

AR and VR content integration: project-based task quality and effect in reading comprehension

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Abstract

The learning media is evaluated in several aspects: the content, teaching methods, and preparation of the teaching and learning, as well as the effect on the student's comprehension. This study aims to analyze the quality of the AR and VR content integration as PBT influences the students' comprehension of reading. The mixed method was utilized in this study. Need analysis, situation analysis, and curriculum analysis were used to gather the preliminary data before assigning students of the Reading Course to conduct the project. The syllabus and guidelines for Project-Based Tasks were formulated based on the findings in the initial study. Modelling was required before the students independently work on the project. Experts evaluated the media. Then, the significance of the development project to the students' improvement was also seen based on the statistical analysis of pre-and post-tests. Therefore, result of the expert evaluation and students pre and post-test result are major source of the data. Based on three aspects measured in learning media, course materials, teaching, and learning language, the result from the expert evaluation shows perfect scores are dominant in all aspects. The students' scores also significantly improved in the post-test. It is highly recommended for teachers to combine AR and VR content development properly as the product of project-based tasks as the teaching and learning media.

Keywords: *Augmented Reality Content; Virtual Reality Content; Project-Based Tasks*

INTRODUCTION

Augmented Reality (AR) and Virtual Reality (VR) content integration are crucially acknowledged by teachers and students in the 21st-century teaching and learning era. The employment of project-based learning (PBL) in AR and VR integration has shown the role of learning as a personal experience. Technology literacy and integrating it into the conventional way of learning is required to improve comprehension in EFL. Students need to be able to

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stimulate their motivation in learning with the teacher's guidance and use external motivation to be a part of technology users.

Previous research has explored the benefits of AR and VR in PBL across various disciplines. (Shi et al., 2024) inquired about a group of students in a speaking class. It was found that the group with PjVR (Who conducted a video for their project) outflanked within the aptitudes of language structure and lexicon, talk administration, articulation, and intuitive communication all made strides altogether. In contrast, their behavioral, emotional, cognitive, and social engagement progressed a parcel. (Fadli et al., 2024); (Eliza et al., 2024) uncover that a Portable Virtual Research facility based on Project-Based Learning can be a compelling device to back constructivist learning in electrical estimation. This investigation is open to encourage inquiry about how counterfeit insights can construct valuable considerations.

Other studies that focus on PBL in Reading were conducted by (Himawan et al., 2024). Integrating AR and VR projects in ebooks can help lecturers and students learn critical and creative reading in higher education. It was found that teaching materials were quickly accessible and electronic and collaborated with one of the learning models to measure the success rate of the critical and creative reading process. Product development was carried out by designing materials, models, and evaluations and creating electronic books based on the needs analysis results. Another study that investigates the VR + STEM course was well-received by teachers and students alike, and it significantly increased students' comprehension of scientific ideas and enhanced their design skills (Petersen et al., 2022); (Suteja & Setiawan, 2022); (Li & Kedong, 2017). Project-based learning was proven to simulate students' independence in comprehending all kinds of text (Tursinbaevna et al., 2024); (Shekh-Abed, 2024);

Based on these previous studies, the implementation of AR and VR integration merely focuses on developing digital products as the final form of the PBL project. However, the involvement of social media as an active part of the PBL product had never been the focus of the studies. Meanwhile, social media platforms fulfilled all of the requirements and standards of AR and VR learning media. Despite these advances, there remains a gap in leveraging social media platforms like YouTube for AR and VR integration in reading comprehension projects.

This study aims to fill this gap by investigating how integrating AR and VR projects through YouTube can enhance the quality of project-based tasks and their impact on students' reading comprehension. It also helps all EFL teachers must follow the digital era's demands. Extensive eagerness about recent technologies to entangle learners, advance autonomous learning, instructional media, and interchangeable 21st-century skills is compulsory (Lawrence et al., 2020); (Yang et al., 2018); (Poap et al., 2020). Teachers' and learners' use of digital tools is increasing (Halbach, 2015). Meanwhile, there is an anxiety of the deconstructive effect caused by the existence of digital tools and sources that possibly change our tenor. Teachers utilize digital tools to achieve teaching objectives and follow the trends of students and society. Students use them to get popular information that is not crucially useful and supports their academic improvement (Thomas, 2011). Therefore, integrating AR (Augmented Reality) and VR (Virtual Reality) content as project-based

tasks potentially has a more positive impact on the quality of the product and its effect on the students' comprehension.

