Impact of a gamified application on reading comprehension and attitude of Swahili among young learners in Kenya.

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Abstract
This study addresses the use of technology, specifically a gamified mobile app, in the classroom to teach reading comprehension of Swahili in Kenya. As Swahili is Kenya's national and one of two official languages, it is an important language to master in school. Additionally, the new education system in Kenya has added technology in the classroom as part of the revision to their curriculum. Therefore, the use of a gamified app has been used to teach Swahili in a local private school in Kenya. This pilot study used both qualitative and quantitative methods, such as using questionnaires, a pre- and posttest, and observation with discussion, to gather data from the control group (CG) and experimental group (EG). The results of this study show that the participants expressed enjoyment in learning Swahili by using the gamified app. The EG showed substantial improvement in the reading comprehension from the pre- to posttest $t(21)$ = -2.783, p = 0.011. Further, the students reported that the discussions that they had while working in small groups allowed them to better understand the content of the material.

1. Introduction

The drive to include additional technology in the classroom has been taking place to increase motivation and engagement when learning a Second Language (L2) (Stanley, 2011; Buckley & Doyle, 2016). Additionally, there is evidence that the use of technological tools empowers learners to go beyond the traditional concept of the classroom as well as make the decision as to when and where they would like to learn and practice their L2 (Drexler, 2010; Leowen et al., 2019, Reinders & Benson, 2017). Further, Plonsky and Zeigler (2016) emphasized increased learning opportunities to be gained from implementing gamified language learning to supplement normal classes with their statement, "the affordances of technology might best be exploited to provide learners with optimal language learning opportunities" (p. 17).

While gamified tools are available in education settings in many of the western nations, in the Kenyan classroom setting, gamified online tools available to learn Swahili are not yet readily available. More specifically, the availability of gamified reading comprehension tools

has yet to be created. Because of this, this study has been designed to first create an application for teaching reading comprehension of Swahili and then to assess whether this gamified app increases reading comprehension for students in Kenya. The subsequent sections describe the education in Kenya and the importance of the Swahili language These sections are followed by a literature review of gamification and technology, as the background information is the basis for the research questions of this study. A gamified application based on the StratApp was created for teaching reading comprehension in Swahili. The method section describes the testing procedures, which use both qualitative and quantitative analyses to assess the effectiveness and enjoyment levels from introducing this learning tool to the students.

1.1. Education in Kenya

The 1919 Education Commission report argued that "secular government schools could not be successful without *proper* religious and moral instruction. It recommended the development of education largely through the missionary societies' *assisted schools*". Additionally, it explained that Africans be trained in agricultural and vocational practices rather than academically, while the rest of the population (Europeans and Asians) received the academic training. This separation of the groups (along racial and tribal lines) due to colonial education "had been designed to see the races apart in a complex sort of relationship that ensured that one group was dominant over others" (Lelei & Weidmann, 2012, p.147).

There were objectives set by the first president in office after independence to break the segregation mentality that had grown during the colonial times. At this time, development policies were put in place to address issues of opportunity, access, and equity, which Lelei and Weidman (2016) explained:

1) producing the skilled and high-level personnel needed to facilitate the urgent process of social-economic development,
2) providing education that would help young people acquire a sense of nationhood by promoting positive attitudes of mutual respect that would enable them to live in harmony and contribute to the society's aspirations (Ominde, 1963), and
3) offering equal opportunity and social justice for all Kenyans" (p.147).

The Kenyan education system was last amended after colonization. This, according to Mackatiani *et al.* (2016), happened due to the impact of the social, economic, and political changes that were taking place in post-independence Kenya. Although the political aspect plays the greatest influential role, they added that the other factors that were taken into consideration when creating the education curriculum were historical, geographical, technological, religious, and ideological. These factors were considered due to them being similarly significant and influential in pre-colonial Kenya, as well as a guiding factor for the colonizers to determine the type of education provided in school centres for the local population (Mackatiani, 2016)

Kenya's first president, Kenyatta, saw the role of education as one that restored African dignity, recaptured national heritage, which had diminished due to the imposition of an alien culture and prepared Kenya for its place in a modern international community (The Republic of Kenya, 1965). With this in mind, the education system after independence went through

some adjustments to correct one of the main emerging issues, namely, the demands of the labour market were misaligned with the education being provided.

