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The impact of JeopardyLabs, Kahoot, and Quizizz on Students' Attitudes toward Technology and their L2 Achievement

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Abstract

Adopting an explanatory sequential mixed-methods research design, the study investigated the impact of JeopardyLabs, Kahoot, and Quizizz on students' attitudes toward technology and their L2 achievement. The participants included 212 students of 8th grade of junior secondary school from six cities in Iran, 172 of whom formed the experimental groups who adopted JeopardyLabs, Kahoot, and Quizizz for nine sessions, and the rest (i.e., N=42) formed the control group who attended their regular classes. Quantitative data were collected through the L2 achievement pretest and posttest, and the Pupils' Attitude Toward Technology questionnaire (PATT) (Raat & Vries, 1986) was used to investigate the students' attitudes toward technology use. Qualitative data were collected through a semi-structured interview. The data gathered from the PATT questionnaire and the L2 achievement posttests of the experimental and control groups were compared using Independent Samples *t*-tests. The experimental groups' L2 achievement (i.e., the gain or progress) was compared through the Wilcoxon Signed Ranks test. Interview results were analyzed by adopting the grounded-theory approach to qualitative content analysis. The results indicated that adopting JeopardyLabs, Kahoot, and Quizizz positively impacted students' attitudes toward technology and L2 achievement. These findings may convince teachers, students, and educational authorities to welcome adopting new technologies.
Keywords: Attitude, L2 achievement, JeopardyLabs, Kahoot, Quizizz

Introduction

The rapid growth of technology has significantly affected every aspect of people's lives. Without technology, every aspect of people's lives in this modern

century is doomed to stagnancy. Education as an essential part of peoples' lives is not an exception, and it is rational that the ever-growing use of technology has an important effect on how people learn (Kumar, 2017). As a result of the COVID-19 lockdown, schools were forced to immediately transition to remote technology-based learning because of the challenges of being unprepared (Tarkar, 2020). Many teachers and students started using social media and messengers like WhatsApp to continue their education (Tatnall, 2020). Modern technologies are rapidly developing and disseminating, and their effect on learning and teaching can not be neglected (Solanki & Shyamlee, 2012). Applications that provide help in practicing and identifying students' levels, taking quizzes, and various forms of questions, and applications that encourage team-based and competitive practices are part of technology-enhanced learning and play their essential roles alongside messengers and social media to facilitate learning (Tatnall, 2020).

Measuring the effects of technology adoption on students' achievements in technology-integrated classrooms and discovering to what extent the achievement is under the impact of technology is both essential and complex (McMahon, 2009). As Sherry et al. (2001) maintain, intervention of other learning environment factors makes it very hard to isolate and measure the overall effect of technology on students' achievements.

Technology is believed to have long-lasting effects on education. The choice of new technologies must be made thoughtfully to facilitate and improve the students' L2 achievement and amend their attitude toward technology. The findings of this study may be convincing for policymakers when making decisions about adopting new technologies. Teacher trainers may also benefit from the results of this study in changing teachers' attitudes toward new technologies. These findings might also help convince parents that not all technologies are harmful and time-consuming for their children. The results might also convince material developers and syllabus designers of this study to reconsider their materials and syllabi and change them for more technology-friendly syllabi and materials.

It is undeniable that attitudes matter, and it is undoubtedly vital that people's perceptions, feelings, and understandings about their situations and their consequent behaviors be determined by their attitudes. In fact, the deterministic relationship between attitude and behavior applies to educational contexts, classroom situations, and everyday ordinary life situations (Fazio & Roskos-Ewoldsen, 2005).

Attitude cannot be defined easily because of its complexity and multidimensional nature, making measuring attitude even harder. As stated by Perloff (2020), "Attitude is a mental construct, a psychological and emotional entity which is a natural part of people that describes their characters" (p.36). Eagly (2007) defines

attitude as an inclination to favorably or unfavorably evaluate a specific entity.

After the emergence of educational technology, investigating the attitude toward new technologies and information communication technology (ICT) has been a common line of research among the researchers of the field who have mostly been investigating the determinant factors for the acceptance and adoption of new technologies and ICT in educational contexts (Tamim et al., 2011).

PATT has been extensively measured by the PATT questionnaire designed by Raat and Vries (1986), which was later revised and used in many other countries like PATT-Netherlands, PATT-Sweden, and PATT-USA. The PATT questionnaire was also shortened and revised by Ankiewicz (2019) and was called the PATT-short questionnaire. The current study adopted the PATT-short questionnaire to measure pupils' attitudes toward technology.