Digital platforms, especially social media, positively affect English language learning. However, the quality of the product and the significance of this media still need to be evaluated. Teachers use the media to create a new approach effectively (Ohei, 2019). Many learning objectives need to be created efficiently. Social media also positively improves attitudes toward learning (Zam Zam Al Arif, 2019). It also helps students to develop their ideas in productive language (Suswati Syarbaini, 2019). Particularly in Reading, comprehending materials should involve absorbing information in one way or through interactive communication. Besides, it raises awareness of collaborative interaction with other students to share materials and complete their work (Li, 2017). Moreover, students use it as media to conduct their research and to distribute their research tools, such as surveys or questionnaires (Chai-lee, 2013). However, students tend to act as the consumers of the technology rather than taking a position as the producers.

The integration of AR and VR projects through YouTube allows students to be actively involved as the learning source and facilitates others to consent to each other's thoughts critically. YouTube provides 360-degree videos, providing an interactive environment for learners to practice their English. It also gives the students an engaging reading experience. So far, the use of the Google Expedition remains dominant as the VR learning media in Reading. (Parmaxi et al., 2021) mention that Google Expeditions was guided by teach-back. It is a pedagogical methodology that emphasizes communication and comprehension through spoken interaction. However, the popularity of this media is still far compared to YouTube, which almost all students are familiar with.

Moreover, teachers also need to be aware of the media's drawbacks. The role of the teacher is just as a content provider or informer of content links and students only as consumers. Online learning is significantly less beneficial for individuals with low general self-efficacy in finding vicarious experience information when completing tasks (Vivakaran & Neelamalar, 2018). Most previous studies focus on the implementation and the effect of one type of content on English learning achievement. Meanwhile, a limited study still focuses on developing methods and procedures for using social media and its effect on English teaching. Meanwhile, learning should be a personal experience, eventually leading the students to be lifelong learners.

Based on the above problems, the theoretical basis of this research is ICT-based teaching and learning. Teachers must use this media creatively to obtain high teaching standards as part of the innovative development of information communication technology. AR focuses on delivering digital information into the real world through electronic devices. In comparison, VR is an entirely digital environment that provides interactive user communication. Integrating these two means of information sources into learning media is expected to produce better and higher-quality task products. It is similar to the previous results of this social media, which state that YouTube videos significantly improve student performance in understanding English (Almurashi, 2016); (Rizvi, 2017). Almost every aspect of the ELT is covered by YouTube. Every teacher and student must be motivated to use

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YouTube in ELT. They must consider a proper process of selecting the appropriate videos based on the student's proficiency level, cultural context, and objectives (Kabooaha & Elyas, 2018). By taking those steps, students can improve their recognition, comprehension, and retention of the learning target. Online teaching skills training is more than merely focused on technical information and advice. However, improving pedagogical quality in online language teaching is more important to increase comprehension and skills. So, there are two significant questions addressed in this study. The first question is how the quality of the AR and VR content integration as PBL influences the students' comprehension of reading. The second is how it influences the students' comprehension of reading.

METHOD

A mix of qualitative and quantitative research method was used in this study. (Wiśniewska, 2014); explained that mixed methods research involves integrating qualitative and quantitative research approaches into a single study. This methodology is employed to benefit from both approaches' strengths, allowing for a more comprehensive analysis of research questions. Combining these methods can help validate findings through triangulation and provide a fuller understanding of the research problem by addressing it from multiple perspectives. The steps in this development stage adopted the development model proposed by Borg and Gall. Here, the systematic processes were aimed to produce a good standard for the final product. The YouTube channel must consist of the authentic and actual model of ELT. It is a project-based YouTube channel as the final product of the development (Nurfadhilah, 2018); (ŞAHİNOĞLU, 2022). Moreover, the qualitative method described the quality of the AR and VR content integration Project-based task.

