Angeliki Voreopoulou, 15th Primary School of Evosmos, Greece Antigoni Parmaxi, Cyprus University of Technology, Cyprus

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#### Abstract

The ever-evolving world of technology has penetrated many aspects of our lives including the way of language teaching and learning. Learners are not easily sufficed with traditional classroom practices and there is an ongoing demand for reconstruction and enrichment of current curricula and teaching approaches. Augmented Reality (AR) is one of these technologies that has the potential to bridge virtual and real worlds while offering authentic language experiences and making learning more engaging and interactive. This paper reports the design of an educational intervention aiming at providing primary-level students with a rich learning experience that stimulates a real-life encounter for using English language. The intervention takes the form of an AR-guided tour of a famous European country during which an AR 3D model presents different aspects of the country and encourages learners to interact both with the AR application as well as with their peers. This paper provides an overview of related work employing AR in the EFL context and in the second part there is a detailed description of the actual intervention and its evaluation. The AR assets that enrich the tour along with their added educational value and the limitations of the intervention are also explored.

Keywords: Augmented Reality, Instructional Design, EFL

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## Introduction

The process of learning a foreign language can be a challenging but very rewarding task for young, primary-level students. Research indicates that children, who speak more than one language, seem to be more flexible with respect to thinking critically and creatively, they increase their prospects of future employability (Ford, 2014) and enhance their cultural awareness (Gimatdinova, 2018). However, foreign language teaching is often associated with activities ranging from 'fill-in-the-gaps' tasks, to stale reading comprehension activities and learning long word lists by heart. Also, in many educational environments, there is a lack of opportunities for authentic language practice that further inhibits and aggravates foreign language improvement (Buendgens-Kosten, 2013). Today learners, who have been frequently described as 'Digital Natives' are known for their affinity for rapid information processing, nonlinear thinking, multitasking, and learning through social interactions, behaviours cultivated through early and frequent use of digital technologies such as computer games and online videos (Prensky, 2001; Thompson, 2015). Their interest and engagement are hard to maintain by using simple and conventional methods. Currently, many language teachers seem to be looking for solutions in immersive technologies as they promote rich learning experiences and provide a wide range of opportunities for enhanced student motivation, engagement, satisfaction, accelerated learning, and material memorization (Akcayır & Akçayır, 2017). Digital immersive technologies include virtual reality (VR), augmented reality (AR), and mixed reality (MR), which are all summarized under the term extended reality or cross-reality (XR) (Rauschnabel et al., 2022). Research on immersive learning offers insight into the way learning occurs when students are mentally involved in activities that fade their consciousness of the physical environment (Nilsson et al., 2016). This notion is verified in a meta-review by Beck et al. (2023), who mainly posit the need to focus research not only on the learning outcomes, but on the educational practices and strategies in the current immersive learning environments. In this context, AR enriches the real world with additional information in the form of digital elements like images, texts or videos, 3D items, or audio extracts by superimposing them upon real objects (Azuma, 1997). In other words, the users interact both with the real world and the AR experience simultaneously. AR can be an asset in a language teacher's teaching repertoire as it offers access to a variety of learning contexts that would otherwise be inaccessible, enriched with versatile audiovisual stimuli. Also, AR has increased its popularity among educators primarily because it provides unique opportunities for interactivity and improved visualizations that other technologies fail to do so (Avila-Garzon et al., 2021) and secondly because of the rapid development and affordability of mobile phones and sophisticated equipment that support it (Valero-Franco & Berns, 2024). Although AR has great potential for language teaching and learning, there is a noticeable lack on the design of AR-based language learning experiences (Parmaxi et al., 2024). For this reason, this article presents the design, development, and evaluation of an educational intervention aiming at providing primary-level students with a rich learning experience in the English as a Foreign Language (EFL) classroom. The intervention takes the form of an AR-guided tour of Italy during which an Artificial Intelligence (AI) empowered 3D character presents different aspects of the country and encourages learners to interact both with the AR application as well as with their peers.

