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Augmented Reality in English Language Teaching: Enhancing Engagement, Language Acquisition, and Cultural Awareness Among Moroccan Middle School Learners

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ABSTRACT

This study explores the pedagogical potential of an Augmented Reality (AR)-enhanced instructional activity on learner engagement, English language performance, and cultural awareness among Moroccan middle school learners of English as a Foreign Language (EFL). Adopting a mixed-methods research design, the study involved thirty third-year middle school students who participated in a culturally contextualized AR-based reading activity focusing on Jemaa El-Fnaa, a historically significant Moroccan heritage site. The instructional intervention integrated QR-code-based AR materials, including audiovisual narratives and contextual visual content, designed to supplement a conventional reading task. Quantitative data were collected using pre- and post-intervention performance tests assessing vocabulary, reading comprehension, and writing, each scored on a 20-point scale, alongside a structured Likert-scale questionnaire measuring learner engagement, motivation, perceived learning effectiveness, and cultural awareness. Qualitative classroom observations and open-ended learner feedback were used to support data triangulation. Results indicated statistically significant improvements across the three assessed language domains following the intervention, alongside high levels of reported learner engagement and positive perceptions of the AR-supported activity. While the findings suggest that AR-based instruction can contribute to enhanced learner engagement and short-term language performance within a culturally familiar learning context, the results should be interpreted cautiously due to the limited duration of the intervention and the absence of a control group. The study contributes exploratory evidence to the growing body of research on AR in EFL education, particularly within underrepresented middle school contexts in Morocco, and highlights methodological and infrastructural considerations for future research.

KEYWORDS

Educational Technology

Augmented Reality

English as a Foreign Language

Moroccan Middle School Learners

Learner Engagement

Cultural Awareness

Introduction

The digitalization of education has accelerated over the last twenty years, transforming pedagogical practices across fields and educational levels and making it necessary to rethink how learning spaces can better facilitate learner engagement, interaction, and meaning-making. This change has been especially significant in the context of English Language Teaching (ELT),

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where conventional textbook-oriented and form-based methods have long been criticized for inhibiting genuine communication, contextualized language learning, and meaningful cultural interaction. With the growing penetration of digital technologies into educational life, researchers and practitioners have turned to innovative tools that can enrich the language-learning experience and solve the most enduring pedagogical problems.

Augmented Reality (AR) is one of these new technologies that have received increasing attention among scholars, since it enables the superimposition of digital information comprising images, audio, video, and interactive content onto real-life settings in real time. In contrast to completely immersive virtual environments, AR does not sever learners' contact with their physical environment but instead adds a layer of contextualized digital information. Such an integrative feature facilitates the design of multisensory and interactive learning procedures coupled with situated learning that can be consistent with the learner-centered pedagogical approach and active learning (Al-Gindy et al. 171; AlGerafi et al.; Papanastasiou et al. 425). Empirical studies have associated the use of AR with a higher level of learner motivation, better attention, and deeper conceptual knowledge, especially in cases where the instructional design correlates closely with curricular goals (Sung and Huang 16).

In ELT, AR offers distinctive means of contextualizing linguistic input and encouraging meaningful understanding of language. AR can facilitate this by embedding vocabulary, texts, and communicative tasks in visually rich, culturally grounded environments, promoting comprehension, retention, and active engagement. Empirical research shows that AR-based activities can increase learners' willingness and motivation to complete instructional tasks, particularly in comparison with traditional text-based methods (Huang et al. 2; Parmaxi and Demetriou 861). Such results indicate that AR can be used to address current issues in ELT associated with learner disengagement and the perceived gap between classroom teaching and language application in the real world.

Theoretically, AR-based teaching fits well with constructivist and experiential theories of learning in that both view learning as an active, socially mediated process instead of the passive delivery of information. Constructivist frameworks focus on knowledge building through interaction with the content, peers, and the environment, whereas experiential learning focuses on the importance of concrete experience, reflection, and contextualized practice. These processes are supported by AR environments, where learners can interact with linguistic input through integrated visual, auditory, and textual representations (Lee and Park 936). The multimodal nature of this interaction supports deeper cognitive processing and reinforces the balance between language form, meaning, and context.

