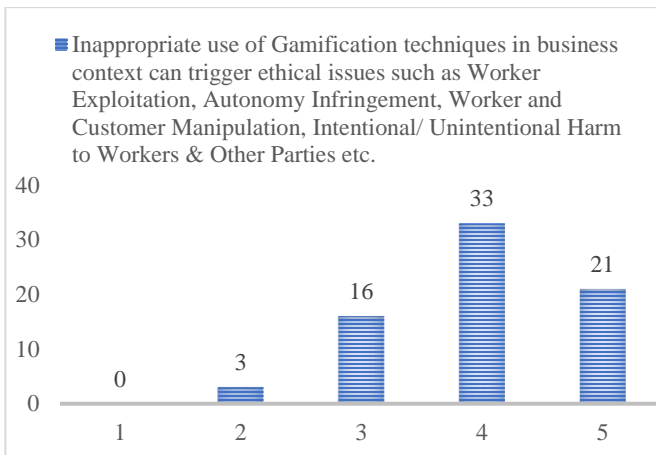


Fig. 4 Inappropriate use of gamification leads to ethical issues

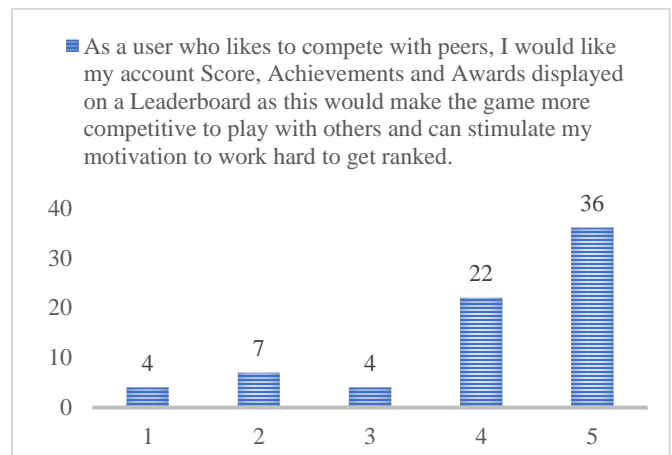


Fig. 7 System to have assets displayed on the leaderboard

Based on Fig. 7, most respondents prefer to have their score, achievements and awards displayed on a leaderboard as well because they believe it would make the game more competitive and, in turn, motivate them to work harder and get ranked on the leaderboard will be stimulated. They believe peer competition is often another way to boost users' improvement.

To further allow users of varying educational backgrounds to reap the possible benefits of what the system offers, the mechanism that reduces the gap between achieving gamification and the final learning outcomes and learning objectives must exist. Thus, having the ability to modify and customize the learning content is effective when it comes to limiting the scope of the system.

True enough, the results indicate that most of the respondents look forward to the integration and inclusion of the feature, as shown in Fig 8 as the high rate of agreement (38.4% of respondents strongly agree, while 39.7% agree). On the contrary, less than 10% of the total respondents responded in disagreement, and the other 12.3% (n = 9) remained neutral.

