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Development of a Gamification Based English Vocabulary Mobile Learning System

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Abstract- English language is the official language in Nigeria and also a language for international communication, the learning of English has become of great value. The importance of English language in student's performance cannot be over emphasized. Reports show that the performance of students in written, reading and spoken English in undergraduate and graduates studies of Nigeria is not impressive. Research has shown that vocabulary is the most important element of any language learning including English language. Motivation is an important factor for learners to learn English Vocabulary continuously and effectively. This paper adopts the use of Gamification based English Vocabulary learning technique to motivate and encourage learners to continue learning English vocabularies effectively.

Keywords- Gamifications, Vocabulary, English, level, Score, Badges, Rewards

I. INTRODUCTION

English is a widely used international language in the world, learning English has become a thing that cannot be ignored. To own excellent vocabulary knowledge, it is beneficial to infer the meanings of an English sentence or article [7,15], but a lot of learners think that memorizing English vocabulary is something difficult especially for long or infrequently used vocabularies. English language was introduced in Nigeria in the early 19th century by the British colonial Administration. Although, English Language is a foreign Language to Nigeria, it is widely used in Nigeria as a second language. It has played a major role in Nigeria which could be seen in our education, government, business, commerce, mass media and most of internal and external communication. Above all, English language has played the role of the language of political unity. Formal education in Nigeria today is a product of English language. Without English, there is the possibility that there may not be anything more than the elementary formal education in Nigeria.

Despite the importance of English Language, the performance of students, both undergraduate and graduates, over the years, has been on a downward trend. Media reports show that the performance of students in written, reading and spoken English is discouraging.

In the recent years, a lot of researchers have made efforts in the study of English learning, and most studies emphasized the importance of vocabulary learning to English learning [2].

Vocabulary is one of the most important elements of language learning. Having a wide vocabulary helps language learners understand written and spoken language. It also helps them express their own ideas more completely. Many researchers also pointed out that the main obstacle for English learning is to face entirely new and unfamiliar words that appear in an English article [14, 11]. In order to read English articles fluently and smoothly, a learner needs to at least, memorize two thousands commonly used English vocabularies [14, 11]. It is obvious that vocabulary learning is very essential to English language learning acquisition, because time spent in English learning in the classroom is limited, since there are many components involved in English language learning (listening, reading, writing and speaking activities), teachers seek alternative ways to help students learn English vocabularies outside the classroom. Mobile learning (m-learning) is one of such alternative. Some recent studies have shown promises in using mobile phones to teach vocabulary, either through SMS (Short Message Service) messaging, or through emails, and also through social media networks such as twitter and Facebook. A smartphone is effective for independent learning such as English vocabulary memorization, because a learner can use the smartphone anytime and anywhere when the learner has time to spare for learning.

Many English vocabulary learning systems were developed for assisting learners to memorize English vocabulary efficiently, in which some of these systems employed games to enhance learner's learning motivation.

In order to maintain the learner's motivation, gamification is employed. It is therefore established that utilizing gamification techniques in e-learning has a positive influence on the user's learning motivation [2]. With proper integration of gamification in the field of e-learning into higher education, a positive impact on the learning process can be achieved, such as higher satisfaction, motivation and greater engagement of students. In this study, the design of a gamification-based English vocabulary system for improving English vocabulary abilities of learners is presented.

II. GAMIFICATION

Gamification is the use of game design elements in non-game contexts. Game elements such as point's level, badges, progress bar, rewards, and leaderboards are used in this study to enable learners enjoy gaming experience and in turn motivate them to continue learning. Efficient difficulty levels and game challenge settings are also considered in order to maximize players' or learners' enjoyment during the learning process. To control the difficulty level, the difficulty curve model is used to adjust the experience point gap for moving from one level to another in the system.

Deterding et al. [3] defined gamification as "the use of game design elements, characteristic for games, in non-game contexts". The regular patterns used in the game design are known as game elements. Some of these elements, sometimes described as components, are seen in most of the games nowadays, including: points, badges, leaderboards, progress bars/progression charts, performance graphs, quests, levels, avatars, social elements, and rewards. All these elements have different purposes and can be adapted to basically any work, business or education related environment [4].