Empirical studies in ELT provide mounting evidence of positive relationships between AR integration and learner motivation, engagement, and perceived learning effectiveness (Marrahi-Gomez and Belda-Medina 2). Research in different learning settings suggests that AR-based tasks can improve learners' interest and sustained attention, especially in vocabulary acquisition and reading comprehension activities (Parmaxi and Demetriou 862; Solak and Cakir 67). Such results are usually attributed to the interactive and immersive nature of AR, which turns traditional learning practices into discovery-oriented ones. However, researchers warn that motivation benefits can be affected by novelty effects, particularly in short-term interventions; hence, caution is required in interpretation, along with transparency of methods.

Although there is a growing body of international research on the practice of AR in language learning, very little academic research has been conducted on the use of AR in North African settings, specifically in EFL classrooms in Moroccan middle schools. English is taught as a foreign language in Morocco, and learners' exposure to it is mostly restricted to classroom lessons. The possibilities of authentic communicative practice and use of language in a contextualized cultural setting are limited by the requirements of the curriculum, class sizes,

and the amount of instructional time available. Additionally, technology-based learning activities are applied unevenly in actual classrooms, particularly in public middle schools, where access to digital resources is not universal.

In this framework, AR is a potentially useful pedagogical resource to fill the gap between discursive teaching of language and meaningful sociocultural experience. By placing language learning in contexts that learners find familiar, AR can allow them to relate the linguistic input to their prior knowledge and experience, increasing its relevance and interest. Recent studies indicate that AR-supported activities can promote cultural awareness by allowing learners to approach culturally important places, practices, and stories in an immersive yet accessible manner (Cheng 1939; Hadjistassou and Louca 28; Liu et al. 1). Although the prevailing body of scholarship centers on target-language cultures, there is growing awareness of the pedagogical importance of incorporating learners' local cultural heritage into EFL teaching.

Cultural awareness is one of the core aspects of communicative competence, especially in foreign language contexts, where language use cannot be separated from sociocultural signification. The integration of local cultural content in ELT may help foster learners' identity and confidence, as well as offering significant contexts for language practice. AR offers such affordances by enabling virtual interaction with culturally relevant locations that would otherwise remain abstract in the classroom. AR-based activities can thus be used to address linguistic and cultural learning goals when they are pedagogically grounded.

The current research responds to these pedagogical and contextual issues by analyzing a culturally contextualized AR-based reading activity carried out in an EFL middle school classroom in Morocco. The intervention targeted Jemaa El-Fnaa, a historic and culturally important public space of deep significance to learners' cultural identity. The task involved printed reading resources and QR-based AR content with audiovisual stories and visual images aimed at complementing the reading text aligned with the objectives of *Focus: 3rd Year of Middle School Student's Book, Unit 14: Holidays and Travel*. These resources were designed to facilitate vocabulary building, reading comprehension, and writing while grounding language acquisition within a familiar cultural environment.

Instead of framing AR as a substitute for traditional instruction, the activity was developed as a pedagogical addition to the existing curricular practices. The intervention was aimed at supporting relationships between linguistic form, meaning, and sociocultural context by teaching English in a locally significant cultural context, in line with the demands of pedagogically founded applications of educational technology.

The current study is conducted in the framework of a mixed-method research design that explores the short-term outcomes of an AR-based activity on the engagement, language performance, namely vocabulary, reading comprehension, writing, and cultural awareness of the learners. Quantitative data were collected through pre- and post-intervention assessments and structured questionnaires, and qualitative information was collected through classroom observations and learners' open-ended feedback. The results are discussed in light of the exploratory character of the research, with explicit consideration of methodological limitations such as the short duration of the intervention and the lack of a control group. Within these limits, the study adds context-specific evidence to research on AR-enhanced EFL instruction in Moroccan middle schools.

