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Measuring Tajweed Augmented Reality-Based Gamification Learning Model (TARGaLM) Implementation for Children in Tajweed Learning

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ABSTRACT

Known for its plain and dry content, tajweed learning is often tedious, particularly for children. Our preliminary study confirmed that most of the learners were uninterested to learn tajweed and this fact was agreed by their educators. Currently, technological advancement helps learning enormously and it has been widely utilised, especially for the digital native generation. Therefore, we highlighted the use of augmented reality and gamification as an attempt to attract children to learn tajweed. Based on experience and motivational theory, tajweed augmented reality-based gamification learning model (TARGaLM) was implemented in the tajweed learning. To investigate the effectiveness of the proposed approach in terms of their emotional engagement (enjoyment) potential and learning performance, 198 children constituted four groups participated in the learning activities. TARGaLM successfully gained positive results of autonomy, challenge, points, badges, leader board, progression, immersion, and feedback, which are crucial for enjoyment. In the post-activity interviews, the students mentioned that the proposed approach was interesting. Furthermore, the proposed approach group indicated the highest decrease in articulation errors from the post-test compared to other groups. The use of current technology and approach not only has potential in bringing enjoyment, but also gives a positive impact on the learning outcomes.

Keywords: ANOVA, augmented reality, enjoyment, experience, gamification, motivation, post hoc test, tajweed learning

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INTRODUCTION

Tajweed knowledge is crucial in every Muslim life as it ensures the correctness of the Quranic recitation. Hence, tajweed learning processes start as early as childhood. Children learning is prominent as Islam emphasises that any religion-related education such as praying, fasting, and Quranic recitation should start at the early age of a Muslim (Ulwan, 2002).

However, previous studies showed that accurate tajweed articulation in Quranic recitations are rather low or moderate for all age levels (Awang et al., 2011; Hassan & Zailaini, 2013a), including the children (Hassan & Zailaini, 2013b; Ismail et al., 2011; Noor et al., 2018). Our preliminary study also found similar result. Shockingly, most of the respondents who were children stated that the tajweed learning processes were tedious and they were uninterested to learn tajweed (Noor et al., 2018). The educators confirmed the findings. Besides, as tajweed has religion-related content, the learning processes are always dry, plain, and limited (Jusoh & Jusoff, 2009).

There are various earlier studies that discussed the use of technological approach to attract learners to learn (Billinghurst et al., 2001; Dunleavy, 2014) the Islamic content specifically (Ismail et al., 2011; Sardan & Rias, 2013; Jusoh & Jusoff, 2009). Augmented reality and gamification are examples of the current technology. Augmented reality enables the virtual contents such as text, animation, sound, and videos to be embedded in the real-world situation (Bakar et al., 2018; Billinghurst, 2002). Gamification permits the utilisation of game elements in the non-game field such as points, level, leader board, and others into the learning process (Barata et al., 2013; Deterding, 2015; Morschheuser et al., 2018). Interactivities, attractiveness, and experiential learning in augmented reality and gamification elicit myriad emotions and appeal to the learners to engage in a learning process (Dunleavy, 2014). Even though there are several studies concerning technological approach to tajweed learning such as Ahsiah et al. (2013), Ismail et al. (2011), and Mssraty and Faryadi (2012), it is still considered scarce compared to other learning content (Noor et al., 2018; Jusoh & Jusoff, 2009). Moreover, through literature search, currently there is still no implementation of augmented reality and gamification employment in tajweed learning, particularly in Malaysia (Noor et al., 2018). The combination of both approaches for learning is possible (Dunleavy, 2014; Noor et al., 2018). However, it requires a thorough design process to avoid cognitive overload during the learning process.

Tajweed learning is often trapped in an uninteresting learning process nature. Therefore, to make the students emotionally engaged in and enjoy the learning process, this study has constructed an innovative model named tajweed augmented reality-based gamification learning model (TARGaLM) as depicted in Figure 1. TARGaLM blends tajweed learning methods (observe, recognise, understand, recall, and articulate), augmented reality, and gamification with four stages of Kolb's experiential learning model, namely concrete experience, reflect observation, abstract conceptualisation, and active experimentation.

Meanwhile, the motivational theory of fantasy, control, curiosity, and challenge was utilised to maximise the learners' engagement in the tajweed learning. The system is coupled with augmented reality and gamification environment to complete the learning processes, which highlight the role of both augmented reality and gamification in enriching experience and interactivity in the learning processes. The system also attracts the learners to learn tajweed, elicits a variety of emotional feelings such as fantasy, control, curiosity, and sense of challenge, as well as improves the learning outcomes.