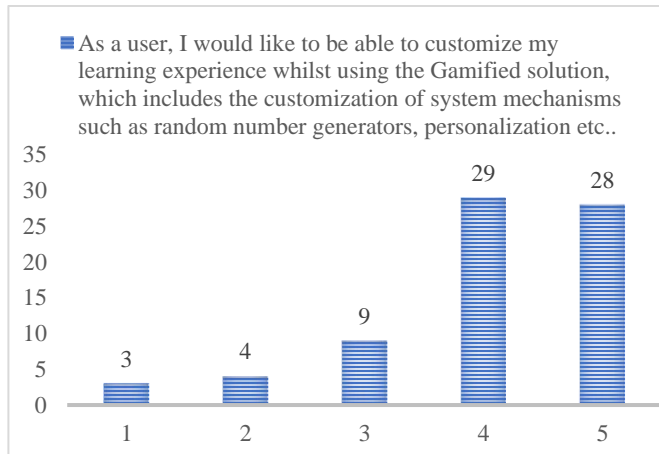


Fig. 8 System customization and personalization availability

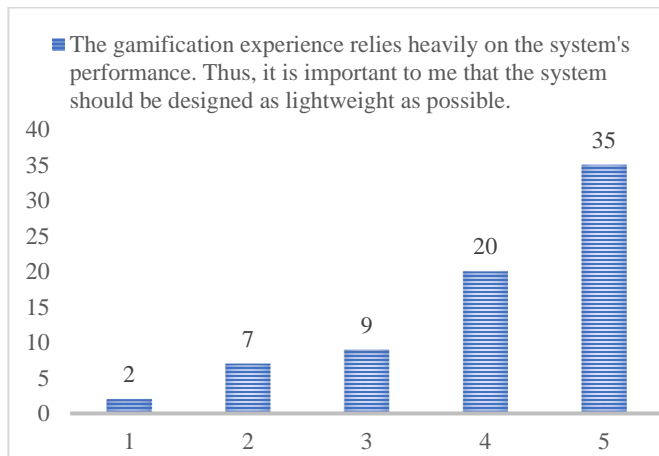


Fig. 9 Gamification experience dependent on system performance

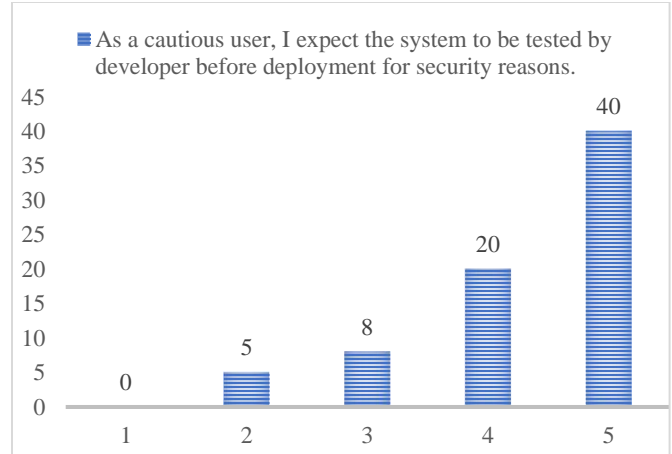


Fig. 10 System tested before deployment

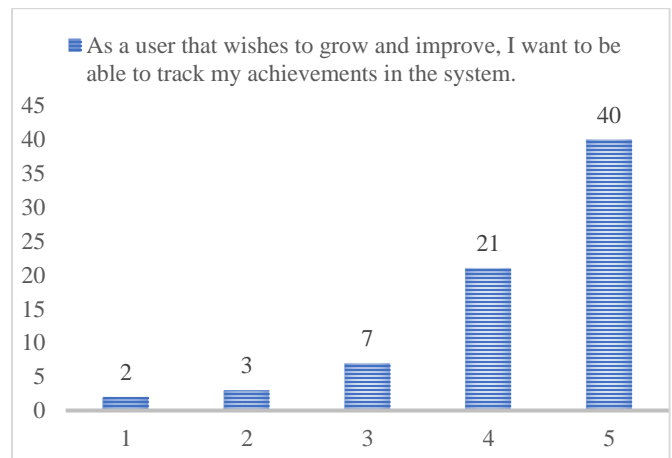


Fig. 11 Trackable user achievements in the system

As shown in Fig. 9, the system performance widely affects the user's experience. In other words, the system should be designed at minimum performance without overconsuming and compromising much of the hardware resources. To achieve this, the code should be as lightweight as feasible to ensure smooth performance across most devices. The designer should also run system and performance assessment tests before production.

Generally, developed systems and software require unit testing and scripting before they are published and deployed on renowned platforms and app stores. This action, in turn, requires the developers to adhere to review guidelines. The survey results indicate that users are widely in favor of such pre-measures before the system can be deployed. Only 11% (n = 8) of the respondents remain neutral, while only 6.8% (n = 8) disagree, as shown in Fig. 10.

Being able to obtain achievements whilst using a gamified system may improve user initiative. The results in Fig. 11 show that most respondents agree with the statement, while 9.6% (n = 7) remain neutral, and less than 10% of the

respondents express their disagreements about adding the gameful element.

To better address the need and relevant requirements before the system can be developed, the requirements are split into a traceable matrix on an ascending Priority Rating scale of 1 to 5. A priority rating of 1 implies that the requirement holds the utmost priority that should be considered and implemented in the system to be developed. Each requirement is ranked based on the severity and priority level for the purpose of scrutiny in the design and implementation of the system.

