


Teachers as Augmented Reality Designers: A Study on Italian as a Foreign Language – Teacher Perceptions

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ABSTRACT

As an emergent technology augmented reality (AR) demonstrated a plethora of advantages in foreign language education, promoting motivation, memorization of contents as well as contextualized learning. However, the majority of teachers are unfamiliar with AR, and their role as designers and facilitators requires further investigation. Moreover, English is the most explored target language, and the study of AR for the teaching of Italian as a foreign language (TIFL) is limited. Therefore, the investigation explored the perceptions of educators on the experience of designing and implementing mobile AR (MAR) for TIFL. In line with other studies, findings showed that, according to teacher perceptions, MAR can promote the overall learning process. However, the study highlighted issues like the availability of open-source MAR platforms and materials specifically designed for language educators. Moreover, the need of ongoing teacher training as well as possible economical and infrastructural limitations in specific social contexts must be considered, before implementing AR on a large-scale.

KEYWORDS

AR design, Augmented Reality, Emergent Technologies, Italian Language Teaching and Learning, Language Education, Metaverse, Mobile Assisted Language Learning, Teacher perceptions

INTRODUCTION

AR enables the integration of digital layers like animations, pictures, videos or audios into the real world (Azuma, 1997). Users can interact with enhanced virtual contents by pointing their mobile device camera to an object, to a Quick Response (QR) code or to a specific place. Differently from Virtual Reality (VR) where the user is totally immersed in a digital environment, AR enables the possibility to interact with virtual contents while being immersed in the real world (Milgram & Kishino, 1994; Pegrum, 2021). Because of the possibility to be implemented by mobile devices like smartphones or tablets, it has been easy for AR to enter the world of education. Formal classroom teaching is being increasingly supported by mobile technologies (Kukulska-Hulme & Morgana, 2021; Sun & Gao, 2020) and when it is implemented for foreign language education, AR “falls into the scope of MALL [Mobile Assisted Language Learning]” (Zhang et al., 2020, p. 218).

Even though AR is demonstrating a number of advantages for language learning, a main gap referring to the role of teachers as AR content creators still needs to be addressed (MacCallum & Parsons, 2019). The majority of educators do not possess the knowledge required to design AR content

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materials (Parmaxi & Demetriou, 2020). Moreover, they are not equipped with the expertise to deal with possible issues that could arise during mobile AR (MAR) classroom implementation (Zhang et al., 2020; Khoshnevisan & Le, 2019). Therefore, studies on teacher perceptions when engaged in designing and implementing MAR activities for the language classroom are necessary, since the role of educators is crucial to support a successful integration of AR in the classroom (Bonner & Reinders, 2018; Lee, 2020). By considering teacher perceptions during the experience of “taking upon the dual role of a language teacher and AR technology designer” (Zhang et al., 2020, p. 230), it will be possible to identify teacher and student needs and, eventually, to develop a set of best practices in order to successfully implement this emergent technology and promote foreign language learning. Regarding the target languages, English and Chinese are the most explored (Parmaxi & Demetriou, 2020) and the implementation of MAR for the teaching of Italian as a Foreign Language (IFL) is limited.

Against these backdrops, the researcher implemented an Action Research study, focussing on a small group of IFL teachers in an Argentinian bilingual Spanish-Italian school. The investigation aimed to describe the experience of educators while collaborating with them in the process of designing and implementing MAR activities through the open-source tool *Metaverse*, in a context where technological and infrastructural resources can be limited. In line with other researches (Chen et al., 2020; Taşkıran, 2019), the analysis showed that according to teacher perceptions MAR has the potential to positively affect the overall teaching and learning process. However, long-term ongoing technical training for teacher is needed. Moreover, results underscored a need for open-source, code free MAR platforms designed for language teachers, as well as a necessity for educators to access online MAR learning resources in languages other than English. Finally, the study highlights the need to enable teachers to customize this emergent technology for their classrooms, avoiding the situation where MAR design is managed by information technology specialists with limited knowledge of effective pedagogies (Bower et al., 2014). Therefore, before implementing MAR on a large-scale, it is necessary to empower teachers, generating democratic access to MAR open-source tools and to learning resources free of economic and linguistic barriers.

Data collected are presented and initial findings of the pilot study discussed. The paper is structured as follows: First, an overview of AR and Mobile Assisted Language Learning (MALL) is conducted, as well as an exploration of the constructs considered to identify teacher perceptions. Afterwards, the methodology, the research aim and questions, the context of the study and the instruments implemented for data collection and analysis are presented. Subsequently, findings are described and discussed. Finally, the contribution concludes with an identification of limitations and future directions.