## **Related Work**

AR has already been introduced in a variety of educational fields ranging from physics (Fidan & Tuncel, 2019) and STEM (Sırakaya & Alsancak Sırakaya, 2022) to geography (Turan et al., 2018) and biology (Yapici & Karakoyun, 2021) and it has grown in popularity

among educators mainly due to the unique opportunities for interaction and enhanced visualizations that it offers and secondly because educators can have access to Smartphones, tablets, AR headsets, and AR glasses at a reasonable cost (Billinghurst & Duenser, 2012; Solar Bezmalinovic et al., 2022). Additionally, smartphones' high technology cameras and sensors, which support the bulk of AR applications, contribute significantly to AR becoming one of the most influential and indispensable technologies of the years to come in education (Alakärppä et al., 2017). AR can have applications to all levels of education from early childhood and primary education (Castellanos & Pérez, 2017) to secondary and higher education (Burkhard & Schmitt, 2009). Weerasinghe et al. (2019) reported that among 30 studies surveyed, the majority of them have been conducted at primary level followed by secondary level and only a small percentage was run with undergraduate students. A similar review was made by Muñoz (2017) whereas Bacca Acosta et al. (2014) in a survey of 32 studies revealed that the biggest percentage of AR applications was targeting university students. Although there is an inconsistency in results due to the different aspects of AR surveys, we can conclude that AR may be used for all education levels and age groups. Moreover, further research in a variety of educational settings has highlighted the positive impact of AR on content retention, better memorization, increased learning motivation and content understanding, improved academic results (Di Serio et al., 2013; Wei et al., 2015), improved physical task performance, collaboration, enhanced learning achievement and optimal conditions for personalized learning that can accommodate different learning styles (Akçayır & Akçayır, 2017; Chen et al., 2017; Radu, 2014). Furthermore, additional metastudies emphasize the value of AR in education (Hantono et al., 2018; Karakus et al., 2019; Khoshnevisan & Le, 2018; Petrovich et al., 2018; Sommerauer & Müller, 2018; Wen & Looi, 2019).

In terms of language learning and AR there have been attempts to provide an insight into the affordances of this ground-breaking technology into the pedagogy of teaching languages. Although relevant research is still at an early age, some recurrently cited affordances of AR focus on students' increased motivation and engagement (Akçayır & Akçayır, 2017; Binhomran & Altalhab, 2021; Tsai, 2020; Wen, 2021; Valero & Berns, 2024). In a similar vein, AR provides authenticity and opportunities for meaningful communication (Parmaxi & Demetriou, 2020; Punar et al., 2022, Panagiotidis, 2021) and improved cultural awareness (Boboc et al., 2022, Papanastasiou et al., 2019; Chen et al., 2023). Additionally, there have been several studies that noted increased levels of learner confidence and reduced levels of anxiety (Panagiotidis, 2021; Pegrum, 2021; Lin & Yu, 2023). Likewise, there has been reported improved learning performance in a variety of language competencies and components (Akçayır & Akçayır, 2017; Tobar-Muñoz et al., 2017; Rozi et al., 2021; Wedyan et al., 2022; Liao et al., 2023) as well as increased learner achievement (Akçayır & Akçayır, 2017; Parmaxi & Demetriou, 2020; Panagiotidis, 2021; Punar Özçelik et al, 2022). There have also been a few studies that have successfully investigated the extent to which AR supports embodied and active learning (Pegrum, 2021) as well as the influence of AR and its impact on the development of 21<sup>st</sup> century skills (Akçayır & Akçayır, 2017). It is also crucial to mention that although there are encouraging results about the appropriateness and the effectiveness of AR as a pedagogical tool, there is still room for more studies that necessarily need to include educators in the design and the implementation phase of AR application interventions (Prieto et al., 2014). In that view, there was an attempt to design, develop and evaluate an AR-supported language learning experience so as to capture the participants' perceptions about it. In particular, the study focused on answering the following research question:

RQ: What are the participants' perceptions about the AR-supported language learning experience?

# Materials and Methods

# Design of the AR Language Learning Experience

An AR-supported language learning experience entitled 'A Tour ARound Europe: Next destination... Italy' was designed. The main purpose of this AR-supported language learning experience was to offer A2 CEFR primary-school students additional language practice of receptive and productive skills with a focus on pre-taught vocabulary and an opportunity to explore, describe, and present features of Italy. Figure 1 depicts the conceptual framework under which the educational intervention was designed. This framework provides a structured approach to understanding the components and relationships involved in the design of the learning experience. Initially, we defined clear learning objectives, in this case to understand and use basic English phrases and vocabulary related to touring Italy.