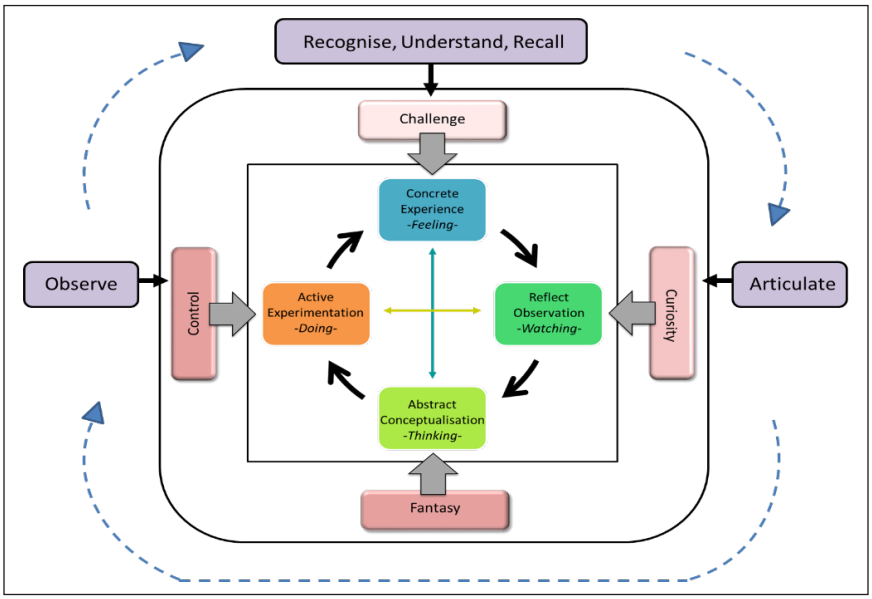

Figure 1. Tajweed augmented reality-based gamification learning model (TARGaLM)

Knowledge gained from experience can definitely be applied to the daily and future life, which is crucial in learning (Huang et al., 2016). Experiential learning is different from the teacher-centred learning as the learners personally control and experience the learning processes (Kolb, 1984). Through interactive learning processes, the learners obtain understanding of the core of the learning content and will parallelly comprehend the relations between the concepts or rules.

Experiential learning model proposed by Kolb argued that learning is a process of experience transformation. The model discussed four cyclic stages of learning, namely concrete experience (CE), reflect observation (RO), abstract conceptualisation (AC), and active experimentation (AE). In the proposed approach, the adapted experiential learning cycles for tajweed learning require:

- CE (feeling) – the learners learn through direct experience and specific experience with peers.
- RO (watching) – the learners observe the experience and make judgements.

- AC (thinking) – the learners learn and are able to understand ideas, concepts, rules, and situations.
- AE (doing) – the learners achieve the goals by completing tasks and activities (challenges).

Motivational theory also plays its own role in ensuring the learners remain in the learning experience (Malone & Lepper, 1987). Fantasy, control, curiosity, and challenge theory of motivation is a robust theory that has been applied in many learning fields (Kim & Lee, 2013), including both augmented reality and game design environment (Dunleavy, 2014). In general, TARGaLM utilises motivational theory in various ways as shown in Table 1.

Experience and motivation adoption in technological learning environment offer one of the utmost emotional effects on the learners, which is enjoyment (Fu et al., 2009; Lumby, 2011; Malone & Lepper, 1987). Concentration, immersion, clear goals, autonomy, feedback, and competence can be used to evaluate enjoyment (Sweetser & Wyeth, 2005) in relation

Table 1
Motivational theory use in TARGaLM

Theory	Description
Fantasy	• Fantasy feeling is evoked in the TARGaLM approach in several ways, for example: • Learn by using augmented reality • Utilisation of animations, audio, or videos, particularly the 3D or 2D animations for explaining the rules of each letter. • Practise the tajweed contents by using a digital game, which emphasised: • The search and select the correct or wrong letters and pronunciations – highlight the use of multimedia elements. • Storyline was formed, particularly in the digital game for completing the learning processes. • Receive rewards • Points, badges, and unlocking contents for learners who complete an activity which evokes the sense of mastery. • Markers' scan in augmented reality • Audio and video utilisation
Control	• Learners can select the markers based on what they want to learn. • Learners can begin the practices by their own selection of topics.
Curiosity	• Curiosity in TARGaLM approach was evoked through (for examples): • Provide the graphics, 2D or 3D graphics, and animations to show the inner mouth for tajweed pronunciations. • Wrong or correct audio recitations of particular Quranic sentences for tajweed. • Myriad levels of challenges in the practices. • Appropriate use of multimedia elements.
Challenge	• Challenge integrated in the overall process (augmented reality for learning, digital game for practising, and audio/video recording for assessment). • The tajweed contents were scaffold based on the complexity (easy, intermediate, expert), particularly in the practice part. • Emphasised the use of game mechanics (points, badge, leader board, and others) for performance feedback and also positive feedback to encourage learners' self-esteem.

to experience and motivation (Fu et al., 2009; Malone & Lepper, 1987). When learners are actively involved in a learning environment such as by dealing with various stimuli from several sources and solve different tasks and activities, the learners' concentration will increase. Fantasy and curiosity feeling elicitation can also attract the learners' attention which help the learners to maintain their focus in the environment (Sweetser & Wyeth, 2005). Besides concentration, well-designed experience and motivation in a learning process is possible to make the learners immerse in the environment (Alexiou et al., 2012). The feeling of less aware of their surrounding area, time, and the current life are examples of immersion effects on the learners.

