

ORIGINAL RESEARCH ARTICLE

Technology-infused teams-games-tournaments in English language class: a mixed method study on students' achievement and perception

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Technology in language instruction has become a new norm due to its effectiveness, and one example is the Teams-Games-Tournaments (TGT) method. The purpose of this study is to measure students' achievement in English language classes by using technology-infused TGT and ask the students to evaluate their learning experience with this method. This research involved 30 students as the control group and 30 students as the experimental group from two sections of the same general English course at a Thailand university. Pre- and post-tests of the control and the experimental group were conducted to assess the success of the method. At the end of the term, a questionnaire consisting of closed and open-ended questions was used to record the students' perceptions. The findings showed that the experimental group's scores were higher suggesting the success of the method in improving students' achievement. The experimental group's perceptions as expressed in the questionnaire under cooperation, motivation, achievement, and satisfaction were highly positive as students gave, on average, ratings of more than 4.0 to all categories. The implication of these findings was the effective application of this method in English classes.

Keywords: teams-games-tournaments; achievement; perception; English language learning

Introduction

Even though English has become one of the mandatory lessons in Thailand from primary education up to tertiary education, students' competence in the language still does not show a significant improvement (Anggoro & Nguyen, 2021). The overall English ability of Thai people in 2022 is, according to English First (EF), in the 'very low level', and has been at the same level since 2019 (English First, n.d.). Various problematic factors have contributed to this unsatisfying outcome. One of the main problems is the students' lack of communicative competence in class. English teaching comprises the grammar-translation method and does not focus on language production (Kwang-sawad, 2017). Furthermore, the lessons are mostly teacher-centred, and students lack

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practice to use the target language (Arakkitsakul, 2019). Li (2022) found that the lack of target language production by learners can induce boredom in a foreign language class.

Given these reasons, instructors need to create a variety of activities to facilitate interaction with the target language to ensure maximum benefits for the students. Cooperative learning is seen as one of the most effective ways to boost students' motivation. Johnson et al. (1998) mention five key elements to which cooperative learning can lead. The elements include positive interdependence, reliability, engagement, interpersonal skills, and group processing. These key elements enhance interactions, encourage collaboration, and, as a result, will motivate learning from one another. One of the cooperative learning methods which has gained a lot of attention is Teams-Games-Tournament (TGT). Studies by Budiyono (2020), Valid (2020), and de Castro (2011) reported the positive effects of TGT on students' English learning achievement. The TGT method promotes teamwork which encourages active learning (Budiyono, 2020), and provides students with activities that lead to positive interdependence (Sánchez, 2017). The interactions were typically swift and also students-centered activities which make them more motivated and self-reliant (García & Esmeralda, 2014; Jou, 2008).

Since students are hooked on some technological devices such as smart phones and tablets, instructors need to make use of this situation to benefit their learning through a technology-infused version of TGT. As a matter of fact, combining the use of technology with instructions has been found to be effective (Sengsri & Anggoro, 2021). It also has been found that the use of technology such as interactive response systems in English language classrooms improved students' achievement, interest, and self-efficacy (Anak Yunus & Hua, 2021; Anggoro & Pratiwi, 2023). Using technological devices in the classroom offers a huge potential as they are easy to use with interesting features such as mobile phone applications (Zhang, 2013). Besides, instead of treating students' talking as a challenging situation in class, the instructors can use this situation as a part of cooperative learning in the target language to increase their engagement in producing spoken English. As mentioned earlier, cooperative learning is one of the most effective ways to boost students' interest in learning (Namaziandost et al., 2019).

Our study paired technological tools with one popular method of cooperative learning, namely TGT. Currently, there is an insufficiency of research exploring the integration of TGT with current technology tools, particularly in the English teaching context. A few research publications were found in the context of mathematics and science instruction such as studies by Pello (2018) and Wahyuningsih et al. (2021). Thus, this study aimed to (1) investigate whether there was a significant increase in the students' achievement using technology-infused TGT and (2) explore students' perceptions of this method according to four categories namely cooperation, motivation, achievement, and satisfaction.