The basis of this information was provided by the Ominde Commission (1976), which recommended a unified education system. The Commission's report embraced the notion of "*harambee*" (self-help) schools which were to be built through pooling together of resources from the different small communities in which they were located, endorsed free primary education as an important objective for educational development; and it also recommended the involvement of the government in the provision of education for all Kenyans. The main shortcoming of the Ominde Report was that the curriculum was targeted toward urbanized Kenyans, who were a minority in the time following independence.

In order to design a more balanced curriculum, in 1981, the Government appointed a commission chaired by Professor Mackay (Eshiwani, 1993). Kitainge (2004) states that the aim of this commission was to formulate an education system that designed a curriculum which included theoretical as well as practical skills at each level that would produce self-reliant individuals that could fit into self-employment, formal employment or would proceed for further training.

Nevertheless, in the work carried out by the two commissions, minimal emphasis was put on the teaching methods of the recommended subjects/disciplines, and thus stakeholders realized the need to review the new education system. In 1999, the Government appointed the Commission of Inquiry into the Education system of Kenya, which came up with the Koech Report. This report highlighted the problems that the education system had in Kenya and published a proposal called Totally Integrated Quality Education and Training (TIQUET), which was meant to improve the former system.

If the initial education system teaching methodology largely relied on the traditional approach of teaching, the new one came with the intention of creating a more self-sufficient workforce. Aumtabi (2021) elucidated that there has been consensus that Kenya needed to replace the former system, which had become exam-dependent, with one that is competency-based so as to shift the focus from exam results to skill and knowledge acquisition and application. The change of the initial education system in Kenya to the more recently adopted education curriculum (Competency-Based Curriculum) included a new aspect of teaching methodology: digital learning. The Gachathi Report, 1976 and the Mackay Report of Education, 1981 that followed built on the recommendations that the Ominde report had suggested. These additional recommendations targeted the mismatch between the education being offered and the growing labour market (Lelei & Weidman, 2012; Akala, 2021).

1.2. Swahili language in Kenya

The importance and impact of Swahili in and on Kenyan history and society cannot be underestimated as it played a large role as the communicating and unifying language among the people of Kenya during colonization, particularly between people from different tribal groups. It became a language that carried and symbolized the national identity of Kenya. This is the main reason that Swahili was one of the languages (in addition to English) that were required to be taught from primary up to high school level to achieve a high level of proficiency,

as explained by Githiora (2008). The main method adopted to achieve this is through the use of textbooks.

With the implementation of the new education system, the shift of the students to active participants can play a role in influencing the attitude that they have towards the Swahili language learning process. Attitude plays a role in the learning process as it can influence various aspects of an individual, such as emotions, values, beliefs, and behaviour, which in turn can affect the way of thinking, acting, and behaving, which has implications for teaching and learning. (Mensah et al., 2013)

It has been noted that with the use of technology-based activities, students can learn better as they are actively part of the learning process. This, in turn, determines the level of success in the students' willingness and engagement in the process of learning a language. Additionally, technology has been shown to "be linked to content language learning, engagement, motivation, satisfaction for students" (Dehghanzadeh, 2019, p.1).

1.3.Gamification and technology

Increased urbanisation has created the need to modernise the education that students are being taught to reflect the current workforce requirements (Lelei & Weidman, 2012). Similar to the flexibility that internet access provides, gamified technology-assisted language learning can provide an avenue through which students can practice what they have been taught. (Loewen et al, 2019; Chen et al, 2019) Gamified technology in a language classroom can give the students added motivation to work and master the material that they are learning. (Odera, 2011) Odera went on to explain that "students who are intrinsically motivated will work hard and learn more because of their personal interest in the materials." This will move the students from being passive to active actors in the process of learning Swahili, one of the official languages and the only National Language in Kenya.

In gamification, game elements are used to engage learners with the content and to progress toward a goal. For example, when somebody logs into a computer application correctly, she/he receives a badge. Receiving a badge is an element of a game, but in this case, such action is not related to other game activities, for example, moving to a new level, solving a puzzle, or matching two or more items (Kapp, 2012). Bunchball (2010) describes game mechanics as the fundamental actions, processes, and control mechanisms that are applied to 'gamify' activity and to create engaging experiences for learners. Game mechanics include but are not limited to point, level, badges, leader board, charity and gifts, challenge, space, storytelling, and virtual goods (Bunchball, 2010; Caballe & Clariso, 2016). Game dynamics trigger, stimulate, and drive the emotions of the learners to experience the game. Game dynamics include but are not limited to status, achievement, reward, self-expression, competition, altruism, challenge, fun, and satisfaction (Bunchball, 2010).