Aggregating the results from the Requirements Survey, a Business Requirements Document and the Functional Requirements Specifications are prepared in Table 7 and Table 8.

Functional Requirements (FR) are product features that developers must first identify to allow users to complete and accomplish their tasks. As a general note, functional requirements often describe the system's behavior under

certain conditions. Functional requirements address users' needs from the system, which are the project's core objectives. In the proposed system, the main functions are listed in Table 8.

Based on the responses captured from the targeted user group and the requirements analysis performed above, the system is developed accordingly, considering all the requirements.

Fig. 12 depicts the screen display at the proposed system's launch of the application program. Users are greeted with a login page. Before they can access the system, signing in is required. If the user credentials cannot be found in the cloud database, a label will appear within the frame, informing users to re-enter all credentials and confirm if the account exists. On the backend, the system verifies the user input through Google's Firebase authorization, ensuring that the data is valid. Without an existing account, users will be unable to access the system. Hence, first-time users must click on the 'SIGN UP NOW' GUI button that would create a new Register class object and window.

Table 7. Business Requirements Document

Business Requirements	Definition	Priority Rating
Direct and interactive & learning engagement content	Gamification elements are to be incorporated into specific use cases of the system according to the classroom context.	2
Standard-based & internationally recognized learning contents	The infused learning content must be designed accordingly that correlates to the user's learning background to ensure classroom teachings are suitable for the general purpose and use.	1
To reduce dependence on conventional teaching methods of accounting and increase interactivity for learners	Contents must be designed in a fun and interactive way to promote user interaction and activity better.	3
System to follow moral and publicly recognised ethics and rule of conduct	The game mode must be designed with a humanistic and holistic approach without compromising business ethics.	4

Table 8. Functional Requirements Specification

Functional Requirements	Definition	Priority Rating
Immersive Storyline	Whilst in-game, users will be able to decide and choose which path to go for as part of the gameplay. Each decision made by users triggers certain events in the system itself.	5
Leaderboard and Scoreboard	Each time a user unlocks an achievement or reaches new high scores, they should be captured by the system, and the top players/ users will be shown on a Leaderboard for all users to view	1
Content Customization	Users coming from different accounting backgrounds could personalize learning content is imperative to allow users freely configure the learning contents and outcomes they can gain from the system.	1
Learning Progress Monitor	As players progress through the game, they will be able to see the learning progress to understand their standings and pace better.	4
Minimal System Requirements	Despite catering to users running the system on low-performance devices, this should not jeopardise the contents and learning objectives of the game but only lower the system requirements and resource consumption needed to run the system.	1

