



Exploring the viability of augmented reality game-enhanced education in WhatsApp flipped and blended classes versus the face-to-face classes

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Abstract

The application of augmented reality games (ARG) as an emerging innovative technology has become a significant component of instructional learning contexts in recent years. ARG-based education as a form of student-centered learning situates students in a learning environment that integrates virtual elements with physical environments through three-dimensional pictures and videos on mobile devices for educational purposes. To connect the use of digital tools into the language classrooms and allow learners to view the real world, this study examined the viability of ARG-enhanced education on English foreign language (EFL) learners' learning of giving and asking for directions in flipped and blended contexts. The study involved 60 EFL elementary students of homogenous English proficiency, organized into two comparative and one control group, with 20 participants in each group. For the pre-test, an 18-item multiple-choice test with one written and oral question was administered to assess the learners' knowledge of asking for and giving directions. After taking the pre-test, the two comparative groups received 16 sessions of ARG-enhanced education (one with a blended and the other with a flipped classroom approach), while the control group received placebo instructions. The flipped group received the instructional materials preceding the online group, while the blended group received instruction in both online and face-to-face classes. The control group received instruction in a face-to-face context. After 8-weeks of treatment sessions, all participants of the study took the post-test. According to the results, both flipped and blended groups receiving ARG-enhanced education performed better than the control group in learning how to give and ask for directions. The results of this study may pave the way for EFL teachers and students to use ARG-based technology in online and traditional classes.

Keywords Augmented Reality Games · Blended class · Giving and asking for directions · Flipped class · Learning English · Teaching English · WhatsApp

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1 Introduction

One of the world's best-emerging digital technologies in education is the application of augmented reality (AR) tools which functions as a catalyst in motivating teachers and students to work in new ways. AR can be thought of as a bridge between the virtual and the real-world (Di Serio et al., 2013) which enhances English foreign language (EFL) learners' visualization of the real world through the use of virtual objects delivered via technology (Rau et al., 2018). Considering the fact that AR technology is a new topic in the field of education (Wu, 2019), studies on this technological tool are, therefore, at the fledgling stage (Lee & Park, 2020). Available literature suggests that augmented reality game (ARG) technology is an effective learning tool (Ruiz-Ariza et al., 2018), because it brings real-life objects into language classrooms and enables learners to combine physical experience with their imagination (Parmaxi & Demetriou, 2020) which helps scaffold their learning (Gaol & Prasolova-Førland, 2022), and experience virtual objects as part of their present world. Basically, AR technology is a facilitative method that helps students activate their prior knowledge as they integrate real observations with digital content (Hsu, 2017). In addition, AR is a tool that supports learning through various channels, including sound, picture, writing, video, and animation (Wojciechowski & Cellary, 2013) which helps both teachers and students to enhance the quality of teaching materials (Wu, 2019), and provide authentic contexts for the second language (L2) learning and teaching (Perry, 2018) in understanding and experiencing abstract constructs, and concepts.

Flipped and blended instructions are two common types of Educational Technology (Ed-Tech) pedagogies that emphasize problem-solving and peer-assisted learning (Vivek & Ramkumar, 2021). In the flipped class, teachers' instructional lectures are pre-recorded and delivered before class in order to develop student-centered activities (Lai et al., 2018). In a blended teaching strategy, both face-to-face and online classes are combined to enhance the learning quality (Rasheed et al., 2020). According to Hwang et al. (2015), these are innovative instructional approaches that change the traditional concept of learning time in educational settings. Since Bergman and Sams (2012) popularized implementing flipped classes to the world, AR studies on the combination between AR and advanced teaching methods such as flipped and blended classes are still in their infancy. Even though there are many surveys about technology-enhanced English teaching and learning, there has not been a parallel uptake of AR-enhanced instruction on EFL learners' structure of giving and asking for instructions in flipped, blended and face-to-face classes in formal language learning settings. The union of the implementation of flipped and blended active methodologies with ARG selected for this experimental research during the period of semi-presence-based education due to the COVID-19 pandemic, can be considered a wide success for making online classes more appealing and developing EFL teachers' teaching, as well as enabling EFL learners to interact with the physical world around them and optimize their performance. Although different studies confirmed the affordance, a full-scale study that could discuss how they can be applied to language learning

contexts seemed to be missing in the literature. More specifically, almost none focuses on the practice of asking/giving directions (giving instructions to a tourist to find a place in a city) in blended/flipped contexts enhanced with AR in the frame of EFL courses. In order to address the validity of AR in EFL classes, this study developed a novel ARG-enhanced instruction app that taught giving and asking for directions to EFL students using interactive 3D technology, so far lacking in the literature. To fill the gap, the following research question was proposed:

What is the impact of ARG-enhanced education on EFL learners' learning of how to give and ask for directions in WhatsApp flipped and blended classes versus the face-to-face one?

2 Literature review

As this study aims to explore how to achieve an effective ARG-enhanced education combined with blended and flipped learning, a brief introduction to these three trends is given below.

2.1 AR-based enhanced education

The literature indicates that the utilization of new and modern technology like AR is a promising instructional method which helps learners find more opportunities to acquire new skills and associate the relationship between virtual contents and real objects (Akçayır & Akçayır, 2017). AR can also support learners' learning incredibly by offering new learning opportunities and also creating new challenges for them (Wu et al., 2013). Moreover, utilizing AR-based teaching allows students to direct their learning, be independent, and develop authenticity (Cakir & Korkmaz, 2019). More importantly, the use of AR apps provides students with in-time interaction within their classes which increases and deepens their learning (Chen & Tsai, 2012; Hsu, 2017). As AR blends digital information with the context of the real world, it facilitates learners' understanding by visualizing (El Kabtane et al., 2020), and interacting with information (Marks & Thomas, 2022). Implementing AR-based technology in classes also increases students' attention, confidence (Di Serio et al., 2013), enjoyment, and curiosity (López-Faican & Jaen, 2020). Similarly, learners' perception toward learning from AR-enhanced education was investigated by Chen et al. (2020), who revealed a positive learning experience and perception from learners toward AR-based teaching.