L2 achievement

L2 learning is about achievement, and L2 achievement refers to attaining a precise, adequate proficiency level. A common and appropriate source for measuring it is the cumulative scores of each learner during a semester (Moskovsky, 2016). The scores of schools' final exams were also used in many studies to measure L2 achievement. Artieda (2017), in his research, measured L2 achievement through the students' final school exam scores.

A general English multiple-choice achievement exam including items on vocabulary, reading comprehension, and grammar of the first, second, and third Iranian school English books that the participants had already passed during the last three years was designed and adopted by Tabatabei and Mashayekhi (2013) to measure the L2 achievement of the participants in their study. In Lamb's (2012) motivational study using learners' achievement in the Indonesian junior high school context, learners' achievement was measured by their cumulative scores obtained during one semester in their actual English class. In this study, L2 achievement was measured by a pretest and a posttest, each including 20 multiple choice questions, including vocabulary and grammar of the 8th-grade school book, which was already designed and revised after experts' view and used in pilot studies.

JeopardyLabs

According to Meirose and Klatt (2017), JeopardyLabs is a web-based gamified learning tool that is available for free with fee-based upgrades that can be used as a supplement to learning by learners who can individually play the games or compete in team-based games and even teachers who can create their versions of these games or make use of the already-made games of the other users from all around the world.

JeopardyLabs provides the "out of the box" template with a background of blue color, and font of yellow and white, which reminds users of the Jeopardy board used in the

television game shows. JeopardyLabs provides a scorekeeping feature in its free version. An Internet connection is not required for copying, sharing, and accessing the game boards via a downloaded version (Meirose & Klatt, 2017).

Kahoot

As Vick (2019) demonstrated, Kahoot is a prevalent gamified learning tool adopted by more than 2.5 billion users from over 200 countries who use Kahoot as a break from traditional activities and as a homework assignment. Some users even adopt Kahoot to review pupils' learning as a formative assessment. Based on Sweetser and Wyeth (2005), Kahoot was the first SRS designed to provide a game-like experience for the students through principles of designing games according to intrinsic motivation theory and game flow.

The application was originally the result of a research project on a lecture Quiz in which numerous prototypes have been designed and checked with some experiments for several years at the University of Science and Technology in Norway by Wang et al. (2008). The results of their experiments on the prototypes indicated that Lecture Quiz successfully improved pupils' motivation, attention, engagement, and learning achievement with social learning entertainment activities.

A new company was launched in 2012 to design a modern learning application, which was initially named Kahoot, that combined audience responses, role-plays, and audiovisual aids**.** The only application which was created as a video game from the ground up was Kahoot, even though several other students' response systems had many game features (Wang, 2015).

Quizizz

As Goksun and Gursoy (2019) explain, Quizizz is a free online game-based learning tool that offers online quizzes, cultural games, word tests, and individual and team-based competitions. This web tool competition can reinforce learning by entertaining and motivating learners to participate actively in classroom activities and homework assignments. Teachers can easily use it for formative assessment. Teachers can use Quizizz to conduct fun, energetic, and engaging learners-paced formative assessments for pupils of various ages. Students can play Quizizz through PCs, laptops, tablets, smartphones, or any other device with a browser. Teachers can use already-made Quizizzes or create their own Quizizzes and receive precise reports, including both class and student-level reports. For more information, www.quizizz.com can be checked.

Following Chaiyo and Nokham (2017), Quizizz is a gamified learning application analogous to Kahoot, where questions and answers are both shown to the students' devices, and no projected screen is required. There is also no need to synchronize the answering sessions in Quizizz. Consequently, it is unnecessary for

students to wait for all their classmates to continue playing or answer other questions. It is worth mentioning here that, in this study, the adoption of JeopardyLabs, Kahoot, and Quizziz was measured based on the complete and active participation of students of experimental groups during the nine sessions of treatment in face-to-face classes and the students' screenshots of the thoroughly followed links which were sent in their online class groups on Shad (i.e., Iranian school students' social messenger) as practices of JeopardyLabs, Kahoot and Quizizz.

Previous research findings

Attitude toward technology

Based on Saydakhmatova (2020), computer-assisted language learning (CALL) can improve learners' attitudes and self-confidence. Morgan (2008) also concluded that adopting new technological innovations can positively affect pupils' learning attitudes. They would instead do technology-based assignments rather than pencil and paper assignments. As indicated by Raat and Vries (1986), technology as an extensive and diffuse notion should be described considering the perception of the concept of technology students have in their minds. Affection or feeling, cognition or knowledge, and conation or behavior, which are three components of attitude, should be operationalized by designing reliable and valid scales that represent the three components of technology and various distinguishable dimensions considering the notion of 'technology.'