Respondents

There were two experts involved in the evaluation of the project products. They focused on two different aspects; content (English reading) and media of learning. Both of the experts are practitioners as well as professors of English teaching and Media of Teaching. Moreover, to figure out the effect of the PBT to the students' comprehension, there were 32 student of English reading comprehension class at English teaching department purposively selected as the participant for this study.

Instruments

The first instrument was the scoring rubric of the media and content analysis utilized by experts to figure out the quality of the PBT products. The aspects being examined are based on the criteria of EFL Media proposed by Anderson (2008). Second, the use of pre and post-test of reading comprehension to evaluate students progress of before and after conducting and running the project learning.

Procedures

The model is adapted and implemented using the following procedures: need analysis, situation analysis, and curriculum analysis to gather the pre-elementary data. This step's result determines the problems students and

lecturers face in the reading comprehension course. This study also limitedly employs only one class among parallel classes. The study instruments cover pre-and post-tests, questionnaires, observation lists, documentation, and the YouTube channel. First, a test is used to measure the significant effect of the media in improving students' knowledge and competency in ELT. Second, a questionnaire is given to gather qualitative data and to see the overall students' perspectives and opinions on using a project-based YouTube channel for their reading comprehension course. The experts get the observation list to get the development and progress of the revision in the syllabus draft, lesson plan, and videos, as well as the direct interview with the course lecturer.

After that, video documentation is uploaded online as content for YouTube channels. Based on the data, the researcher ensures procedures are done based on the standard. It focuses on students' ELT skills and experience. The data are 1) The expert validation checklist. 2) The individual test result. 3) The observation list. 4) The lecturer observation list. Next, the researcher develops a course syllabus comprising the target, topics, references, preparation plan, and tool. Then, formulate the frame of development. The experts validate the first draft of the course syllabus and ensure that it is consistent with the course plan and the study's objectives. After the revision process of the course syllabus, the final draft is published and distributed to the students of the RC course. Instructions and guidelines for the assignment are necessary before the project-based YouTube channel starts. In these steps, the role of the lecturers in modelling is crucial. So, the students have the standard achievement for the upcoming project.

Next, students start to develop the project by finding the sources of the material, teaching media, learning evaluation media, and teaching skills needed for that particular context. After that, students write their lesson plans explaining the lesson description, objectives, and steps until the evaluation process. After submitting their lesson plan and getting suggestions and approval from the lecturer, the recording videos are run collaboratively among all the class members.

The first videos are presented and discussed during and outside the classroom hours. The Fitur of YouTube live was employed to provide direct interactive communication between users and teacher. Moreover, comment section also crucially takes part in AR and VR content integration projects. Their peer evaluation and comments are essential to finding mistakes or misleading teaching content. The lecturer also criticizes the raw recording of the students' videos. In these steps, students develop the videos' revision form. Then, they are required to do the final editing of the videos and get approval from the lecturers. Next, lecturers and students collaboratively create the YouTube channel. It must be openly shared to let all class members easily access the channel anywhere without any limitations. Then, the final product of the videos must be uploaded as content for the YouTube channel. After all the developing processes are finished, the students must have a post-test. A pre-test is given to the students to figure out their present knowledge and skills of ELT before getting involved in developing the new media to see the significance of the study to the students. Statistical analysis is used to analyze pre-tests and post-tests and to determine the significant effect of this media on

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improving students' knowledge and skills of ELT. Finally, the writer derives the conclusion.

Data analysis

The data were analyzed as follows. Thematic analysis was used to compare the results of the experts' evaluation. There should be a balance between the content and learning media criteria. The criteria were set to categorize the media's quality to reveal which AR and VR content integration aligns with educational purposes. Regression analysis was utilized for the quantitative data to determine the relationship between AR and VR content quality and reading comprehension outcomes. Meanwhile, this study uses *paired sample t-tests* of pre and post-test results to assess the effect of this project on improving students' reading comprehension. Then, the data were analyzed by integrating the findings and combining the insights of the thematic analysis, regression, and pre-and post-test results.

