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Effects of augmented reality on perceived motivation for struggling readers: Mix-method analysis

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Abstract

Higher education students who struggle with reading may find some relief via the use of technology, especially new and developing forms of technology. Even though augmented reality (AR) has been used in the classroom with great success to motivate and engage children who are difficult to teach, there hasn't been a lot of research done on how augmented print may help those who have trouble reading. The purpose of this study is to investigate the effect of augmented reality on perceived motivation for students currently enrolled in higher education, namely their engagement with and understanding of an upgraded design theory book, as well as their perceived motivation to read. This research was conducted using the mix method approach, supported with some different methodologies. The findings reveal that increased support for academic literature enhances motivation, engagement, and confidence in understanding, impacting both struggling and proficient readers. We concluded that students, regardless of their reading level, expressed a willingness to use AR reading assistance for future books. Further research is crucial given the heightened levels of motivation and confidence. This research aligns with technological advancements, and educators can influence the development of augmented reality apps for classroom use. Future studies should focus on students with reading difficulties, exploring the optimal design of AR experiences and learning games to enhance understanding and retention of art history lectures in higher education.

Keywords: augmented reality; effect; motivation; struggling readers

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Augmented reality (AR) allows students to encounter content in several different ways, which increases the likelihood that they will be engaged in the learning process and motivated to do so. The definition of augmented reality is contingent on the perspective of the individual who is interacting with and experiencing the augmented reality medium. It is possible to define augmented reality as a medium in which digital information is overlaid on the actual world; however, this definition is not definitive (Craig, 2013). AR is the process of superimposing digital content on top of the actual environment, and it can be experienced through the use of digital portable devices such as smartphones and tablets. AR refers to the process of superimposing digital content on top of the actual environment. The camera on the smartphone can identify physical material via the monitoring of natural features or GPS coordinates, which then causes the augmented content to be shown. A spectator may see the digital material that is superimposed over the real-time picture that is being brought in via the camera by looking through the handheld digital device that is being used. Augmented reality makes it possible to imbue the real environment with digital resources that were not before available. For example, AR may provide additional digital assistance and aids for those who struggle with reading, which they can use in conjunction with traditional printed text and books. Students' experiences and comprehension are enriched as a result of the interconnectedness of the resources of the physical world (Che Dalim et al., 2020).

Research indicates that augmented reality may have the ability to boost both engagement and motivation. An educator who was asked to participate in an interview during the course of the research that was carried out by Dunleavy et al., (2009) stated that "one of the most difficult challenges for classroom instructors is attempting to engage pupils who are uninspired in traditional classrooms." The finding that these children are highly engaged throughout an AR course is noteworthy and encouraging. When AR is combined with textual information, it has the potential to boost the amount of engagement and motivation that is felt by the reader. It is now possible, because to the application of augmented reality technology, to acquire knowledge via means other than just reading it on paper (Venkatesh, 2015). For instance, the use of three-dimensional

models could attract the curiosity of readers who are on the fence while also fostering deeper knowledge (Yulian et al., 2022).

There are a variety of applications for AR that may be utilized in the classroom. The creation of augmented classroom material is possible with the use of applications such as Layar, Blippar, and Aurasma. Unfortunately, these tools may either be difficult to operate with or costly to purchase. There are currently no streamlined augmented reality technologies available that are expressly designed for teachers to utilize in the classroom. Aurasma is the most budget-friendly option for usage in educational settings among the three other instruments that were discussed before. Aurasma has been successfully used in the classroom by several educators, and step-by-step guides for using the app in educational settings can be obtained on the internet. Previous studies have pointed to an increasing trend about the significant management overhead that is associated with AR. Nevertheless, thanks to AR creation tools such as Aurasma, teachers and students alike can design and personalize their own educational AR experiences (Craig, 2013). The capacity to construct individualized AR enables teachers to provide reading assistance for students who are having difficulty reading; yet, the process of doing so may be time intensive at the moment.

By augmenting printed content with reading aid strategies that have been proven to be successful, such as explicit teaching approaches like scaffolding, AR may be able to assist those who have difficulty reading. As a receptive skill, reading is vital in L2 academic settings where learners are required to read (Amalia, 2020; Amumpuni, 2022). Education has centered its emphasis on the teaching and learning of 21st-century literacy skills (Bakar, 2019) or workplace skills which infuse skills of creativity, and language literacy (Farizawati et al., 2022). The study provides support for the instructional method of explicit teaching, particularly when it is used for students who are having difficulty (Marchand et al, 2013). During a learning activity, scaffolding, which is a component of direct and explicit teaching (Lestari & Anugerahwati, 2022), deconstructs a problem by providing prompts for ideas and concepts. In other words, scaffolding takes a problem and breaks it down into its parts. If students have a large vocabulary, not only are they better able to access the information, but they are also better able to absorb it and put it to use. As the proverb goes, "Vocabulary knowledge is content knowledge" (Templeton et al, 2015). The outcomes of a study that was revealed that scaffolded comprehension questions that were available digitally boosted one's level of understanding. It helps struggling readers to receive vocabulary and explicit teaching through scaffolding. It should also help struggling readers supplement a printed text with these components, as it helps struggling readers to receive vocabulary and explicit teaching through scaffolding. It is hoped that the provision of this extra support would result in an improvement in both self-assurance and the sense of one's level of comprehension.