In any learning environment, clear goals are crucial to ensure the learners will experience activities effectively to achieve the required outcomes (Tan, 2015). Moreover, the sense of fantasy, control, curiosity, and challenge can be properly constructed to motivate the learners when the learning goals and objectives are well-defined (Malone & Lepper, 1987). On the other hand, autonomy has also been proven to be essential in learning experience, particularly to bring enjoyment to the learners (Sweetser & Wyeth, 2005). The processes of feeling, watching, thinking, and doing are significant when the learners are able to control the environment on their own (Lumby, 2011). The experience and motivational theory applied in a learning process are meaningless if the learners cannot retrieve the appropriate feedback in the process (Sweetser & Wyeth, 2005). Feedback covers all the responses provided by the learning processes.

Besides that, experiencing the learning processes and then staying engaged in the environment will also contribute to competence among the learners (Ryan & Deci, 2000). Competence is related to the improvements gained from the learning processes (Fu et al., 2009). Basically, several factors can be used to assess the learners' thoughts regarding their competence such as challenge, knowledge or skill improvement, points, badges, leader board, and progression. To be competent, a learner needs to complete activities or tasks and solve problems (challenges) provided in the learning processes (Iten & Petko, 2014). The improvement of knowledge shows that the learning processes are able to bring competence to the learners. Point and badge collection indicates the effort of the learners in mastering the learning content. Meanwhile, leader board and progression show the achievement or competence levels of the learners compared to others (Codish & Ravid, 2014). Fundamentally, by applying experience and motivational theory in TARGaLM, enjoyment can be achieved successfully by assessing concentration, immersion, clear goals, autonomy, feedback, and competence.

However, a comprehensive implementation of experience and motivation is required to avoid any unattractiveness or cognitive overload of the proposed approach (Dunleavy, 2014; Huang et al., 2016). Accordingly, this study seeks to investigate the effectiveness of the proposed approach for positive emotion, which is enjoyment elicitation potentials and its effect on the performance.

METHOD

To understand the emotional engagement (enjoyment) potential and learning effects of the gamification and augmented reality use in the tajweed learning context, this study adapted enjoyment questionnaires from Fu et al. (2009) and Codish and Ravid (2014) as well as employing pre-test and post-test in the experimental design sessions. The questionnaires consisted of six main dimensions, namely concentration, immersion, clear goals, autonomy, feedback, and competence (knowledge improvement, points, badges, leader board, and progression). Meanwhile, audio or video recording sessions (Hassan & Zailaini, 2013a) were conducted before and after the experimental session as the tajweed learning emphasised the articulation of the letters and verses in Quranic recitation.

A pilot study was conducted to measure the precision of the measures in assessing the emotional engagement. Thirty-three primary school students were involved in the pilot test and a reliability test was performed by computing the Cronbach's coefficient alpha. According to the test results as depicted in Table 2, most of the alpha values were more than 0.7 except for the challenge dimension. Coefficient alpha values above 0.7 were acceptable for the internal consistency of the questionnaires (Nunnally, 1978). However, the constructs in the challenge(*) dimension remained because the values were also acceptable as they were close to 0.7 (Loewenthal, 2004). For the actual experiment, 198 subjects who were the upper-level primary school students were involved in the experimental sessions. The students were randomly assigned into four groups of different learning approaches with approximately equal numbers of male and female students in each group.

Group A was involved in the conventional learning approach (control), Group B only used augmented reality application as well as conventional *practices* and *assessment* (experimental group I), Group C was involved in video learning and gamification

Table 2
Reliability test for the questionnaire

Dimension	Cronbach's Coefficient Alpha values	Number of Items
Concentration	0.790	3
Immersion	0.750	4
Clear Goals	0.887	3
Autonomy	0.749	3
Feedback	0.801	3
Competence:		
Challenge	0.689*	4
Knowledge Improvement	0.712	5
Points	0.767	3
Badges	0.747	5
Leader board	0.854	3
Progression	0.733	4

(experimental group II), and Group D was involved in both the augmented reality and gamification approach (experimental group III) (Huang et al., 2016). The objective of dividing the students into different learning approaches was to investigate the effectiveness of the proposed approach (Group D) compared to the other approaches in tajweed learning in terms of their emotional engagement and performance.

To avoid any interference and invalid data collection, the experimental sessions (briefing, pre-test data collection, and learning activities) and post-test data collection were conducted concurrently for all the groups. Each group was briefed about the experiment procedures. The test sessions began with voice and video recordings of the individual students reciting five surahs from the Quran; Al-Alaq (1-6), Al-Fiil (1-6), Al-Kafirun (1-6), Al-Masadd (1-5), and Al-Ikhlas (1-4) (Hassan & Zailaini, 2013a). These recordings acted as the pre-test data. Upon completion of the recordings, each respective group began their tajweed learning processes. This study utilised the most basic tajweed learning content which were articulation from the vocal cord (*halkum*), through the tongue and nose (nasalisation and non-nasalisation), as well as the Qolqolah rules (Hassan, 2014; Jawatankuasa Buku Teks Sekolah Rendah Agama, 2011). The learning content for each group was identical during the experiments. Figure 2 shows that the tajweed learning requirements are mapped into the process, challenges, and activities in the experiments for each group's learning processes (Kementerian Pendidikan Malaysia, 2017).