AUGMENTED REALITY AND MOBILE ASSISTED LANGUAGE LEARNING

Azuma (1997) originally defined AR as an emergent technology that enables the integration of computer-generated virtual objects into the real world. AR consists of a variation of VR and while VR completely immerses the user in a synthetic environment, AR supplements reality by superimposing digital contents upon the actual world. Understanding the type of connection that VR and AR establish with the real environment is crucial for their characterisation (Milgram & Kishino, 1994), since the main difference between the two technologies consists of the bridge that AR maintains with the real world (Billinghurst, 2002; Pegrum, 2021).

These characteristics of AR allowed it to be particularly suitable for the classroom. Therefore, when it is implemented through mobile devices in order to support language education, AR enters the field of MALL (Zhang et al., 2020), since MALL refers to “mobile technologies in language learning, especially in situations where device portability offers specific advantages” (Kukulskahulme, 2013, p. 3701). As a research field concerned with the consequences of the pervasiveness of mobile technologies on language education, MALL is concerned with three types of mobility: the mobility of the content, the mobility of the device and the mobility of the learner. These three types of mobility continuously blend, with the focus remaining mainly on the mobility of the learner, as in the case of the present study (Pegrum, 2021).

Advantages of Augmented Reality for Language Education

Despite its novelty in foreign language education, AR demonstrates a plethora of advantages. It “enables learning to be enhanced and contextualised” (MacCallum & Parsons, 2019, p. 21), enhancing students’ active interaction with learning materials (Solak & Cakir, 2015) as well as positively affecting motivation and engagement (Chen et al., 2020; Taşkıran, 2019). AR promotes collaboration among stakeholders as well as memorization of contents (Akçayır & Akçayır, 2017; Diegmann et al., 2015; MacCallum & Parsons, 2019). It encourages out-of-class language use (Cervi-Wilson, Brick, 2018; Thorne et al., 2019), enabling learners to implement the target language in a spontaneous way (Zhang et al., 2020) and it positively affects the overall learning process (Campbell et al. 2016; Cipresso et al., 2018). Furthermore, AR improves long-term memory retention (Radu, 2014) and it enables collaborative and situated learning (Squire & Klopfer, 2007; Thorne et al., 2019).

Despite these advantages, one of the major drawbacks is that “educators are predominantly unfamiliar with an emerging technology such as AR” (Khoshnevisan & Le, 2019, p. 72). Moreover, according to Khoshnevisan and Le (2019), more empirical studies on the process of AR content design conducted by educators are needed. In order to contribute to addressing these challenges, the researcher collaborated with IFL teachers during the process of MAR activities design and implementation. Since the aim of the study was to describe educators’ perspectives, an exploration of the theoretical framework adopted in order to identify teacher perceptions is considered fundamental in the context of this paper.

Defining Teacher Perception: Teacher Attitudes and Beliefs

To achieve the aim of the description of IFL teacher experiences of MAR design and implementation, teacher perception is considered a central construct for the study. According to Ertmer et al. (2012), as well as to Tondeur et al. (2017), teacher attitudes and teacher beliefs are two crucial concepts for the exploration of teacher perception on technology integration in classroom.

A plethora of definitions of attitude have been elaborated in a number of scientific fields. An attitude has been defined as a psychological construct (Oppenheim, 1982), as dispositions (Campbell, 1963) or memory associations (Fazio, 1990). From the number of definitions available in the literature, the researcher adopted the description elaborated by Eagly and Chaiken (1993). The two scholars defined attitude as a ‘a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor’ (Eagly & Chaiken, 1993, p. 1). Moreover, this definition was interpreted in the context of the study considering the perspective of Allport (1935) from the field of social psychology. He described the central role that attitudes have in our interpretation of the environment and in the modalities in which human beings interact with objects and people. Therefore, attitudes can be considered as individuals’ reactions to a condition, a situation or an object. Consequently, the concept of attitude as here presented plays a crucial role in exploring teacher perceptions of MAR.

The other central construct adopted in the study in order to define teacher perception is the one of teacher beliefs. According to Petko (2012), “a belief can be understood as a subjective element of knowledge that an individual considers true and important in relation to a specific subject’ and that is ‘bound up with a person’s past history, emotions, and personal values” (Petko, 2012, p. 1353). Therefore, perception is affected and shaped by the memory of previous experiences. In terms of teacher perceptions of MAR implementation, an example could be represented by a teacher that had negative experiences with a technology before. The past events create a filter able to affect future experiences.