Figure 1: Conceptual Framework

Our objectives were aligned with the current curricula of CEFR A2 students. The communicative approach can be found at the heart of this framework as it emphasizes the importance of interaction and communication in the learning process. In the case of the ARsupported learning experience learners were engaged in meaningful communication as they adopted the role of a tourist following a virtual tour of Italy. Informed by our learning objectives, the instructor designed specific AR-supported tasks with the use of MirageXR, an application that allows teachers to use AR authoring tools. The tasks aimed at being interactive, purposeful, and contextually relevant. The AR-supported activity enabled learners to virtually visit Italy and interact with an AI-empowered 3D character. Our approach to task design is deeply rooted in constructivism which posits that learners construct knowledge through experiences and interactions. Orchestration of classroom activities was also considered. This includes making decisions about how to manage resources, and student interaction strategies for facilitating group work, guiding discussions, and providing feedback. In this case, a rotation model was considered as only one AR device was available. Students worked in pairs or in small groups and could work in the first station with the ARsupported activity and then complete tasks that were informed by their AR-supported experience. Moreover, adjustments had to be made to the classroom setting, which included rearranging the seating and grouping to provide learners with adequate space to move around while interacting with the AR. The culmination of these elements leads to our learning experience design. This holistic design integrates the communicative approach, clear learning objectives, thoughtfully crafted tasks, and constructivist principles to create engaging and effective learning experiences. The goal is to provide learners with opportunities to actively engage, reflect, and construct knowledge in meaningful ways using AR.

# Description of the AR-Supported Language Learning Activity

'Tour ARound Europe: Next Destination...Italy' is an AR language learning activity designed to last approximately 60 minutes with the students working in pairs or in small groups to immerse themselves into the culturally rich landscape of Italy and to explore various aspects of the country, while using the MirageXR app. In this immersive experience, learners interact with an AI-empowered 3D character called Francesca, who serves as their tour guide. They can ask Francesca questions and receive answers, enhancing their engagement and understanding. The experience also includes 3D objects such as the famous Italian ice cream (gelato), the Mona Lisa's painting, and a map of Europe for learners to have an overview of where Italy is located. Additionally, pictures of an Italian couple, famous Italian monuments, and the Italian flag are used to enrich the visual context (see Figure 2). Audio messages provide instructions to learners for task completion, ensuring a seamless and interactive learning journey. This AR activity is divided into three stages.



Figure 2: Students navigating through some steps of the AR activity

a) Before the AR activity, learners worked in pairs or small groups and noted down what they already knew about Italy. Next, learners were introduced to the worksheet they would use during the AR activity and took time to familiarize themselves with it. They also learned about the concept of the tour guide, who will be guiding them through the experience. Finally, learners worked together to form questions about the things they would have liked to ask the tour guide about Italy and assigned each other different roles for the activity completion.

b) During the AR activity, learners navigated themselves through a seven-step process while using the Mirage XR app and their worksheet. First, they meet their tour guide, a 3D AI-empowered character, called Francesca. She introduces herself and encourages learners to ask her questions. In the second step, learners explore basic information about Italy with the help of a 3D map of Europe and the tour guide. They can ask Francesca about the capital city, the language, the terrain of Italy, and the colours of the flag. Step 3 focuses on famous

landmarks, where a picture depicting three of the most iconic Italian landmarks as well as the tour guide help learners enrich their knowledge about them. In the fourth step, learners explore Italian food inspired by a 3D ice cream model and the tour guide. In Step 5, learners engage with augmentations that include a 3D painting of the Mona Lisa, an audio message and the tour guide. They listen to the audio message related to Leonardo Da Vinci and have the opportunity to pose questions to the tour guide about him and his famous painting, while observing it from a close distance. In Step 6, learners receive some information about Italians through an audio message, a picture of an Italian couple, and the tour guide, who is ready to answer any questions related to the picture. Finally, in Step 7, learners reflect on what they liked most about Italy and anything else they would like to learn about the country with the help of the 3D AI-empowered character.

c) After the AR activity, learners were engaged in various follow up tasks depending on their interests and abilities. For instance, some of them made presentations whereas others wrote an email to a friend, describing their experiences during the virtual guided tour of Italy.

# Challenges

During the implementation of the AR activity, there were some practical challenges which were creatively resolved. Initially, there was a need to find sufficient compatible devices for the learners to work on. Unfortunately, only one device at school premises could support MirageXR and its features. Thus, a rotation model was considered. Another challenge was the lack of a strong Wi-Fi network, which hindered the smooth operation of the activity but was addressed through alternative connectivity solutions. Finally, adjustments had to be made to the classroom setting, which included rearranging the seating and grouping to provide learners with adequate space to move around.

# Methods

For this study, a qualitative research approach was employed to explore school students' perceptions on the effectiveness of an AR-supported language learning experience. A convenience sample was used consisting of 18 ten-year-old primary school learners with a varied mix in terms of gender, and academic achievement. Data collection involved two tools; a questionnaire and notes taken by the teacher during the activity. The questionnaire was designed to collect information from the participants in relation to different aspects of the educational experience, including its importance, value and influence, on their learning. It included both open and close-ended questions giving students the freedom to provide feedback. In addition to the questionnaire, the teacher, who was also a member of the research team, kept field notes about students' participation, engagement and reactions, while the collection of additional contextual information and supplemented the questionnaire results thus allowing the researchers to shed light on students' perspectives. In other words, both explicit responses and implicit behaviours were captured and contributed to the exploration of students' perceptions regarding the AR language learning experience.