Teams-games-tournaments

TGT is one of the effective methods of cooperative learning whose main purpose is to actively involve students in the learning process (Johnson & Johnson, 2009). Johnson et al., (1998) mention five key elements to which cooperative learning can lead including positive interdependence, reliability, engagement, interpersonal skills, and group processing. TGT's distinction from other cooperative learning methods is the inclusion of tournaments. Figure 1 illustrates the stages of TGT (Hosseini, 2008). The first stage is an important phase since it prepares the students to cope with the knowledge used and activities conducted during the tournament. During the second



Figure 1. Stages of TGT.

phase, they discuss what they need to do and share tasks. The discussion helps promote their sense of responsibility and independence. They also start brainstorming to prepare for the last stage. In the last phase, the tournament games, students answer questions and pursue some activities to get to be the winner. This phase builds the students' confidence and the students from each team take turns to answer for equal participation.

TGT and students' achievement

TGT has been utilised to improve students' learning achievement (González et al., 2014; Veloo & Chairhany, 2013). González et al. (2014) reported that students taught using TGT showed a significant learning improvement by comparing the results of the pretest and post-test. This finding is congruous with the work of Veloo and Chairhany (2013) who conducted an experiment using two groups, the experimental taught with TGT and the control taught using the traditional method. They disclosed that the experimental group scored significantly higher than the control group.

In English language teaching, TGT has also been one of the methods whose effectiveness in improving students' achievement has been reported. For instance, Budiyo (2020) administered a study on the implementation of TGT in an English class and reported positive outcomes as students' scores were significantly improved. Valid (2020) conducted a study to compare the effect of TGT and another cooperative learning method, STAD, on students' English reading skills and found that the class taught using TGT was more successful. This study is in line with previous research that reported the positive impact of TGT on students' English reading skills (de Castro, 2011; Hastuti & Yuliasri, 2015). Besides reading, studies disclosed that TGT positively affects the learning of other English skills including speaking (Gusadha, 2020; Nasution, 2013), listening (Solikah, 2019), vocabulary (Sunarti et al., 2019), and grammar (Yovita, 2017). Thus, TGT is an effective method to improve students' English achievement. Nonetheless, previous research also reported weaknesses of TGT concerning students' achievement. Ambarwati et al. (2016) mentioned that in a class where TGT is used, there is an imbalance in students' mastery of the lesson.

TGT and students' perceptions

Research by García and Esmeralda (2014) focused on using gamification group activities to transfer learning and motivate students. A questionnaire was given at the end of the term to show the students' perceptions. The findings showed that the students strongly recommended applying this method as it stimulated them in learning, improved class participation, and brought a positive atmosphere. In addition to this study, TGT has also benefited instruction in other settings (Ambarwati et al., 2016; Budiyo, 2020; García & Esmeralda, 2014; González et al., 2014; Legaki et al., 2020).

This cooperative learning method has the potential to create not only fun English instructions but, more importantly, a comfortable learning environment where students can develop their language skills (de Castro, 2011; Gusadha, 2020; Hastuti & Yuliasri, 2015; Manuputty, 2020; Sunarti et al., 2019). Using TGT in language learning is crucial according to García and Esmeralda (2014). This model improves the atmosphere in the classroom to be more enjoyable using variables such as motivation, interest, and self-confidence. Not only utilised in speaking and vocabulary, but TGT can also be used to facilitate teaching language skills that have been notoriously known as not interesting such as grammar, reading, and writing in a more enjoyable way (Manuputty, 2020; Valid, 2020; Yovita, 2017). Jou (2008) used TGT in her research to investigate the case of integrating cooperative learning into novel teaching at a university in Southern Taiwan. TGT was used to help with the students' vocabulary and reading comprehension. Class observation, interviews, and questionnaires elicited from the students were used to analyse the students' perception of this method. The students' perception showed that they had a positive attitude towards this method. Concerning that, students stated that this method was proven to improve their motivation due to extra points given to the winner, and their social skills as they practiced working in a team and respecting one another.

