

Exploring Augmented Reality Affordances for Media Literacy in the EFL Context

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Abstract: The ever-evolving information and communication technologies (ICTs) have affected the learners' preferences for on-demand and on-the-spot access to information that challenge the traditional classroom practices and call for a reconstruction of curricula. New educational approaches are to be encompassed so as to align with the tech-savvy Generation Z needs and the contemporary digitized world that demands competences and skills for successful and well-informed personal and professional choices. Nevertheless, consumption and creation of new knowledge in the plethora of the new crowdsourced information ecosystem have to be critically accessed, analyzed, evaluated, and leveraged so as to lead to creativity and innovation. This paper is a report of the design of an educational intervention with the intent to enhance students' media literacy skills in the English as a Foreign Language (EFL) secondary education context leveraging immersive technologies. In the first part there is a review of related work leveraging AR affordances in the EFL context. The second part explores the instructional design and pedagogical framework that AR assets can enrich a course material on media literacy for inclusive education practices taking into consideration students' preferences on their learning process.

Keywords: augmented reality, media literacy, EFL, secondary education, instructional design

1. Introduction

Technology has revolutionized the way we live, work, learn about and experience the world. The new generation of learners, *Generation Z*, and the one that succeeds it, *Generation Alpha*, were born in the world of Internet and ubiquity of handheld devices. As such, they have access to new knowledge and information that derives beyond the traditional brick-and-mortar education, leveraging the affordances of on-the-spot and on-demand answers to questions that previous generations did not enjoy. The teacher is no longer the authority of knowledge transfer nor is the school textbook, leading learners to demotivation and disengagement. These distinct characteristics can be interpreted as a personalized learning experience, based on individual needs and preferences, to either acquire a general perception of what the world we live in is like, or pursue an answer to a specific question with the intent to fill gaps of knowledge. To add to this, the ever-evolving new technologies combined with the recent COVID-19 restrictions and unprecedented and abrupt need to educational shift to virtual environments has transformed the educational landscape and enhanced the appreciation of their affordances by the broader learning community. Though there were considerable educational interventions with the use of technologies long before the COVID-19 era, the recognition of their value to seamlessly continue the learning process opened new doors and prospects, accelerated our digital skills development, and thus led to our awakening to the need of creating new paths to learning and transforming the educational landscape (Bozkurt et al, 2020).

The integration of emerging media into lesson content has brought about new opportunities for learners' engagement, motivation, and satisfaction as it allows for enrichment of the way they experience the learning process making connections to the real world. The ubiquity and pervasiveness of mobile devices, this new reality, can positively influence the learning ecosystem, leveraging what new technologies have to offer, making the invisible visible, and the inaccessible accessible at a low cost. In light of this, when it comes to language learning, especially in an interdisciplinary approach with Content and Language Integrated Learning (CLIL), the multimodality of Augmented Reality (AR) and Virtual Reality (VR) can be seen as a successor of past Computer-Assisted Language Learning (CALL) and Mobile Assisted Language Learning (MALL) that can help students personalize their learning experience gaining significant insights on comprehension and analysis of abstract notions and poor contextualization of learning objects. This multimodality aspect aligns with the Universal Design for Learning (UDL) principles (CAST, 2011), as these principles, namely, multiple means for representation, engagement, and action and expression find fruitful ground to be implemented in the instructional design of AR/VR activities, providing learners with an inclusive, rich learning experience. Additional benefits focus on information overload management; collaboration; communication and sharing; creation; and problem-solving.

The paper consists of two main parts. In the first part there is an exploration of Augmented Reality practices in the EFL secondary education context, and insights gained based on what literature suggests. In the second part there is a report of steps taken to design an extensive 4-month course for a project for EFL learners on a transnational level, leveraging the ARTutor App affordances that do not require any sophisticated ICT skills on behalf of the instructional designer. A pre-course survey informed the analysis stage of learners' needs, competences, and learning preferences. The design of the course was based on a participatory culture that learners had their own voice on selecting the type of augmentations to be added to and enrich the materials developed and assessment method.