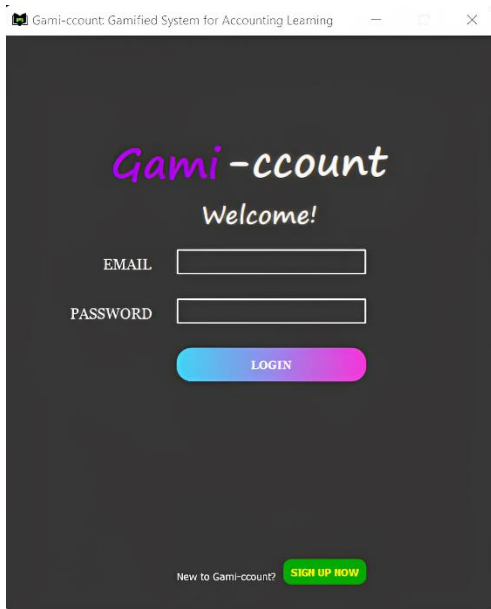


Fig. 12 User Login Window

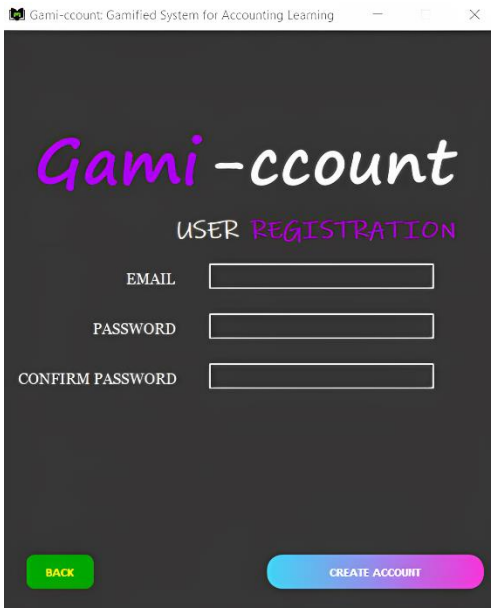


Fig. 13 User Account Registration Window

Fig. 13 shows the user account registration window. Users will be able to register a new account in the account registration window. A 'BACK' button is in place just in case users want to return to the previous Login window. Clicking the button would create a Login class object and window. On the other hand, if the user creates an account successfully, they will be redirected back to the login page automatically. All credentials entered will be checked and verified by Firebase Authentication. In the case where the user violates any of the password requirements, such as the password having less than the required amount of password characters or where they have entered an invalid email domain and address, an error label message will be unhidden to notify the user of the information.

Fig. 14 shows the main menu window any user will land upon successfully logging into the system. A soothing and welcoming audio theme will be played in the background, and the user will be presented with various buttons for different uses. Clicking the 'Launch Gami-ccount' button will instantly launch the Gami-ccount's core trivia system. To customize the question pool for the trivia, users can import their customized questions saved in a .csv file with a pre-defined format. A live leaderboard that is in sync with other player information can be accessed by clicking the 'Leaderboard' button. Users can configure audio settings in the 'Settings' button. The 'Instructions' button opens up a brief introduction and relevant information to users. Finally, the 'Log Out' button will log the user out of the current system and end the execution of the application program.

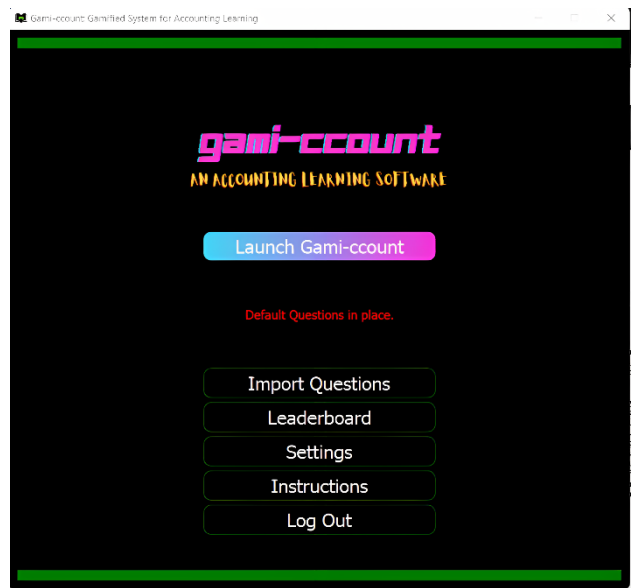


Fig. 14 Gami-ccount Menu

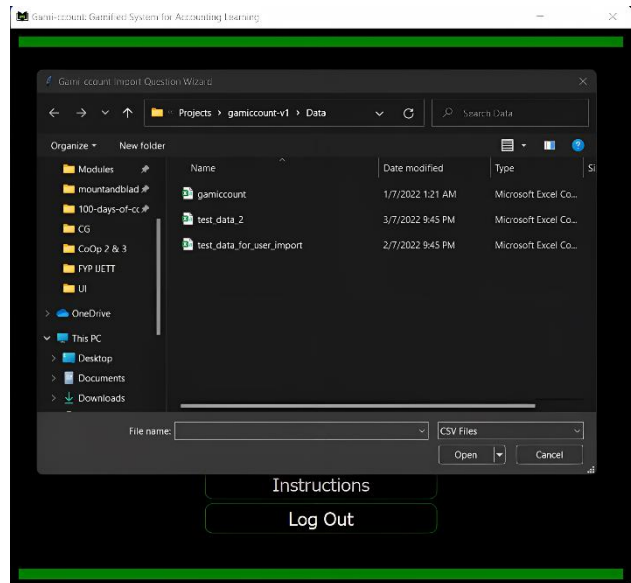


Fig. 15 Import Question Wizard

Gami-ccount's Import Question Wizard, as in Fig. 15, allows users to customize the trivia pool by uploading their own .csv file with the questions contained in the system. If the formats are valid and processed in the system, a green label message will appear in the main menu, signaling the user that the custom questions are in place. Users may proceed to launch the trivia, and they will be able to revise specific accounting chapters using the questions imported.