Implementing AR-based technology in classes improves the quality of language teaching and students' learning achievements (Sahin & Yilmaz, 2020) and their motivation (Ibáñez et al., 2020). As some researchers pointed out, teaching through an AR-based learning system facilitates students' reading. For example, Danaei et al. (2020) examined retelling and answering reading comprehension of elementary children reading an AR storybook and compared it with their peers reading the traditional print version of the same book and concluded that those who read augmented storybooks are significantly better in reading storybooks. Likewise, Yilmaz

et al. (2017), confirmed that most children enjoy using AR picture books. Similar studies done by, Koç et al. (2022); Liu and Tsai (2013) confirmed that integrating AR-based writing activities into instruction can help learners in their English writing. A study by Yilmaz et al. (2022) points out a positive effect of using AR- educational toys on children's learning of English words. Using AR-based teaching strategies can contribute to the development of students' phonics. In a study, Lim-sukhawat et al. (2016) examined the effect of an AR game application on students' phonics learning, and confirmed that AR application makes learners' learning more engaging by enabling them to interact with the AR app. AR-enhanced education has also been reported to be an effective method for teaching mathematics (Ibili et al., 2019), science (Çetin & Türkan, 2021), and technology courses (Baran et al., 2020).

The literature has also shown that AR-based learning is supported by experiential learning, the contiguity principle of multimedia learning theories, and cognitive information processing theory (Chen & Tsai, 2012). According to the experiential learning theory, learners achieve a meaningful learning experience by applying concepts in real-world scenarios. As stated by Godwin-Jones (2016), AR can provide an interactive phenomenon for EFL learners that it helps them combine digital platforms with their needs in real-time and specific situations. The contiguity principle of multimedia learning also integrates text and graphics, and its practicality and reliability have been widely confirmed (Jiang et al., 2017). AR apps are also related to cognitive information processing theory which states that learners have different information processing channels for visual and aural materials (Chen & Tsai, 2012). As AR-enhanced technology can be considered as a bridge between the virtual and real-world, the displayed information on AR apps can be transferred to learners' short-term memory and their further usage of apps may transfer information into their working memory, and finally into their long term memory.

2.2 Flipped classroom approach

Flipped learning has gained increasing attention from teachers as a delivery system of instruction where teaching is conducted outside of the traditional classes and students are involved in active interactive learning (Lai et al., 2018). Implementing flipped-based teaching strategy helps learners engage in creative activities, problem-solving whether individually or in groups, and collaborative learning (Bond, 2020). Implementation of this approach helps learners develop strategies for self-evaluation of their progress (Wang & Qi, 2018). As students watch online instructional videos prior to class, they have more time to prepare themselves for their teachers' questions and enhance their self-regulatory learning (Van Alten et al., 2020). Studies have shown that flipping a class makes students responsible for their learning and take ownership of their learning process (Yang & Chen, 2020). To understand the learning materials, learners interact and cooperate with their teacher and peers which is consistent with the interactional theory (Long, 1996), Vygotsky's socio-cultural theory (1978), and learning theories of Communicative Language Teaching (CLT) (Shekary & Tahririan, 2006).

The potential of flipped learning methodology for fostering learners' language development in studies that focus on EFL classes has also attracted the attention of researchers (Andujar & Nadif, 2020). One of the studies which explored the impact of flipped teaching with the use of computers in teaching EFL writing is the study done by Ghuftron and Nurdianingsih (2019). The researchers concluded that employing a flip-class environment fosters better communication amongst EFL learners and inspires them to put their self-regulation skills into practice and engage in-class learning activities. In another study, Abdullah et al. (2019) investigated the impact of implementing the flipped learning methodology on the motivation level of EFL learners to speak English. Their study manifested the positive impact of flipped methodology as a teaching approach helped EFL learners to be involved in the speaking activities over time and engage in speaking activities. The beneficial impact of the flipped classroom has been reported on students' reading by Huang and Hong (2016). The findings of their study indicated the effectiveness of using flipped English classrooms among EFL learners as the flipped class gives EFL learners control over the teaching process by viewing teachers' instructional videos at home. Similarly, Ahmad (2016) designed a research focusing on the effect of the flipped classroom model on EFL students' listening comprehension, and concluded that the flipped classroom significantly improves EFL learners' listening comprehension skills. Moreover, reversing the face-to-face teaching class has shown its effects on improving EFL students' pronunciation (Bakla, 2018), and grammar performance (Saidah, 2019). The studies mentioned stated that, compared to the face-to-face classes, the flipped learning improves students' pronunciation and grammar through using generated content and actively engaging learners to discuss their problems with their peers.

2.2.1 ARG-based flipped classrooms

In a few flipped classes, AR technology has also been adopted. For instance, Chang and Hwang (2018) investigated how AR-based learning mode can be used for developing a flipped learning system so they examined the effect of AR-based flipped classes on elementary students' scientific project tasks, and revealed that using AR-based flipped teaching classes assists participants in better project implementation and also enriches their learning motivation, critical thinking, and teamwork skills. Similarly, Lu et al. (2021) ran a pilot survey about students' perception of the AR software by reading through pre-recorded instructional materials in the app before their online classes and showed their positive attitude toward learning real-life Chemistry.

2.3 Blended classroom approach

The value of implementing blended learning in education has been identified by a lot of researchers. For example, the impact of blended learning context was evaluated on EFL students' reading ability by Setyawan (2019) who found that utilizing the blended teaching method has a positive impact on students' reading scores as their social interaction

is facilitated and they can discuss their reading difficulties within their group and obtain their peers' feedback (Yang, 2012). The study undertaken by Ehsanifard et al. (2020) is another example of a study in which the researchers examined the impact of blended learning on the speaking ability of EFL learners in comparison to the traditional teaching method. The researchers stated that EFL learners in the blended group who attend both online and traditional classes improved their speaking proficiency more than the group who just attended the face-to-face classes. Ginaya et al. (2018) and Wang (2021) also investigated the effects of blended learning on students' speaking ability and indicated that the implementation of a blended learning environment can cause students to be academically more successful in their speaking skills than those who study in a traditional class. Likewise, Purnawarman et al. (2016) intended to evaluate the effect of blended learning on EFL students' writing ability and concluded that students are stimulated to explore more ideas in their writing activities in blended classes. The positive impact of blended teaching on improving EFL learners' listening skills was investigated by Li (2020) who showed that blended classes provide a stimulating environment for learning and motivate learners to take their listening activities more seriously and develop good listening habits. Moreover, blended classes can boost EFL learners' overall satisfaction rate and lead to their positive perceptions (Wang et al., 2019). The positive impacts of the blended teaching approach also have been stated in teaching English sub-skills such as vocabulary (Pazio, 2010), and grammar (Qindah, 2018).