Literature Review

Augmented Reality (AR) is a fairly recent educational technology that has gained growing academic interest in recent years due to its ability to improve learning in various fields and

levels of learning. AR has drawn particular interest in English as a Foreign Language (EFL) teaching, given its ability to superimpose digital data, including images, audio, video, and interactivity, on real-world settings in real time. This affordance lets learners interact with language input in a rich, engaging, and contextually situated way that is broadly believed to be instructionally effective in language education, where contextual and meaningful exposure is the primary component of language learning and memory. It is worth noting that AR allows immersive integration of technology at a low cost and does not require sophisticated equipment.

Theoretically, AR aligns closely with constructivist, connectivist, and experiential learning models, which define learning as an active process formed through interaction, contextualization, and experience rather than passive knowledge delivery. Constructivist theories underscore that learners construct knowledge by interacting with the material, other learners, and the surrounding environment, whereas experiential learning underscores the importance of tangible experiences and reflection in the learning process. These processes are facilitated by AR environments that embed linguistic input in meaningful contexts, combining visual, auditory, and textual input and enabling deeper information processing and firmer links among language form, meaning, and use (Lee and Park 937).

Empirical research on the application of AR in EFL classrooms provides substantial evidence that learner engagement and motivation are the main advantages of the practice. Empirical studies and systematic reviews consistently show that AR-oriented activities attract learners' attention and enhance their desire to engage in instructional activity compared with conventional text-based or teacher-centered strategies (Schorr et al. 13; Huang et al. 11). Curiosity, sustained attention, and exploratory learning have been shown to be aroused by the interactive and immersive quality of AR, which converts traditional classroom activities into more active engagement. Such affective results can be considered especially applicable to the EFL situation, where a learner might feel that language learning is monotonous or disconnected from the real world.

Meanwhile, researchers warn that novelty effects can inflate gains in engagement and motivation, particularly during short-term interventions. A number of researchers observe that learners' enthusiasm after first exposure to AR technology can decrease over time unless its instructional integration is pedagogically meaningful and sustained (Schorr et al. 12). This consideration highlights how critical it is to separate short-term affective effects from long-term instructional ones, especially in research without longitudinal designs or comparison groups.

In addition to affective variables, a growing literature has studied measurable language learning outcomes of AR in EFL situations. Research in secondary and tertiary educational environments indicates that AR-based teaching may enhance vocabulary learning, reading comprehension, and retention by contextualizing linguistic input through visual and tangible features (Bursali and Yilmaz 127; Ebadi and Ashrafabadi 9746). Quasi-experimental studies often report statistically significant differences between the AR-supported and traditional instruction groups, especially when the AR activities are clearly defined with regard to learning goals (Belda-Medina 7; Bamanger 37). AR can potentially support semantic processing and memory consolidation by placing new words and textual information within meaningful contexts.

Despite these encouraging results, consistent methodological weaknesses can be found in the literature. Numerous studies rest on short-term interventions, small samples, and non-randomized designs, which limit the generalizability of findings. Moreover, few studies report effect sizes or long-term retention, which restricts the ability to draw conclusions about lasting learning benefits. Such constraints point to the need for more experimental and longitudinal research designs that can isolate the instructional effects of AR and determine its long-term influence on language development.

Other conditions, such as teacher factors, are also critical to the successful implementation of AR in language education. Research on teacher attitudes and self-efficacy indicates that most teachers report favorable views of AR, yet classroom implementation requires sustained professional growth and pedagogical training (Okumus and Savas 16575). In the absence of proper preparation, AR may be implemented more as a technological novelty than as a teaching resource aligned with curricular goals. The pedagogical success of AR thus lies in teachers' capability to create meaningful AR-related assignments and manage classroom dynamics.

Under-resourced schools and institutions, where access to technology, technical assistance, and professional development opportunities may be low, face these difficulties especially acutely. Research in resource-constrained or developing environments has identified obstacles including poor internet connectivity, limited access to AR-capable devices, and a lack of institutional support (Wu et al. 42). Consequently, the usefulness and scalability of AR-based teaching differ significantly across settings, and claims about the method's applicability should be kept in perspective.