Gamification techniques strive to leverage people's natural desire for competition, achievement, status, altruism, community collaboration, and many more. Rewards such as Badges and points are used to elevate status by showcasing the talents, expertise and accomplishments of users. Competition is another technique that can be used in gamification. The desire to appear on leaderboard drives players to complete more tasks, in turn, fulfilling deeper engagement [18]. Gamification taps into the basic desires and needs of the user impulses which revolve around the idea of status and achievement [6].

Motivation is very important in learning. It has been observed that if students are not motivated, they may not be able to solve a problem, even though they have the skills to solve it. On the other hand, if they are highly motivated, even though they have limited ability, motivation will help them find a way to solve a challenge and also improve on the skills. However, according to [5], motivation and ability alone are not enough. A 'trigger', which is like a call for action, is also required so as to tell the user to achieve a certain behavior. Software applications can serve as such 'trigger' to change people's attitudes and behavior.

Gamification has been shown to engage and motivate learners when used properly in or outside the classrooms [10, 13]. Gamification combines both intrinsic and extrinsic motivation to raise user engagement and also influence their behavior towards learning. Intrinsic motivation is an internal desire to perform a task and results in high-quality learning and creativity while Extrinsic motivation occurs when external rewards not related to the task itself drive the user to take an action, for example, money, good grades, awards [16]. The use of game elements increases students’ motivation because they get fully engaged when faced with a challenging task.

III. RELATED WORKS

Lam [9] presented the use of Gamification in Vocabulary Learning; students learned and reviewed vocabulary through two online games, namely “Fling the Teacher” and “Jeopardy”. The aim of the survey was to find out students’ opinions and attitudes towards using online games in learning vocabulary and its effectiveness. The results showed that students preferred using this technology when learning vocabulary, not only because it was more fun and exciting, but because it also facilitated vocabulary retention. However, it came with some limitations; the learning procedure was restricted to classroom learning alone and also the learning materials were obtained from students’ class notes, thereby making it impossible to learn outside classroom environment.

Hasegawa et al. [8] developed an effective vocabulary learning support system for the learner’s sustainable motivation. The system supported learners’ motivation using gamification techniques and a new efficient difficulty setting method by calculating the ratio of mastered words to unmastered words. The system menus and functions were written in Chinese, which made it unsuitable for non-Chinese speaking countries such as Nigeria. In this study, a mobile English learning application utilizing gamification techniques for keeping the learner’s motivation is adopted.

IV. SYSTEM ARCHITECTURE

The architecture of the proposed system is presented in Figure 1. The system consists of five modules: a database, learning interface, vocabulary recommendation module, learning performance assessment module and test module.

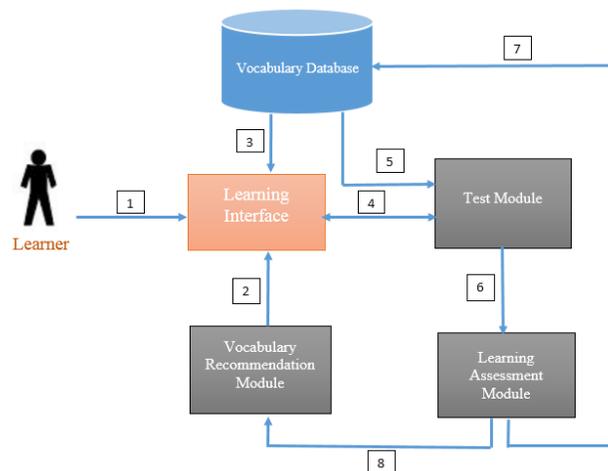


Fig. 1. Architecture of the proposed System adapted from [1]

A. The Vocabulary Recommendation Module:

This module recommends English vocabulary to individual learner according to the game level of the individual learner (game level). If a learner chooses to perform the learning process, then the vocabulary recommendation module will recommend the appropriate vocabulary to the learner according to learner's game level during learning process.

B. The Test Module:

This module automatically generates a corresponding testing sheet according to the learned vocabularies of individual learner for the purpose of assessing the learning performance. To assess learners’ learning performance during learning processes, the test module will randomly select corresponding testing questions relating to the

learned vocabularies to evaluate the learner learning outcomes and the answered questions are stored in the database as learning history.