# Analysis

A thematic analysis was performed on the qualitative data. According to Braun and Clarke (2006), a thematic analysis is a flexible yet efficient method of finding, evaluating, and summarizing patterns or themes in the data. By using this approach, the research team was

able to classify and take into consideration the diverse and rich viewpoints of the participants, which resulted in a thorough understanding of their perceptions regarding the use of AR-supported language learning experience.

For this study, manual data analysis was carried out, which involved carefully examining the qualitative data gathered from the open-ended questionnaire and the researcher's field notes. Inductively, themes were derived from the data based on the research question.

## Results

This section presents the findings with major themes and topics that emerged. For transparency, themes presented in the findings below appear in italics. The findings of this study revealed that the majority of the participants gave favourable responses and considered the AR-supported language learning experience motivating, fun and pleasant. As soon as the lesson began an 'air of excitement and anticipation' (Instructor's field notes) was evident throughout the classroom as documented by the teacher. The students eagerly got into their groups, received their device and waited for the teacher to let them begin the long-awaited AR activity. One participant, referred to as Student A, expressed enjoyment and engagement by stating 'I had lots of fun'. Similarly, Students B and C shared feelings of curiosity, surprise and satisfaction by reporting 'I didn't expect it would be so pleasant' and 'It was a pleasant activity! I had a great time'. The teacher's field notes confirm these positive perceptions, noting that 'the students' faces lit up with excitement' (Instructors' field notes) as they launched MirageXR and interacted with the AR elements and the AI character. Throughout the session the learners participated actively and even the most reluctant students were motivated. The teacher also noticed and reported that 'The classroom is filled with laughter and chatter' and a pleasant learning environment was created, while the students immersed themselves in this AR tour of Italy.

Additionally, the students and the teacher equally reported that this AR activity had an impact on the participants' English language performance and vocabulary acquisition. The students stated that this AR-supported language learning experience helped them improve their English and offered opportunities to practice vocabulary in an engaging way. More specifically, Student E and C stated respectively 'I learned more English' and 'I learned lots of new things' therefore indicating a feeling of confidence and *self-improvement*. Similarly, Student A admitted having boosted his/her vocabulary by saying 'I had fun and improved my vocabulary'. These statements were also verified by the teacher's observations reporting that students were immersed in a positive and productive learning environment, where they practiced English while interacting eagerly with each other and with the AR app and by sharing their newly acquired knowledge about Italian culture in English.

Further comments by the students revealed that they greatly appreciated the *playfulness*, *audiovisual and AI empowered elements* in the activity. As the teacher moved around in the classroom, she noticed that the 3D objects captured students' attention and sparked their curiosity. They willingly interacted with them, closely observed them so as to better understand vocabulary and concepts. The teacher noted that the combination of audio and visual stimuli, such as the 3D painting of the Mona Lisa and the gelato helped students to stay concentrated and engaged throughout the activity.

Moreover, there were comments that highlight the added value of the activity in enhancing the learners' *cultural awareness*. The students indicated that this AR-supported learning

experience provided them with information about Italy and glimpses into Italian culture and heritage highlighting the educational impact of the activity as well as a sense of discovery and engagement. Teacher's observations also verified these statements as she spotted students sharing their impressions and commenting enthusiastically on the facts they had learned about Italy during the activity and the follow-up sessions.

Finally, *joint effort* was another theme that emerged. As noted earlier, only one device was available and a rotation-model was employed that allowed students to work in pairs or in small groups. It was highlighted that students helped each other and even assigned roles to each other. One student was keeping the notes, another one was holding the device. Learning from each other and cultivating a sense of peer-learning community is an aspect that entails the potential for a more dynamic experience. However, it has to be stated that there are several issues that need improvement. Some students expressed concerns about the weak Wi-Fi connection that caused lagging and affected the smooth running of the activity. This technical issue cannot be ignored as it can ultimately affect the overall AR language learning experience, if not dealt immediately. As the teacher reported she opted for alternative connectivity resources by using the Interactive Board as a hotspot and finally resolving the issue. Additionally, a few participants complained that the *fast-talking pace of the virtual tour* guide was not suitable for their level of proficiency and that it occasionally hindered their understanding. Finally, some students asked for easier and less complicated access to the AR app, which highlights the need for more user-friendly applications that can easily be introduced and integrated into the language learning context. As AR continues to evolve, it will be crucial to address all usability concerns so as to effectively enhance AR-based instruction in the EFL classrooms.