In order to consider the concept of belief in relation to MAR adoption in classroom, the author operationalized it by adopting two crucial teacher pedagogical beliefs from the technology acceptance model (TAM), elaborated by Davis in 1989. Perceived usefulness (PU) and perceived ease of use (PEU) (Davis, 1989) are two teacher beliefs that could result in a significant barrier to meaningful technology integration (Ertmer et al., 2012; Sun & Gao, 2020). Therefore, they were considered as strong indicators of teacher perception of MAR.

PU refers to the perceived degree to which the implementation of a specific technology is considered to be able to increase an overall job performance (Davis, 1989). Similar to PU, PEU has

a direct effect on teacher perceptions of technology integration, since it relates to the degree to which a person expects that using a certain computer software or system is going to be easy (Davis, 1989). Other relevant constructs considered to be able to have an impact on defining teacher perception of MAR, and therefore adopted in the study, were teachers' levels of anxiety and comfort (Webb & Domain, 2019).

METHODOLOGY

Research Design

Considering the aim and the collaborative nature of the study, Action Research (O'Leary, 2004) was considered to be the most appropriate methodological framework, for its participatory nature and its practical focus. The research study derived from the experience of the researcher as an IFL teacher in the secondary school where the study was conducted. During this experience, the researcher was able to observe the infrastructural problems that teachers had to face when implementing a technology in the classroom and, consequently, the overall scarcity of technology implementation. However, it was only two years later, when the researcher left the school, that the study started to be scientifically developed.

The Action Research framework enabled teachers to actively collaborate in the research development with the design of the activities implemented, as well as with their insights and actions. The O'Leary (2004) Action Research model is structured in the four cyclical steps of observing, reflecting, planning and acting. Conceiving these stages as macro cycles for the implementation of the research study, the project was developed as follows:

- March - June 2021, observing: Preliminary contact with the principal and the Italian language department coordinator of the secondary school involved.

The aim of this first stage was to provide an introduction to the project, to share educational needs, as well as to negotiate modalities, time and resources with the IFL school department. This first preliminary phase was strengthened by revising the relevant literature on AR implementation for language learning. As Pine (2013) underlined, meaningful RQ in the context of Action Research “can derive not only from conversations with colleagues or classroom observations, but also from professional literature” (Pine, 2013, p. 237). Consequently, the observation cycle enabled the identification of the research problem and of the research questions.

- June – August 2021, reflecting: Professional development for teachers on MAR.

Online meetings were conducted individually in order to present the overall *Metaverse* platform as well as its main functionalities. Moreover, teachers were able to discuss their needs with the researcher and to align the MAR intervention with the school curriculum, as well as with student learning needs. During this phase, the first preliminary interviews were conducted immediately after each meeting. These pre-design and pre-implementation interviews allowed the researcher to confirm the problem identified in the literature and to explore teacher attitudes towards MAR in the pre-design phase.

- July – September 2021, planning and acting: Design of the MAR activities by teachers and plan of intervention.

Based on the observation and reflection phases, a plan for intervention was developed and shared with teachers. In order to support participants in the process of creating MAR contents for the classroom, tutorials on the main functionalities of the *Metaverse* platform were developed by the researcher and individually sent to participants. Each teacher developed her own plan of intervention

according to the school curriculum as well as to their student needs and they started to work on the MAR activities design individually.

- October – November 2021, acting: MAR implementation in the classroom.

After independently choosing and adapting materials for the creation of the MAR activities, teachers implemented them in classrooms, drawing on their individual pedagogical approaches. Students' language abilities were elicited by a number of receptive and productive tasks, according to the need of each classroom. In this acting phase, the researcher played the role of consultant and monitored the implementation. Afterwards, post-implementation interviews were conducted.

RESEARCH AIM AND RESEARCH QUESTIONS

Considering the aim of the study, as well as the scarceness of studies on IFL, RQs were elaborated as follows:

- RQ1). What are teacher attitudes towards Mobile Augmented Reality for the Teaching of Italian as a Foreign Language?
- RQ2). How do teachers describe their experiences in relation to the process of designing MAR activities for teaching for the TIFL?
- RQ3). What do teachers perceive to be the main challenges and opportunities in the implementation of MAR in the IFL classroom?

Even though the purpose of the study was to explore and describe the perceptions of IFL teachers on the experience of MAR design and implementation, the researcher maintained a focus on the transformative, critical epistemological nature of Action Research (Ivankova, 2015). By collaborating with educators, supporting them in the process of designing and implementing MAR, the researcher aimed to an empowerment of teachers in a context where the limited infrastructural, technological and human resources act as barriers to the professional development of educators as well as to the introduction of new, emergent pedagogies.