A current trend in the AR field in EFL has been the emphasis on cultural awareness and intercultural competence. Researchers increasingly stress that language learning cannot be separated from cultural comprehension and that successful EFL teaching should incorporate both the linguistic and cultural aspects of communication (Hicham et al. 2). AR provides unique possibilities for introducing cultural texts into immersive learning experiences in which learners can encounter cultural lifestyles, destinations, and stories beyond lifeless textbook accounts (Di Fuccio et al. 21). Empirical evidence indicates that activities based on AR can improve cultural knowledge and strengthen the links between linguistic expressions and sociocultural interpretation.

Notably, much existing research has emphasized exposure to target-language or foreign cultures, while comparatively fewer studies have examined the pedagogical value of integrating learners' local or national cultural heritage into AR-supported EFL instruction. Recent scholarship suggests that grounding language learning in learners' own cultural contexts can enhance relevance, learner identity, and confidence, particularly in foreign language settings where learners may feel detached from the target language community (Hadjistassou and Louca 27; Liu et al. 2). This gap highlights the need for context-sensitive research exploring how AR can be used to value local culture while supporting language development.

Overall, the literature suggests that AR holds considerable promise for enhancing learner engagement, motivation, language achievement, and cultural awareness in EFL education when pedagogically grounded and contextually appropriate. At the same time, significant gaps remain, particularly regarding middle school EFL settings in developing countries, short-term versus sustained instructional effects, and the integration of local cultural content. The present study seeks to address these gaps by examining a culturally contextualized AR-based reading activity in a Moroccan middle school EFL context, while explicitly acknowledging the methodological constraints associated with exploratory, short-duration interventions.

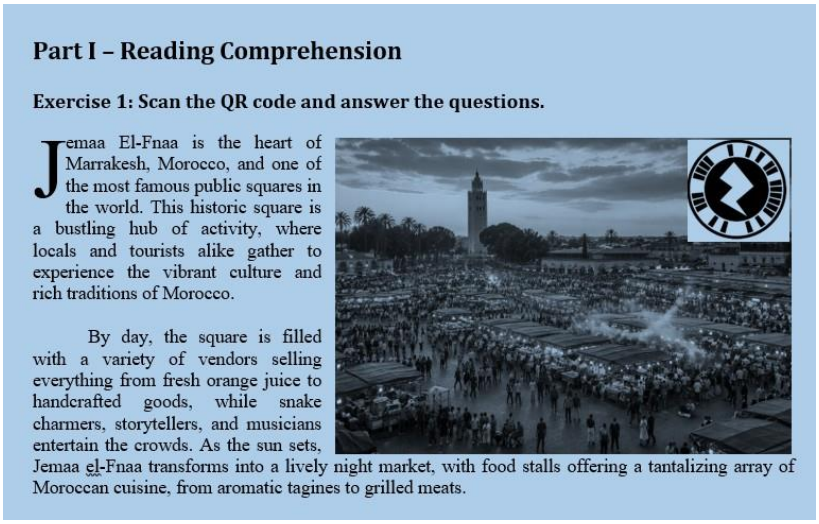
Methodology

The current study used a mixed-methods research design to examine the immediate pedagogic impact of an Augmented Reality (AR)-based instructional exercise on English language acquisition in a Moroccan middle-school English as a Foreign Language (EFL) context. The combination of quantitative methods, using learner questionnaires and pre- and post-tests, and qualitative procedures, based on classroom observations, was intended to capture objective changes in learners' language performance as well as their subjective evaluations of

engagement, motivation, and cultural awareness prompted by the instructional intervention. The triangulation of the methodology was achieved through a combination of performance-based measurement, questionnaires completed by the learners, and classroom observations.