2.3.1 ARG-based blended learning

Blended learning and AR have been connected in a few studies to evaluate students' academic achievements. For instance, to increase the flexibility and interaction of learning activities, Chen et al. (2017) examined elementary students' learning of the growth patterns of the leaves and their feelings towards a mix of blended teaching and AR app and showed that they were interested in the learning course and AR technology brings a new experience to learning in the blended learning. In a similar study, Mumtaz et al. (2017) confirmed that by using AR in blended learning environments, learners' confidence and motivation towards learning are enhanced, and learning can be greater than in non-AR contexts. Literature shows the benefits of the different approaches taken in this study not only when they are considered separately, but at their intersection as well. It therefore seems quite promising to apply these combinations (ARG + flipped/blended learning) to what, to the best of our knowledge, is still a non-trodden field: that of teaching spatial references in EFL. More specifically, the study will focus on teaching how to ask for and giving directions.

3 Method

3.1 Research design

The purpose of the study was to compare the effects of flipped and blended classes on students' learning of how to give and ask for directions through the use of

ARG-based enhanced education, by adopting a quasi-experimental design. Thus, the independent variables which the instructor manipulated and tried to identify how they influenced the dependent variable included AR-enhanced education, teaching through flipped and blended classes, and the dependent variable that the instructor measured the outcome of the independent variables in the dependent variable was EFL learners' learning of how to give and ask for directions. There were a pre-test and a post-test for all these groups and treatment (Fig. 1).

3.2 Participants

Seventy-five EFL learners from three English classes at Safir Language Institute in Isfahan were screened to decide who would take part in this study. Before their enrolment in the language institute, the learners were interviewed by two English language teachers and were placed at the beginner levels according to their English speaking skills. To choose homogeneous participants, an Oxford Quick Placement Test (OQPT) was administered. Based on the results, sixty participants with a mean score of 39.14 and a standard deviation of 6.42 were selected for the study. As all of the participants had access to mobile phones with WhatsApp and constant Internet connection, they were randomly divided into three groups of 20 participants each, namely control, flipped, and blended. The three groups underwent different procedures: the flipped group received instructional videos two days prior to the online class and did their tasks within the online group; the blended group received instructional videos through the WhatsApp group and took part in the face-to-face classes and the control group received instructional material in a face-to-face class. The participants' age ranged between 13 to 16.

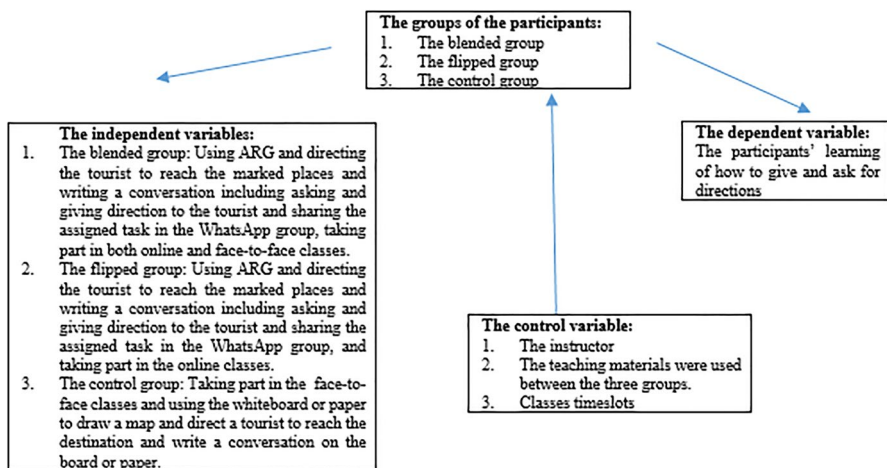


Fig. 1 The variables

3.3 Instruments

3.3.1 OQPT

To form homogeneous groups, the OQPT placement test which is a well-established English language proficiency test was administered to measure the learners' general language ability for placing them in appropriate levels. The OQPT has been pre-tested and validated by several researchers with different cultural backgrounds in different countries (Hassaskhah & Roudsari, 2015). This test comes with 60 questions on vocabulary, grammar, reading, and cloze test, which provides an overall estimate of the proficiency level of the participants.

3.3.2 Teaching material

The instructional book used for the present research was, *Interchange Fifth Edition Full Contact Intro B* (Richards, 2017). The book includes a student's book, the class audio, the video program, an online self-study overview, and an online workbook overview. The book consists of sixteen units and is divided into 8 units by the head of the institute to be taught over two separate 16 sessions.

3.3.3 Pre-test

For the pre-test, an 18 item multiple-choice test with one written and the oral question was administered for assessing the learners' knowledge of asking for and giving direction. The test consisted of 4 listening questions which required the participants to listen to a conversation and choose the place the speaker has asked for directions. The test also included 5 multiple-choice questions about asking directions, 9 about the prepositions of the place, and one question which asked the participants to write directions to a specified place. After the test, the teacher asked the participants individually to give verbal directions to the designated place. It should be mentioned that two English language teachers confirmed the face and content validity of the tests. Cronbach alpha was used for calculating the reliability of the test and the obtained reliability index came to $r=0.81$.

3.3.4 Post-test

After 8-week treatment sessions that were held twice a week, a post-test was developed by the teacher which included 18 multiple-choice items with one written and one oral question for measuring the participants' knowledge of asking for and giving directions. It should be mentioned that the sequence of the questions in the post-test was jumbled to avoid the test practice effect. The content and face validity of the post-test also were confirmed by two EFL teachers. Cronbach

alpha was used for calculating the reliability of the test and the obtained reliability index came to $r = 0.79$.

3.3.5 ARG

Twelve simple tourist guide games with basic marker-based AR features related to the topics of asking for and giving instructions such as *imperatives*, *there is/there are*, *where is/where are*, *prepositions of the places*, *the use of articles*, and *asking directions* were developed by the instructor in collaboration with the game developers. The designed game app was developed using Unity3D game Engine with Vuforia software development kit, and 3D models of historical buildings. The designed games were compatible with the participants' smartphone platforms, including iOS and Android. The game app required a smartphone with AR features, namely a camera. The game consisted of a map with some images of historical places on it, which the participants were supposed to scan. The map was physical and every user had access to her/his own version of the map. The game entailed 12 different tasks, all about giving directions to a virtual tourist to find some specific historical places in the city. It should be mentioned that, when the participants were playing the game, ARG superimposed texts into the screen such as grammatical topics of asking for and giving instructions, prepositions of place, movements, and names of places.

Each learning game could be played for 15 min and the participants completed the 12 designated tasks such as giving instructions to a virtual tourist to find the designated historical places of the city in each game. In the game, the participants could scan a historical place on the map to turn it into a 3D model and then place a virtual tourist into the surrounding streets of the scanned historical place and move the tourist around the streets and help him find the place, spot it and mark it. They were also asked to place the tourist within the designated historical place and take pictures and then share them with their peers on the instructor's made WhatsApp group (Figs. 2 and 3).