Group A is the control group. The group members learnt through the conventional approach. All the learning, practices, and assessments were conducted in a conventional manner. Group B learnt using the augmented reality system only and the *practices* and *assessment* parts were completed conventionally and handled by an educator. Group C used video-based learning and gamification systems and Group D utilised the augmented reality and gamification approach for both the *learning* and *practices.* For augmented

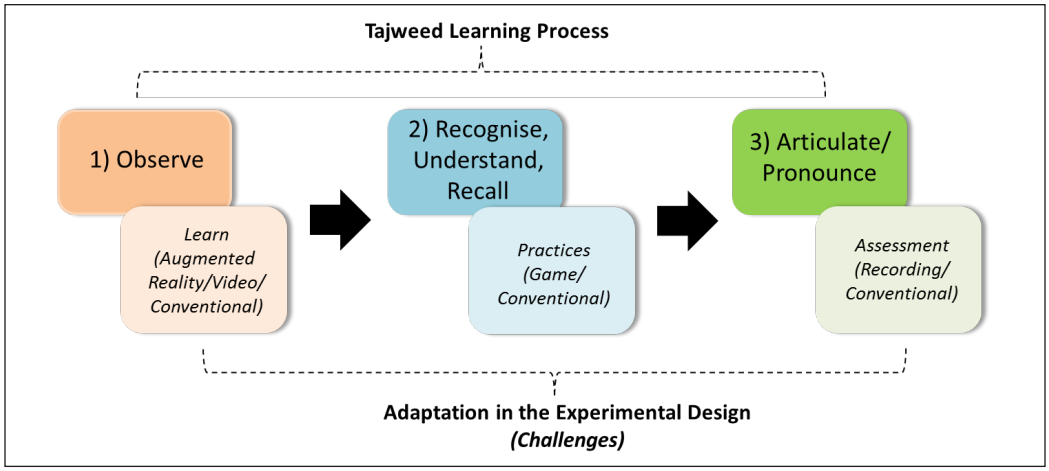

Figure 2. Tajweed learning process and the employment of the approaches

reality system, *hijaiyah* letters were used as the markers as deployed by Rambli et al. (2013). Tajweed learning emphasises articulation of the Quranic letters and verses in certain rules and they were articulated differently (Hassan, 2014). In general, the students in Group D performed the tajweed learning processes as illustrated in Figure 3. This study also adopted crucial elements of gamification employment as described by Tan (2015), which are goal and rules, gameplay, feedback, game space design, and storyline. Further implementation explanations for the TARGaLM application can be retrieved from Noor et al. (2018) in general.

The students in both groups C and D needed to record their recitations individually for the *assessment* part with the help of the researcher. The results of the *assessments* were displayed to the students briefly the next day.

Since students in Group A had friends and peers in completing the learning approach together as mentioned by their educators, students in Groups B, C, and D completed the session in pairs. The decision was made for several reasons. First, as the nature of the tajweed learning emphasises the articulation or pronunciations of the letters or verses, our pilot study revealed that when the students had their peers with them, they tended to repeat the articulation of the learning content simultaneously while completing the learning