Pupils' attitudes toward technology are multidimensional as more possible dimensions such as interest in technology, importance of technology, and diversity of technology appeared from various aspects of technology that Raat and Vries (1986) found among the participants of their study who were 13 to 15 years old students. Incantalupo et al. (2014), in another study, analyzed the collected data from an American school in different ways to demonstrate PATT-USA validity and reliability to investigate the capability of each scale in distinguishing between pupils' attitude and knowledge, adopting the descriptive statistics and an ANOVA. The discriminant validity results (mean correlation of a scale with other scales) for the scales ranged from 0.18 for the consequence of the technology scale to 0.44 for the Knowledge of Technology. Moreover, España-Delgado (2023) conducted a mixed-methods study to investigate 27 Colombian sixth-grade EFL students' perceptions of such game-based learning tools as Quizizz, Kahoot, and Quizalize in virtual classes and to explore their effect on students' language learning motivation. The results of a Likert scale questionnaire and a focus group interview indicated that the students perceived Kahoot, Quizizz, and Quizalize as fun, helpful, engaging, and entertaining, which they believed increased their motivation and, eventually, their L2 achievement.

Technology-based L2 achievement

Turan and Meral (2018) investigated the impact of game-based online student response systems and non-game-based online student response systems on the participants' engagement, test anxiety, and achievement. The study design was quasi-experimental with pretest and posttest groups, and 46 participants were all seventh-grade students. Twenty-three participants formed the experimental group, and 23 formed the control group. Socrative, as an online student response system, was used in the control group, and Kahoot, as a gamified student response system, was used in the experimental group for one month of learning a chapter of their social study course. The results revealed that Kahoot significantly positively affected the participants' achievement and decreased their test anxiety compared to Socrative. In another study by Wang et al. (2014), the effects of cognitive tool adoption on teachers' classroom practices and pupils' development of modern technological skills were investigated. The data were gathered by monitoring 25 teachers teaching at high schools and adopting cognitive tools with their pupils on social media and in their face-to-face classes at 24 schools over four academic years. Teachers' continuing application and use of cognitive tools were checked to improve this program and make it more usable, sustainable, and scalable for future professional development. It was concluded that the integration of technology in kindergarten to 12th grade (K-12) was heavily teacher-dependent and its effect on students' learning, especially their higher-order cognitive skills, was not enough and that letting pupils gain control over the technology adoption in their classroom practices brought positive changes for teachers, and positive effects on pupils' ICT skills and science learning.

JeopardyLabs

In a study by Shaban and Egbert (2018), the necessities and requirements for the diffusion of new technologies were investigated. Following their research, teacher education literature that addresses new technology applications should focus on the necessity of viewing pupils as a priority. Four formal professional development workshops were held in the study. Through these workshops, the participants learned how to use some software like Jeopardylabs, Popplet, Glogster, Socrative, VoiceThread, StoryJumper, Kahoot, Factile, etc. After four months, individual semi-structured interviews were administered to investigate the pupils' perception of the application of new technologies. Understanding the features and qualities of education technology, such as comparative advantage, ease of adoption, compatibility, and trialability, affected the acceptance and application of these programs. Moreover, many participants verified the necessity of taking advantage of new technologies as an inescapable part of our lives as 21st- century teachers.

Kahoot

Wang and Tahir (2020) presented a literature review results which included 93

studies about the impact of adopting Kahoot for academic purposes and, significantly, whether Kahoot impacted students' academic performance, classroom dynamics, attitudes and perceptions of teachers and pupils toward technology, and pupils' anxiety. It was found that Kahoot significantly impacted students' academic performance, classroom dynamics, attitudes and perceptions of teachers and pupils toward technology, and pupils' anxiety. However, based on some studies, Kahoot had little or no effect on learning performance. Similarly, Lee et al. (2018) conducted a mixed-methods study to investigate the impact of adopting Kahoot as an online instant response system for pupils of rural Thai classes who often had weaker learning performance because of restricted access to new technologies and had more difficulties adopting them for learning purposes. Data were collected using surveys, students' assignments, quizzes, learning journals, and interviews. Their results showed that Kahoot adoption improved rural Thai pupils' motivation, learning efficacy, and achievement. It attracted their attention and classroom engagement and motivated them to preview and review the materials.

Ahmed et al. (2022) explored the impact of Kahoot on 50 Iranian EFL learners' vocabulary recall and retention. They randomly assigned the participants to two equal groups: experimental and control groups. Then, they measured the participants' English vocabulary knowledge through a vocabulary pretest. They taught the new vocabulary items using Kahoot! Game in the EG, while they taught the new words using traditional instruction in the control group. The Paired Samples and Independent Samples t-tests revealed significant differences between the immediate and delayed posttests of the two groups, which favored the experimental group.