Fig. 2 An example of scanning the AR marker on the map

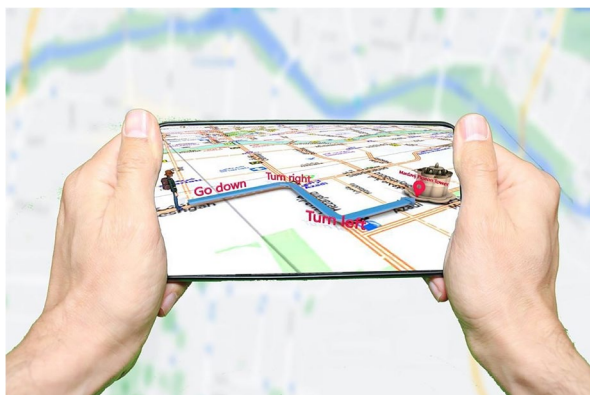


Fig. 3 A shot of the AR game



3.3.6 WhatsApp

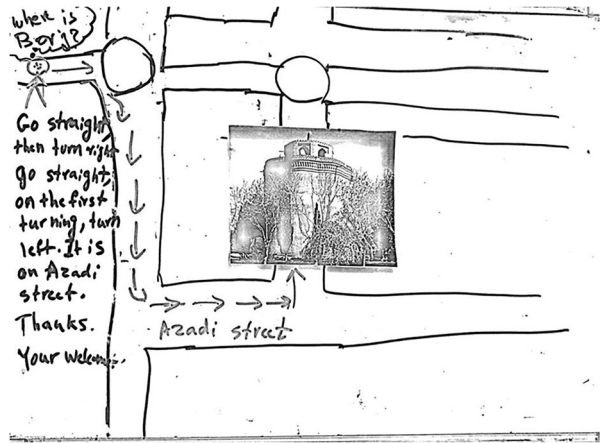
WhatsApp is a social media messaging application that allows its users to send free text messages, pictures, audio files, and videos to each other. Because WhatsApp's practicality within the educational environment has been tested by many teachers, and its potential for supporting and teaching foreign language learning (Alamer & Al Khateeb, 2021) has recently grown in popularity, it was used in this study to deliver the course content to the participants in both comparative groups. The instructor created two different groups named the flipped group and the blended group, and asked the participants of both groups to join their groups. The participants of both groups installed WhatsApp on their cell phones, tablets, or laptops and joined their designated groups via teachers' sent links.

3.4 Treatment sessions

3.4.1 The treatment of the control group

The treatment sessions for the control group were held on Sundays and Tuesdays of the week from 8:00 to 10:00 a.m. During each session, in order to teach the participants how to take part in a conversation around directions, the teacher taught them the essentials of giving directions such as *how to start conversations, requests, offers, imperatives, prepositions of place and movement, means of transport, there is/ there are, where is/where are, names of places, checking/ clarifying, and ending conversations*. The teacher put a map on the board and in each session taught the participants the designated teaching tasks and asked them to do a role play and take part in the traditional games such as drawing a map on the board and guiding a tourist to get to the marked historical place. They were also required to write a conversation including giving and asking direction and share it with their friends and ask for their feedback (Fig. 4).

Fig. 4 An example of guiding a tourist to find a designated place on the board



Procedures for the Control Group

	Activities of the control group	Timelots
Weekly instruction of the control group	1 st activity	10 min
	Instruction on vocabularies	
	2 nd activity	10 min
	Asking the participants to practice the words	
	3 rd activity	10 min
	Instruction on direction phrases	
	Asking the participants to practice the phrases	10 min
	4 rd activity	20 min
	Task-based group activity	
	5 th activity	10 min
	Feedback and consolidation	
	6 th Playing game on the board	15 min
	7 th activity	5 min
	Reviewing and assigning homework	

3.4.2 The treatment of the flipped group

In flipped classroom approach, the teacher’s lectures and students’ activities in a typical traditional learning class were reversed and were integrated with the teacher prepared instructional videos. As for the instruction for the participants in the flipped group, the 20 participants to the flipped group were gathered in a WhatsApp group by the teacher. The class sessions for the flipped group were held on Saturdays and Mondays of the week from 8:00 to 10:00 a.m. It should be mentioned that, the instructor made 12 short instructive videos about *starting conversations, requests, offers, imperatives, prepositions of place and movement, means of transport, there is/ there are, names of places, checking/ clarifying, and*

ending conversations for each session. The instructor recorded the videos herself with her cell phone and uploaded two videos on the WhatsApp group two days before the online class. She did her best to control her teaching and teach the same content in all three groups. She filmed her face on the screen for about 10 s as an introduction and wrap-up. After the introduction, she narrated her PowerPoints of the designated lesson. The participants to the flipped group were instructed to watch the video and carry out individual learning activities prior to their online class and prepare themselves for the meetings with their teacher.

In the WhatsApp group, the participants were able to comment on the video and post questions for the teacher and their classmates. In addition, prior to the online class, the participants were asked to make conversations with the tourist of the game and send them in the group whether in oral or written form. The teacher discussed the videos with the students at the beginning of each online class so that she could figure out whether all the participants had watched the video or not. During the discussion within the online class, the teacher clarified any areas of confusion and answered the participants' questions. If the group members found mistakes, they had to correct the mistakes and explain their corrections within the group. After the feedback part, the teacher asked the participants to play ARG in a group activity and asked them to place the virtual tourist avatar at the designated starting place and guide him to get to the designated place and take a picture when the tourist reached the place and share it in the group. They were also asked to write a conversation about guiding the tourist and prepare it for the following session (Fig. 5).