2. Review of related work

Latest trends in technologies, such as Augmented Reality (AR) technologies have already been successfully leveraged by industry, science, commerce, tourism, engineering, training, to name a few fields, as digital content is superimposed over real objects enriching the physical world with additional information in real time (Azuma, 1997). They have also started to gain field in the educational context as they may enhance the learning experience and accommodate learners' diverse needs. As Lytridis and Tsinakos (2018, p. 1) posit, "Augmented Reality is a technology which enriches human senses and mixes real and virtual environments, leading to a new, more informative and stimulating environment". As such, AR applications have a positive effect on educational outcomes such as learner achievement, attitude, motivation, attention, and retention in the learning process (Mustafa & Tuncel, 2019). Literature suggests that enhancing learning achievement and motivation are the most obvious findings from AR and VR research (Bacca et al., 2014; Akçayır & Akçayır, 2017; Khoshnevisan & Le, 2018). Papanastasiou et al. (2019) contend that it is the learner-centered experience and flexibility in discovering and constructing knowledge at their own pace that immersive technology property allows for added value to the learning process. Enriching the content with materials in different modalities such as auditory stimuli, written text, infographics, images, videos, 3D models, etc, on the premise that they are based on a well-informed instructional design, as Akçayır and Akçayır (2017) note, diminishes the cognitive load, stress and anxiety levels (Liu, 2009). Accordingly, in the special education context, assistive technologies can also play a crucial role in facilitating the learning process of learners that may be either physically or cognitively challenged with the integration of multimedia elements (Lee, 2007; Dunleavy et al., 2009; Forsyth, 2011; del Cerro Velázquez & Morales Méndez, 2018; Quintero et al., 2019).

Blyth (2018) posits that developers are currently making VR and AR more accessible, more user-friendly, and with cheaper versions of existing products. These features expand possibilities of CLIL approach to be incorporated in the foreign language learning context, by providing realistic and authentic situations through emotional auditory and visual stimuli. As such, students have a better understanding of languages and cultures in a 'virtually authentic' context from a sociocultural perspective. Zhang, Wang, and Wu (2020) stress the sociocultural aspect of language acquisition valuable insights into the development of human language from a psychological perspective. They reference Lantolf et al.'s (2015, p. 207) recent definition of sociocultural theory (SCT) as a theory of mind that acknowledges that "human mental functioning is fundamentally a mediated process that is organized by cultural artifacts, activities, and concepts", denoting key constructs in SCT, including mediation, internalization, and the Zone of Proximal Development (ZPD) as essential components of meaningful and long-lasting learning experiences.

In the context of adolescent foreign language learners, Kucuk, Yilmaz, and Goktas (2014) investigate learners' achievement, attitude, and cognitive load levels when learning English as a foreign language with the aid of AR. A book was created with the aid of marker-based technology and Metaio Creator software, and materials were additionally supported by English pronunciation. The implementation phase involved four sessions, in computer laboratories and under the guidance of teachers to ensure digital skills capability. Findings reveal that cognitive load levels and anxiety of students are low when engaged in the process of self-directed learning in an AR environment. Based on Mayer's (2002) multimedia theory as a base to form AR environments, the authors note that the importance of well-designed interactive multimedia materials for learner's active participation in alignment with the learning objectives to facilitate students' experiential information processing capacity from various perspectives and decrease of cognitive load. In more recent studies, Bursali and Yilmaz (2019) conducted a survey with a mixed method, recruiting 5th grade students that were split in experimental and focus groups in order to discuss the effect of AR applications on secondary school students' reading comprehension and learning permanency. Findings reveal that the experimental group students showed a higher level of reading comprehension and learning permanency. The students also reported that