The empirical research was conducted in one of the public secondary institutions in the northern part of Morocco. Thirty-three third-year students (aged 14–15) volunteered to be part of the convenience sample. The respondents all attended the same English course and were assessed by their instructor as having pre-intermediate to intermediate levels of proficiency. Before the intervention, the participants had limited exposure to technologically mediated instruction and no prior experience with AR-based learning activities. The small sample was therefore appropriate for an exploratory within-group study of short-term instructional outcomes, but not for generalization.

The teaching treatment consisted of a culturally specific AR-enhanced reading activity about Jemaa El-Fnaa, a historic and culturally important public place in Morocco. Instructional materials included a printed English reading book, namely *Focus: 3rd Year of Middle School Student's Book*, along with vocabulary support materials and comprehension tasks aligned with the middle school curriculum. QR codes embedded in the print materials allowed learners to access AR-enhanced content on school-provided tablets. The AR package included brief audiovisual stories, visual images, and background cultural information intended to supplement the text and aid comprehension, lexical learning, and literacy.



Part I – Reading Comprehension

Exercise 1: Scan the QR code and answer the questions.

Jemaa El-Fnaa is the heart of Marrakesh, Morocco, and one of the most famous public squares in the world. This historic square is a bustling hub of activity, where locals and tourists alike gather to experience the vibrant culture and rich traditions of Morocco.

By day, the square is filled with a variety of vendors selling everything from fresh orange juice to handcrafted goods, while snake charmers, storytellers, and musicians entertain the crowds. As the sun sets, Jemaa el-Fnaa transforms into a lively night market, with food stalls offering a tantalizing array of Moroccan cuisine, from aromatic tagines to grilled meats.

Fig. 1. AR-Enhanced Reading Activity for Jemaa El-Fnaa with QR Code Developed by Zappar

The intervention took place within a sixty-minute English lesson. Following a brief introduction to the topic and a briefing about accessing and moving around the AR materials, learners worked with the reading text and the AR content independently and in small groups, scanning the QR codes, viewing the multimedia, and completing the comprehension and vocabulary exercises. The instructor took on the role of facilitator, providing technical support where necessary and monitoring learner participation and task completion without direct instructional interference.

Quantitative data were collected through a performance-based language test and a structured learner questionnaire. The test assessed vocabulary knowledge, reading comprehension, and writing ability, each scored out of 20, for an overall maximum of 60. A single scoring rubric was used consistently in both the pre- and post-tests. The pre-test was administered seven days before the intervention, and the post-test immediately after the AR-mediated lesson. The instruments were not identical but were matched in difficulty and task type to achieve equivalence.

The learner questionnaire was given immediately after the intervention and included mostly Likert-scale questions (1 = strongly disagree to 5 = strongly agree) that assessed engagement, motivation, perceived learning effectiveness, AR material usability, cultural awareness, and overall satisfaction. A limited number of open-ended items elicited qualitative feedback on what the participants learned, what benefits they gained, and what challenges they faced.

Classroom observations conducted by the teacher supplemented the qualitative data during the intervention. The observational notes centered on indicators including time on task, learner participation, peer interaction, and the usability of the AR materials. These observations served to contextualize and triangulate the quantitative results but were not independent measures.

Quantitative data analysis started with descriptive statistics (means and standard deviations) to summarize the pre- and post-test performance in terms of vocabulary, reading comprehension, and writing. Paired-samples t-tests were used to determine the statistical significance of the observed changes in each language skill. Such an analytic plan was consistent with the within-group design and the matched pre- and post-intervention data. The traditional alpha level ($p < .05$) was used to determine statistical significance.

Thematic analysis was applied to the qualitative data drawn from open-ended questionnaire responses and classroom observation notes. Learners' answers were coded inductively to identify recurrent patterns concerning engagement, comprehension, cultural awareness, and attitudes toward AR-supported learning. Self-reported perceptions were supported by observation notes, which provided background on classroom activity during the intervention.