RESULTS AND DISCUSSION

The data from expert evaluations highlight several key points regarding the quality of the AR and VR content used in the project-based tasks. Based on the expert evaluation, the results show that AR and VR content produced in PBL takes various ranges of scores from fair to excellent. However, no indicators are failing. The major strengths of this media are the program menu, instruction manual, and layout. Overall, the media's structure and usability are categorized as vital. However, some areas for improvement were also found in the quality of the video, readability of the text, quality of the thumbnail pictures, and the background of the video. Meanwhile, from content evaluation, the scores are predominantly good to excellent. The strengths were found in content compatibility, concept accuracy, purpose of learning, and language suitability. The areas for improvement were found in the training aspect. Here, the additional support in technology literacy is needed.

The result also shows the effect of AR and VR content integration on students' reading comprehension, as demonstrated by the paired sample t-test. It was found that there was a significant improvement in students' reading comprehension scores from the pre-test to the post-test, indicating that integrating AR and VR content into project-based tasks was effective. Two supporting factors clarify this data. First, previous studies suggest that project-based learning environments, particularly those utilizing AR and VR, offer hands-on experiences and foster skills like autonomous learning and collaborative problem-solving. Second, AR and VR content in project-based tasks enhances motivation and engagement, leading to better educational outcomes.

Moderate to Excellent Result of the AR And VR Content of Project-Based Tasks

The data from one ELT content expert and instructional media expert validation shows the quality of the YouTube channel as the teaching and learning media. Then, the validation process is also crucial after the YouTube channel is published. The media content is robust and effective in many areas,

though there is room for improvement. Enhancing video quality, text readability, and visual elements like thumbnails and backgrounds can optimize the learning experience. The details can be seen from these following tables.

Table 1. Expert Evaluation Result for Expert of Media

Aspects	Indicators	Score				
		1	2	3	4	5
Program	Program Menu				√	
	Instruction manual			√		
	Students' Response			√		
Performance	Letter font				√	
	Space				√	
	Quality of the video		√			
	Readability of the text		√			
	Quality of the thumbnail pictures		√			
	Layout			√		
	Navigation button			√		
	Background		√			
	Titles arrangement				√	
	Interaction setting			√		
Total		0	4	5	4	0

There are no-fail indicators. However, there is no single perfect indicator. Most scores are based on *fair*, *sound*, and *excellent* scores. However, four fair scores go for the quality of the video, readability of the text, quality of the thumbnail pictures, and the background of the video. None of the indicators of each aspect fails, and the good-to-perfect scores are dominant. However, several indicators must be improved, such as training. The ability to arouse students' curiosity is still in the *fair*. So, the students still need more motivation to open up and watch other content on the channel. They only focus on some content and disobey other videos.

Table 2. Expert Evaluation Result for Expert of Content

Aspects	Indicators	Score				
		1	2	3	4	5
Materials	Content compatibility with core competency and basic competency				√	
	Concept accuracy			√		
	Materials rejuvenation			√		

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	Materials presentation order			√		
	Suitability of the example			√		
Teaching and Learning	Purpose of learning					√
	Motivation					√
	Summary			√		
	Clarity of the learning indicators					√
	Training		√			
	Suitability of the video with the materials					√
Language	Suitability of the language with the students' level					√
	Language clarity					√
	Terms accuracy			√		
	Grammar, pronunciation, and spelling accuracy		√			
	The ability to arouse students' curiosity		√			
Total		0	3	4	6	0

The Effect of AR and VR Content Integration PBT to Students Reading Comprehension

This study finds out that a YouTube channel as a project-based assignment in form of the integration of AR and VR content PBT tasks are likely to be effective for several reasons. The first is presenting the results of previous studies in project-based learning. They provide valid data to consider this research feasible. It places students of the course as the object of learning so that the objectives must also be in line. Developing a project-based YouTube Channel for reading comprehension courses will provide students with hands-on experiences for each individual. It also develops pedagogical and management skills (Dooly & Masats, 2011). They are expected to be familiar with autonomous language learning and collaborative problem-solving. TBLT increases motivation and teaching satisfaction. These results arise from the products produced during the learning process, which requires a lot of preparation, revision, time, and effort to stimulate student and teacher motivation to perform better (Astawa et al., 2017).