Procedures for the Flipped Group

Weekly instruction of the flipped group

Activities which were done by the teacher two days before the online class

1st activity

Sending short instructional videos about direction vocabulary and direction phrases to the group two days before the online class

Activities which were done in the online class (WhatsApp group)

Timeslots

1st activity

10 min

Asking the participants about the first video

2nd Activity

10 min

Asking the participants to pronounce the words and send their voices to the group

3rd activity

10 min

Asking the participants about the second video

4th activity

10 min

Asking the participants to pronounce the direction phrases and send their voices to the group

5th activity

20 min

Task-based group activity (playing with the app and making conversations with the tourist of the game and preparing them for the following session)

6^h activity

10 min

Giving feedback and consolidation to each other's written or oral conversation

7th activity

15 min

Asking the participants to play ARG

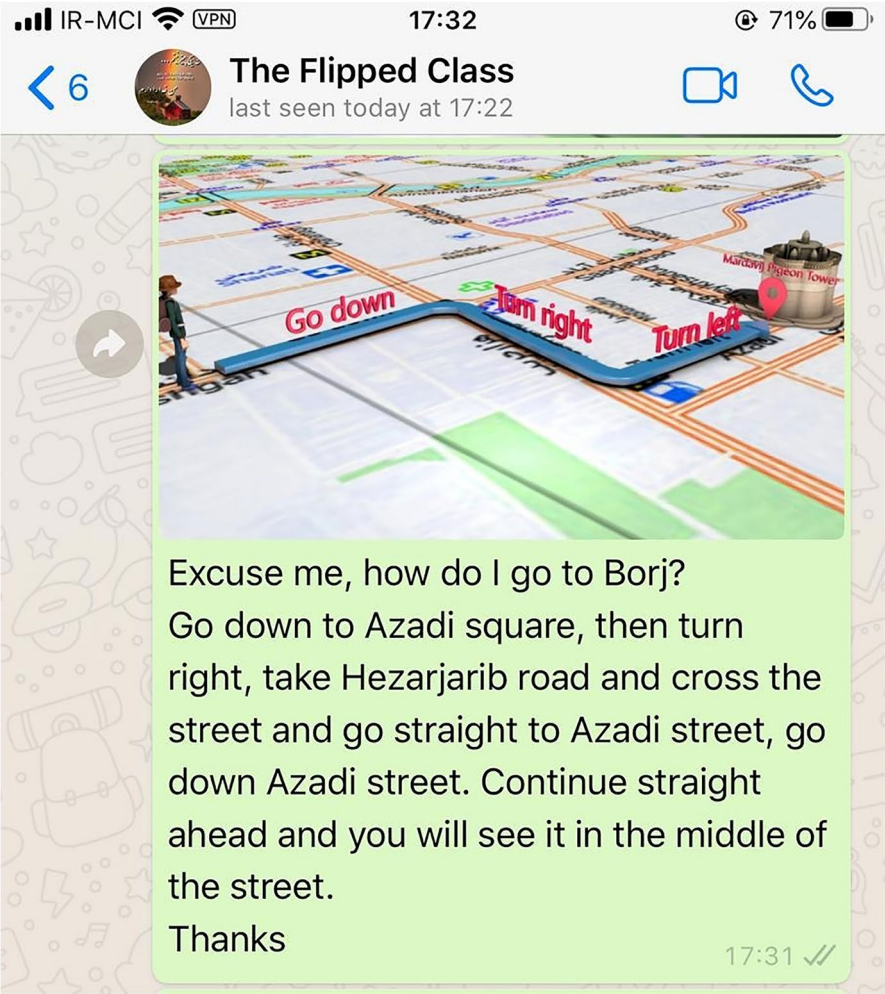


Fig. 5 An example of participants’ shared sample within the flipped group

Weekly instruction of the flipped group		
8 th activity		5 min
Reviewing directions and assigning homework		

3.4.3 The treatment of the blended group

Blended learning is a teaching strategy in which both face-to-face learning context and on-line activities are combined allowing students to act jointly and

collaborate with their peers and teacher in the educational process. The participants in the blended group participated and received instruction on both the WhatsApp group and the face-to-face class. The teacher created another WhatsApp group and added the 20 participants to the blended class. The class sessions of the blended group took place respectively on the WhatsApp and the face-to-face class on Sundays and Tuesdays of the week from 10:00 to 12:00 a.m.

The teacher also sent the same videos which were sent to the flipped group to the blended group in the online class. After receiving the videos, the participants had to download, and view the instructional material while attending the online class. After giving them time to watch the videos, the teacher asked them some questions related to the videos or PowerPoints to make sure that they had watched them. It should be mentioned that the participants' online interactions were synchronous and they were interacting online in real-time. In case everyone posed any questions, the other participants were supposed to cooperate in order to find out the proper answer or explanation.

The instruction of the blended group was not limited to the participants' cooperation and communicative activities in the online class. During the face-to-face time also, the participants were supposed to communicate and share their understandings and ideas about the instructional material with each other. They were also asked to play with their app and make conversations with the avatar and share them with their peers whether in oral or written form. Their writings and conversations were also reviewed by the teacher and their classmates in the face-to-face class and they received their feedback. Regarding the order of material presentation and homework, the blended group followed the same order of activities that were used in the control and flipped groups.

Procedures for the Blended Group

Weekly instruction of the Blended group

<i>Activities within the online class (the WhatsApp group)</i>	<i>Timeslots</i>
1 st activity	
Sending short instructive videos about direction vocabulary to the group within the class time	
2 nd activity	20 min
Asking them to pronounce the words and send their voices to the group	
3 rd activity	
Sending short instructive videos about introducing direction phrases to the group	
4 th activity	20 min
Asking them to pronounce the direction phrases and send their voices to the group	
<i>Activities within the face-to-face class</i>	
1 st activity	20 min
Task-based group activity	
2 nd activity	10 min
feedback and consolidation	
3 rd activity	15 min
Asking them to play ARG	
4 th activity	5 min
Reviewing directions and assigning homework	

4 Data analysis

4.1 Inter-rater reliability of the pre-test and post-test questions

For evaluating the participants’ knowledge of giving and asking for directions in both written and oral questions, the instructor asked them to write and talk about a direction to a designated place for the pre-test and post-test. To avoid the test effect, for each pre-test and post-test different places were selected. The scoring procedure of the oral and written questions was done by two raters. Pearson correlations was used to identify the inter-rater reliability. Results indicated a noticeable correlation between the two raters who rated the participants’ performance on both oral and written questions for pre-test ($r(88)=0.814$, which represents a large effect size, $p=0.00$) and post-test ($r(88)=0.829$, representing a large effect size, $p=0.00$).

The data collected through this study were analyzed using one-way ANOVA to compare the statistically significant differences between the means of the three groups, and find out about the effect of treatments. First, the assumption of normality was checked. Table 1 displays the results of testing normality of the pre-test and post-test. According to the results, the computed ratios were lower than ± 1.96 , so the normality assumption was retained.