Context of the Study and Participants

The migrant history that connects Argentina to Italy determined the actual richness of IFL courses in the Country (Patat, 2004). Argentina is nowadays the second Country in the entire American continent for number of students (MAECI, 2019). Considering the importance of the Italian language and culture in Argentina as well as the backdrops from the literature, the Country is considered a purposeful context for the study.

A total of thirteen IFL teachers were invited to participate in the study. Educators were contacted with the support of the Italian consulate, which informed the Italian language department coordinator. An informed consent form was sent to educators and a total of 7 teachers decided to participate. They were all women, five had been teaching for more than 15 years, while two of them had been teaching between two and five years. They were aged from 25 to 62, none of them had implemented AR before with their students and only one of them knew about AR at the time of the study.

Metaverse

Metaverse (<https://studio.gometa.io>) is the open-source platform implemented for the study. It is designed to create educational contents through an intuitive website, where users can introduce a number of contents in different templates. Contents can be audio or video files, weblinks, animations or YouTube pages, as showed in Figure 1. Each template corresponds to a 'scene', that students are able to access by scanning a QR code through the related mobile App (Figure 2). Scenes are linked in order to create an AR experience, without the need to be able to code or program. Because of these

Figure 1. Sample screen of Metaverse Studio creator with an activity designed by an IFL teacher (Metaverse, 2022)

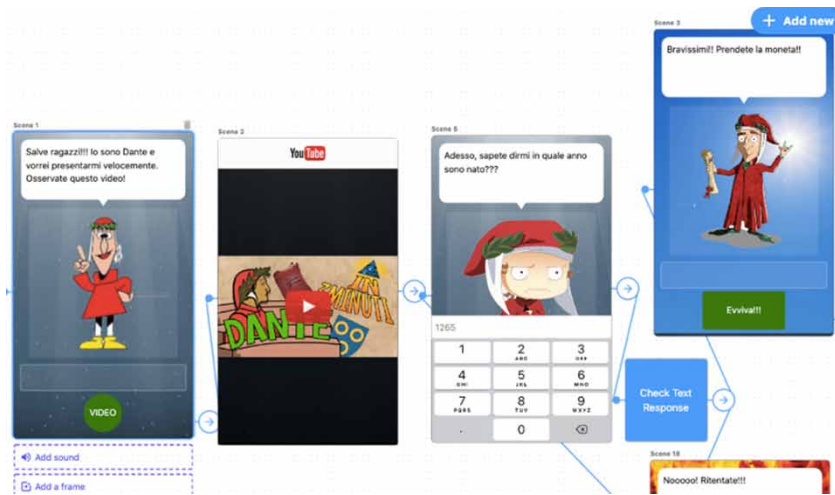


Figure 2. Sample screen of Metaverse Studio App content as accessed by students (Metaverse, 2022)



features and because it is freely available both for Android and iOS, the Metaverse Studio App was chosen among others with more elevated costs and longer learning curves (like Aris, Zapworks or Minsar), that could have resulted in a more time consuming and cognitively overloading experience for teachers.

Data Collection

Data collection was conducted for a semester through semi-structured pre- and post-implementation interviews. Four of the seven teachers that participated to the study were interviewed. With the aim of verifying the impact of the project on their perceptions of MAR implementation in their classrooms, as well as on their teaching praxis, teachers were interviewed twice, at the beginning and at the end of the project. The pre-design and implementation interviews were conducted during the reflection

phase of the research design (June-August 2021), while the post-design and implementation interviews were conducted after the action phase (November 2021). Therefore, a total of eight individual semi-structured online interviews were video-recorded through the platform of Google Meet and the average length was between 45 to 55 minutes.

Participatory observations during the MAR activities design phase should have been conducted and field notes collected. However, the researcher was not authorized to enter the field in this phase of the study because of the restrictions imposed for the Covid-19 pandemic. Therefore, data on MAR design were collected through questions added to the post implementation interviews. The purposes of the interviews conducted at the beginning of the research study were to analyze teacher attitudes towards MAR in terms of:

- anxiety and comfort in relation to the idea of learning how to design MAR activities
- MAR's expected impact on students' motivation
- expected advantages and disadvantages of MAR integration
- possibilities or difficulties to adjust MAR to the school syllabus.

Moreover, the preliminary interviews aimed at exploring teachers' digital literacy, their actual implementation of technology in the classroom at the time of the study and their needs regarding education and training on emergent technologies.

Post implementation interviews investigated the same constructs of the preliminary phase, in order to explore the consequences of the MAR design and implementation phases on teacher attitudes. Furthermore, questions related to the perceived Task Technology Fit, the PEU (Davis, 1989) and to the future motivation to use MAR in the classroom were asked.