Moreover, the data from the students who joined this course improved students' pre-test and post-test results. The data were analyzed using SPSS. The result indicates that the value of sig. Two-tailed is .000, which is lower than 0.05. So, there is a significant difference between each variable. The table below shows the detailed results of the statistical analysis.

Table. 3 The Result of the Paired-sample t-test

Paired Samples Test				
Paired Differences	t	df	Sig. (2-	

	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		tailed)
				Lower	Upper	
Pair 1 Pre-Test Post-Test	-11.16667	6.13377	1.25205	-13.75673	-8.57660	-8.919 23 .000

The study results show that integrating AR and VR content in the YouTube channel can entrain students. Students' entanglement increases students' skills in reading comprehension. However, this study cannot give more detailed results on the students' grammar aspects as other previous studies found that YouTube materials stimulate students to think creatively and critically about the grammar of a recording text or video (Kurniawati, 2013). The data from the content expert also clarify it. The results underline the low quality of students' grammar, pronunciation, and spelling. Another study is in line with this result. The improvement of reading comprehension relates to several disciplines. The disciplines had significant moderating effects, and the types of AR had marginally substantial effects, while educational stages, display devices, intervention duration, group size, and strategies used had insignificant influence.

The impact of AR technology on educational media is connected to seven moderators: disciplines, educational stages, types of AR (marker-based, markerless-based, or location-based), display devices (mobiles, tablets, computers, or headsets), intervention duration, group size, and instructional strategies (Xu et al., 2022). Developing AR and VR content integration fulfilled different types of learning: visual, auditory, kinaesthetic, etc. Since reading is a receptive skill requiring other skills to be present, this media involves the student's more prolonged duration of learning. This situation simultaneously provides various information and knowledge.

Bower et al. (2013) also discovered that Augmented Reality with student work samples and their feedback indicated that the approach resulted in high levels of independent thinking, creativity, and critical analysis. (Şimşek & Direkçi, 2024) state that AR students are significantly better at reorganizing, inferential comprehension, evaluation, and appreciation. In other words, the augmented reality content contributes to reading comprehension performances. (Shaaban & Mohamed, 2024) state that the effectiveness of AR technology in developing reading comprehension skills covers three points: answering questions, guessing meaning from context, and scanning.

Another important aspect is the students' public speaking skills. They need to practice intensely for their self-confidence. (Liu et al., 2024) say students performed significantly higher on story-retelling tests. They retell the story structures regarding settings and plots well. In addition, AR pictures successfully increase attention and confidence in reading. The level of understanding of a reading text is also stimulated by the duration and motivation of presenting the final product to the public. These findings align with the study conducted by (Weng et al., 2024), which says immersive technologies bolster learners' attitudes and skills.

In reading comprehension, learners' attitudes contribute significantly to reading success. Moreover, teamwork in the group has a vital role in

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producing high-quality content. Lectures must guide the students to have a proportional team. The guideline has a specific part in detail, such as content observer, language, and technical observer. The other team must actively and effectively contribute by giving corrections and feedback to the first video draft before taking another take of the video until the final product. Students rely on feedback. During the classroom presentation, the content creators need the best way to take notes of the teacher's and peers' comments to be used in the revised version of the final video. Technology-enhanced higher education (TEHE) is implemented through AR and VR content integration.

Exploring regional and institutional collaborations through social networks revealed that geographically adjacent institutions fostered close collaborations. Massive Online Open Courses, AI and big data in education, Gamification and engagement, learning effectiveness and strategies, social networks, and discussion forums, COVID-19 and online learning, and Plagiarism detection and learning analytics also require students to be more creative as well as original in presenting their reading result (Chen et al., 2024). Integrating AR and VR content strengthens the finding that using AR provides a level of learning breadth for teachers and students. It makes the learning process more exciting and more comprehensive (Rugaiyah et al., 2024).