they experienced satisfaction from their participation in AR-based reading activities, and low anxiety levels. Chang, Chen, and Liao (2020) conducted a study based on Keller's (1987) ARCS learning motivation theory, namely, attention, relevance, confidence, and satisfaction to support situational classroom learning and improve performance and foreign language learning effectiveness with the use of augmented reality. The English learning scenario was supported by HD Reveal Aurasma platform and app with the intent to enhance language input and output with airport situation-related conversation themes. The experimental results, as in previous studies, revealed that the real-life AR scenarios enhanced student confidence in learning English, and applying AR teaching materials in situational context classes can provide near real-life scenarios and improve the learning satisfaction of students. Nevertheless, so far studies focus on a short-term implementation period in educational settings testing homogeneous socio-cultural student attitudes, in instructor-based selection of materials. Additionally, AR-based collaborative learning and social interaction in the EFL context in the digitally connected world has not been examined on a broad scale. According to UNESCO's (2017, p. 4) 2030 agenda for sustainable development, inclusive education systems should focus on creating more inclusive and equitable societies, ensuring that 'no one is left behind', which coupled with the need of the contemporary learner for interaction in a digitally connected multicultural context, call for further research.

3. The educational intervention

Based on what literature suggests and to fill gaps, there will be an effort to design an educational intervention that will further explore AR affordances within a pedagogical framework addressing socio-culturally diverse student populations. The present paper presents steps taken to address the needs of students of three different educational settings and countries that will interact for four months on a project on media literacy skills enhancement, with materials developed in English and on the subject matter purposefully enhanced with multimedia elements added on the [ARTutor](#) web authoring platform. ARTutor consists of a web-based application that acts as an AR authoring tool, and an accompanying mobile application that is used to access and interact with the educational AR content (Lytridis, Tsinakos & Kazanidis, 2018). The platform was chosen based on (a) free access; (b) non-IT expert requirements for an educator to leverage its functionalities; (c) students' response to the pre-course survey to state preferences on the media choices that they would like to explore in their learning process; (d) its functionalities that can accommodate a variety of augmentations, ranging from images, 3D models, audio, video, and embedded links, and (e) its compatibility with a wide range of mobile devices. Additionally, the design of the study aims to involve students in AR-based media production.

3.1 Description of the educational intervention

Based on participants' responses on media preferences, the material was produced in the ARTutor web authoring tool in order to enrich students' learning experiences in digital and media literacy skills enhancement and maximize opportunities for personalized, inclusive learning combining augmented reality (AR) affordances and language learning in a CLIL educational context. For the *Media Literacy in Practice* course, text and static presentation of digital and classroom printed material in the form of a booklet was created and enriched with 11 augmentations that include AR assets such as images-infographics, auditory augmentations, videos, and links that facilitate the implementation of the Universal Design for Learning (UDL) Principles (CAST, 2011) in the English as a Foreign Language (EFL) learning setting. More specifically, the assets added bear the following educational affordances:

- The visualization of abstract concepts allowing for dual coding connotations – *infographics*
- Auditory explanations with examples and further information on the written text to facilitate students with reading difficulties (SEN) and enhance L2 listening (and pronunciation) skills – *mp3*
- Multisensory explanations that enhance long term memory retention of information – *video*
- Gamification as a means of edutainment and alternative formative and summative assessment – *embedded links*
- A collaborative digital wall for social-constructivism approach and participatory learning to facilitate group work, evaluation, and reflection on the learning process – *embedded link*.

The material produced can be used either within the classroom setting or at students' own time, space, and pace to provide opportunities for unlimited access to supportive, personalized learning, limiting digital distraction from the learning object of the printed material. It was designed to enrich a course on media literacy based on students' prior knowledge, cognitive level, digital competences, and learning preferences and

provide opportunities for AR-based collaborative work. The multimodality employed complies with the Universal Design for Learning Principles. Theory and examples of the assets deployed in the intervention are depicted in Figure 1.