DATA ANALYSIS

Data were analyzed by the author of the study with a Reflexive Thematic Analysis (RTA) method (Braun & Clarke, 2021). The choice of this approach was based on the crucial role that it provides to subjectivity in the construction of knowledge, since it is considered as fundamental in the research process. The author of the study was aware that her role as a researcher in the context of an Action Research study would have had an impact on participants' perceptions of the experience, and vice versa. Therefore, it was important to reflect on how the author's and participants' systems of values would have influenced the entire process of data collection and perception. Since data were not conceived as having to fit in a pre-existing framework of theoretical constructs, the analysis was conducted through an inductive bottom-up approach to data content (Braun & Clarke, 2021). Such a perspective allowed the researcher to explore new ways of conceptualizing MAR implementation starting from teachers' observations, assumptions, and belief systems.

Data analysis was undertaken following the six phases of Braun and Clarke (2021) RTA. As the authors of the approach underline, these phases are not linear, but they consist of a recursive process that moves back and forward throughout the dataset, until the final structure is reached. The first phase of the process is the familiarization, that the researcher undertakes by manually transcribing the interviews first, and by reading them repeatedly afterwards. During this phase, the researcher identified a number of interesting points for analysis, that were organized in a more systematic and rigorous structure through the coding phase, during which more than 60 codes were identified.

During the several attempts to organize the codes into a theme structure in the third phase of the analysis, the researcher reflected on the fact that the clusters identified were reflecting micro differences in the dataset. Therefore, codes could have been organized in more broad patterns of meaning that would have inductively led to a theme structure able to describe the dataset. Transcripts were read and analyzed again, going back to the coding phase and reflecting on the RQs, as well as on the questions asked in the interviews and a total of 30 codes were identified. Starting from these new codes, it was easier for the researcher to cluster them in broader patterns of meaning, that were

identified in two main overarching themes (Braun & Clarke, 2021), being respectively: impact of MAR on teaching and impact of MAR on students.

However, reflecting on the descriptive aim of the study the researcher realized that this structure was too broad to describe the internal and more subtle aspects of teacher attitudes and perceptions regarding the experience. Henceforth, the author adopted a more deductive approach to data interpretation, developing a final structure of six themes, five sub-themes and 30 codes. Finally, in the fifth phase of the analysis, themes and sub-themes were refined, defined and named according to the core concepts they clustered and organized in relation to the RQs, as can be seen in Table 1.

Table 1. Coding scheme of the interviews

	Themes, Subthemes and Codes
RQ1	I. MAR EXPECTED IMPACT ON STUDENTS
	<ul style="list-style-type: none"> • Enhancement of motivation Multimodality Interactivity Gamified approach • Improvement of learning outcomes Promotion of contents retention Promotion of autonomous learning • Implementation of smartphone as a pedagogical tool Smartphone as a collaborator Post pandemic need of smartphone implementation Smartphone as a distractor
	II. MAR EXPECTED IMPACT ON TEACHING
	<ul style="list-style-type: none"> • Improvement of teaching Student centered approach Improvement of teacher skills • Anxiety for lack of teacher training Lack of courses on new technologies Inappropriateness of courses on new technologies
RQ2	I. AR TOOL FEATURES
	Easy to learn Easy to remember Necessity to keep using it Need for learning material not in English Sometimes complex to use
	II. OVERALL DESIGN EXPERIENCE
	Stimulating Interesting Sometime complex Necessity to be tutored
RQ3	I. MAR OPPORTUNITIES
	Motivating for students Engaging Possibility to include smartphone as a teaching tool Possibility to implement it regularly Easy to align with the curriculum Possibility to use it with more complex features
	II. MAR CHALLENGES
	Technical problems with the App No internet connection available at school Internet connection problems with students' smartphones'

FINDINGS AND DISCUSSION

Findings are presented and discussed with reference to the RQs. Data extracts are translated into English from Italian for the purpose of this paper, following the recommendations of Resch and Enzenhofer (2018) on cross-language and multilingual research.

RQ1. Theme I: MAR Expected Impact on Students

Regarding the first RQ, it can be stated that IFL teachers that participated in the study have positive attitudes towards MAR, as described by the themes ‘MAR expected impact on students’ and ‘MAR expected impact on teaching’. Regarding the first theme, teachers consider MAR an effective tool to enhance motivation, to improve learning outcomes and to promote a pedagogical implementation of smartphone. Teacher 2, for example, claimed: “Well, I think it’s absolutely engaging, because students are in a completely different situation to what they’re used to in the classroom” (Teacher 2).