Hamedi et al. (2022) explored the effect of utilizing formative assessment by Kahoot application on the vocabulary development of 60 Iranian intermediate EFL learners and their burnout level. The participants in the experimental group used Kahoot to address a few questions related to each lesson's vocabulary. In contrast, their counterparts in the control group performed the activities in their student and workbooks. After ten sessions of treatment, they took the posttest. The data analysis revealed that Kahoot, as a game-based formative assessment tool, had a statistically significant impact on the vocabulary development of Iranian EFL learners. On the other hand, using the Kahoot application significantly reduced the burnout level of the participants.

Quizizz

Porcaro et al. (2016) investigated the role of flipped classes in teaching undergraduate international students and their attitudes toward teaching materials. The students' scores in two years' final exams in traditional and flipped classes adopting Kahoot and Quizizz were compared. The results indicated that the passing rate of the

final exams improved from 47 to 48 % in the traditional approach and from 56–to 65 % in the flipped classroom approach.

Significance of the study and research questions

Accepting and adopting innovations and new technologies takes time, money, and effort, and a positive attitude is needed. The chance of teachers' and students' efficient adoption of new technologies in their classrooms is often not very high (Raynard, 2017). Also, as Sherry et al. (2001) rightly maintain, the intervention of other learning environment factors makes it hard to isolate and measure the overall effect of technology on students' achievements. However, teachers seem to know that technology naturally improves students' L2 achievement.

Measuring the change in students' attitudes toward technology, specifically JeopardyLabs, Kahoot, and Quizizz's effect on students' L2 achievement test scores, shed light upon these new technologies' appropriateness and usefulness for future use by Iranian students and teachers in Iranian schools. The reasons beyond the students' attitude toward new technologies are also better known after measuring the effect of adopting JeopardyLabs, Kahoot, and Quizizz in the classes.

The interviews also give a chance to learn about students' needs and desires for new technologies and investigate the success of JeopardyLabs, Kahoot, and Quizizz in changing the students' attitude toward new technologies and meeting their needs, which can provide a better insight into Iranian teachers and students' future technology choices for better and more effective change in their attitudes toward technology and in their L2 achievement. Thus, the following research questions were formulated for the study.

RQ1. Does adopting JeopardyLabs, Kahoot, and Quizizz applications significantly impact students' attitudes toward technology?

RQ2. Does adopting JeopardyLabs, Kahoot, and Quizizz applications significantly impact students' L2 achievement?

Methodology

Participants

Two hundred and twelve Iranian public school students of 8th grade from 14 schools in six cities and many villages of two provinces of Iran were selected based on convenience sampling. The participants ranged from 14 to 16 and included 172 male and 40 female students aged from 14 to 16. The participants had already studied English at school for one year, including two terms, and had successfully passed the two school exams of 7th grade.

Instruments

Pupils' Attitude Toward Technology Questionnaire (PATT)

A PATT questionnaire, which was designed by Raat and Vries (1986) and revised and validated by Ankiewicz (2019) and Bame et al. (1993), was adopted in the

study. PATT is a Likert scale measure consisting of 54 items, of which 12 items measure interest in technology, 7 measure consequences of technology, nine measure attitude toward technology, 12 measure teaching technology, and 14 measure knowledge of technology.

It should be mentioned here that since the participants' English proficiency was not at a level to comprehend the questionnaire items well, a concern which might adversely affect the results, PATT was translated into the participants' mother tongue (i.e., Persian) by the researchers and was back-translated into English by two experts in the field (See Appendix A). This questionnaire was subjected to KMO estimation and factor analysis to ensure validity. The discriminant validity results (i.e., mean correlation of a scale with other scales) ranged from 0.18 for the Consequence of Technology scale to 0.44 for the Knowledge of Technology scale. A Principal Components factor analysis accompanied by varimax rotation supported a refined structure of the attitude part of the questionnaire (PATT-USA) consisting of 54 items in 5 scales with a loading of at least 0.30. Adopting Cronbach's Alpha internal consistency estimation, the reliability of PATT was estimated to be 0.88 for General Interest in Technology, 0.80 for Consequences of Technology, 0.78 for Attitude toward Technology, 0.90 for Technology Teaching, and 0.83 for Knowledge of Technology.

L2 Achievement Tests

A pretest (See Appendix B) and posttest (See Appendix C) were used to reveal the effect of the adoption of new technologies (i.e., the three specific applications used in the present study, namely, JeopardyLabs, Kahoot, and Quizizz) on the students' L2 achievement. Each test includes 20 multiple choice questions, including vocabulary and grammar of *Prospect 2*, the English textbook for 8th grade junior secondary school in Iran. The pretest and posttest questions were already designed and used in a pilot study with a group of 30 randomly selected students, and the questions were revised after the judgment of two experts in the field and item analysis.