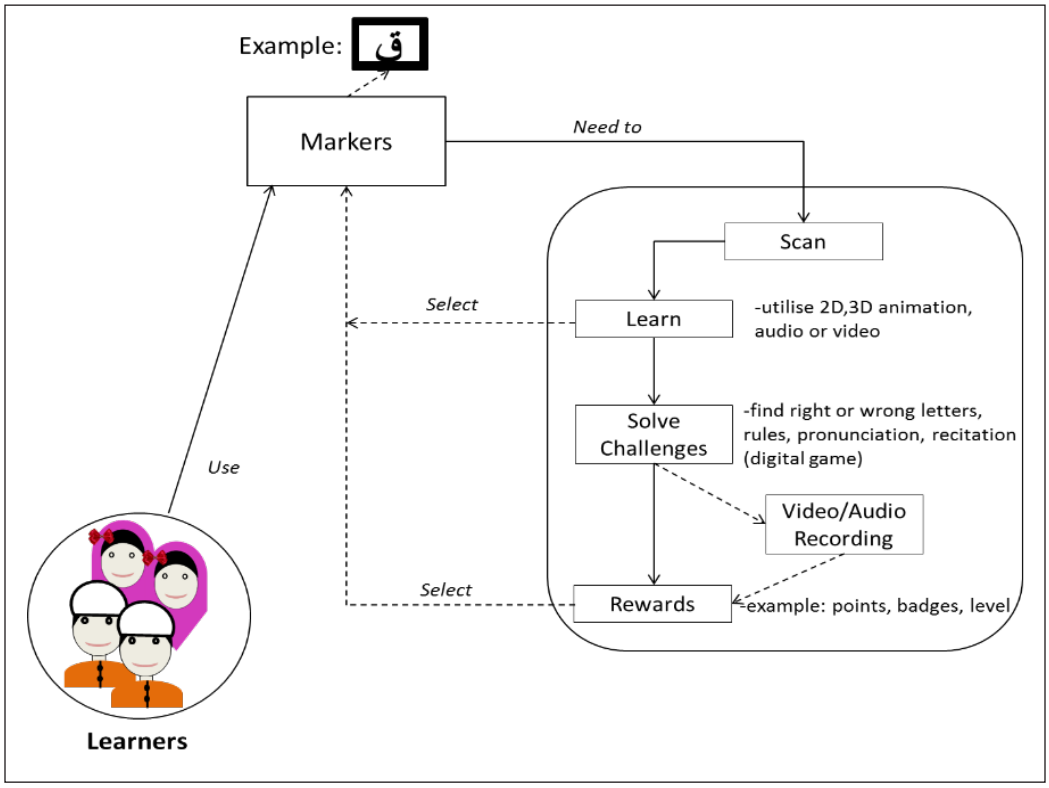

Figure 3. The tajweed learning process for the proposed approach

processes in the approach. However, the researcher asked both of them to interact with the systems equally to ensure they gain experience from the sessions. Second, the students seemed to be more comfortable and relaxed while performing the learning session as he or she had a peer to discuss and solve the tasks and challenges together, which is common in the conventional learning. Furthermore, collaborative learning with peers in a learning session, particularly technological-related approach, enhances the students' confidence and self-efficacy to learn and succeed in the learning process (Sung & Hwang, 2013). It is also an effective opportunity for assuring retention and problem-solving in a learning process (Janssen et al., 2010).

Considering that the students might have a close peer, they were given the options to choose the peer they wanted to be with. After the students finished the learning process, approximately between 75 to 90 minutes, they were asked to complete the post-test. After the post-test recording sessions ended, they answered the provided questionnaire. Table 3 summarises the group division in the study. Meanwhile, Figure 4 depicts the implemented experimental design example in this study.

Table 3
Group division in experimental design

Group	Learning Approach for Experimental Study	Participants	Topics (all groups)
A	Conventional	Pair/Peer	Articulations: - Vocal cord (*halkum*) - tongue - nose (nasalisation and non-nasalisation) - Qolqolah
B	Augmented reality prototype + questions/answers sessions (conventional)	Pair	
C	Video and game prototype (gamification)	Pair	
D	Augmented reality and game prototype (gamification)	Pair	

Figure 4. Experimental design implementation example of the study

RESULTS AND DISCUSSION

This study aims to investigate the effectiveness of the augmented reality and gamification utilisation compared to other approaches in tajweed learning. Evaluations have been deployed to see whether the proposed approach has the potential to elicit positive emotions (enjoyment) as an attempt to eliminate the tedious feeling in tajweed learning and to improve the performance. There are several factors that can be investigated to determine the learners' feelings or emotional attraction towards a technological approach or system (Fu et al., 2009; Malone & Lepper, 1987). This study investigated the factors of concentration, immersion, clear goals, autonomy, feedback, and competence dimension for ensuring the possibility of the positive emotional elicitation in the proposed approach. Those measures were also in line for evaluating learners' experience and motivation in technological environment, which exposed the enjoyment feeling towards the approach (Fu et al., 2009; Malone & Lepper, 1987; Nakamura & Csikszentmihalyi, 2002).

Table 4 shows the demographics of the participants in the experimental study. 198 participants were involved in this evaluation. There was a balanced number of participants for Groups A (51, 25.8%), B (49, 24.7%), C (50, 25.3%), and D (48, 24.2%) as well as for gender; male (106, 53.6%) and female (92, 46.5%). Even though the number of

Table 4
Demographic analysis of the participants (N = 198)

Item	Classification	Frequency (%)
Group	Group A	51 (25.8)
	Group B	49 (24.7)
	Group C	50 (25.3)
	Group D	48 (24.2)
Gender	Male	106 (53.6)
	Female	92 (46.5)
Age	10	69 (34.8)
	11	64 (32.3)
	12	65 (32.9)
Computer use	Yes	166 (83.8)
	No	32 (16.2)
Playing games on the computer	Often	19 (9.6)
	Rarely	161 (81.3)
	None	18 (9.1)
Augmented reality information	Yes	43 (21.7)
	No	155 (78.3)
Augmented reality use	Yes	35 (17.7)
	No	163 (82.3)
Technology approach for learning	Yes	152 (76.8)
	No	46 (23.2)

participants who often played games on the computer (19, 9.6%) and for both augmented reality information (43, 21.7%) and use (35, 17.7%) is small, the participants were able to use the computer (166, 83.8%), which reasonably indicated their capabilities for involving in the experimental studies.