Therefore, the first sub-theme for the theme ‘MAR expected impact on students’ was named ‘Enhancement of motivation’ and it shows how, according to teacher perceptions, MAR can promote an active interaction with learning contents through three elements, indicated by the three codes of the theme, that are respectively ‘multimodality’, ‘interactivity’ and ‘gamified approach’. Teacher 4 said that MAR “It is more similar to games, to what students are used to do every day. I think that it’s going to be very inspiring and engaging for them” (Teacher 4). These teacher beliefs are in line with results from other studies, that demonstrated the impact of AR on the improvement of students’ motivation, enjoyment and relationship with the group (Chen et al. 2020; Taşkıran, 2019).

The second subtheme for ‘MAR expected impact on students’ is called ‘Improvement of Learning outcomes’ and it relates to teacher beliefs regarding the possibility of MAR to promote ‘contents retention’ and ‘autonomous learning’ (being these the two related codes). Teacher 1 stated that: “It seems to me that it [Metaverse] allows this thing of learning autonomously. By watching a video or reading something, students can learn in the way that they prefer, while advancing in the activity ” (Teacher 1). Similarly, teacher 3 said: “Well, I think that this is useful not only to introduce something new, but especially to fix and retain contents” (Teacher 3). These results are in line with studies that showed how AR implementation in classroom had positive impact on long-term memory retention (Radu, 2014) and contents memorization (Campbell, 2016; Cipresso et al., 2018).

The last sub-theme identified for the expected impact of MAR on students is named ‘Implementation of smartphones as pedagogical tools’ and it describes teacher perceptions on the implementation of smartphones in classroom. The three related codes are ‘Smartphone as a collaborator’, ‘Post-pandemic need of smartphone implementation’ and ‘Smartphone as a distractor’. The first two codes show how teachers have a positive perception of smartphone implementation promoted by MAR, considering it a ‘collaborator’ and a tool that, especially after the pandemic, has become essential for classroom teaching. Teacher 2 said in this regard: “Well, so far smartphones have been enemies of teaching. Now, with this kind of instrument, I feel that smartphones become like friends. It passes from being an enemy to be a friend, a collaborator” (Teacher 2). Moreover, teacher 4 observed: “Well, between smartphones and their hands there is nothing (laughs). Students are used, especially after the pandemic, to use smartphones at school and FOR the school (0.2). So, this [Metaverse] can help to see them as pedagogical tools” (Teacher 4). Therefore, MAR promotes a pedagogical implementation of smartphones, that from a teacher perspective is perceived to be necessary, especially after the Covid-19 pandemic.

The last code is named ‘smartphone as a distractor’ and it describes the perceived downside of MAR according to teacher perception. Teacher 4 said: ‘There is a risk that they are using smartphones to do something else’ (Teacher 4) and teacher 6 observed: ‘We should find a strategy to design the activities in a way that it is so engaging for them that they won’t be doing other things’ (Teacher 6). This code is interesting because of the novelty of the phenomenon. A plethora of studies focused on the advantages of smartphones implementation for language teaching (Godwin-Jones, 2017; Lee, 2020). However, more research is needed in order to identify the challenges that smartphone implementation in the classroom could enable (Metruk, 2022).

RQ1. Theme II: MAR Expected Impact on Teaching

Theme 2 explores the constructs of PEU, PU, Anxiety and Comfort strictly in relation to the teaching process, differently from Theme 1 that focused on the expected MAR impact on students' motivation and learning. The first sub-theme is called 'Improvement of Teaching' and it is in line with other results that showed the advantages of AR to promote student-centered learning and creativity (Diegmann et al., 2015). According to teacher perception, MAR has the capability to reduce a perceived gap among teachers and learners by promoting a more student-centered approach. The related codes are indeed 'Student centered approach' and 'Improvement of teacher skills'. Teacher 3 said for example that MAR 'definitely adds something, gives us more resources. Especially because students have changed, so we have to adapt' (Teacher 3). Moreover, teacher 5 explained that:

"I think that when we face something new, we all have some fear [...] But one must be brave (laughs) and cross that border, otherwise you risk to stay in class in the same way you did thirty years ago, when students were completely different (Teacher 5).

However, the second sub-theme is in contrast with the first one and it is called 'Anxiety for lack of teacher training'. The related codes are 'Lack of courses on new technologies' and 'Inappropriateness of courses on new technologies'. These codes describe the anxiety that participants of the study were expecting to experience when learning how to design and implement MAR. Therefore, this last sub-theme is particularly valuable for this study, since it identifies those limitations and challenges that teachers have to deal with in order to implement MAR in different social and cultural contexts.