The problem faced by students in the technical aspects is more to the editing process of the video. Many students disobey the video's artistic aspects. They focus on the materials. However, it influences and engages viewers to watch the video. Furthermore, this study significantly enhances the findings of previous studies. Sadler and Dooly (2016) find that flipped class materials place the foundation of the shared course. This media effectively puts the students in active preparation for the materials and gets them involved in preparing the way, as well as examples of the learning objectives set in the core competency. Students no longer act as the receiver in the teaching and learning process but take the role of the teacher for themselves and others.

This process creates a better and more significant chance for the students to comprehend the strategies and skills needed in the subject matter. This study also strongly proves the finding of (Révész, 2019), which says that Tasks-Based Language Teaching (TBLT). It supports the implementation through a project-based YouTube channel that effectively leads well-managed preparation and procedures conducted by teachers to the students. YouTube material stimulates students to think creatively and critically about the grammar of text or recorded videos. A positive attitude to embedded text is because students can assume and relate the material to previous knowledge. Therefore, understanding learning resources is much faster than using conventional textbooks or printed materials.

The use of YouTube videos as a final project product is effective for conveying authentic situations. The inverted class material is the foundation of the joint course (Sadler & Dooly, 2016). It means that developing learning materials and learning outcomes from social media, including YouTube, aligns with core principles from the current perspective of ELT courses. Uploading material and learning outcomes will increase the responsibility of teachers and students to improve the quality of the material or the final results of learning.

It also automatically triggers teachers and students to have a better teaching and learning process. Joint courses also control them and keep them away from plagiarism. In other words, besides improving pedagogical skills or English content, YouTube has many other advantages.

Innovative and interactive teaching and learning methods are essential to successful learning. Interactive can be defined as communication between cultures and familiarity with the source and target languages. The provision of material offers daily communication. It can bring about a higher interpretation, which can be done through visual texts. YouTube content videos can present this text authentically (Zhu & Shu, 2017) also showed that PBT encourages the development of the latest innovative curriculum for elementary classes in China. That is, PBT is very effectively used by students at the teaching practice level to prepare them to become creative and innovative teachers who develop teaching materials and methods in their classes. (Imbaquingo & Cárdenas, 2023) also explain that PBL provides an active and innovative approach to fostering student engagement and improving reading and comprehension skills.

CONCLUSION

Based on the result of the study, the quality of the AR and VR integration content of project-based tasks is still categorized as middle to high quality. None of the products of the content fails to fulfil the criteria entirely, yet none of the products can achieve all high standard criteria. Second, developing this project helps improve students' reading comprehension. It allows more significant time to analyze and discuss other student's thoughts on the content materials before presenting the conclusion of the reading text through the integration of AR and VR integration content of the project-based tasks.

The study provides compelling evidence for the effectiveness of integrating Augmented Reality (AR) and Virtual Reality (VR) content in project-based tasks to enhance students' reading comprehension skills. Expert evaluations of the AR and VR content highlighted the media's overall quality, ranging from fair to excellent, with particular strengths in program structure and usability. However, video quality, text readability, and visual elements needed improvement.

Quantitative data analysis, including paired sample t-tests, revealed a significant improvement in students' reading comprehension scores from pre-test to post-test, demonstrating the positive impact of AR and VR integration in PBL tasks. The findings align with previous research indicating that AR and VR enhance hands-on experiences, autonomous learning, and collaborative problem-solving, increasing student motivation and engagement.

From a content perspective, the materials scored predominantly good to excellent, particularly in content compatibility, concept accuracy, and language suitability. The need for additional support in technology literacy was noted, emphasizing the importance of training in these areas.

Overall, the study underscores the potential of AR and VR technologies in creating immersive and interactive learning environments that improve reading comprehension. By addressing the identified areas for improvement, educators can further enhance the effectiveness of these innovative teaching tools, ultimately leading to better educational outcomes.

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AUTHOR STATEMENTS

Wahyuningsih Wahyuningsih: conceptualization, methodology. software, data curation, writing-original draft preparation, and investigation. Didik Murwantono: writing-reviewing and editing

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