1.4. A gamified app to learn Swahili

It is important to emphasize that within all these educational changes, the Swahili language classroom in Kenya is being encouraged to include "digital resources for language learning can offer possibilities that extend beyond traditional classroom methods" (Leof et al., 2019). The reason is the necessity for these children to learn (Swahili) as soon as they arrive at school because although it is the vehicular language in the schools of Kenya, as well as one of the working languages of the African Union, many of the students speak other aboriginal languages at home, which implies that many students have comprehension difficulties in Swahili, and this slows their learning process.

An added problem is that in Kenya, many schools do not have computers or even cable internet connections. According to the World Bank Report (2020), in Sub-Saharan Africa, "mobile penetration is actually at times higher than that of TV, radio or computers, specifically among the poor families. For example, in households of primary-aged students in Africa, 46% of poor households own mobiles, while for radio, that number is only 30%, 4% own a TV, 1% own a computer, and 0.3% have access to the internet" (p.15). For this reason, if we think of digital resources as computers, it is difficult to follow this pedagogical advice, but we may think of the devices that a large part of the population own: a mobile device.

Issues on the effectiveness of combining gamified language learning within the traditional classroom setting in the classroom to make learning more effective (Rego, 2015; Zhang, 2015; Lam *et al*, 2018). This has been achieved through the use of gamified activities in the classroom, which has been shown to be a prominent instructional method to motivate students and increase their engagement and motivation during learning processes (Jackson & McNamara, 2013). It is important to note that the use of gamification, as explained by Flores (2015) "empowers and engages the learner with motivational skills towards a learning approach and sustaining a relaxed atmosphere" (p. 32). Authors such as Dehghanzadeh et al., (2019) and Jackson and McNamara (2013) described the process of language learning through gamification as being one of the most prominent instructional method's that motivates students and helps increase their engagement and motivation during learning processes.

With all this being said, we believe that the most available resource that may work well in this scenario is a gamified app on a mobile phone, used as a support tool in the students' learning process. Also, since we are focusing on young learners, our proposal is to use a gamified language app to improve the efficacy in reading comprehension in Swahili. The research questions of this research study are the following:

RQ1: Does using a gamified app help improve reading comprehension when learning Swahili?

RQ2: How effective is gamification technology in improving Swahili reading comprehension?

RQ3: How does gamification technology influence the students' attitude towards learning an L2?

RQ4: Does gender play a role among the students when using gamified technology to learn an L2?

2. Methodology

2.1. Research design

The data was collected using both qualitative and quantitative research methods. This was done with the use of a pretest-posttest design where a test that was issued to the students before and after the experiment and the results were analysed quantitatively. Also, a pre-questionnaire was given to both the students and teachers before the study followed by a post-questionnaire at the completion of the study to determine their perceptions and attitudes of practicing Swahili with the use of technology which has been integrated into classroom teaching. The questionnaire data was analysed qualitatively.

The research design is further detailed in the pictorial diagram below (Figure 1).
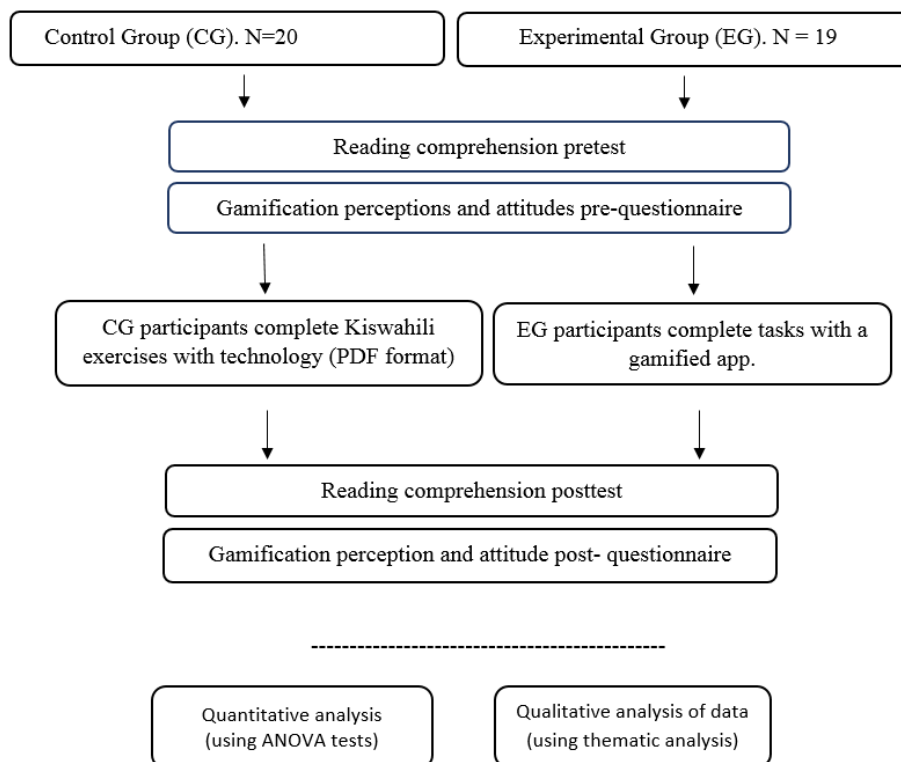
Figure 1. Research design