Ethical procedures were followed strictly throughout the project. Participation was entirely voluntary, and learners received clear, age-appropriate information about the purpose and methods of the study. All data were collected with the consent of the school administration. All learner records were anonymized, and confidentiality was maintained in the analysis and dissemination. The AR material underwent a preliminary check to ascertain its suitability in terms of age, culture, and curricular objectives.

Since the study is exploratory, a number of methodological limitations should be noted. The intervention involved one sixty-minute session, and no control or comparison group was included, which restricted the ability to establish a cause-and-effect relationship. The sample size is also relatively small, which limits the generalizability of the results. The interpretation of the results took these constraints into account, positioning the study as a preliminary one aimed at informing more rigorous future research designs.

Results

Quantitative results are reported with descriptive and inferential statistics, whereas qualitative results draw on classroom observations and learners' open-ended feedback to contextualize the observed patterns without going beyond descriptive reporting.

The post-intervention questionnaire, complemented by classroom observations, was used to analyze learner engagement during the AR-supported reading activity. On the whole, learners reported high interest, motivation, and sustained attention during the activity, and the observational data supported this by showing extended time on task, active communication with peers, and consistent engagement with the AR materials throughout the lesson. As Table 1 shows, the majority of responses fell in the agree and strongly agree categories for all engagement items, though the presence of neutral and lower ratings reflects some variability in individual learner experiences rather than uniformly high engagement.

Table 1
Learner Engagement During the AR-Based Reading Activity ($N = 30$)

Item	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
The AR activity made the reading passage more interesting	65%	25%	7%	3%	0%
I felt more motivated to participate in the AR activity	60%	30%	5%	5%	0%
The AR content helped me stay focused during the activity	55%	35%	7%	3%	0%

Learners' language performance was evaluated using the pre-test and post-test results in vocabulary, reading comprehension, and writing, each on a 20-point scale. Descriptive analysis showed improvements in the means of all three language domains after the AR-based intervention. As Table 2 illustrates, improvement was seen at the group level, whereas variation in individual gains reflects differences in initial proficiency as well as in interaction with the instructional resources.

Table 2
Descriptive Statistics for Pre- and Post-Test Scores (20-Point Scale, $N = 30$)

Measure	Pre-Test Mean	Post-Test Mean	Mean Gain	*SD* (Gain)
Vocabulary	13.23	15.80	2.57	1.43
Reading Comprehension	14.27	15.88	1.61	0.89
Writing	12.98	14.55	1.58	1.09

Paired-samples *t*-tests were used to establish the statistical significance of the increases in observed scores on each language skill. The results show statistically significant differences between pre-test and post-test scores across all three domains at the $p < .05$ level. These inferential statistics are summarized in Table 3 and are reported as a within-group comparison, without causal attribution beyond what the study design allows.

Table 3
Paired-Samples *t*-Test Results for Language Learning Outcomes ($N = 30$)

Measure	*t*(29)	*p*
Vocabulary	9.83	< .001
Reading Comprehension	9.87	< .001
Writing	7.91	< .001

Learners' perceptions of cultural awareness development were investigated through a questionnaire covering knowledge of Moroccan culture, association of the reading text with real-life situations, and confidence in discussing cultural issues in English. The feedback shows positive perceptions of cultural learning outcomes related to the AR-based activity. As Table 4

shows, the majority of learners agreed or strongly agreed that the activity helped them understand and contextualize the culture.

Table 4
Learner Perceptions of Cultural Awareness Development ($N = 30$)

Item	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
The AR activity enhanced my understanding of Moroccan culture	70%	25%	5%	0%	0%
The AR content helped me connect the text to real-world scenarios	65%	30%	5%	0%	0%
I feel more confident discussing Moroccan culture in English	60%	35%	5%	0%	0%

Items on the post-intervention questionnaire were also used to obtain learners' evaluations of usability and technical performance. Most participants said that the AR application was simple and worked well throughout the lesson, allowing them to concentrate on instructional activities. Table 5 summarizes these responses concerning usability and technical quality.