Semi-Structured Interview

A semi-structured interview was used to reveal the participants' perception of the impact of JeopardyLabs, Kahoot, and Quizizz on their attitude toward technology. The interview questions were validated through an expert judgment of three PhD holders in Applied Linguistics interested in CALL/MALL (See Appendix D).

Procedures

The data collection span was from September 2021 to December 2021. The PATT questionnaire and L2 achievement pretest were administered in online classes through online survey methods like Google Forms and social media and messengers like Telegram, Shad, etc. Students distributed the questions in person for the regions where face-to-face courses were available. All participants filled out the PATT

questionnaire and took an L2 achievement pretest. One hundred and seventy participants in the experimental group received treatments in nine sessions. Kahoot, Jeopardylabs, and Quizizz were new technologies introduced and practiced during these nine sessions. The participants of the experimental groups first learned how to use JeopardyLabs, Kahoot, and Quizizz websites and downloaded the applications. Some text messages were sent to their social media groups in Shad, and some movies explaining how to search, find, download, and use JeopardyLabs, Kahoot, and Quizizz were sent to their social media groups or shown and described in their face-to-face classes. Next, the teachers suggested some suitable Jeopardy, Kahoots, and Quizizz for students to study, practice, compete, and play with. Some sample links were sent to their groups as well. Then, they learned how to search and find appropriate Jeopardys, Kahoots, and Quizizzes. Finally, they knew how to design their Jeopardys, Kahoots, and Quizizzes. They were also allowed to share their works or the links of the suitable Jeopardy, Kahoots, and Quizizzes they had found with their classmates.

Forty-two students from the control group attended their regular classes during these nine sessions, during which their teachers taught them three lessons of Prospect 2, which were about countries and nationality, weekdays and daily activities, and abilities. They had audiovisual presentations, checking and explanation, audiovisual practice, and pair and group work in their classes. They had assignments for every session and received feedback on their assignments. All participants filled out the PATT questionnaire again and took an L2 achievement posttest. The change in performance in L2 achievement pre- and posttests of the experimental and control group participants was compared using appropriate statistical techniques. The change in participants' attitudes toward technology in both groups was measured and compared before and after the treatments through the PATT questionnaire results to triangulate the data for validation purposes. The attitude of the participants toward technologies was also assessed through a semi-structured interview conducted with 60 participants who voluntarily attended the interviews.

Data Analysis

The validity of PATT was checked using the Kaiser- Meyer-Olkin Measure of Sampling Adequacy (KMO) and Bartlett's Test of Sphericity and Confirmatory Factor Analysis (CFA). Cronbach's Alpha internal consistency estimation was also used to check the reliability of the PATT questionnaire and L2 achievement pretest and posttest. Kolmogorov-Smirnov test was run to examine the distributions' normality in PATT and L2 achievement pretest and posttest. An Independent Samples *t*-test was run to ensure that the two groups manifested no significant difference concerning their attitude toward new technologies at the outset of the study. An Independent Samples *t*-test was run to compare the posttest scores of the two groups concerning their attitude

toward new technologies at the end. To compare the L2 achievement pretest of the two groups, the researcher initially opted to run an Independent Samples *t*-test. Due to violating the assumption of normality of distribution in the L2 achievement pretest of the two groups, the Mann-Whitney U test was run, which is the non-parametric alternative to the Independent Samples *t*-test.

Due to violating the assumption of normality of distribution, the L2 achievement pretest and posttest scores of the experimental group were compared by running the Wilcoxon Signed Ranks test, the non-parametric alternative to the Paired samples t-test.

Interview results were analyzed through content analysis adopting the grounded-theory approach of qualitative data analysis. The codes and themes (i.e., the typical patterns and recurring themes of the participants' responses) were extracted from the interview transcripts to show their attitudes toward the impact of adopting JeopardyLabs, Kahoot, and Quizizz.

Results

The Validity And Reliability of PATT

The PATT Questionnaire was administered to the participants, and a Confirmatory Factor Analysis (CFA) was conducted. The KMO Measure of Sampling Adequacy was estimated to be 0.89, way above the recommended value of 0.70, and Bartlett's Test of Sphericity was found to be statistically significant (X^2 (1431) = 6243.11, p=0.000< 0.05). The commonalities were above 0.4, confirming that each item shared some common variance. Moreover, the analyses yielded five factors explaining a 51.01 percent variance for the entire set of variables. Using Cronbach's Alpha procedure, the reliability of the PATT Questionnaire in the present study was estimated to be 0.94 overall.

The Reliability of L2 Achievement Pretest and Posttest

Using Cronbach's Alpha procedure, the reliability of the L2 achievement pretest in the present study was estimated to be 0.83. Moreover, using Cronbach's Alpha procedure, the reliability of the L2 achievement posttest in the present study was estimated to be 0.84.