Table 5 demonstrates tajweed learning proficiency and opinions. The table shows that although the participants were interested in tajweed (107, 54%), their retention (162, 81.8%) and comprehension level (152, 76.8%) were low. In order to perform in the learning, almost half of the participants agreed that the current learning method could be improved (98, 48.5%). The participants noted that technological approach (176, 88.9%) could be used as an alternative for learning tajweed.

Table 5
Tajweed learning proficiency and opinion (N = 198)

Item	Classification	Frequency (%)
Interest	Yes	107 (54)
	Less	91 (46)
	No	0 (0)
Easy to memorise	Yes	26 (13.1)
	Less	162 (81.8)
	No	10 (5.1)
Comprehension level	Yes	34 (17.2)
	Less	152 (76.8)
	No	12 (6.1)
Current learning method preference	Prefer	96 (48.5)
	Can be improved	98 (49.5)
	Does not prefer	4 (2.0)
Technology approach for tajweed learning	Yes	176 (88.9)
	No	22 (11.1)

In order to view the differences from the four groups for the aforementioned measures, ANOVA and post hoc tests were performed. Table 6, Table 7(a), Table 7(b) and Table 7(c) display the results for both analyses.

Table 6
ANOVA test results

	df	SoS	MS	F	Sig.
Concentration					
Between groups	3	0.745	0.248	0.672	0.570
Within groups	194	71.624	0.369		
Immersion					
Between groups	3	5.084	1.695	4.870	0.003*
Within groups	194	67.513	0.348		

Table 6 *(continue)*

	df	SoS	MS	F	Sig.
Clear Goals					
Between groups	3	1.124	0.375	1.031	0.380
Within groups	194	70.515	0.363		
Autonomy					
Between groups	3	35.927	11.976	32.903	0.000*
Within groups	194	70.609	0.364		
Feedback					
Between groups	3	22.292	7.431	18.549	0.000*
Within groups	194	77.713	0.401		
Challenge					
Between groups	3	16.794	5.598	13.760	0.000*
Within groups	194	78.927	0.407		
Knowledge Improvement					
Between groups	3	0.072	0.024	0.089	0.966
Within groups	194	52.361	0.270		
Points					
Between groups	3	19.578	6.526	17.868	0.000*
Within groups	194	70.857	0.365		
Badges					
Between groups	3	49.095	16.365	59.195	0.000*
Within groups	194	53.633	0.276		
Leader board					
Between groups	3	16.903	5.634	10.568	0.000*
Within groups	194	103.431	0.533		
Progression					
Between groups	3	17.882	5.961	18.710	0.000*
Within groups	194	61.805	0.319		

* Significance level p < .05

Table 7(a)
Post hoc test results - multiple comparison

Group		**Mean Difference (I-J) For Each Dimension**			
(I)	**(J)**	**Concentration**	**Clear Goals**	**Autonomy**	**Challenge**
D	A	0.013 (p=1.000)	0.084 (p=0.899)	1.054* (p=0.000)	0.742* (p=0.000)
	B	0.145 (p=0.643)	0.206 (p=0.335)	0.227 (p=0.251)	0.295 (0.107)
	C	-0.003 (p=1.000)	0.051 (p=0.976)	0.066 (p=0.951)	0.073 (p=0.943)

* Significance level p < .05

Table 7(b)
Post hoc test results - multiple comparison

Group		Mean Difference (I-J) For Each Dimension			
(I)	**(J)**	**Knowledge Improvement**	**Points**	**Badges**	**Leader board**
D	A	-0.035 (p=0.987)	0.788* (p=0.000)	0.899* (p=0.000)	0.728* (p=0.009)
	B	-0.019 (p=0.998)	0.251 (p=0.176)	1.060* (p=0.000)	0.332 (p=0.117)
	C	0.014 (p=0.999)	0.051 (p=0.975)	-0.220 (p=0.997)	0.044 (p=0.991)

* Significance level p < .05

Table 7(c)
Post hoc test results - multiple comparison

Group		Mean Difference (I-J) For Each Dimension		
(I)	**(J)**	**Progression**	**Immersion**	**Feedback**
D	A	0.749* (p=0.000)	0.217 (p=0.263)	0.812* (p=0.000)
	B	0.340* (p=0.018)	0.397* (p=0.006)	0.601* (p=0.000)
	C	0.046 (p=0.978)	0.023 (p=0.998)	0.124 (p=0.766)

* Significance level p < .05

From the 11 dimensions investigated, eight dimensions of measurement reached a level of statistical significance ($p < 0.05$). The eight dimensions are autonomy, challenge, points, badges, leader board, progression, immersion, and feedback. Meanwhile, concentration, clear goals, and knowledge improvement showed no significant difference ($p < 0.05$) between the four groups, which indicated that all the groups offered concentration, clear goals, and knowledge improvement to the learners. By looking at the post hoc tests for autonomy, challenge, points, and leader board, the mean difference patterns between Groups D and A were quite similar to each other in which the mean difference is high ($m > 0.7$) for each dimension. However, the mean difference for autonomy was the highest ($m > 1.0$) among those dimensions, which indicated that the learners had intensely less control over the process or content during the conventional learning. Meanwhile, there was only a slightly mean difference ($m < 0.1$) for Group C compared to Group D for those five dimensions. Group C utilised video learning and gamification approach, which could be almost similar with the proposed approach for Group D. Therefore, the learners' perceptions were probably not much different for the dimensions.