Table 5
Learner Evaluation of AR Usability and Technical Performance ($N = 30$)

Item	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
The AR application was easy to use	70%	25%	5%	0%	0%
I encountered no technical difficulties during the activity	65%	30%	5%	0%	0%
The quality of the AR content was high	75%	20%	5%	0%	0%

General satisfaction with the AR-supported learning experience was high, and the majority of learners made positive remarks about the activity and expressed a desire to participate in similar technology-based classes in the future. Table 6 indicates that most participants were satisfied with the AR-based reading experience, viewed it as a valuable learning experience, and would recommend using AR in future lessons, although slight differences across items may reflect variation in individual learners' preferences.

Table 6
Learner Satisfaction with the AR-Based Activity ($N = 30$)

Item	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I am satisfied with the AR-based reading activity	75%	20%	5%	0%	0%
I would recommend using AR in future classes	80%	15%	5%	0%	0%
The AR activity was a valuable learning experience	70%	25%	5%	0%	0%

These quantitative results were further framed by qualitative feedback in the form of open-ended questionnaire answers and observational data in the classroom. Students often reported that the AR activity was interesting and helped them learn vocabulary and cultural information. The observations in the classroom showed more interaction between peers, active participation, and engagement during the lesson.

These impressions were supported by observation in the classroom, which found increased interaction between peers, active participation, and sustained attention throughout the session. Students worked in small groups when exploring the AR material, discussing cultural facts, asking questions, and helping each other to navigate the multimedia material. The AR activity provoked curiosity and exploratory behavior, as students accessed videos and images multiple times to support their interpretation or obtain additional information about Moroccan traditions and the historical importance of the square.

Moreover, the qualitative data revealed that the AR materials supported the contextualized learning in such a way that the students could connect the linguistic input with culturally relevant experiences. Several learners stated that they gained confidence in speaking about Moroccan culture in English, which demonstrates that the exercise strengthened not only their understanding of Moroccan culture but also their opportunities for meaningful communication. Attention and concentration were observed to increase, and distracted behaviors were fewer than during traditional text-only reading tasks, suggesting that the multimodal elements of AR served as scaffolds for both language and cultural learning.

Taken together, the qualitative feedback indicates that the students reacted positively to the AR-enhanced reading activity, showing greater engagement, collaborative learning, and better understanding of cultural material. These findings complement the quantitative results and suggest that culturally contextualized AR interventions can support both linguistic and cultural learning outcomes in middle school EFL settings.

Discussion and Conclusion

The current research investigated the short-term impacts of a culturally contextualized Augmented Reality (AR)-enhanced reading task on the engagement of learners, language performance, and cultural awareness in an EFL learning environment at a middle school in Morocco. By incorporating AR technology into a traditional reading task, the study identified the possibility of using immersive, multimodal, and culturally recognizable materials to improve learner engagement and language-related outcomes within a short period of instruction. Its results provide exploratory evidence of the pedagogical possibilities of AR in underrepresented EFL settings and highlight critical methodological and contextual concerns.

With regard to learner engagement and motivation, the results show that learners reacted positively to the AR-aided activity. Questionnaire responses and classroom observations indicate that the multimedia elements and interactivity sustained attention, participation, and interest during the lesson. These findings align with previous studies indicating that AR can increase engagement by converting text-based activities into interactive learning (Parmaxi and Demetriou 862; Schorr et al. 8). The visual and exploratory quality of AR seems to have aided learners' concentration and their inclination toward the reading activity, especially in EFL classrooms where engagement is generally difficult to sustain.

Nonetheless, these engagement outcomes should be interpreted with care. The intervention was a single one-hour session and learners' first experience with AR-based instruction. As earlier studies have noted, increased activity in such situations can partly be explained by novelty effects rather than long-term pedagogical influence (Schorr et al. 9). Along these lines, the engagement observed in this study must be interpreted as a short-term affective response. This explanation concurs with calls for longitudinal studies capable of differentiating between excitement induced by initial exposure and long-term motivational gains.