Answering Research Questions

Results Of Research Question 1

Before having any treatment, both groups received the PATT Questionnaire. The experimental group's mean and standard deviation were 152.69 and 22.59, respectively, while those of the control group stood at 151.54 and 21.88, respectively. To examine the normality of the distributions, the Kolmogorov-Smirnov normality test was run, the results of which are presented in Table 1.

Table 1

One-Sample Kolmogorov-Smirnov normality test for the two groups pretest on their attitude towards new technologies

		Experimental (pretest)	Control (pretest)
N		170	42
Normal Parameters[a,b]	Mean	152.69	151.54
	Std. Deviation	22.58	21.88
Most Extreme Differences	Absolute	.08	.09
	Positive	.07	.08
	Negative	-.084	-.09
Kolmogorov-Smirnov Z		1.10	.62
Asymp. Sig. (2-tailed)		.177	.82
a. Test distribution is Normal.			
b. Calculated from data.			

As presented in Table 1, the Sig. value scores for attitude toward new technologies pretest scores of the two groups were higher (EG Sig.= .17 and CG Sig.= .82) than the critical value (.05). Thus, the normality of distribution was supported (Tabachnick & Fidell, 2007).

An Independent Samples t-test was run to make sure that the two groups manifested no significant difference at the outset of the study concerning their attitude toward new technologies, the results of which showed that the difference between the two mean scores turned out to be non-significant (t (210) =0.29, p=0.76>0.05).

Following the treatment's termination, the PATT Questionnaire was administered to the two groups. The experimental group's mean and standard deviation were 163.98 and 25.86, respectively, while those of the control group stood at 152.59 and 22.28, respectively. To examine the normality of the distributions, the Kolmogorov-Smirnov normality test was run, the results of which are presented in Table 2.

Table 2

One-Sample Kolmogorov-Smirnov test for the two groups posttest on the attitude toward new technologies

		Experimental (posttest)	Control (posttest)
N		170	42
Normal Parameters[a,b]	Mean	163.98	152.59

	Std. Deviation	25.86	22.28
Most Extreme Differences	Absolute	.079	.09
	Positive	.053	.06
	Negative	-.079	-.09
Kolmogorov-Smirnov Z		1.02	.59
Asymp. Sig. (2-tailed)		.24	.87
a. Test distribution is Normal.			
b. Calculated from data.			

As presented in Table 2, the normality of distribution was supported (Tabachnick & Fidell, 2007).

Thus, to answer the first research question of the study, an Independent Samples *t*-test was run to compare the posttest scores of the two groups concerning their attitude toward new technologies.

Table 3

Independent Samples t-test on the attitude toward new technologies posttest means

	Levene's Test for Equality of Variances		*t*-test for Equality of Means				
	F	*Sig.*	*t*	*df*	*Sig.* (2-tailed)	Mean Difference	*Std.* Error Difference
Equal variances assumed	2.62	.10	2.87	210	.009	11.39	3.58
Equal variances not assumed			2.87	70.93	.005	11.39	3.58

As is evident in Table 3, the difference between the mean scores turned out to be significant (t (210) = 2.87, p=0.009<0.05). Thus, the participants in the experimental group (M=163.98; SD=25.86) had a significantly more positive attitude toward new technologies than their counterparts in the control group (M=152.59; SD=22.28). The effect size was estimated to be medium, with a Cohen's d of 0.47. In other words, adopting JeopardyLabs, Kahoot, and Quizizz applications significantly impacted students' attitudes toward new technologies.

Results Of Research Question 2

The Sig. value score for L2 achievement pretest scores of the experimental group was lower than the critical value (.05). Therefore, the normality of distribution was not supported (Tabachnick & Fidell, 2007), necessitating the adoption of the Mann-Whitney U test to compare the means of the two groups. The mean rank of the L2 achievement pretest of the experimental group was 110.15, while the mean rank of the L2 achievement pretest of the control group was 91.74.

The results of the Mann-Whitney test indicated that at the 0.05 level of significance, there was no significant difference between the L2 achievement pretest scores of the two groups (U = 2950.00, N1 = 170, N2 = 42, z = -1.74, p = 0.08 > 0.05); Therefore, it can be stated that any difference between the two groups at the end of the study would be the results of the treatment.

In the L2 achievement posttest, the experimental group's mean and standard deviation were 11.42 and 6.95, respectively, while those of the control group stood at 6.95 and 3.90, respectively.

To examine the normality of the distributions, the Kolmogorov-Smirnov normality test was run, the results of which are presented in Table 4.