Technology-infused TGT

Poláková and Klímová (2019) observed that due to their early and extensive exposure to various technologies, the current generation, known as Generation Z, seamlessly incorporates technology into their daily lives. Thus, one of the suggested ideas is to integrate TGT with technological tools. Aykut (2008) argues that technology can integrate several skills into one activity, promote autonomy, and focus on the content. Another fact to highlight is that technology gives students higher chances to interact with their classmates and teachers (Alseweed, 2013), thus giving them a better chance for engagement. Engagement is also proven essential for their achievement. Hanna (2014), who investigated the use of competing technologies in the classroom, confirmed that gamification of learning improved the learners' performance significantly as it gave opportunities for peer monitoring to prepare for their exams. A lot of applications have been invented to facilitate interactive gamification, such as Sociative, Kahoot, Quizizz, and many more. Besides, social media platforms including Facebook are equipped with some interesting features like the ability to create private groups for communication, information sharing, and storage. The implication is that the online tools from students' gadgets, such as smart phones and tablets, can be paired with tournaments in the classroom, showing potential for better English learning output. Nevertheless, there is a lack of studies investigating the integration of TGT with current technology tools, particularly in the English teaching context.

One study by Wahyuningsih et al. (2021) utilised an online gamified quiz, Socrative, to improve the practice of TGT in a science class. They found that the interaction between TGT and Socrative significantly enhances both learning outcomes and motivation in students, with a strong positive correlation ($r = 0.884$) between learning motivation and outcomes. Meanwhile, another study by Pello (2018) reported the utilisation of Kahoot in performing TGT in a Mathematics class. The experimental group, taught with TGT and Kahoot, showed significantly higher learning outcomes than the control class, indicating the effectiveness of these tools in enhancing student performance compared to conventional methods. Hence, these studies stress the significance of this research. They highlight the potential of technology-infused TGT for various learning purposes, including the learning of the English language.

Method

Research questions

- Does the implementation of technology-infused TGT lead to an improvement in students' academic achievement?
- What are the students' perceptions of the technology-infused TGT method in terms of cooperation, motivation, achievement, and satisfaction?

Participants and setting

The study was conducted at a university in Thailand. Two similar groups of students were selected to be placed in the experimental and control groups. There were 30 freshmen (23 females and 7 males) in the experimental group and 30 freshmen (28 females and 2 males) in the control group. Both groups consisted of low-intermediate students. In relation to the CEFR framework, the students in both groups were mostly at level A2 and a few were at level B1 according to their English proficiency test results organised by the university. At the start of the academic year, students underwent an English proficiency test, assessing both receptive and productive skills, as designed and organised by the university. The study was conducted for one academic term consisting of 12 weeks. The pre-test occurred in Week 1, and the post-test was administered during Week 13, which was the final exam week. The questions for the pre and post-test were prepared carefully to align with the course and one research question of the study, which was related to students' academic achievement.

Activities in the technology integrated-TGT-classroom

The course, named English Listening and Speaking, served as the next step after an introductory course called English Communication Skills, given in the previous term. The objective was to increase students' skills in listening and speaking. In addition to the two skills, the course still maintained a balance of other skills such as reading, writing, vocabulary, and grammar.

Both control and experimental groups learnt the same skills and had the same goal. However, the treatment of the control group was strictly based on the instructions from the textbook. Meanwhile, in addition to the textbook, technology-infused TGT was implemented in the experimental group over a total of 12 meetings during

the term. Various technological tools were used to facilitate TGT activities, such as Kahoot, Quizizz, Socrative, Quizalize, Pear Deck, Nearpod, etc. The tools used corresponded to the activities performed, as described further in the text. The goals were to foster cooperation, motivation, achievement, and satisfaction among students. Some of the technology-integrated TGT activities were:

- **Vocabulary building:** Kahoot, offering both free and premium versions, encompasses gamified learning, user-created content, multiplayer mode, accessibility across devices, detailed reports, collaborative learning, diverse question types, integration capabilities, learning games, and engaging visuals. Among others, Kahoot is good for vocabulary building. After the teacher gave the materials, students started working together as a group to help each other understand the meanings, synonyms, and antonyms of particular words. They also worked together to learn the part of speech of each word. After that, the tournament was conducted by using Kahoot. Multiple choices, true and false, word order, puzzle, poll, and slides are some of the features of Kahoot. In addition to Kahoot, possible platforms for vocabulary building through interactive team mode quizzes include Quizizz, Quizalize, Quizlet, and Socrative.
- **Reading Comprehension:** Socrative's Space Race feature, facilitating group competition and collaboration in answering questions, is a valuable enhancement to the TGT model. The free version of this feature currently accommodates up to 50 students in one race. A passage was uploaded to Socrative and the teams were asked to choose and write the main idea, supporting ideas, and connectors. It was an efficient approach for the students since they could gather with their teammates for the correct answer. In addition to Socrative, possible platforms for reading comprehension through interactive team mode quizzes include Quizizz, Quizalize, and Kahoot.
- **Grammar:** Quizizz can be utilised for a grammar tournament as it also offers a team mode. Similar to reading, traditional grammar instructions were considered unappealing. This application provides competitive features named power-up where each team can get immunity, power play, and even double points. During the competition, each team saw the live dashboard to show who led the game. In addition to Quizizz, possible platforms for vocabulary building through interactive team mode quizzes include Kahoot, Quizalize, Quizlet, and Socrative.
- **Writing:** Pear Deck is an interactive slide that enables students to engage during the lesson. Students can actively engage with a teacher's prompt in real-time, responding through different formats like text, drawing, or multiple-choice, as directed by the teacher's instructions. During TGT, each team wrote sentences and or paragraphs and the teacher could check through the dashboard which team was the fastest and wrote the best work. During the selection of the winner, the teacher showed the dashboard to students so they could learn from other teams' responses. Besides Pear Deck, other platforms that can facilitate team writing practice include Nearpod, Facebook, and Google Docs.
- **Listening:** Facebook facilitated a lot of skills including listening. Facebook's features, such as group creation and the ability for all group members, including teachers and students, to upload videos and files, contribute to the success of this method. In a listening comprehension task, the students listened to a story or watched a video prepared by a teacher. Following the discussion with their team, students were required to document their findings by writing or sharing

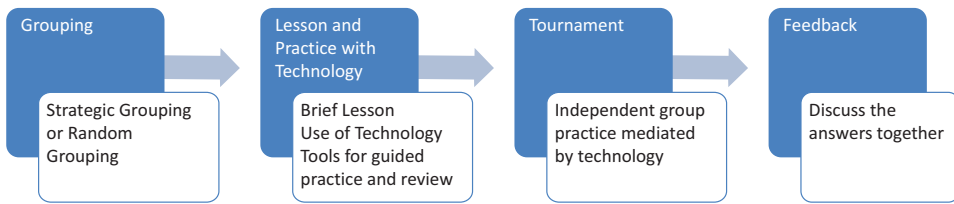


Figure 2. Flow of Activities.

video summaries on the Facebook group. The teacher created a private Facebook group in which they had full control of the members and activities in the group. All files and posts can only be accessed by the members of the group. Besides Facebook, other platforms that can facilitate team listening practice include Pear Deck and Nearpod.

From the above explanations, generally technology platforms with interactive team quizzes were used for vocabulary building, reading comprehension, and grammar. Technology tools that could provide real-time short and extended written responses facilitated not only writing but also listening tasks by enabling students to listen to the information embedded in uploaded audios and videos and then document their understanding.

In the research setting, a class lasted for 2 h. In a lesson, there might be more than one technology-mediated tournament, depending on the number and difficulty of topics and skills. Figure 2 shows activities in a single tournament.