Concerning language performance, the learners showed statistically significant improvement in vocabulary, reading comprehension, and writing after the AR-based intervention. These gains indicate that embedding linguistic input in multimodal and contextualized materials can facilitate short-term learning by enhancing the links among language form, meaning, and context. AR-based visuals and interactive features may have served as scaffolding tools that helped learners understand and retain lexical information, which in turn supported better processing of the textual input. This finding is in line with previous research that has found positive effects of AR on vocabulary and reading comprehension in EFL settings (Bursali and Yilmaz 127; Ebadi and Ashrafabadi 9746).

However, the lack of a control or comparison group restricts causal inference. The observed performance gains cannot be attributed solely to the use of AR, because other factors might also have played a role, including focused instructional time, familiarity with the tasks, and learners' attention. Consequently, the results can be considered an indication of AR's possible efficacy when meaningfully incorporated into reading instruction, rather than definitive evidence of it. Such a conservative approach reflects broader methodological constraints found in the AR literature, in which small samples and short-term interventions are still prevalent (Belda-Medina 7; Bamanger 31).

The results concerning cultural awareness also indicate that culturally oriented learning can be supported through AR-based instruction when language learning is situated within familiar sociocultural parameters. Students reported feeling more confident talking about Moroccan cultural issues in English and better able to relate textual materials to the real world. These effects are congruent with past studies emphasizing AR's ability to mediate language acquisition and cultural cognition by placing linguistic stimuli in meaningful conditions (Di Fuccio et al. 2). The virtual interaction with Jemaa El-Fnaa also seems to have allowed learners to draw on prior cultural knowledge and express themselves in English.

Notably, this work contributes to the literature by demonstrating the educational usefulness of integrating learners' local cultural heritage into AR-based EFL teaching. Although much previous research focuses on exposure to target-language or foreign cultures, few studies examine how AR can be applied to valorize learners' own cultural contexts. Instruction based on locally significant material can improve relevance, learner identity, and confidence, especially in second language contexts where students might feel that English is unrelated to their experiences.

Learners' perceptions of usability and satisfaction suggest that AR-supported instruction can be adopted in the classroom within the technical and cognitive capacities of middle school learners, at least under controlled classroom conditions. The majority of respondents stated that the AR materials were convenient and highly reliable, which enabled them to spend more time on instructional tasks rather than technical issues. This evidence indicates that properly organized AR activities can be accessible even to learners with minimal or no previous experience of educational technologies. These perceptions should be understood, however, in the context of implementation circumstances.

The success of the AR activity depended on the availability of school-provided devices, reliable infrastructure, and teacher facilitation. These conditions are not always consistent in rural Moroccan public schools, especially those with limited resources. Thus, claims about the scalability and sustainability of AR-based instruction should be made with discretion. Wider adoption would require institutional investment, teacher training, and infrastructure development, echoing prior studies that highlight the significance of contextual and institutional variables in educational technology adoption (Wu et al. 42).

A number of constraints must be recognized. The brevity of the intervention precludes conclusions about long-term learning impacts, and the sample is small and restricted to a single classroom, which limits generalizability. The absence of a comparison group precludes causal inference, and the strongly positive perceptions may have been amplified by the immediacy of post-intervention data collection. Future research should employ longitudinal designs, larger and more diverse samples, and experimental or quasi-experimental approaches to offer more robust evidence. More research on productive language skills and teachers' perspectives would also enrich knowledge of AR's pedagogical potential.

In conclusion, this paper offers exploratory evidence that culturally contextualized AR-based reading activities can facilitate learner engagement, short-term language performance, and cultural awareness in Moroccan middle school EFL classes. Although AR cannot be regarded as a solution in its own right, its considered and contextually sensitive application can support language learning experiences, provided that it is adjusted to curricular objectives and infrastructural realities. By placing language learning within learners' immediate cultural surroundings, AR offers a significant prospect of relating linguistic development to lived experience, while underscoring that future studies should be approached with methodological rigor and contextual awareness.

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