C. The Learning Performance Assessment Module:

This module aims at collecting learner testing results from the test module, then re-evaluates individual learner ability. Each test question generated by the Test module has points attached to it. These accumulated points are used by the learning performance assessment module to progress a player to a new level based on the difficulty level adjustment model. The learning performance assessment module, then stores these information in the user portfolio database for personalized English vocabulary recommendation learning.

D. Vocabulary Database:

This database contains the English vocabulary words to be used as learning materials, the test questions to assess the learners' learning performance on vocabularies learnt, user profile and user learning progress. All the English vocabularies stored in the English vocabulary and test database are from the repository of Graduate Record Examination (GRE). The system applies the grading level of GRE to categorize each vocabulary into different game levels.

The GRE is divided into three levels with content appropriate to each level; Basic, Intermediate and Advanced levels. These levels are further subdivided into ten game levels. The Basic level vocabularies form the first three game levels, while the Intermediate level vocabularies form the next three game levels and the Advanced level vocabularies form the last four game levels. The system consists of a total of 100 vocabularies and 100 test questions. The system operation procedure is summarized as follows:

- | | |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 1. | Learner logs into the system through the learning Interface. The learning Interface checks the individual learner's profile. If learner is a beginner, it requests for the learner/player to create a profile. The learner starts the learning process. |
| Step 2. | The vocabulary recommendation module obtains the game level of individual learners and all learned vocabulary from the vocabulary database. |
| Step 3. | If a learner is learning for the first time, the vocabulary recommendation module then recommends new vocabulary to the learner. |
| Step 4 and 5. | The test module then checks the vocabulary database for questions related to the learned vocabularies and presents it to the learner as game tasks or challenge |
| Step 6 and 7. | The learning performance module assesses the result from the test agent and increases the learner's game level using Experience points gained in a previous level. It then stores this new information in the vocabulary database. |
| Step 8. | Learner returns to Step 2 to perform the next learning cycle or quit the game, thereby terminating the learning process. |

V. GAMIFICATION MODEL

The gamification model refers to the digital game-based learning framework proposed by Tan et al. [17], which can be utilized to fulfill the systems concept, which encourages learners' motivation to learn in m-learning environment. Surveying four game-based models [17], proposed a framework in which an educational game should be composed of three elements which include; Multimodal, task and feedback:

- **Multimodal**

A variety of interaction that connects a learner and a game, namely, sounds, animations, effects etc. (incorporating synonyms, sounds, antonyms and example sentence in this case)

- **Task**

A question or problem in the game to help learner to absorb the learning content (i.e., English vocabulary word with appropriate difficulty that adjusts to learner's skills in this case)

- **Feedback**

Feedback for learners is vital in an educational game. A suitable feedback reduces the learner's misunderstanding.

A Gamification model was adapted from [12] and it consists of;

- a) A set of tasks $k \in K$ that need to be performed
- b) A set of game design elements $g \in G$, where G is gamification
- c) A set of users $u \in U$ processing task K enhanced by G , where U is the total number of users.

Gaming experience begins with tasks or missions that should have clear goals and provide immediate feedback. These goals should be both challenging and achievable, thus giving rise to various conflicts and challenges. Too much challenging goals will not be achievable, and easily achieved goals will not be challenging. Some players will lack the enthusiasm to engage with too difficult or too easy missions, while some others will classify them as not enjoyable.

Ideally, game challenges should increase when the player advances in levels. As the player becomes more proficient with the game and his/her character becomes tougher, the amount of experience or any other metric needed to advance a level should be more than the amount needed on the previous leveling up. Similar techniques are applied in almost all Role Playing Games (RPGs) to adjust the experience point gap for leveling up automatically. The formula is given as:

$$T_{XP}(N) = T_{XP}(N - 1) + (P_2 * C_L)$$

where, N = New game level

$T_{XP}(N)$ = Total Experience points for progressing into level N.

$T_{XP}(N - 1)$ = Total Experience points gained in the previous level.