4.2 Comparing groups on pre-test

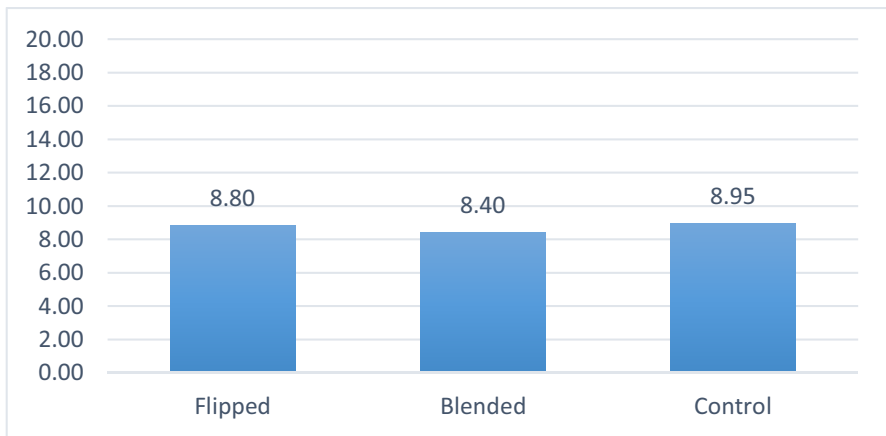
A one-way ANOVA was run to compare the flipped, blended, and control groups’ means on the pre-test in order to prove that they were homogenous in terms of the knowledge of giving and asking for directions prior to the administration of the treatments. As displayed in Table 2, the non-significant results of the linearity test; i.e. ($F(1, 52) 0.219, p>0.05$) indicated that the relationship between the pre-test (covariate) and the post-test (dependent variable) of giving and asking for directions was not linear. That was why the research was forced to employ two separate one-way analyses of variances to compare the three groups’ performance on pre-test and post-test of giving and asking for directions (Fig. 6).

Table 1 Descriptive statistics; testing normality of pre-test and post-test

Group	N		Skewness			Kurtosis		
			Statistic	Std. error	Ration	Statistic	Std. error	Ratio
Flipped	Pre-test	20	0.744	0.512	1.45	-0.269	0.992	-0.27
	Post-test	20	-0.399	0.512	-0.78	-0.703	0.992	-0.71
Blended	Pre-test	20	0.888	0.512	1.73	0.783	0.992	0.79
	Post-test	20	-0.081	0.512	-0.16	-1.043	0.992	-1.05
Control	Pre-test	20	0.920	0.512	1.80	1.282	0.992	1.29
	Post-test	20	0.158	0.512	0.31	-0.440	0.992	-0.44

Table 2 Testing linearity of relationship between pre-test and post-test

		Sum of squares	df	Mean square	F	Sig
Between groups	(Combined)	41.070	7	5.867	0.913	0.504
	Linearity	1.409	1	1.409	0.219	0.642
	Deviation from Linearity	39.661	6	6.610	1.028	0.418
Within groups		334.264	52	6.428		
Total		375.333	59			

**Fig. 6** Comparing the pre-test**Table 3** Test of homogeneity of variances

		Levene statistic	df1	df2	Sig
Pre-test based on	Mean	0.024	2	57	0.976
	Median	0.097	2	57	0.907
	Median and with adjusted df	0.097	2	54.699	0.907
	Trimmed mean	0.041	2	57	0.960

As displayed in Table 3, the non-significant results of the Levene's test ($F(2, 57) = 0.097, p > 0.05$) indicated that the three groups were homogeneous in terms of their variances on the pre-test of giving and asking for directions.

Table 4 displays the descriptive statistics for the three groups on the pre-test of giving and asking for directions. The results showed that the flipped ($M = 8.80, SD = 1.43$), blended ($M = 8.40, SD = 1.46$) and control ($M = 8.95, SD = 1.50$) groups which had fairly close means on the pre-test of giving and asking for directions.

Table 5 displays the main results of one-way ANOVA. The results ($F(2, 57) = 0.749, p > 0.05, \omega^2 = 0.008$ representing a weak effect size) indicated that there

Table 4 Descriptive statistics of the pre-test

	N	Mean	Std. deviation	Std. error	95% Confidence interval for mean	
					Lower bound	Upper bound
Flipped	20	8.80	1.436	0.321	8.13	9.47
Blended	20	8.40	1.465	0.328	7.71	9.09
Control	20	8.95	1.504	0.336	8.25	9.65
Total	60	8.72	1.462	0.189	8.34	9.09

Table 5 One-way ANOVA of the pre-test

	Sum of squares	df	Mean square	F	Sig
Between groups	3.233	2	1.617	0.749	0.477
Within groups	122.950	57	2.157		
Total	126.183	59			

Table 6 Test of homogeneity of variances of the posttest

		Levene statistic	df1	df2	Sig
Posttest based on	Mean	5.338	2	57	0.008
	Median	4.550	2	57	0.015
	Median and with adjusted df	4.550	2	41.814	0.016
	trimmed mean	5.375	2	57	0.007

were not any significant differences between the three groups' means on the pre-test of giving and asking for directions.

4.3 Comparing groups on the post-test

A one-way ANOVA was run to compare the flipped, blended and control groups' means on the posttest of giving and asking for directions in order to probe the research question raised in this study. Before discussing the results of one-way ANOVA on the posttest of giving and asking for directions, it should be noted that the assumption of homogeneity of variances of the groups was not retained. As displayed in Table 6, the significant results of the Levene's test ($F(2, 57) = 4.55$, $p < 0.05$) indicated that the three groups were not homogeneous in terms of their variances on the posttest of giving and asking for directions. However, there was no need to worry about the violation of this assumption. As noted by Bachman (2005), Pallant (2016) and Field (2018), if groups enjoy equal sample sizes, as is the case in this study, the violation of the assumption of homogeneity of variances can be ignored (Fig. 7).

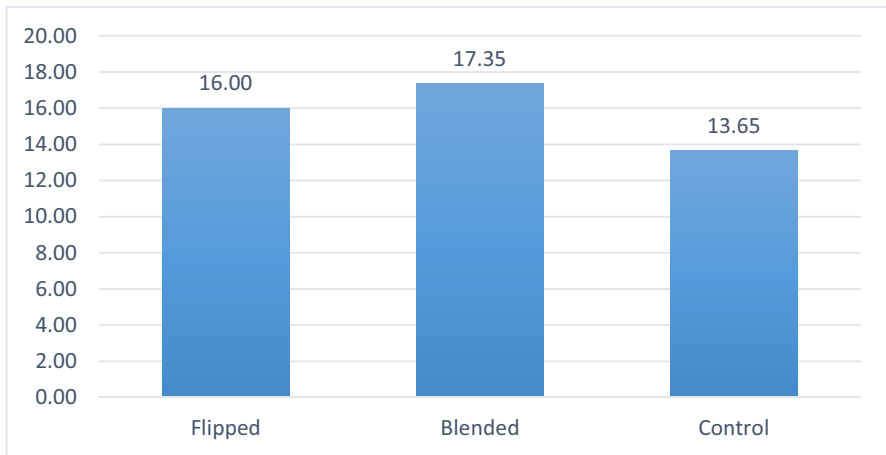


Fig. 7 Comparing the post-test

Table 7 displays the descriptive statistics for the three groups on the posttest of giving and asking for directions. The results showed that the blended group ($M = 17.35$, $SD = 0.988$) had the highest mean on the posttest of giving and asking for directions. This was followed by the flipped ($M = 16$, $SD = 2.36$) and control ($M = 13.65$, $SD = 2.41$) groups.