Furthermore, teachers expected MAR to be easy to learn and use, saying for example that the Metaverse "Seemed simple, perhaps the most difficult thing is to translate the page into Spanish. But it seemed quite understandable. I mean, the basic things seemed simple, then there are a lot of more complex things that you can do" (Teacher 1). However, teachers expressed some anxiety, due to the limited professional support that they always received from their institution at the moment of implementing new technologies. Teacher 1 and 2 said, for example: "The school has few times offered courses. This was when the Office package first appeared, Word, Excel. After this, nothing. Nothing, nothing at all! (Teacher 1). "No, absolutely not. The school never supports us in learning new things. And during the pandemic, it has really been self-learning" (Teacher 2).

Moreover, educators highlighted the need to access online learning resources on Metaverse Studio in languages other than English, showing other difficulties related to linguistic barriers. Maybe the most insightful extract on what it really means for a more than sixty year old teacher to learn how to implement an emergent technology such as AR is the following:

"Everything that has to do with technology it is always a challenge for me. I feel scared, powerless, but there is a desire to learn! Now I am having trouble to understand how this App works, but I know it's a matter of trying and trying again until you can do something. Then the satisfaction that you feel when you can do these things is very big! When I was a child television was black and white (laughs) and today I'm thinking of using a smartphone to give a lesson! The distance is enormous for me!" (Teacher 2).

RQ2. Theme I: AR Tool Features. Theme II: Overall Design Experience

While the first part of the analysis referred to the expected difficulty of MAR design and implementation according to teacher perception, the second RQ aims to describe the actual experience of designing MAR activities. The two themes identified in the data are 'AR tool features' and 'Overall design experience'.

Regarding the first theme, overall, teachers described Metaverse as an easy tool to learn and use. However, some teachers underlined the need of learning material in languages other than English, as well as some difficulties in remembering how to use the platform after leaving it for a while. The

related codes are indeed 'Easy to learn', 'Easy to remember', 'Necessity to keep using it', 'Need for learning material not in English' and 'Sometimes complex to use'. Teacher 1 said for example:

"The experience was truly motivating for several reasons. Mainly because the tool being predictable, accessible and intuitive it made me want to improve the activity continuously. I could think of thousands of ideas that were possible to carry out, in my case almost all related to the Italian culture more than to the language itself" (Teacher 1).

Regarding the overall experience, according to teacher perceptions it was 'Stimulating' and 'Interesting' (as the related codes suggest). However, teacher also described the experience of designing MAR activities as 'Sometimes complex' and with a 'Necessity to be tutored'.

RQ3. Theme I: MAR Opportunities. Theme II: MAR Challenges

After implementing the MAR activities that they designed, teachers were interviewed on the main challenges and opportunities that they faced during this experience. Overall, teacher perceptions after the implementation confirmed the expectations they had at the beginning of the study. Consequently, the codes related to theme 1 are: 'Motivating for students', 'Engaging', 'Possibility to include smartphone as a teaching tool', 'Possibility to implement it regularly', 'Easy to align with the curriculum' and 'Possibility to use it with more complex features'. Teacher 3 observed, for example: "It is more interactive, very similar to games, to what they are used to do with their phones. The possibility to use mobile phones, with characters close to their world, was very engaging for students" (Teacher 3).

However, some technical problems were experienced as well during classroom implementation, as demonstrated by extracts like:

"When we started to use it [MAR] students were very engaged. Then it started to freeze, and I saw that students were not engaged anymore. In the future, if there are problems and the group is not involved, I won't implement it" (Teacher 2).

Therefore, even though the implementation confirmed teachers' positive attitudes towards MAR, a number of challenges were experienced. The codes related to this aspect are 'Technical problems with the App', 'No internet connection available at school' and 'Internet connection problems with students' smartphones'. Consequently, the implementation phase underlined two fundamental issues. On the one hand, specific technical problems of the MAR App employed could cause a decrease of interest towards future implementation in the classroom. On the other, infrastructural and economic limitations of specific social contexts have to be considered before implementing AR on a large scale, in order to avoid a broadening of the digital divide.

CONCLUSION

With the purpose of addressing the main gaps in the literature of MAR implementation for foreign language teaching and learning, the researcher implemented an Action Research study (O' Leary, 2004). The aim was twofold: on the one hand, it aimed to a description of IFL teachers' experiences of MAR design and implementation. On the other, the purpose was to collaborate with educators in a specific context in order to enable them to customize and autonomously implement an emergent technology such as AR. Moreover, the study addressed the importance to investigate languages other than English (Parmaxi & Demetriou, 2020).