Despite these challenges, the findings of this study reveal that the students appreciated their AR language learning experience and that they are willing to participate again in more AR activities.

## **Discussion and Conclusions**

The present study strives to capture the 18 young English language learners' perspectives on an AR language learning experience. The findings of the study have provided noticeable insights into the potential of this AR-supported language learning experience. Learners' responses and the teachers' field notes on participants' active engagement have highlighted the pedagogical possibilities deriving from this educational AR-based intervention. The components of the AR language learning activity succeeded in creating a fun and engaging learning atmosphere. This outcome is quite important as it has already been shown that active involvement and positive attitudes contribute significantly to successful language learning (Dörnyei & Ushioda, 2013).

The students' enthusiastic response and active participation emphasise the pedagogical possibilities of AR-based language instruction. The AR activity succeeded in creating a fun and naturally stimulating learning atmosphere. Intrinsic motivation and self-driven engagement resulted in students eagerly completing the task and appreciating the educational outcomes. This finding is in alignment with similar studies related to enhanced learner motivation and engagement combined with AR in language teaching (Akçayır & Akçayır, 2017; Binhomran & Altalhab, 2021; Tsai, 2020; Wen, 2021; Valero & Berns, 2024).

Additionally, this study's findings indicated that the AR-supported language learning activity had an impact on the participants' perceived vocabulary acquisition and English language proficiency. According to the participants, the AR task gave them plenty of opportunities to practice the language in an interesting, motivating, fun and satisfactory way. These results were supported by the teacher's field notes, which showed that the students were fully engaged in the task and they eagerly responded to the virtual tour guide's cues while refining their vocabulary and conversational skills. This is consistent with earlier studies that have shown how AR can help learners practice situated language and increase their communicative ability (Akçayır & Akçayır, 2017; Tobar-Muñoz et al., 2017; Hsu, 2017; Rozi et al., 2021; Wedyan et al., 2022; Liao et al., 2023).

Furthermore, cultural awareness was also raised through the activity. This is also in agreement with similar studies conducted with regard to the effect of AR in improving cultural awareness (Boboc et al., 2022, Papanastasiou et al., 2019; Chen et al., 2023). Finally, joint effort was also noted, building a sense of a supportive peer community. This is also in line with Perry's (2021) study who emphasized the importance of students engaging with one another in the learning process especially in environments that encourage interaction and cooperation.

However, the survey highlighted certain shortcomings including the virtual tour guide's talking pace and technical problems with unstable Wi-Fi connections. These results reveal how crucial it is to have reliable technology features that can be customized to meet the demands of innovative and technology enhanced lessons. Furthermore, several students asked for easier and simpler access to the AR app, underlining the need for user-friendly interfaces and clear instructions which enable the smooth incorporation of AR technology into language learning contexts of all levels.

Despite these difficulties, the students' desire to take part in more AR activities for language learning demonstrates that the advantages of this technology outweigh its current limitations. The more educators continue to explore the application of emerging technologies in the classroom the more findings and results will occur to supplement our knowledge on how AR can improve language learning outcomes and create a stimulating, immersive, and culturally rich learning environment.

This study involved a small sample size, and therefore cannot be used to make broad claims for all contexts or situations. This study can be enriched and extended with several future work recommendations, which can potentially include the design and development of more AR tours in different European cities, expanding the "Tour ARround Europe " to destinations like Spain and the UK to name but a few. Also, the interaction with the AI agent can be further enhanced by developing role-playing scenarios where the AI agent takes on different roles, such as a shopkeeper or museum guide, requiring students to use their language skills to interact in a specific context. Additional customisation can also take place by adjusting the prompts given to the AI character or by providing additional scaffolding, for instance by having key notes on vocabulary as pre-AR activity, to learners with lower proficiency levels. Additionally, the study could be expanded to include a larger sample of students from different educational levels and sectors. Moreover, the experience can also be enriched by incorporating gamification elements, such as achievement badges to motivate students and track their progress, or AR scavenger hunts during which students follow clues and solve language-based puzzles. Finally, interactive storytelling experiences can also be developed, where students make choices that affect the outcome of the story, practicing language skills

in context. Also, there can be stories that immerse students in a country's culture and provide a richer learning experience, such as participating in historical events, festivals, or simple daily life scenarios.

Looking ahead, the integration of AR into language courses has the potential to revolutionize ELT as a whole. AR may immerse learners into real-world situations, support situated practice, and offer tailored feedback. Most importantly, AR can create a sense of curiosity and enthusiasm that is crucial for successful language learning.

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