Meanwhile, badges, progression, and feedback dimensions indicated that the mean difference patterns between Groups A and B compared to Group D were both high, which were statistically significant ($p < 0.05$). Badge dimension recorded the highest

mean difference for both Groups A and B ($m > 0.8$). This indicates that badges have not been utilised in both groups. These results are acceptable as the control group (Group A) and experimental group I (Group B) included conventional learning, practices, and assessment in the processes, which had been reminded to be implemented as similar as the actual and regular class session. For progression and feedback, the mean differences for both dimensions in Group A are the highest ($m > 0.7$). In contrast, even though the mean differences for both dimensions were rather low ($m = 0.340$ and $m = 0.601$) for Group B as the values did not exceed $m > 0.7$, the significant values ($p = 0.018$ and $p = 0.000$) showed that they were statistically significant compared to Group D. The learners in Group A perhaps had a confusion about how they saw their progression in the conventional approach. Even though we believed that all groups received appropriate feedback from educators or the developed system, the mean difference ($m > 0.6$) showed that feedback needed were fewer in both Groups A and B compared to Group D. In general, some of the results related to points, badges, leader board, and progression were in line with Codish and Ravid's (2014) study. Even though the dimensions were significant for the groups, there were various mean value differences between the dimensions which showed that the learners' view could be differentiated by the learning approach and types of learners. Since the participants were randomly selected, the various types of learners might blend in the groups of the study.

The mean differences for concentration, clear goals, and knowledge improvement dimensions between Groups A, B, and C compared to Group D were relatively small ($m > 0.7$) and non-significant ($p > 0.05$). Some of the results showed that the mean values were negative, which indicated the learners in the comparison group favoured the dimension over Group D. There was a negative mean difference for concentration between Groups D and C. However, the value was only slightly different ($m = -0.003$). This result was supported by Fu et al. (2009), who clarified that a more complex technological learning approach might reflect the learners' preferences and focus.

For knowledge improvement, the results showed that there were negative mean differences for both Groups A and B ($m = -0.035$ and $m = -0.019$) compared to Group D, with only a slight difference for Group B. Although previous studies found that technological learning approach could improve knowledge (Fu et al., 2009; Sweetser & Wyeth, 2005), the conventional approach was still relevant to improve the learners' knowledge (Codish & Ravid, 2014; Sabu, 2012). In addition, in this study, the conventional learning routine of tajweed learning might make some of the learners in Group A believed that the conventional learning approach was the most effective for their knowledge improvement. Furthermore, the utilisation of new and less exposed technology or approach to tajweed learning might invite doubts to its effectiveness for knowledge improvement and retention. Compared to Group D, only Group B shows that there was a significant difference in immersion

dimension, while Groups A and C were not significant. The utilisation of augmented reality only in Group B learning processes might be one of the reasons for the children feeling less immersed.

On the other hand, we also collected pre-test and post-test data of Quranic recitations before and after the learning processes to investigate the performance of the proposed approach compared to others. Descriptive and paired samples *t* test analyses were applied to analyse 360 audio or video data from 180 participants, after excluding several missing and corrupted files. Table 8 and Table 9 show the results.

Table 8
Paired samples statistics and tests for audio/video recordings of Quranic recitations

G.	Test	N	Mean	SD	t	df	Sig.
A	Pre	40	16.1000	6.38026	2.317	39	0.026*
	Post	40	14.5750	5.24716			
B	Pre	46	15.2174	8.02472	2.564	45	0.014*
	Post	46	13.8478	6.63984			
C	Pre	47	12.5319	6.58011	1.521	46	0.135
	Post	47	11.5532	5.94470			
D	Pre	47	15.2553	6.48901	4.195	46	0.000*
	Post	47	12.7234	5.91131			

* Significance level p < .05

Contrary to Group C, the results indicated that there was a significant difference for three groups, which were Groups A, B, and D with the values of $p = 0.026$, $p = 0.014$ and $p = 0.000$ in the Quranic recitation. For the proposed approach, Group D indicated the most significant value ($p = 0.000$) whereby the mean values exhibited the highest reduction of Quranic articulation errors from pre-test ($m = 15.2553$) to post-test (12.7234). These findings were supported by previous studies (Ismail et al., 2011; Muhammad et al., 2012), whereby the tajweed knowledge and articulations were improved after utilising technological learning approaches for game and intelligent application. Tajweed learning is known for its dry, plain, and limited learning approach, which makes the learners feel bored and uninterested (Noor et al., 2018; Jusoh & Jusoff, 2009). Augmented reality and gamification make the learning alive and give positive outcomes to the performance. Even though the learners had little doubt on the proposed approach in the knowledge improvement dimension, the results proved that the tajweed knowledge and use improved well from the learning approach process. However, the results showed that the learning performance was not significant for Group C, which meant the articulation errors did not significantly decrease after the learning process. Group C completed video-based learning and gamification approach in the learning process. Apparently, the result might be due to several conditions, which are (a) the learners' capabilities in digesting the learning

content during the learning processes and (b) the various types of learners' learning styles (Gagné & White, 1978) could also be a factor, which referred to learners who were not technologically oriented to learn.