Table 8 displays the main results of one-way ANOVA. The results ($F(2, 57) = 17.00$, $p < 0.05$, $\omega^2 = 0.348$ representing a large effect size) indicated that there were significant differences between the three groups' means on the posttest of giving and asking for directions.

Table 7 Descriptive statistics of the posttest

	N	Mean	Std. deviation	Std. error	95% Confidence interval for mean	
					Lower bound	Upper bound
Flipped	20	16.00	2.362	0.528	14.89	17.11
Blended	20	17.35	0.988	0.221	16.89	17.81
Control	20	13.65	2.412	0.539	12.52	14.78
Total	60	15.67	2.522	0.326	15.02	16.32

Table 8 One-way ANOVA of the posttest

	Sum of squares	df	Mean square	F	Sig
Between groups	140.233	2	70.117	17.000	0.000
Within groups	235.100	57	4.125		
Total	375.333	59			

Table 9 displays the results of post-hoc Scheffe’s tests. Based on these results and the descriptive statistics displayed in Table 7 it can be concluded that;

- A: The flipped group ($M = 16$) significantly outperformed the control group ($M = 13.65$) on the posttest of giving and asking for directions ($MD = 2.35$, $p < 0.05$).
- B: There was not any significant difference between blended ($M = 17.35$) and flipped ($M = 16$) groups’ means on the posttest of giving and asking for directions ($MD = 1.35$, $p > 0.05$).
- C: The blended group ($M = 17.35$) significantly outperformed the control group ($M = 13.65$) on the posttest of giving and asking for directions ($MD = 3.70$, $p < 0.05$).

5 Discussion

This study explored the viability of ARG- enhanced education on EFL learners’ learning of how to ask for and give directions in the flipped and blended classes. The results of this study demonstrated that both flipped ($M = 16$) and blended ($M = 17.35$) groups gained better results than the control group ($M = 13.65$) in the post-test of giving and asking for directions. Besides, it was shown that there was not a significant difference between the two comparative groups in the post-test. The significant effect of the treatments on both groups (the blended and the flipped groups) was due to the application of the ARG-enhanced education to teach directions. ARG used in the present research was a 3D technology which merged the historical places of city and digital streets in real time to promote the participants’ visualization of guiding someone to find a place which provided them with both interactivity and visual representation. The participants of both flipped and blended groups were asked to play ARG and place the virtual tourist avatar at the designated starting place and guide him to get to the designated place and take a picture when the tourist reached the place and share it in their group. Moving the virtual tourist in a 3D space fostered the participants’ interaction and allowed them to interact with the virtual tourist in real

Table 9 Post-Hoc Scheffe’s tests of the posttest

(I) Group	(J) Group	Mean difference (I-J)	Std. error	Sig	95% Confidence interval	
					Lower bound	Upper bound
Flipped	Control	2.350*	0.642	0.002	0.74	3.96
Blended	Flipped	1.350	0.642	0.119	-0.26	2.96
	Control	3.700*	0.642	0.000	2.09	5.31

*. The mean difference is significant at the 0.05 level

streets and historical buildings and made them fully immerse themselves in the context created by the ARG-app, as such its use enabled interaction which is consistent with the interactional theory (Long, 1996), Vygotsky's sociocultural theory (1978) and learning theories CLT (Ahmad, 2016) and also it supports the findings of other studies that showed AR-enhanced education had the most significant interaction effect (Chen & Tsai, 2012; Hsu, 2017). Additionally, when the participants were playing the game, ARG superimposed texts into the screen such as grammatical topics of asking for and giving instructions, prepositions of place, movements, and names of places, which provided them a more comprehensive understanding of the subject, allowing them to visualize prepositions of the place, and the historical buildings by virtually interacting with them. It helped contextualize EFL learning material which assisted the participants in comprehending the rules and applying them to interact with the virtual tourist within the physical settings that supports Chen and Li (2010) who stated that ARG-apps help EFL learners achieve knowledge internalization. Therefore, ARG-app used in this study enhanced teaching effectiveness for the participants of both comparative groups.

The participants of both comparative groups were also asked to write a conversation about guiding the tourist and send it to their group. ARG- app of this study also provided the participants with in-time interactions as they gave feedback to their peers' shared pictures of the game and their written conversations which increased their engagement and helped them to have a better comprehension of the learning material. In addition, it enhanced the participants' perception of real environment and allowed them to view historical places and surrounding streets augmented with virtual 3D objects. ARG- application in both flipped and blended classes supported situated learning scenario, whereby the participants interacted with the virtual tourist. It provided them a realistic context which helped them to obtain an actual experience of helping a virtual tourist and remember it as an actual tourist who was looking for directions. Regarding these facts, the results of the study are in line with findings of other studies that showed AR- enhanced education had a positive effect on learning (e.g., Akçayır & Akçayır, 2017; Hsu, 2017; Limsukhawat et al., 2016; Wu et al., 2013; Yilmaz et al., 2017). As the participants of both comparative groups had a mission to guide the virtual tourist to find the designated historical places, this kind of inquiry-based learning experience increased their motivation and interest to accomplish the task. According to Chen et al. (2020) AR-based teaching motivates learners and increases their self-efficacy and promotes their achievements (Lo & Hew, 2020). The use of Ed-tech technology such as ARG-based education in this study boosted the participants' understanding of the grammar structure of *giving and asking for instructions* which is in line with the results of other Ed Tech-enhanced studies (Englund et al., 2017). According to Chang and Hwang (2018), AR-based activities develop students' collaboration for developing activities as they interact with their peers. ARG-enhanced education used in the present study led the participants to create a cooperative

learning context as it encouraged them to prepare imaginary dialogues and share it with their peers so they could experience fruitful interactions and cooperation with each other and their teacher. The results also showed that ARG-enhanced activity integrated in both flipped and blended classes was a helpful activity which helped the comparative participants to visualize the real-world scenes and improve their learning motivation. According to the results, the two comparative groups learned individually from the ARG-based learning which supports Capone et al.'s (2017) finding that students learn a different learning method from the individualistic and competitive Ed-Tech tools.