2.2. Research participants

The participants are students from a local private school near the capital of Nairobi. There are approximately 20 – 22 students per class. The participants were in two classes, one was the Experimental Group and the other was the Control Group.

In this experiment, the participants were between the ages of 10- and 11-years. The control group (CG) had a total of 19 participants, which consisted of 12 females and 7 males. The experimental group (EG) had 20 participants (9 female, 11 male). All the participants had used a tablet before and therefore were comfortable using it.

The exact same texts with the same questions were presented to both groups of participants. The CG read the texts in tablets, in PDF format. The control group read the texts in the gamified app. Both groups worked in small groups (3-4 participants in each group) due to the lack of tablets to work individually.

2.3. Research instruments

2.3.1. The Gamification App
The gamification app used in this study was an adaptation of the StratApp. The StratApp was created originally as a tool for increasing reading comprehension in English. This application was designed for mobile devices, which includes android and IOS systems and it is able to be downloaded for free. This application has been translated to work in Swahili using images and phrases specific to the culture in Kenya. A translation team worked through the course of one year to have the app ready to use in this pilot study.

2.3.2. Reading comprehension pre-test and post-test.
The tests were created using the Official Education syllabus as a guideline. In order to ensure that the material was in line with the governmental syllabus, a specialist was consulted (see Annex 1)

2.3.3. Gamification perceptions and attitudes perceptions questionnaires.
Four questionnaires were created for the two different groups that would take part in the experiment: two for the students (CG) pre and post experiment; two for the students (EG) pre and post experiment. The questionnaire used "yes" and "no" questions, Likert scale questions and open-ended questions. The open-ended questions allowed the participants to give their opinions on the gamified app used. The questionnaires were created and given to the participants digitally using Microsoft Forms. Once the questionnaire was created, it was validated by other language teachers and the questionnaires were modified and improved according to their feedback.

3. Results

3.1. Quantitative results
We compared the pretest and posttest results to see whether there was a difference in gender and a difference in overall performance.

The ANOVA verifies there is no difference in gender in the performance of the students either on the pretest or on the posttest $F(1,9) = 0.138$, $p = 0.719$ (see Table 1 below).

Table 1. Gender differences

Within Subjects Effects

Cases	Sum of Squares	df	Mean Square	F	p
Gender	8.100	1	8.100	1.270	0.289
Residuals	57.400	9	6.378		
Testing	16.900	1	16.900	8.642	0.016
Residuals	17.600	9	1.956		
Gender * Testing	0.400	1	0.400	0.138	0.719
Residuals	26.100	9	2.900		

Note. Type III Sum of Squares

Between Subjects Effects ▼

Cases	Sum of Squares	df	Mean Square	F	p
Residuals	77.900	9	8.656		

Note. Type III Sum of Squares

However, when comparing the pre-test and post-test data without including gender as a variable, the results of the *t* test show that the difference between the pre-test (M = 8.727, SD = 2.676) and post-test (M = 9.955, SD = 1.463) is significant $t(21) = -2.783$, p = 0.011 (see Table 2 below).

Table 2. Reading comprehension improvement. Comparison.

Paired Samples T-Test

Measure 1		Measure 2	t	df	p
Pretest	–	Posttest	−2.783	21	0.011

Note. Student's t-test.

Descriptives

Descriptives

	N	Mean	SD	SE
Pretest	22	8.727	2.676	0.570
Posttest	22	9.955	1.463	0.312

This means that there is no gender difference found in the testing. However, there is a difference in the performance for the students in the experimental group who used the app, which is significant and, as the mean score is higher for the post-test, the difference shows this group improved in their reading abilities from the pre-test to the post-test.