The following is an example of how the activities were administered in a single lesson:

- The teacher divided the students into certain groups through random and strategic grouping. Random grouping involved arbitrarily assigning students using various methods, such as an online wheel of names, to promote interactions among students in class. Strategic grouping gave the teacher greater control to group students. For example, a teacher could group students with people they had never teamed up with before. Team members then created creative group names. Both grouping techniques were administered interchangeably to balance spontaneous interactions and controlled collaborations, promoting a dynamic learning environment.
- The teacher presented the students with teaching point 1 (e.g. grammar: past tense). The teacher gave all groups 15 min for discussion by giving a similar task. The practice task was given through an interactive platform (e.g. Quizziz) by posting the link or the game PIN on the class Facebook group.
- After that, the tournament started. The teacher gave the students the link or game PIN of the quiz that the teacher had prepared before the lesson. Each team then tried to finish the quiz correctly within the time given. The team with the correct answer got points for the 1st round.
- The teacher gave feedback and discussed the answers to the first quiz with all the teams.
- After that, the 2nd round began. The teacher could decide whether to group the students again or to let them stay in the same group. If the groups demonstrated

effective collaboration, they were retained. However, the teacher typically rearranged students if they were observed to have difficulty working together.

- Again, the teacher gave students time around 15 min to explore the structures of a writing example that the teacher gave them.
- During the tournaments, for a team to have a chance to answer questions, a challenge was given. For example, they were given a simple to medium mathematics problem and a group who could answer it correctly had a chance to answer the question. An interactive platform (e.g. Pear Deck) was utilised in this tournament. Pear Deck was utilised for its capability to facilitate real-time text responses, making it suitable for writing tasks. At the beginning of the tournament, one person from each team needed to join the interactive session to enable them to answer the questions.
- The teacher gave feedback and discussed students' answers or responses. The team with the correct answer got points and the winner was the team with the highest score from rounds 1 and 2 combined. The teacher also gave extra points to the most valuable player during the tournament.

Instruments and measures

This study employed a pre- and post-test along with a questionnaire at the end of a term.

Pre and post-test

These tests were conducted to address the first research objective, the effectiveness of the instructional method. Both tests included the same number of questions on vocabulary, grammar, reading, and listening. There was also an open-ended question to test writing proficiency. These elements were included in the tests as they are part of the materials taught throughout the term. The pre and post tests were carefully developed and assessed by an internal board of reviewers consisting of university English professors. The tests were then revised and reassessed until they were accepted and ready for use. The revisions involved adjusting the difficulty levels of the items. The results of both tests were compared to see the effectiveness of the method during the term. Both tests were given to the experimental group, consisting of 30 students, and to the control group, who were not taught with this method, with the same number of students.

Survey on students' perceptions

To address the second research objective, a questionnaire using Google Forms was developed to measure students' perception. Google Forms was selected because it is free, easy to use, and can accommodate the desired question types. Before its utilisation, the questionnaire was sent to a panel of experts, university professors, who assessed the content validity of the tool by using the index of item-objective congruence. The feedback was mostly positive. There were minor corrections in mechanics and grammar. The finished questionnaire was then given to the experimental group at the end of the term. It contained demographic questions (age, gender) and 20 5-item Likert-scale questions about their perceptions. As per Harpe's (2015) explanation,

Likert scales operate on the premise that an underlying phenomenon can be quantified by amalgamating an individual's evaluations of their emotions, attitudes, or perceptions in response to a set of individual statements or items. In this study, the perception includes cooperation, motivation, achievement, and satisfaction. These four topics are closely related to TGT. Previous studies on TGT discussed similar topics. For instance, Veloo and Chairhany (2013) investigated the effects of TGT on students' achievement and attitude involving cooperation and satisfaction; Rakhmawati (2018) and Luo et al. (2020) studied the effects of TGT on learning motivation. The Likert-scale responses ranged from 1 to 5, where '1' means strongly disagree and '5' means strongly agree. Students were allowed to use translation in filling in the questionnaire. The questionnaire items are listed further in the text. In addition to the Likert-scale items, there was one open-ended question for students to express comments, thoughts, and suggestions on TGT.

Data analysis

Data collected for the first research objective underwent quantitative data analysis. The data were analysed using iterative method, as they were analysed descriptively and inferentially. The inductive reasonings were then presented based on the findings. The analysis involved the use of descriptive statistics (Means & SDs) as well as inferential statistics (paired t-test). The t-test was used to test the hypothesis that the implementation of technology-infused Team-Based Game Tournament (TGT) leads to statistically significant improvement in students' academic achievement compared to traditional teaching methods. The test was conducted using SPSS.