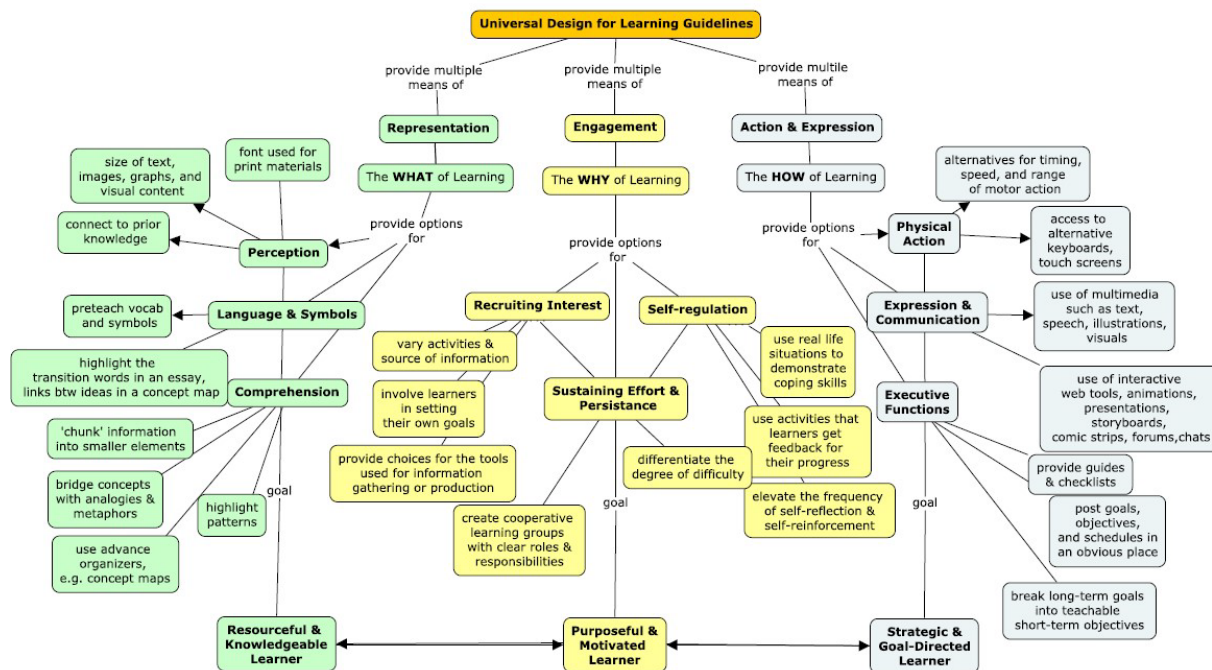


Figure 1: Theory and examples of the employment of UDL principles in the study (Lazou, 2019)

3.2 The educational purpose and goals of the intervention

The main aim of this intervention is to enrich learners' experiences in an educational setting with AR assets that seamlessly blend the physical environment with the digital content, contextualizing the EFL materials on the thematic area of media literacy. The AR-booklet assets address the UDL framework for (a) perception and comprehension of concepts, as a multiple means of representation; (b) recruiting of interest, self-regulation, and sustainable interest for engagement; and (c) physical action, expression and communication, and executive functions for action and expression, providing ample opportunities for mastery of the content and the language through inclusive educational practices (Figure 1), reaching high levels of Bloom's taxonomy. More specifically, by the end of the course the learners, with the aid of the AR assets, will be able to:

- define and list basic media literacy concepts
- identify and categorize different types of misleading information
- use the media literacy strategies to interpret news articles
- analyze, deconstruct and reconstruct information
- apply theory to check distorted truth, bias, and opinion versus fact
- evaluate and reflect on how successful they are in fact-checking
- create quality content

3.3 The implementation processes

The ADDIE model of instructional design (Kurt, 2018), that is, analysis, design, development, implementation, and evaluation was employed in the specific educational intervention. As such, in order to achieve digital and media literacy skills enhancement for the educational setting intended to be used, the following steps were taken to produce the AR enriched material for the educational intervention:

3.3.1 Analysis

- i. Analyze students' prior knowledge in L2 and their digital and media literacy background.