During the pilot study data were collected through online semi-structured interviews, during the pre- and post-MAR design and implementation phases of the study. According to the initial findings, IFL teachers in Argentina have positive attitudes towards MAR, since it is perceived as a technology

able to enhance students' motivation, as well as to promote learning and contents retention through interactivity, multimodality and a gamified approach (Pegrum, 2021; Taskiran, 2019). Moreover, MAR is perceived to be an effective pedagogical tool by teachers, able to implement a student-centered approach, to narrow a perceived gap between teachers and students, as well as to promote autonomous language learning (Diegmann et al., 2015).

Furthermore, MAR is considered as a tool to enhance a pedagogical implementation of smartphones, considered necessary after the Covid-19 pandemic. Moreover, MAR could avoid the cases in which students could be distracted by inappropriate smartphones use in classroom. However, more research is needed in order to identify the possible challenges to be addressed when implementing smartphones for foreign language teaching (Metruck, 2022). Regarding MAR feasibility and learnability, teacher perceptions were positive since they considered the Metaverse platform easy to work with. However, for some participants it was perceived as complex and not easy to undertake. This aspect would benefit from more research, in order to understand what are the specific variables that influence teacher perceptions. Moreover, the design experience highlighted the need for long-term, ongoing teacher training programs, as well as the need for learning materials in languages other than English.

Regarding MAR implementation, both opportunities and challenges were experienced. Teachers confirmed their positive attitudes, however two main issues emerged. On the one hand, the decrease of interest towards future implementation of MAR both from teachers and learners if technical problems of the App are not solved. On the other, the difficulties that the implementation of MAR must face in a Country where infrastructural and economic resources are different from most of the countries where research has been conducted so far. Future directions should be aimed at overcoming economical and linguistical barriers, before thinking of implementing AR on a large-scale. Moreover, the development of learning materials and resources freely accessible online in languages other than English could support teachers in different parts of the world during the process of autonomously learning to implement MAR. Finally, open-source, code free, MAR platforms specifically designed for language teachers should be developed, in order to enable teachers to choose the MAR resources more appropriate for their needs and students.

However, few limitations must be addressed. Even though the study implemented a purposeful sampling aiming at a multi-perspectival, emancipatory and deconstructive interpretation of the results, it must be considered that large-scale investigations regarding the implementation of MAR for the TIFL are necessary. Teachers have the first responsibility in including MAR in the classroom, therefore more studies on teachers' experiences of MAR design and implementation in specific contexts could contribute to a better understanding of teacher needs. In order to achieve this goal, participatory observation consists of a crucial tool for researchers. As previously explained, in the context of this study it was not possible to enter the field because of the restrictions related to the Covid-19 pandemic. A collection of data through classroom observations would have further enriched the results, giving a more insightful view on teacher needs, on teacher-students interactions as well as on the overall perception of the AR tool. In conclusion, a consideration of the limitations and of the issues discussed in the context of this paper could direct towards a narrowing of the digital divide, that a technology like AR risks to broaden if its integration in education is not concerned with specific teacher needs and resources in multiple linguistical, economic and cultural contexts.

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APPENDIX 1

Table 1. Coding scheme of the interviews

	Themes, Subthemes and Codes
RQ1	I. MAR EXPECTED IMPACT ON STUDENTS
	<ul style="list-style-type: none"> • Enhancement of motivation Multimodality Interactivity Gamified approach
	<ul style="list-style-type: none"> • Improvement of learning outcomes Promotion of contents retention Promotion of autonomous learning
	<ul style="list-style-type: none"> • Implementation of smartphone as a pedagogical tool Smartphone as a collaborator Post pandemic need of smartphone implementation Smartphone as a distractor
RQ2	II. MAR EXPECTED IMPACT ON TEACHING
	<ul style="list-style-type: none"> • Improvement of teaching Student centered approach Improvement of teacher skills
	<ul style="list-style-type: none"> • Anxiety for lack of teacher training Lack of courses on new technologies Inappropriateness of courses on new technologies
RQ3	I. AR TOOL FEATURES
	Easy to learn Easy to remember Necessity to keep using it Need for learning material not in English Sometimes complex to use
	II. OVERALL DESIGN EXPERIENCE
RQ3	Stimulating Interesting Sometime complex Necessity to be tutored
	I. MAR OPPORTUNITIES
	Motivating for students Engaging Possibility to include smartphone as a teaching tool Possibility to implement it regularly Easy to align with the curriculum Possibility to use it with more complex features
RQ3	II. MAR CHALLENGES
	Technical problems with the App No internet connection available at school Internet connection problems with students' smartphones'