To incorporate the functional requirement of the leaderboard and scoreboard, Gami-ccount accommodates all information of existing application system users. They are displayed on a public leaderboard that is open to all users to view. The information displayed is always in-sync with the server database and can be viewed concurrently, as in Fig. 16.

	UID	User Email	Score	
1	KU7M31gISMjYzqFkKwIT4uK2	t1@gmail.com	880	None
2	GdvMsa8B8PpI9WHrHrPtbKkCpx1	H@gmail.com	480	None
3	gFRahHuszaXiaCASoS8PIeORU2	test1@gmail.c...	220	None
4	zbBsgb4A00CuCxcT0ccKZgkng1	jernie161899...	160	None
5	nKbu75dG3f4t6H1DYW0lvLuet2	johnychoy55...	100	None
6	LigW1KBP9vZIPWeSAVkyWVIZG2	chang215@gm...	70	None
7	ptkdl1Uxw00cAFwKtjuwP2zvng1	andrianoe605...	60	None
8	007dKvqQah78d31Aq0DZl80t83	l3@gmail.com	30	None
9	ImZp65SM5TqyZ2Gn8TqjMje1	t2@gmail.com	20	None
10	l02lyUkMHnz54MFSPQp6a81ns1	mishal123@...	20	None
11	cqTK6jW0wB8NfXpI98LlxQe93	jack@gmail.com	10	None