- ii. Analyze and determine learning objectives.
- iii. Analyze ARTutor web platform authoring affordances.
- iv. Analyze mobile learning affordances.
- v. Analyze the learning environment that is suitable to be implemented.

3.3.2 Design

- i. Design learning materials and activities in alignment with the intended outcomes.
- ii. Design multimedia elements, such as text, graphic, audio, video, and games, addressing students' responses on learning preferences.
- iii. Design the collection of triggered images for marker-based AR content.

3.3.3 Development

- i. Develop the booklet (learning contents), indicate the triggered images with clear instructions for easy-to-follow steps for students ("Scan the image for further info..."), and turn it into a pdf file.
- ii. Develop the learning contents consisting of multimedia elements that can be uploaded in the web authoring tool of ARTutor platform.
- iii. Save all materials developed in a folder for easy access when moving to the implementation phase of the booklet AR enrichment on the web authoring tool.

3.3.4 Implementation

- i. Upload the pdf file of the booklet developed (learning content) on the ARTutor platform.
- ii. Align the selected images per page to be triggered with each of the multimedia elements.
- iii. Save the new enriched booklet and download it with its corresponding QR code.

3.3.5 Evaluation

- i. Evaluate the usability of the application by testing the augmentations on the mobile app on both digital and printed form of the booklet, as depicted in Figure 2.
- ii. Collect feedback regarding user acceptance of the application from volunteer users.

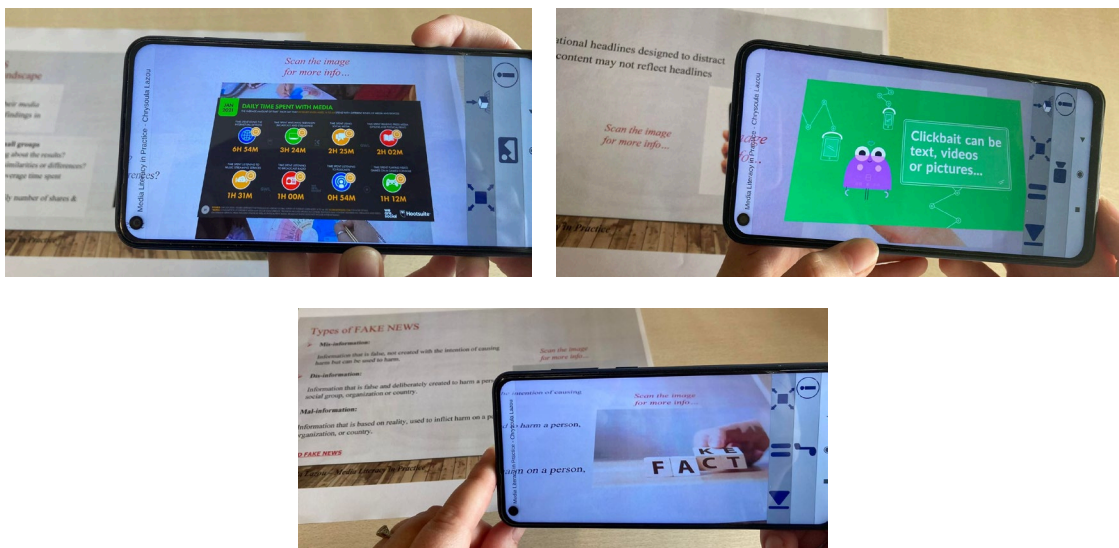


Figure 2: Examples of visual, multimedia, and auditory augmentations added to the printed material. The first figure (left) displays feedback on an activity (infographic with statistics), the second (right) a video, and the third (down) an auditory explanation on theory

3.4 Prototype implementation details and tools used

The study explores how participants can benefit from the multimodality that immersive technologies can provide learners for inclusive educational practices. To this end, there was a strategic design of activities that are in alignment with the intended learning outcomes. The augmentations added were purposefully added based on participants' responses to their learning preferences, including a variety of multisensory media and

assets that the functionalities of the platform employed support. Table 1 consists an analytical description of the activities in the booklet with the indication of the page, the corresponding learning goals, the assets that were added to enrich and add value to the material based on UDL, and the additional external tools used.