P_2 = Experience points needed for progressing from level 1 to level 2 which is predetermined

C_L = Current game level

VI. SYSTEM IMPLEMENTATION

This section describes the implementation of the English vocabulary learning system (EVOLS). Currently, all client-side program code is implemented using HTML5, CSS3 and Javascript. The server side scripts were implemented using PHP 7.0. The backend was implemented using MySQL. Other tool include; Website2apk converter (Android Mobile application software development tool). The system is available as a mobile web application and also as an android application. Figure 2(a) shows the vocabulary learning interface.



Fig 2(a)

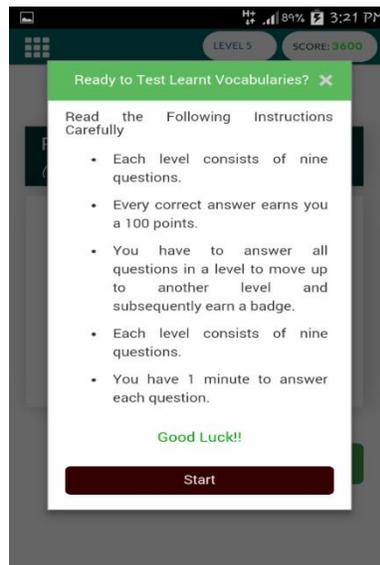


Fig 2(b)

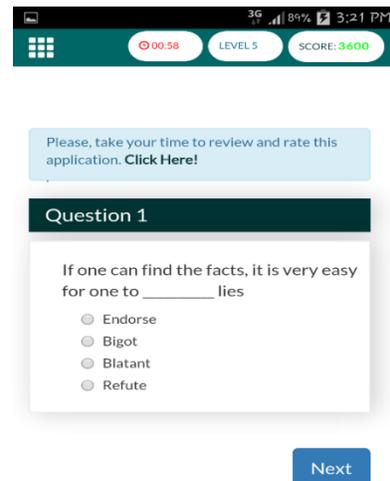


Fig 2(c)

Figure 2 shows the implemented English vocabulary learning system (a) the learning interface of the system (b) the test taking instructions prior to the test page (c) the test page.

In figure 2a, learning page contains the vocabularies to be learnt and a NEXT and PREVIOUS button for navigating through the vocabularies. The top-right corner contains boxes for the player level and the player score. Also, attached to each vocabulary, is a speaker button. This button, when clicked, pronounces the corresponding vocabulary and its meaning. When the last vocabulary for a particular level is reached, the NEXT button changes to TAKE TEST button, this button is used to navigate to the test page for the user to answer the test questions relating to the learnt vocabularies. The top-left corner shows a side bar button, that when clicked, will display more navigation menus such as, Profile, Leaderboard, About and Logout. This side bar button is consistent on all other pages in the application.

Fig 2 (b) shows a pop-up that contains the instructions about the test to be taken for users to answer. The instruction is to enable the user have a clear understanding on how to take the test and how the test section works.

Fig 2(c) depicts the test page. This page allows users to take test relating to the learnt vocabularies. The test consists of ten questions and four options of answer, which are loaded one per page and also presented at random to the users. On answering each question, the user is shown if each selected answer is correct or wrong via a pop up alert and a progress bar. If the user answers all the questions in a particular level, the system moves the user to the next level and a badge is earned, else the user remains in the same level.

Fig. 3(a) shows the user profile page which contains information about the user. This information includes input supplied by a user during registration, such as player name, email address, and profile picture. Also, it contains information about the user progress such as, user level, score, badge earned in the current level, achievement. Lastly, it contains buttons for editing user profile and also for completely deleting a profile.