Fig. 16 Live Leaderboard

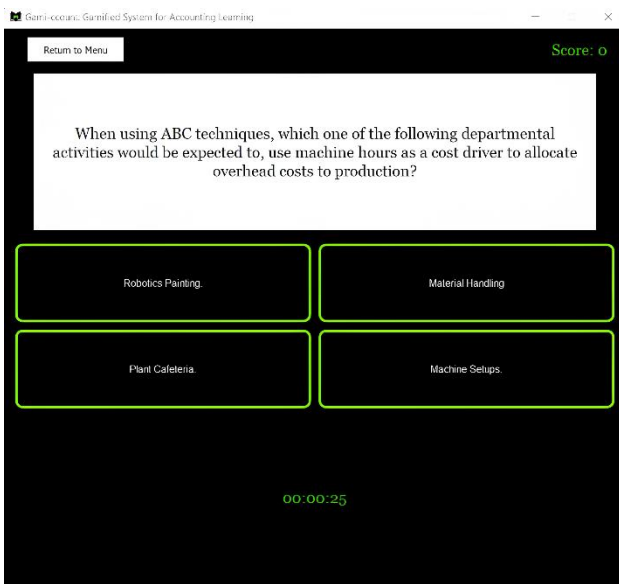


Fig. 17 Default Trivia Question Sample

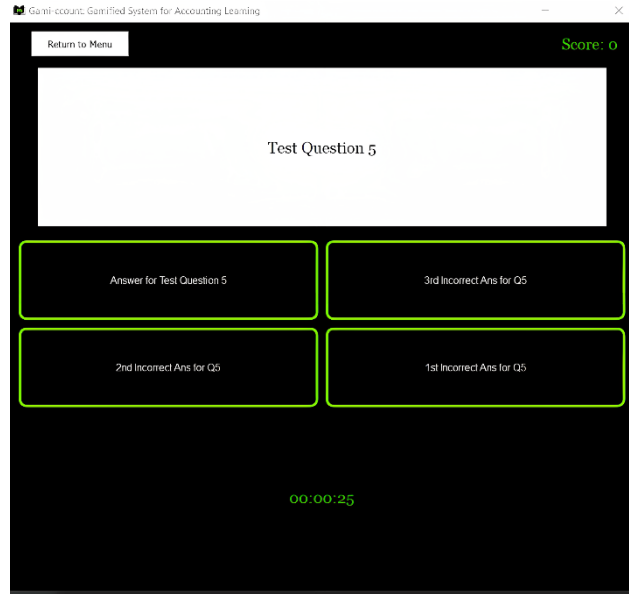


Fig. 18 User-defined/ Custom Trivia Question Sample

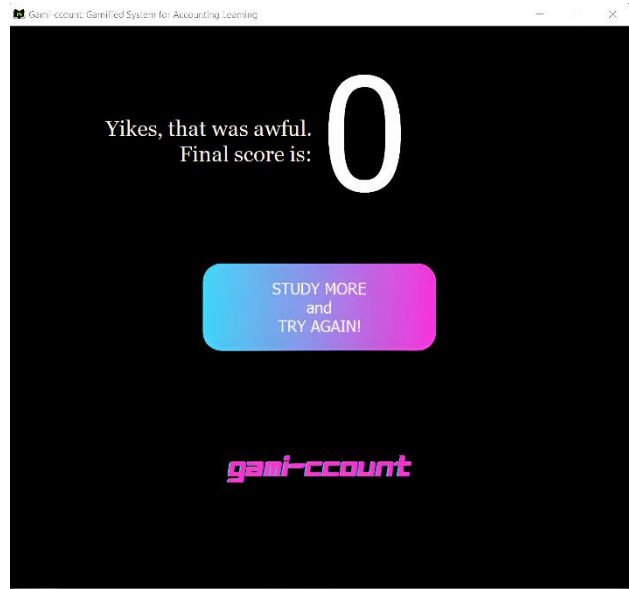


Fig. 19 Defeat Condition Triggered

By default, the trivia pool will be populated with a mixed set of ACCA questions unless customized otherwise, as shown in Fig. 17. Clicking on the 'Return to Menu' button will compile and save the last score attained by the user during the round into the system database, while redirecting the user back to the main menu. A BGM will be played in the background to improve the trivia experience further. Every button click will activate a "click" sound effect as well.

As shown in Fig. 18, once a custom set of questions is imported into the pool via the Import Question Wizard in the main menu, the system will generate specific questions with answer choices from the trivia question pool by a random index. Users may import new question sets repeatedly.

Fig. 19 shows a sample screen output encountered by users when the closing conditions have been triggered. By default, the design requires only one wrong answer choice to trigger the losing conditions. Therefore, users are encouraged to study well before attempting the quiz to avoid incorrectly answering, ultimately leading to their defeat. Upon losing the round, a sound effect is played. Clicking on the “STUDY MORE and TRY AGAIN” button will redirect users back to the main menu.

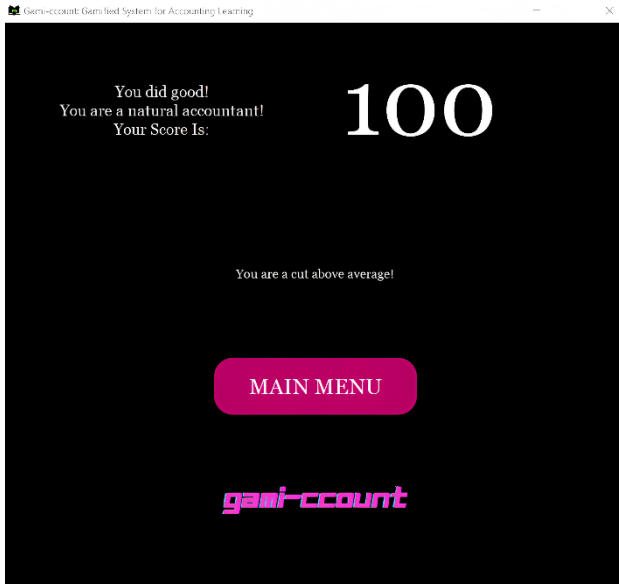


Fig. 20 Winning Condition Triggered

Fig. 20 shows a sample screen output when users successfully complete the trivia round without making a mistake. A cheerful and positive sound effect will be played upon winning the game. Clicking on the “Main Menu” button will lead users back to the Main menu, where they can either try again, exit the program, or load up a new accounting question set using the Import Question Wizard.