Both flipped and blended teaching strategies created a learner-centered learning context that required high level of the participants' activity. They were completely active members during their learning process and were engaged in active type of learning. Hung (2018) maintains that in flipped and blended classes, learners have more beneficial language learning due to having active role in their language learning process. Moreover, the activity and cooperation of the participants in both comparative groups, created a kind of independency in terms of language learning that can be turned into gradual autonomous learning by applying these two teaching strategies. In the flipped class, as students did their homework in their class, they were active and engaged in doing the task (Lo & Hew, 2020; Wang, 2017a, b) as such implementing flipped classroom strategy creates an active learning opportunity for rehearsal of language which enhances EFL learners' peer collaboration and fosters their critical thinking skills (Kong, 2015).

In both flipped and blended classes, as the participants practiced the tailor-made materials and activities before the class, a kind of schemata was created in their mind about the designated topic, and then the schema was activated during the class time. Moreover, in both classes, the researcher used ARG-enhanced education and in-class discussion, which helped the participants reinforce collaboration. As a result, they learnt not only through their own experiences, but also by the reciprocal sharing of their interactions with their peers which is according to the interactionist framework that aims for facilitating language learning by the intersection of input and output through collaborative and meaningful interaction (Shekary & Tahririan, 2006).

5.1 Conclusion

This study explored the impact of ARG-enhanced education on EFL learners' learning of asking for and giving directions in flipped and blended classes. Considering the type of treatment, based on the results, ARG-enhanced education had a positive impact on the participants' improvement in these tasks in both blended and flipped classes. It showed that Ed-Tech tools such as ARG-enhanced education played an important role in improving the participants' active engagement in learning. The results of the study justify the claim that

different Ed-Tech tools, like ARG used in flipped and blended classes, can help improve language teaching and learning process.

5.2 Limitations of the study

Although the empirical evidence of the study supports the applicability of the ARG-enhanced education in flipped and blended classes versus the conventional one, the limitations of the study may require follow-up research to corroborate the findings. First, this study was conducted only with high school students. University learners may respond differently. Moreover, this work relied on a single learning topic, giving and asking for directions, such that research results cannot be generalized to other topics. This study also did not explore the learning achievement of EFL students in reading comprehension, so future studies are also suggested to explore the role of ARG-enhanced education in developing other skills and components of second language such as reading comprehension. In addition to ARG-playing experience, the personal characteristics of learners may also affect their performance while using the ARG-app, which is also valuable to be further investigated.

Considering the possible pedagogical implications of the study, the findings of the present study show that ARG-apps can be employed in education to encourage learners to engage in an interactive learning context, increase their engagement and facilitate their understanding by visualizing. The use of ARG-apps can scaffold EFL learning process as they provide an enhanced experience in learning. Students can benefit ARG-enhanced education to learn English any-time any-where. ARG app used in the present study demonstrated that the EFL learners engaged deeply with the content and gained team work skills that supported them in collaboratively and effectively learning of asking for and giving directions in the flipped and blended classes. The results of this study can help language teachers to enhance their teaching techniques and meet the new generation of learners' needs in terms of using and benefiting from new technological developments and augmented reality apps. ARG-enhanced education could be employed by second language teachers to make learners combine physical experience with their imagination while learning language components. English teachers could also use ARG-apps in their classes to make learning last longer and be more effective. Besides that, material developers and syllables designers can employ the findings of this study to incorporate ARG apps in education to increase engagement of learners and support learning through various channels by means of sound, picture, writing, video and animation to cater for various learning preferences of language learners. Moreover, language syllabus designers can supply programs to incorporate augmented reality games into language courses to improve learners' learning outcomes.

Appendix 1

The pre-test

A: Listen to the directions and look at the map and then choose the correct answer.



- 1: The speaker gives directions to the.....
- 2: The speaker gives directions to the
- 3: The speaker gives directions to the
- 4: The speaker gives directions to the

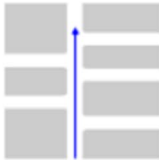
B: Choose the correct answer.





- 5.
 - a) Take the third turning on the left.
 - b) Turn right.
 - c) Turn left.



- 6.
 - a) Take the first turning on the left.
 - b) Take the left turning on the first.
 - c) Take the turning on the left first.

7. 
- a) Go on straight.
b) Go straight off.
c) Go straight on.

8. 
- a) Take second turning on the right.
b) Take the second turning on the right.
c) Take the second turning on right.

9. 
- a) Take the first turning on the right.
b) Take the second turning on the right.
c) Take the third turning on the right.

10. Go straight at the traffic lights.
a) on
b) up
c) down
11. You need to walk this road quickly. There's lots of traffic.
a) across
b) through
c) round
12. Go.....the flower shop, the drugstore, and the supermarket.
a) across
b) past
c) opposite

C: Observe the map and choose the correct preposition.



13. The music store is Santos Dumont Street and Rosa e Silva Avenue.
 - a) on the corner of
 - b) next to
 - c) behind
14. The hospital is the pet shop.
 - a) behind
 - b) between
 - c) opposite
15. The school is Amélia Street and Rosa e Silva Avenue.
 - a) on the corner of
 - b) on
 - c) behind
16. The bank is on Santos Dumont Street the flower shop.
 - a) opposite
 - b) behind
 - c) in front of
17. The pet shop is Amélia Street.
 - a) on
 - b) between
 - c) next to
18. The bookstore is the supermarket.
 - a) next to
 - b) between
 - c) behind

D: Look at the following map and guide the tourist to the designated place. Complete the conversation.



A: Excuse me, how do I go to Borj?

.....

.....

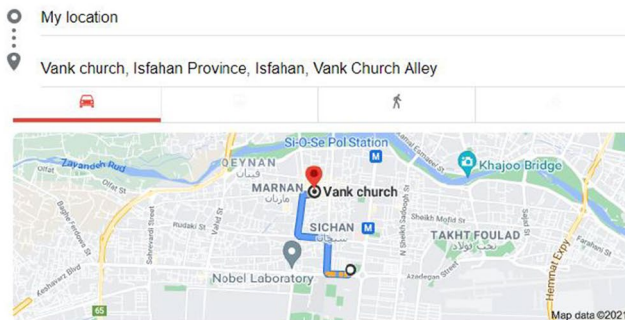
.....

.....

.....

A: Thanks

E: Look at the following map and tell your teacher how to get to Vank Church.



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Data availability The pre and post tests and the teaching materials are available from the corresponding author on reasonable request.

Declarations

Conflict of interest None.

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