Table 1: Prototype implementation activities, learning goals, assets, tools used, and added value

Activity	Learning goal/Objective	Augmentation/Asset	Tool used	Added value based on UDL
1. My Media Landscape (p. 5)	Familiarize with types of mass media and explore media consumption trends	Infographic	Web source	Visualization of results based on statistical information/curated feedback – <i>engagement, self-regulation</i>
2. Media Literacy Core Concepts (p. 6)	Enumerate and illustrate on MIL Core Concepts	Auditory augmentation	Voice recorder	Further oral explanations of abstract concepts/ personalized learning inclusive for SEN students /listening skills enhancement – <i>perception, communication and expression</i>
3. MIL Core Concepts game (p. 7)	Check understanding	Educational game	wordwall.net	Edutainment/ alternative formative assessment approach – <i>recruiting interest, sustaining effort and persistence</i>
4. Evaluating news articles (p. 8)	Identify key strategies for MIL and develop fact checking skills	Infographic	Web source (Image from MCLA Library)	Visualization of strategies with pointers to enhance memory retention – <i>perception, language and symbols, provide guides and checklists</i>
5. Types of fake news (p. 9)	a. Categorize the types of fake news according to intentions b. Enhance vocab and L2 prefix nuances	Auditory augmentation	Voice recorder	Additional information and examples of content and language nuances (CLIL) – <i>comprehension, bridge concepts with analogies</i>
6. Clickbait explained (p. 11)	Analyze content, deconstruct and reconstruct meaning	Video	YouTube	Multisensory material to explain abstract notions with examples – <i>long term memory enhancement</i>
7. Pseudoscience vs Science (p. 12)	a. Differentiate content that is not curated but misinterpretation of scientific studies. b. analyze, compare and contrast concepts in L2	Infographic	Web source	Visualization of text that clarifies misunderstanding/L2 vocabulary enhancement – <i>language and symbols, executive function</i>
8. The Millionaire Game /Play and Learn (p. 13)	Check understanding	Educational game	Learningapps.org	Individualized formative assessment to reach mastery of content – <i>recruiting interest, sustaining effort and persistence</i>
9. The Wheel of Emotions (p. 14)	a. Analyze the power of format in the media b. Illustrate the nuances of synonyms c. Apply critical thinking skills to check emotions	Image	Plutchik's Wheel of Emotions image	Visualization and illustration of vocab on emotions nuances - colour intensity related to visual impact on emotions – <i>perception, language and symbols, comprehension</i>

Activity	Learning goal/Objective	Augmentation/Asset	Tool used	Added value based on UDL
10. MIL interactive Game (p. 15)	a. Apply new knowledge to real life context b. Evaluate L2 reading comprehension, critical thinking skills and media literacy competences	Interactive game	Quizizz.com	Reflective summative assessment – <i>recruiting interest, sustaining effort and persistence, self-reflection</i>
11. “Collaborative Digital Wall” - Consumption and creation of information based on MIL key strategies through collaborative learning (p. 2)	a. Develop digital, social, soft, and critical thinking skills b. Evaluate new knowledge c. Create new content d. Reflect on the learning process	Interactive digital wall for collaborative /Participatory learning experience	Padlet.com	Social constructivism learning in online environments. Interactive digital wall for collaborative learning/collection of artifacts/ reflection (ePortfolio) – <i>self-reflection, communication, action and expression</i>

4. The potential benefits and considerations

4.1 The potential benefits

Lytridis and Tsinakos (2018, p. 2) reference a systematic review of 17 studies between 2012 and 2017 conducted by Fotaris et al. (2017), according to which it is supported that “AR in education can potentially influence the students’ attendance, knowledge transfer, skill acquisition, hands-on digital experience in education in a variety of domains”. In a more recent survey, Radu et al. (2022) investigate the impact of AR technologies on cognitive, motivational, and social processes, noting that AR encouraged more balanced group dynamics reducing the dominance of group leaders in collaborative educational settings. In CLIL approach, content and language are of equal importance and serve as equal goals of instruction (Dearden, 2015) in a social-constructivism learning environment. As such, the AR interventions are designed to facilitate mastery of content and development of language receptive and productive skills based on inclusive educational practices that align with the UDL principles, as depicted in Table 1. More specifically, the educational intervention was designed to investigate the degree that students will have the opportunity to