4.2. User Acceptance Testing Results

The User Acceptance Test (UAT) is carried out once the prototype system is built. Out of 35 respondents who took part in the UAT, each facet of the test aspects would need at least to reach an obvious agreement rate or favor level of 17 (35 respondents * 50%) to be considered a pass. Based on the results shown in Table 9, 83% of respondents (n = 29) agree on finding the UI of Gami-ccount to be user-friendly and that the system is easy to use. However, from an aesthetic point of view, the system layouts, multimedia elements, color tone, and theme could be improved, as seen from the low agreement rate of 13, 14 and 12, respectively. Despite so, the majority of the respondents (n = 19) stated that they would recommend the system to their friends and family who wish to learn and strengthen their accounting knowledge. 17 respondents strongly agree that the system can meet the primary objectives of enhancing learning engagement and motivation in accounting through its use and functionalities. The overall result of UAT is shown in Table 9 below and indicated by the following: SD = Strongly Disagree, D = Disagree, N= Neutral, A= Agree, SA= Strongly Agree.

Table 9. User Acceptance Testing Responses

UAT Questions	SD	D	N	A	SA
The system developed and its user interface(UI) are user-friendly and easy to use.	0	1	5	10	19
The system/ application layout is well-defined.	1	2	3	16	13
The color tone and theme of the system are friendly to the eyes and for browsing for long hours.	1	2	6	12	14
The multimedia elements (font, graphics, buttons) are appropriate.	1	1	6	15	12
I am able to log in to the system and create new accounts without complications.	0	1	4	11	19
I am able to improve my accounting learning experiences through the system.	0	1	2	9	23
I see myself recommending this system to my friends and family who wish to learn to account.	1	3	7	5	19
The system developed can meet the project's primary objectives and requirements.	0	1	5	12	17
Rating Questions	Extremely Poor	Poor	Neutral	Good	Excellent
Please rate the trivia feature.	1	4	5	13	12
Please rate the audio feature.	0	0	4	10	21

5. Conclusion

Although gamification has been around for some time, there is not much research applying the technique to improving accounting-learning experiences. With an increasing demand for gamified solutions to enhance students' interest and learning capabilities in accounting, educational and academic institutions would have to invest in e-learning technology, digital products, and resources. The most prestigious and wealthy schools may be able to afford the costs behind such an implementation; however, it may be a different case for less-privileged and less-funded schools, especially in rural areas and developing countries. The recent developments around the evolving pandemic have worsened the situation, and the need for online and remote learning has never been more significant. One of the solutions to tackle this issue is to utilize game-based/ gamified learning platforms or software to educate accounting learners. This approach could create a more engaging and interactive learning session compared with the conventional classroom teaching method. In Malaysia, schools or even universities rarely embrace the use of gamified applications in learning ACCA-levels of accounting knowledge. In the case where students are not in the classroom or not in teaching sessions, the remaining options to make revisions of ACCA accounting will be either watching online lectures, scouring through numerous reading materials and resources or via the pen and paper method. Although some steps may be necessary to attain the skills and knowledge to handle the ACCA exam, for many, these could turn out unproductive and dull due to the lack of interesting and interactive elements which enrich the learning process. This is where gamification could change the game.

The functions and features that should be designed and made available in the proposed prototype system were finalized and realized upon intensive academic research and the attainment of user requirements. The prototype is able to meet the primary requirements and goals. The main features are fully functional, and the developer can manipulate and

process data without hassle. However, numerous other features and improvements are worthy of further discussion and exploration to further highlight the system's capabilities, which will be discussed further in this section. The primary setbacks to implementing a more engaging and vibrant gamification system include the lack of professional knowledge and proficiency in the utility of the programming language – Python and its GUI dependencies -PyQt5, throughout the system's design. To better highlight and capture the essence of the system, several secondary features, such as the rewards system, difficulty selection, in-game player action evaluator etc., had to be removed and scrapped to prevent the modules from clogging the performance and consuming unnecessary memory space during program execution. However, such issues can be overcome by gaining a more profound understanding of Python, such as employing the proper use of data structures, using fewer global variables and dot operations, or using list comprehension to reduce code block length etc.

In addition, some of the system modules initially designed to incorporate OOP concepts had been completely overhauled and redesigned as the program simply became larger in size due to the need for higher memory allocation, which ultimately led to a slow execution and lagging performance in production. It also conflicts with the user's interest and does not align with one of the aforementioned functional requirements. All limitations mentioned will be addressed in the future. Several other features and functionalities which can be added to increase the system's capabilities include allowing users to simultaneously play against their friends and peers, creating private rooms and game lobbies for a private round, levelling and rewards system, better UI design, score engine etc.

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