For the second objective, a mixed-method data analysis was conducted. Closed-ended items were examined using descriptive quantitative techniques in Google spreadsheet. Additionally, qualitative data from the open-ended section were analysed through content analysis. The data in the form of responses were useful to provide more details and let students explain themselves. The gathered qualitative data were read, and some were translated from Thai to English. Then, common themes from the data were sought.

They were coded by looking for the specified common themes which are divided into four categories: cooperation, motivation, achievement, and satisfaction (Table 1). The responses that were not related to the coded themes were also mentioned in the discussion.

Results

The effectiveness of the technology-infused TGT method

Both the experimental group and the control group had 30 students. Their pre- and post-test scores were depicted in Table 2. The figure showed the mean, standard deviation, and standard error deviation of both groups' pre and post-test.

Table 2 showed that both groups had almost similar pre-test scores of around 70. However, the control group had an average post-test score of 74.4 while the experimental group reached 79.6 at the end of the term. Since the sample size was small, determining the distribution of the scores was important for choosing an appropriate statistical method. So a Shapiro–Wilk test was performed and did not show evidence of non-normality for the pretest ($W = 0.987$ p-value = 0.775)

Table 1. Questionnaire items.

Perceptions	Item samples
Cooperation	I am more interested to work in groups than individually. I enjoy learning when my teacher does the teams-games-tournaments because I can work with my friends. The online tools make it easier for me to do group work. Working in groups improve my cooperation skills. Overall, I am happy to work with friends.
Motivation	I am more interested in the lesson when my teacher uses online tools. I feel more engaged when my teacher uses online tools. Participating in group activities allows me to be more involved in class. Group activities make me feel more relaxed in class. Overall, the activities motivate me to learn English more.
Achievement	Working in groups helps me learn more. My English-speaking skills have improved because I practiced a lot during the class. The activities enhanced my English listening skills. Engaging in these activities helps me learn and practice new words and how to use proper grammar. I enjoy learning when my teacher does the teams-games-tournaments because it helps me learn more.
Satisfaction	I enjoy learning when my teacher does the teams-games-tournaments because it is fun and exciting. I am satisfied with the class activities. I want my teacher to keep using online tools. I want my teacher to continue doing group activities. Overall, I am happy with teams-games-tournaments.

Table 2. Students' achievement from pre and post-test results.

	Groups	N	Mean	Std. Dev	Std. Error Mean
Pretest	Experimental	30	70.3667	6.09400	1.11261
	Control	30	70.2333	6.11771	1.11694
Posttest	Experimental	30	79.6000	4.60584	0.84091
	Control	30	74.4000	4.60584	0.84091

Table 3. Tests of normality.

	Kolmogorov–Smirnova			Shapiro–Wilk		
	Statistic	df	Sig.	Statistic	Df	Sig.
Pretest	0.106	60	0.90	0.987	60	0.775
Posttest	0.119	60	0.035	0.972	60	0.179

and the post-test ($W = 0.972, p = 0.179$). Based on this outcome, t-test was applicable.

As Table 4 showed, the p-value of the pre – post-test was less than < 0.05 showing a highly significant difference between the pre and post-test scores of the experimental

group. It confirmed that the treatment highly gave a positive effect on the students' achievement. This finding suggests that the treatment positively affects students' achievement which is congruous with previous studies conducted by Budiyono (2020), González et al. (2014), and Veloo and Chairhany (2013) that claimed that the TGT method significantly helps boost the students' performance.

Students' perception

The response from the questionnaire was tabulated and analysed. The questionnaire focused on four factors namely cooperation, motivation, achievement, and satisfaction. Overall responses to the statements were tabulated in Table 5.

Table 5 presented the mean and standard deviation of the students' ratings from a score of 1 (very disagree) to 5 (very agree) on their position towards each of the factors (McLeod, 2019). The mean was obtained from the average score of students' ratings on some items in the specific factor. This means the higher the mean of items of each factor, the more positive the perception. It can be seen from the table, students in general had positive impressions towards the implementation of the technology-infused TGT method.