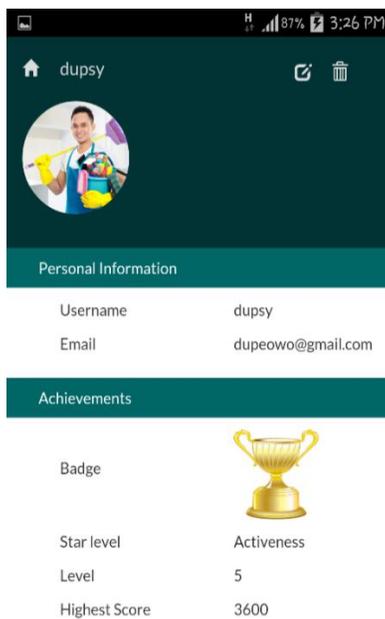


Fig 3(a)

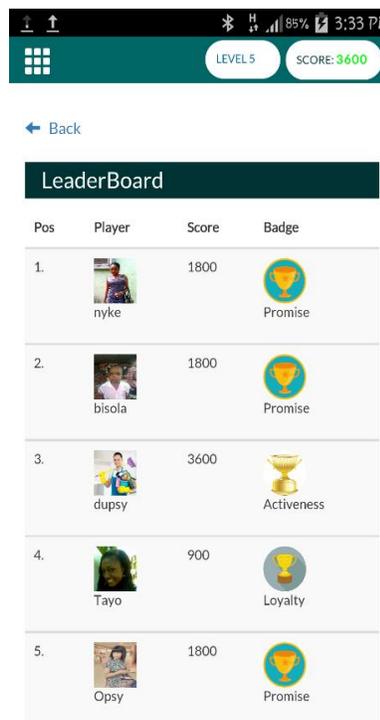


Fig 3(b)

Fig. 3 (a) user profile page (b) leaderboard page

Fig 3 (b) shows the leaderboard page. The leaderboard page shows the list of users with top five high scores. This page is aimed to motivate the user to keep learning through the application by wanting to be part of the top five scores in the system.

VII. EVALUATION

The evaluation was carried out through a survey form attached to the developed application. The survey was completed online by 71 participants, consisting of 41 males and 30 females. The participants answered the survey for each function on a scale of five, three and one. Five means “Agree”, three means “Neither agree nor disagree”, and one means “Disagree”. The content of the survey and its result is shown in Table 1. According to these results, many participants answered “Agree” for most of the content; however focus is made on some distinguishing contents.

Content 2; friendly user interface, received the highest number of “Agree” response, which was followed by content 1; ease of use, which also received a high number of “Agree” response. These showed that users really found the interface attractive, easy to use and interactive.

Content 7; time trial challenge, received the lowest number of “Agree” response and the highest number of neither “Neither Agree nor Disagree” response. From further interaction from the users, it was discovered that the time the users were provided to complete a task or challenge was too little and thus, they were unable to complete a particular level.

Content 6; efficient difficulty level settings received the highest “Disagree” responses, although, it also received a high number of “Agree” responses. This was due to the fact, that users were required to answer all questions in a particular level correctly before they can move up to a new level and as such, some users felt it was too difficult to move up the game levels.

Content 8; good rewards and badges, received the third highest number of “Agree” response and no “Disagree” response, which showed that users really loved the rewards and badges given by the application.

Content 10 and content 11 received a high number of “Agree” responses and few or no “Disagree” responses. This showed that users enjoyed playing with the application and were motivated by the application to keep learning English vocabulary. Figure 4 shows a graph showing the survey performance of the proposed system.

Table 1 Summary of users’ responses to online survey

Content	Agree	Neither Agree nor Disagree	Disagree
1.The application is easy to use	69 (97.2%)	2 (2.8%)	0 (0%)
2.The application has a friendly User Interface	70 (98.6%)	1 (1.4%)	0 (0%)
3.The application provides Clear points and Ranking System	67 (94.4%)	3 (4.2%)	1 (1.4%)
4.The application provides a good feedback system	66 (93.0%)	2 (2.8%)	3 (4.2%)

5.The Learning procedure is easy to understand	64 (90.1%)	7 (9.9 %)	0 (0%)
6.The application has efficient difficulty level settings	60 (84.5%)	5 (7.0%)	6 (8.5%)
7.I love the Time trial challenge provided by this application	59 (83.1%)	10 (14.1%)	2 (2.8%)
8.I love the Rewards and Badges given by this application	68 (95.8%)	3 (4.2%)	0 (0%)
9.The application has clear learning Instructions	66 (93.0%)	4 (5.6%)	1 (1.4%)
10. The application motivates me to learn English vocabulary the more	67 (94.4%)	3 (4.2%)	1 (1.4%)
11. I enjoyed playing with this application	64 (90.1%)	7 (9.9%)	0 (0%)