Table 4

One-Sample Kolmogorov-Smirnov test for the two groups posttest on the L2 achievement

		Experimental (posttest)	Control (posttest)
N		170	42
Normal Parameters[a,b]	Mean	11.42	6.95
	Std. Deviation	4.62	3.90
Most Extreme Differences	Absolute	.08	.15
	Positive	.08	.15
	Negative	-.07	-.10
Kolmogorov-Smirnov Z		1.04	1.01
Asymp. Sig. (2-tailed)		.22	.25

a. Test distribution is Normal.

b. Calculated from data.

As presented in Table 4, the normality of distribution was supported (Tabachnick & Fidell, 2007). Thus, an Independent Samples *t*-test was run to compare the posttest scores of the two groups concerning their L2 achievement.

Table 5

Independent Samples t-test on the L2 achievement posttest means

Levene's Test for

	Equality of Variances		*t*-test for Equality of Means				
	F	*Sig.*	*t*	*df*	*Sig.* (2-tailed)	Mean Difference	*Std.* Error Difference
Equal variances assumed	5.06	.02	5.78	210	.000	4.47	.72
Equal variances not assumed			6.40	72.34	.000	4.47	.72

As indicated in Table 5, the difference between the mean scores turned out to be significant (t (72.34) = 6.40, p=0.000<0.05). Therefore, the participants in the experimental group (M=11.42; SD=4.62) had a significantly higher L2 achievement than their counterparts in the control group (M=6.95; SD=3.90). The effect size was large, with a Cohen's d of 1.04. In other words, adopting JeopardyLabs, Kahoot, and Quizizz applications significantly impacted students' L2 achievement.

Due to violating the assumption of normality of distribution, the L2 achievement pretest and posttest of the experimental group were compared by running the Wilcoxon Signed Ranks test, the non-parametric alternative to the Paired samples t-test. The mean and the standard deviation of the experimental group's pretest were 8.60 and 4.19, respectively, while those of their posttest stood at 11.42 and 4.62, respectively.

The Wilcoxon signed-rank test results showed a significant difference between the pretest and the posttest of the experimental group participants regarding their L2 achievement (Z = - 8.876, p = 0.000<0.05). Consequently, it can be concluded that adopting JeopardyLabs, Kahoot, and Quizizz applications significantly impacted students' L2 achievement.

Moreover, the mean and standard deviation of the participants' L2 achievement pretest in the control group were 7.50 and 4, respectively. In contrast, the mean and standard deviation of the control group' L2 achievement posttest were 6.95 and 3.90. The results of the Paired-Samples t-test indicated that there was no significant difference between the participants' pretest and posttest scores in the control group concerning their L2 achievement (t (41) =0.803, p=0.42 >.05).

Interview Results

The participants' responses to the interview questions showed that 95 percent had never heard about JeopardyLabs, Kahoot, and Quizizz before. Eighty-three percent of the participants thought their scores improved because of using JeopardyLabs,

Kahoot, and Quizizz. Eighty-five percent of the participants felt that their attitude toward technology changed because of using JeopardyLabs, Kahoot, and Quizizz. Eighty-one percent of the participants thought using JeopardyLabs, Kahoot, and Quizizz was easy for them and had no problems using them. Eighty-five percent of the participants thought that using JeopardyLabs, Kahoot, and Quizizz was beneficial for them, and 21 percent of the participants reported that JeopardyLabs, Kahoot and Quizizz were competitive and motivating. Almost all participants recommended adopting JeopardyLabs, Kahoot, and Quizizz to enhance students' scores and attitudes toward technology.

Discussion

The present study investigated the impact of JeopardyLabs, Kahoot, and Quizizz on students' attitudes toward technology and their L2 achievement. The results of the first research question illustrated that adopting JeopardyLabs, Kahoot, and Quizizz significantly positively impacted students' attitudes toward technology. The results of the present study in this respect follow those of Porcaro et al. (2016), wherein the flipped classroom was adopted, and the pupils' attitude toward teaching materials was investigated, which indicated that the participants' passing rate of the final exams improved dramatically in the flipped classroom and that the students participated in the classes more actively and with better preparation. However, it should be mentioned that Porcaro et al.'s (2016) study mainly investigated the impact of adopting curriculum design in a flipped classroom on improved learning and attitude compared to a traditional class. The students had many other pre-class, in-class, and post-class activities within the flipped classroom, and also Kahoot, Quizizz, Socrative, Qualtrics, and Qzzr were used in the flipped classroom.

The improvement in the students' scores in Porcaro et al.'s (2016) study was attributed to flipped learning and not just the adoption of Kahoot, Quizizz, Socrative, Qualtrics, and Qzzr. However, in the present study, the experimental and control groups shared everything except for adopting JeopardyLabs, Kahoot, and Quizizz. Consequently, the improvement in the students' scores and the change in their attitude in the current study can only be attributed to the adoption of JeopardyLabs, Kahoot, and Quizizz.