3.1. Qualitative results

Of the 20 participants in the experimental group, 49% (9 participants) indicated that they really liked Swahili (rated it as 5), while 51%, 7 rated it neutral (3) and 4 rated it as like learning Swahili (4).

When asked in the questionnaire whether they would like to use a learning app to practice Swahili (pre-test), 18 of the 20 participants (90%) strongly agreed that they would like to use such an app. When collecting the responses post-test, 18 of the 20 participants strongly agreed to using an app to practice Swahili, while 2 participants agreed (rated 4) to using an app to practice Swahili. Although most of the participants (70%) had not used a tablet to practice a subject or topic that had been taught, those who did use a tablet explained that they used it when schools went online (during COVID-19 period), while those who had not used a tablet thought that it would be fun and exciting.

When asked if they thought whether using an app would help them practice Swahili better, more than half strongly agreed (55%) while those who agreed were 25% and 15% were those that were neutral. When asked to rate (post-test) "how do you think using an app that is a game has helped you practice Swahili better", 55% strongly agree that it has helped them practice Swahili better, and 35% agree that it has helped them, while 5% strongly disagree that it had helped them practice Swahili better. This is similar to the responses that they gave when they answered the question (pre-test) "do you think using a tablet that is a game can make you practice Swahili better?" with 90% of the participants responding positively and 10%

negatively. When the same question was asked post-test, 100% or the respondents answered in the affirmative.

The participants expressed how they thought the application would help them using phrases that explain comprehension (understand more, make Swahili better). Similarly, post-test, the participants explained that there was better comprehension and that it was fun to play using a gamified application to practice Swahili.

Both groups (control and experimental group) both enjoyed using the tablets as it was a change from the norm and that created a different and more fun environment. Both groups worked in small groups (2-3) participants per group so that they could all use the tablets that were available at the same time to do the exercises. As they got to work is small groups, they got to discuss the questions that were in the exercises. These small discussions had the benefit of the participants teaching each other. Both groups (CG and EG) participants explain that using the tablet would prevent boredom in the classroom.

4. Discussion

The main goal of this study was to introduce a mobile app that uses gamification to students in Kenya to increase reading comprehension in one of Kenya's official languages. Additionally, our aim was to assess whether the students enjoyed using the application, since, if students enjoy the process of learning, they may be motivated to continue learning and further their education. The results answered the first research question; does using a gamified app help improve reading comprehension when learning Swahili? According to the pretest and posttest results, using a gamified application for reading comprehension showed a significant difference in performance; $t(21) = -2.783$, $p = 0.011$. The second research question; How effective is gamification technology in improving Swahili reading comprehension? The EG students enjoyed interacting with the L2 using a gamified app which influenced and improved their perfomance in the posttest. Additionally, 55% the students expressed in the questionnaire that they preferred and enjoyed using the gamified app more while doing the reading complrehesnion exercises. The third research question looked at the influence of gamification technology on students' attitude towards learning an L2. The students responses in the qualitative post questionnaire expressed their positive attitude towards learning Swahili after using the gamified app with five responses expressing increased comprehension with the statement "understand better" used by five participants. Additionally, other participants said that using gamification technology made learning more fun, which is due to the material being given to them in a new way. Finally, it was noted that although the students were using gamified technology for language learning, there definitive difference in the performance between the genders; $F(1,9) = 0.138$, $p = 0.719$.

5. Conclusions

The results of the study indicate the use of a gamified app in a Kenyan school helps students in the process of improving reading comprehension. Additionally, the results indicated in the

former section suggest the use of a gamified app improves reading comprehension when learning Swahili. The gamified app also improved the attitude of the participants as they enjoyed being exposed and interacting with the material in a gamified way.

For future work, it was recognized that the student's group discussion with the gamified material enhanced the comprehension of the students who had the most difficulty in integrating the material. This element could be a good follow up for future research in optimising the use of gaming apps, for example they are better used individually or as a group.

6. Acknowledgements

7. Ethical statement

To consider the research ethics of the designed experiment, which involved recording names and age of the research participants, written informed consent was obtained from the participants parents before the experiment was explained to the participants in full. As all the participants are minors (below the age of 18) consent of the parents was required before the participants were able to participate in the research. The informed consent letter detailed the specific nature of the research. This included explaining that the data that were collected from participants was only for the research, that participants' names will never appear on any data collected, and that instead a unique identification number will be assigned to their data; the information that participants provide will remain secure such that only the principal investigator of this study will have access to it; the collected data that are no longer needed will be destroyed; and how participation will make a contribution to the study's goals.

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