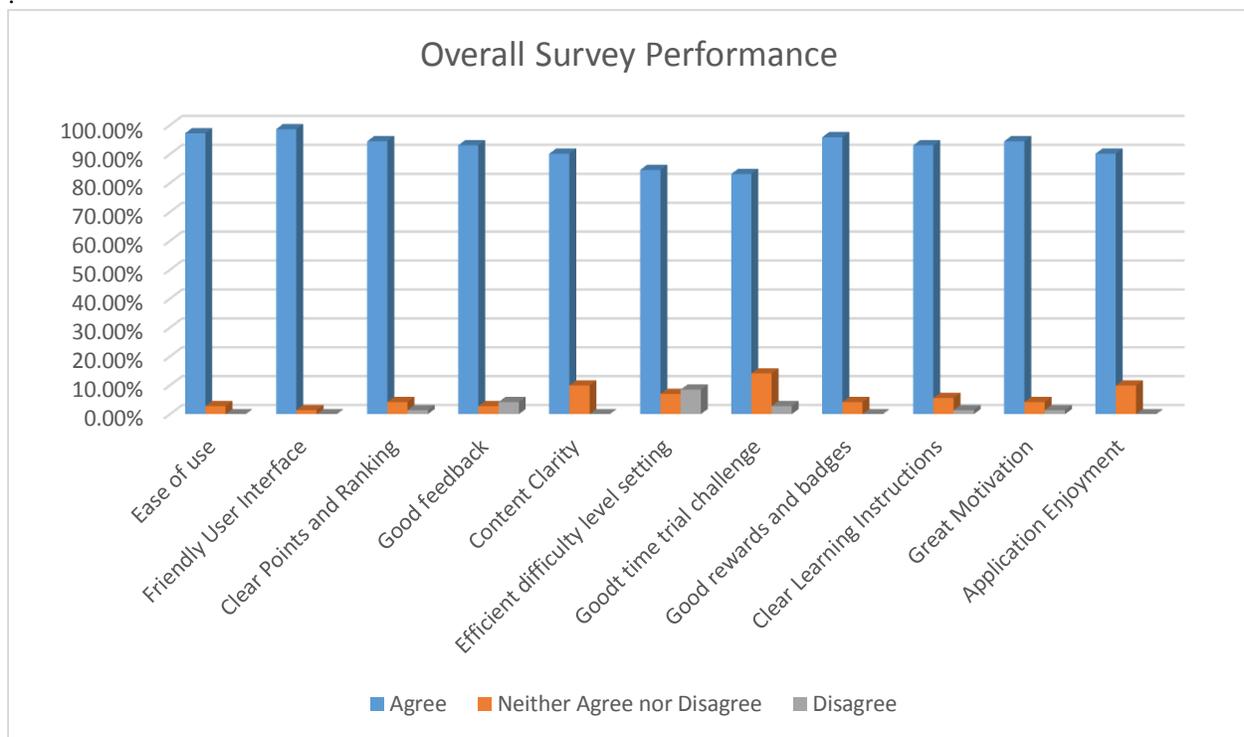


Fig 4. Graph showing the survey performance of the proposed system

VIII. CONCLUSION

Gamification is not a totally new concept; it has been successfully used in the business and education world. Gamification uses game elements and game design techniques to empower and engage learners with motivational skills towards learning approach and sustained relaxed atmosphere. Gamification has also been found to fortify the teaching and learning experience in the 21st century as it helps learners to be motivated towards learning because of the positive and immediate feedback they get from the game.

In this study, a mobile English vocabulary learning system that incorporated gamification techniques as a source of motivation to learners was developed. This application was equipped with necessary game functions for English vocabulary learning. In addition information technology, such as gamifying techniques, text-to-speech functionality, and effective difficulty level settings using the difficulty curve model was deployed.

Experimental results revealed that the developed system has significantly enhanced learner's English vocabulary abilities and promoted learning interests. More significantly, the system facilitated a seamless mobile learning environment for English learning without constraints of time or place imposed by classroom learning.

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