However, the results of the present study are in contrast to a survey by Bhattacherjee and Premkumar (2004), who investigated the change in students' attitudes and beliefs toward technology during their information technology adoption. Moreover, the results of Bhattacherjee and Premkumar's (2004) study showed that the use of technology did not significantly change the participants' attitude toward technology, while the results of the current study indicated that the adoption of new technologies had a significant positive impact on the attitude toward technology.

Because of their long data collection process, which was over three semesters, the responses of their study were reduced from 189 responses in the initial phase to 54 reactions in the final phase, which might have reduced the effectiveness of their sample size for statistical analysis and consequently might have made their results less reliable and generalizable compared to the results of the current study.

The results of the second research question indicated that adopting JeopardyLabs, Kahoot, and Quizizz significantly positively affected students' L2 achievement. This finding is in harmony with the results of a mixed-methods study conducted by Lee et al. (2018) to investigate the impact of adopting Kahoot as an online instant response system in rural Thai classes**.** Their results showed that Kahoot adoption improved rural Thai pupils' motivation, learning efficacy, and achievement. It attracted their attention and classroom engagement and motivated them to preview and review the materials. However, the results of the present study might be more generalizable because it included 212 participants who were students of 14 schools from six different cities in Iran compared to Lee's study, which included only 39 participants who were limited to only rural students of an outer Island of Taiwan which makes their findings less generalizable to larger urban areas.

The results of the present study in this respect also corroborate those of Turan and Meral (2018), who investigated the impact of game-based online student response systems and non-game-based online student response systems on the engagement, test anxiety, and achievement of the participants. Socrative as an online student response system was used in the control group, and Kahoot as a gamified student response system was used in the experimental group. It was revealed that Kahoot significantly positively affected participants' achievement and engagement and decreased their test anxiety compared to Socrative.

Conclusion and Implications of the Study

It can be inferred from the results of this study that the adoption of JeopardyLabs, Kahoot, and Quizizz can have a significant positive impact on students' attitudes toward technology and Students L2 achievement. It can also be inferred from the responses of the interviewees that the participants had not already been familiar with JeopardyLabs, Kahoot, and Quizizz and that they thought that the adoption of JeopardyLabs, Kahoot, and Quizizz had changed their attitude toward technology and improved their L2 achievement.

The participants also had no problem using JeopardyLabs, Kahoot and Quizizz and considered them easy, enjoyable, practical, beneficial, competitive, gamified, and motivating applications. Almost all participants recommended adopting JeopardyLabs, Kahoot, and Quizizz to change students' attitudes toward technology and improve students' L2 achievement. These findings may be convincing for foreign language

education policymakers to make decisions about the adoption of new technologies (e.g., JeopardyLabs, Kahoot, and Quizizz) in education and convince curriculum designers to add new technologies (e.g., JeopardyLabs, Kahoot, and Quizizz) to the school curriculum and dedicate a time for introduction and adoption of new technologies as a school subject for school students. School managers and educational authorities also need to be convinced that technological facilities help improve the students' L2 achievement scores and welcome the adoption of helpful, facilitative, and motivating technologies like the ones adopted in the current study, e.g., JeopardyLabs, Kahoot, and Quizizz in their schools.

Teacher trainers may also benefit from the results of this study to change teachers' attitudes toward new technologies (e.g., JeopardyLabs, Kahoot, and Quizizz) and convince the teachers to add new technologies to the classes and take advantage of these applications to change their students' attitude toward new technologies and improve their L2 achievement. These findings can also help convince parents that not all technologies are harmful and time-consuming for their children.

Limitations and Suggestions for Further Research

This study, like many other studies, might suffer some limitations. First, the number of motivated and active students online is limited because most parents cannot afford to buy smartphones for their children in underdeveloped and developing countries. Second, prolonged data collection made the teachers unwilling to cooperate, limiting the researcher's choices. Next, many parents did not welcome teachers recommending children spend more time with their phones. Finally, school managers also did not welcome new technologies, which the Ministry of Education does not verify. A new line of research is suggested for the researchers in the field to compare the effects of these applications with each other in three different experimental conditions. If future research can dedicate more time, then longer treatments can produce more generalizable and reliable results. Gathering nationwide data from more cities in Iran for future studies can make larger sample sizes, making them look into the issue in a broader context and reach more generalizable, reliable, and precise results. Additionally, adopting these applications for teachers during teacher training courses and workshops and investigating the impact of adopting new technologies and gamified applications on teachers' attitudes toward technology can be a new line of research for future researchers.

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