Table 6 contains some responses to the opened-ended question asking about students' comments towards the method. All comments were generally positive with 76.67% mainly talking about how they enjoyed the way the lesson was delivered using TGT and technology and loved the variety of activities which made learning more exciting. A total of 13.3% of respondents gave positive comments about the

Table 4. The results of the paired-samples *t*-test (*N* = 30).

Pair (Total Scores)	Mean	SD	t	Df	p-value
Pre – Post	-9.233	5.09	-9.922	29	0.000

* Independent T-Test, *p* < 0.01

Table 5. Students' perception towards technology-infused TGT.

Factor	Mean
Cooperation	4.00
Motivation	4.04
Achievement	4.01
Satisfaction	4.06

Table 6. Some students' comments in relation to the method.

When I finished this class, I feel different from another class because it very exciting and has many activities to do in class.

Not really like morning class but overall good class and nice to study with the teacher

I like this lesson because it makes me improve my English skill and I'm happy that I study in this section. This class is many activities to do and I practice a lot of thing in English.

I enjoy learning with my friends-learn in group and love to use online technology tools for my study.

I want to have more learning activities in Kahoot. Because I like and enjoy it.

teacher, praising the teacher's skills and the creation of pleasant memories in class. A total of 3.3% mentioned the technology tools they enjoyed using in tournaments in class. Kahoot was the most mentioned platform, followed by Quizizz and Pear Deck. Finally, 6.67% did not leave any comments.

The first percentage revealed the average positive feedback towards the use of technology-infused TGT in the classroom. The praise towards the teacher also implied their positive reactions towards the teaching method as this model makes the classroom activities memorable experiences. So, generally, the students were content with the teaching method, Technology-Infused TGT. A student's remark underscored favourable impressions of the grouping and technology tools, stating, 'I enjoy learning with my friends-learn in group and love to use online technology tools for my study'. Another student's comment reflected the positive experience she gained from the strategy, 'When I finished this class, I feel different from another class because it very exciting and has many activities to do in class'.

Discussion

Students achievement

The finding suggests that the method, Technology-Infused TGT, is effective in improving students' achievement as the experimental group's post-test value increased significantly compared to that of the control group. To some extent, this result is in line with some previous research (Budiyono, 2020; González et al., 2014; Veloo and Chairhany, 2013) which reported that the post-test achievement of students taught with TGT was significantly higher than that in the pre-test.

As the test used in this study comprised several sections including vocabulary, grammar, listening, reading, and writing, it supports the fact that TGT positively affects the instruction of vocabulary (Sunarti et al., 2019), grammar (Yovita, 2017), listening (Solikah, 2019), reading (Valid, 2020, de Castro, 2011 and Hastuti & Yuliasri, 2015), and writing (Manuputty, 2020). Furthermore, the finding supports the findings of Pello (2018) and Wahyuningsih et al. (2021) who found that TGT using an online gamified quiz was effective at improving students' achievement. The significant increase in the t-test score showed that in general, all students in the experimental group benefitted from this learning method.

Students' perception

The mean of cooperation-related questionnaire items was 4.00 showing that the students preferred TGT rather than working individually. The students enjoy learning whenever they can work with their friends. Johnson and Johnson (2019) confirmed this by stating that TGT is a type of cooperative learning that enables students' active involvement. In the comment section, one student mentioned that she was more interested in working in groups. The comments are all positive from the students stating that this led to a good performance. Another student confirmed that she enjoyed TGT because she could work with her friends. This is in line with the research by O'Donovan et al. (2013) stating that TGT can improve the students' engagement in working together as a group. Similarly, Aykut (2008) mentioned that integrating technology into class promoted cooperative learning among students.