Table 9
Audio/video recording number of articulation errors based on surah and categories for all groups

Surah	Test	Articulation Category			
		Vocal Cord	Tongue	Nose	Qolqolah
Al-Ikhlas	Pre	n/a	3	n/a	483
	Post	n/a	0	n/a	404
Al-Masad	Pre	37	25	71	626
	Post	38	27	38	578
Al-Kafirun	Pre	30	65	300	225
	Post	12	32	308	230
Al-Fiil	Pre	7	137	249	15
	Post	4	86	279	7
Al-Alaq	Pre	8	3	39	343
	Post	3	2	19	332

n/a = not applicable

To describe further on performance, Table 9 shows the results of the articulation error categories (vocal cord, tongue, nose, and Qolqolah) based on the Surah recitation. The table indicates that most articulation errors in the post-test for each category decreased, except for Al-Masad, Al-Kafirun, and Al-Fiil. Al-Masad and Al-Kafirun encountered a slight increase of errors in the post-test results for vocal cord, tongue, and nose articulation. However, it seems that Al-Fiil has quite a high increase in the errors for nose articulation. Since nose articulation is related to nasalisation and non-nasalisation rules, the increase is acceptable since the rules are one of the many errors made by the learners (Hassan, 2014) and sometimes the learners may be confused about when to apply the nasal or non-nasal recitations of the Quranic verses. The findings of the articulation errors were in line with past studies (Awang et al., 2011; Hassan & Zailaini, 2013a, 2013b; Ismail & Zakaria, 2009; Basah, 2010; Kamarudin & Salam, 2012). In fact, when a learner has the knowledge of the tajweed rules and on how the rules are articulated while reciting, the learner's articulations of the rules in the Quranic recitation will be better (Hassan, 2014; Hassan & Zailaini, 2013a, 2013b).

In general, the proposed approach (Group D) potentially evoked the learners' positive emotions in terms of autonomy, challenges, points, and leader board over the conventional approach (Group A). It provides the learners more immersion feeling compared to Group B. Besides, badges, progression, and feedback positively existed in Group D compared to Groups A and B, which helped the learners to have feelings of competence, awareness,

and guidance. Even though there were no significant differences for concentration, clear goals, and knowledge improvement among the groups, the factors still existed in the proposed approach. Those factors ensured that experience and motivation were employed appropriately in the proposed approach, which could also be factors to avoid tediousness in the tajweed learning process. Furthermore, at the end of the sessions, learners in Group D stated that *"The learning process is very interesting"*, *"Can I use the system again tomorrow?"*, *"Wow, I never used this type of approach before, it is so interesting"*. Meanwhile, the learners in other groups mentioned, *"I want to involve in the session too"*, *"That session seems very interesting"*, *"I need to try playing with the cards too"* and many more. The statements provide additional proofs that augmented reality and gamification utilisation triggered the learners' interest and are capable of eliciting positive emotions for the learners to learn.

In terms of performance, the proposed learning approach also shows the most positive outcomes in minimising errors in the Quranic recitation. This describes the virtual-actual interaction created by the approach as well as the availability of appropriate experience, challenge, curiosity, and fantasy can be a factor in facilitating knowledge retention.

CONCLUSION AND SUGGESTION

This study employs augmented reality and gamification approach for tajweed learning in order to minimise tedious feeling towards a dry, plain, and unattractive learning content, and then attract the children to learn tajweed. The results show that the proposed approach gained positive feedback in terms of autonomy, challenge, points, badges, leader board, progression, immersion, and feedback measures of the study. Positive results of the measures exhibit that the learners feel the experience and motivation better than other approaches. Even though concentration, clear, goals and knowledge improvement do not have significant difference among the groups, it still shows that the factors existed in the proposed approach as well as the other groups. Furthermore, positive improvement of Quranic recitations also indicates that the elicitation of positive emotions through experience and motivation facilitates the cognitive process and retention of the learners, which are consistent with past studies by Ismail et al. (2011) and Muhammad et al. (2012).

In general, this study focuses on the augmented reality and gamification approach for tajweed learning. Future work can focus on other Islamic content learning and different implementations since the approach can be implemented in myriad ways such as location-based augmented reality (Dunleavy, 2014), developing the learners' own content (Tan, 2015), and many more (Perry, 2015; Villagrasa et al., 2014). Longitudinal study with different measurement of investigations (Huang et al., 2016) can also enrich the augmented reality and gamification employment in the learning environment.

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