- have unlimited access to learning objects with all assets digitally available, and how this will facilitate students that may lack organizational skills;
- explore innovative, personalized learning instances without being distracted from the textbook;
- experience new possibilities for student-content, student-student interaction both inside and outside the classroom enhancing engagement and motivation;
- connect reading with listening skills (auditory augmentations with teacher’s explanations);
- practice the pronunciation of the new vocabulary through auditory augmentations on the textbook;
- enhance vocabulary in L2 and make connections of abstract concepts with everyday life examples;
- receive feedback on their activities through visualized content;
- connect lists of written texts with visuals, infographics, and pointers;
- work collaboratively and constructively on a shared digital authoring environment embedded in the AR enriched booklet;
- apply critical thinking skills, reflect, and create new content;
- develop digital writing skills in L2;
- self-assess and check progress and mastery of content through trial and error in a playful, engaging way (gamification/edutainment);

- create a group and whole class ePortfolio for the learning journey.

4.2 Considerations

The present educational intervention was designed with the intent to enrich students' learning experiences in an interdisciplinary approach through CLIL method in order to enhance their digital and media literacy skills in a diverse, transnational educational context. As aforementioned, literature suggests that Mobile Augmented Reality (MAR) can provide a very promising, immersive learning experience. Nevertheless, it is essential that certain limitations be taken into consideration. More specifically,

- The students should be introduced to the new technology before the sessions to avoid stress and frustration.
- An introductory session should be devoted to guide the students on how to download the app, check if their mobile devices are compatible with it, and then demonstrate and elaborate on how to use it.
- Students should understand the added value in their learning experience in order to make best use of each asset.
- If used in class, teachers should ensure the network quality of service.
- The augmentations have been designed to serve an educational purpose based on an instructional design approach. As such, given the novelty of the technology, teachers need to take careful steps during the implementation process to ensure a rich learning experience.
- To ensure inclusive educational opportunities for all students, the teacher should provide the enriched materials in both a digital and printed version.
- Privacy and security concerns should be addressed to ensure smooth content delivery.

Part of the considerations were addressed by creating manuals and tutorials for the educators that will implement the educational intervention.

5. Conclusions

Immersive technologies are still in their infancy in the mainstream educational setting and it is essential that meaningful, well-designed assets be added to the traditional printed textbooks and materials if they are to enhance students' experiences and facilitate their learning process. The *Media Literacy in Practice* AR enriched booklet constitutes an educational intervention that leverages the MAR affordances that the ARTutor app provides for an all-inclusive learning experience. The students' learning preferences were explored and guided the selection of AR platform and assets added in the design of the course materials. This effort aspires to meet diverse students' needs as dictated by the UDL principles and learning theories. On this premise, the present design of immersive MAR affordances consists of multisensory elements, such as pictures, infographics, text, audio, video, and embedded links for interactive gamification that can stimulate interest, attention, retention of content, and meaningful learning instances. The collaborative digital wall, based on the social-constructivism approach, was added to promote the development of the 4Cs skillset, that is communication, collaboration, critical thinking, and creativity in the EFL educational context (Pardede, 2020) and the opportunity for reflection and metacognition. The objectives are in alignment with UNESCO's 2030 Agenda (2017) for sustainable development, including SDG4 for quality education, ensuring that no-one is left behind in an ever evolving digitally connected world. Nevertheless, given the novelty of AR-based practices in education, and on the premise that their use can still be shapeable, there is a need to measure results and benefits on a broader scale, in diverse educational contexts, and eliminate potential limitations.

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