The average rating for motivation was pretty strong ($M = 4.04$). Technology-infused TGT was approved well by the students followed by their interest in using TGT along with online tools for their future classes. Students found the lesson more interesting and engaging when online tools were utilised, thus motivating them in learning. This corresponded to a study by García and Esmeralda (2014) which showed that the TGT method created student-centered activities leading to increased motivation and self-reliance. This positivity was also reflected in the comment section. One student wrote that this class made them excited to learn English because the teacher had various activities every week. Similarly, another student said that even though it was a morning class, the method managed to keep them awake and enjoy learning. Furthermore, they would like to continue using this method in future classes. This finding supports research by Ambarwati et al. (2016) about TGT being able to encourage students to study more. Students found the lesson more interesting and more engaging when online tools were utilised, thus motivating them in learning. This trend was also reflected in the comment section. Some comments include that the class made them excited to learn English due to various activities and kept them awake despite morning class.

Students' perception in relation to their achievement by using this method is averagely high ($M = 4.01$). Students liked that they got more points during the TGT tournament. They also agreed that working together helped them learn more. Hanna (2014) highlighted a similar finding that gamification of learning using technology significantly boosted students' performance as it allows collaborative monitoring as exam preparation. In the comment section, students mentioned that this active learning method contributed to their achievement and this method facilitated them to improve their knowledge and vocabulary. 'I like this lesson because it makes me improve my English skill and I'm happy that I study section 1. This class is many activities to do and I practice a lot of thing in English', a student said. In addition, Budiyo (2020) added that achievement is guaranteed as active learning happens in instructions.

In terms of satisfaction, the questionnaire showed that students were satisfied with this method ($M = 4.06$). The signs of satisfaction were depicted in the high ratings whenever given the statements using the words enjoy, happy, and fun. The same thing was found in research by González et al. (2014) which also confirmed that applying TGT in the class improved the students' satisfaction. A total of 76.67% of positive comments were given by the students. One comment highlighted the uniqueness of this method compared to other classes' methods, making it more exciting as a lot of interesting activities were involved. Not only fun, but researchers also highlighted a comfortable learning environment that results from this method, which gives students abundant opportunities to improve their English language skills (de Castro, 2011; Gusadha, 2020; Hastuti & Yuliasri, 2015; Manuputty, 2020; Sunarti et al., 2019).

Conclusion

Innovations have been implemented since Hosseini wrote about the steps of TGT in 2008. This method has been used in many subjects in many countries around the world. This study collected data from a university in Thailand, a country where the implementation of TGT has not, unfortunately, been widespread. After using the method for a trimester, the findings were analysed. From the pre and post-tests, it was concluded that the experimental group's achievement was significantly improved.

This suggests the benefit of using TGT in classroom instructions using technological devices (Budiyo, 2020; González et al., 2014; Veloo & Chairhany, 2013). The active learning atmosphere it established enabled students to improve their English skills. The findings from the questionnaire highlighted the students' positive impressions in four categories: cooperation, motivation, achievement, and satisfaction. Collaborative learning makes the instructions more impactful as the students can study together to prepare for the tournaments. They became self-motivated to learn as they were involved in healthy competition with their classmates. The questionnaire also shows that the students believe they achieved more with this method. Not only are they able to absorb the knowledge, but their independence is improved as they try to contribute their best to their team. Students revealed that they had fun and would like to use this method again in the future.

The implication of this study shows that creating an active environment for English teaching is crucial in allowing students to improve their language skills. Technology-embedded instructions become necessary as it provides a variety of ways students can learn. Furthermore, adding team-games-tournaments to the technology-infused instructions makes a valuable learning experience. Students are engaged, happy, motivated, and actively learning language skills. These will in turn improve their achievement. Even though the research was conducted in Thailand, the Technology-Infused TGT method can be utilised in any EFL/ESL class in a context where active learning is encouraged. The TGT method has also been utilised in many countries, confirming its success.

The limitation of this study lies in the way instruction was delivered. The study was conducted fully on-site, therefore investigating how this method is conducted during hybrid or online classes has become important as the innovations of technology have allowed classes to be conducted synchronously online. A closer look into each student's individual experiences shall be conducted in the future through the teacher's observations to see if each student really performs their best during the team games tournaments.

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Ethics declaration

This research has been granted an ethics certificate from Walailak University: WUEC-21-064-01.

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