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The use of AR and digital text has been found to provide struggling readers with several advantages, especially when combined with the use of suitable reading methods. This paper discusses the case study of augmented reading activity and investigates the use of scaffolded comprehension questions, vocabulary building, and content chunking through AR as a means of combining tried and true instructional strategies with the advantages of using digital text in conjunction with a printed document.

METHOD

The purpose of this research was to investigate the effect of augmented reality on perceived motivation for struggling readers. A mixed method was used to approach through a survey that was embedded inside this study. The research technique allows for the integration of qualitative and quantitative data, which eventually results in a multidimensional approach (Miles et al., 2013). To explore the impact that the educational activity had on the participants' levels of motivation, quantitative data were collected by using the questionnaire of Instructional Material Motivational Survey (IMMS) which was administered to gain this information. In addition to the findings of the quantitative survey, information of a qualitative nature was obtained via participation in a focus group interview. This follow-up was required since there is a paucity of research on the issue of the provision of digital scaffolding and visual reading aids for students who are enrolled in higher education via the use of augmented reality, thus it was important to conduct this study.

The Role of Context in the Study

Students of English at Universitas Jabal Ghafur were the focus of this particular research project. During a unit on visual literacy, students carried out a case study on an augmented reading exercise. At Universitas Jabal Ghafur, the subject known as Visual Literacy is categorized as a history and theory/criticism curriculum under the Teacher Training and Education department. The reading task was carried out with a class that consisted of 19 pupils, all of whom had varying degrees of reading ability. Even though not all students of the English department struggle with reading, research has shown that a greater proportion of art students are dyslexic (Bacon, Bennett, 2013). The students were given the assignment to do an internal evaluation to determine whether or not they perceived themselves to have reading problems. Before this study was conducted, there had never been a legitimate test to determine a person's reading level.

Participants

In the Visual Literacy class, there were a total of 19 students by using purposive sampling (ten males and nine girls, ranging in grade from sophomore to senior) who participated in the exercise during class; of those 19 students, 16

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decided to take part in the research. Sixteen of the 19 students were given the option to take part in the data collecting. These students were working on the Bachelor of Teacher Training and Education degree, and this class satisfied one of the requirements for the history and criticism concentration.

Because we had used Aurasma in previous lessons, everyone in the class was familiar with it already. They were educated about how to get access to the augmented content and make use of it, in addition to how to participate in Qualtrics surveys using a mobile device.

Procedures for the Research Design and Data Collection

The reading exercise was structured on Susan Roth's book Visual Literacy and the Design of Digital Media, which is a study on design theory. It served as the framework for the activity. Using the AR programed known as Aurasma, the students were able to get access to a variety of digital resources, such as a visual synopsis of the text, word definitions, and scaffolded comprehension questions. After an AR reading exercise was finished, a survey and the findings of a small, unstructured focus group were utilized to collect the necessary data for this study. The focus group results were used in conjunction with the survey results. Both qualitative and quantitative facets of the data were gathered throughout the gathering process. This research made use of a variety of instruments, including scaffolded comprehension questions (as they occurred during the activity), an IMMS motivation assessment of AR, a post-activity survey questionnaire, and a focus group. The students who participated were all students at the same school, and they had all used Aurasma several times before taking part in this exercise, so they were all acquainted with how to access augmented material. Ten was the bare minimum need for pupils to use the augmented reality app Aurasma to get information to participate in the various classroom activities. Additionally, as a part of two other projects for the class, each of them had developed their very own distinctive auras (Aurasmas triggers).

Data Analysis

The qualitative data that had been gathered were analyzed in two stages: first, during the first cycle of analysis, and then again during the second cycle of analysis. In addition to the descriptive technique, the in vivo method was also used in this research. In the first cycle, we implemented a method that is referred to as in vivo coding. This is a technique that is a procedure that makes use of words or short phrases from the participant's native language in the data record as codes (Miles et al., 2013). After that, a second cycle of recording the data was carried out. Afterward, Utilizing descriptive coding allowed for the gathered qualitative data to be given a name to facilitate easier analysis. As a direct consequence of this, indexing information was gathered, which was then put to use in the cycle of coding that followed. To analyze the students' use of language in connection to the subject they were learning, we concluded that the qualitative

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method of in vivo coding would be the best method to use. Because our students spoke a variety of languages, we opted to go with descriptive coding so that we could bring together findings and information that were similar although we used different coding systems. After being coded in two different processes, the data were much simpler to understand. Returning to the data after the first coding was finished allowed for the extraction of a further degree of importance from the collected information.

The first stage of the coding process consisted of summarising larger blocks of data so that they could be used in the second cycle technique of coding, which involves grouping those summaries into more specific categories or constructs. This was the primary objective of this first stage of the coding process. To put it another way, the purpose of the first stage of the coding process was to get the data ready for the second cycle method of the coding process. During the second iteration of the coding process, pattern matching was used to search for each of the four separate kinds of summarizers. These included: (a) categories or topics; (b) the reasons or explanations for anything, (c) the interpersonal connections between individuals, and (d) the conceptual frameworks of a theory. To give visual help for the analysis of the data, matrices were shown both during the first cycle of coding and the second cycle of coding. These matrices are a visual representation that shows information in a structured manner to allow the researcher to make conclusions about the data. A comprehensive examination of such data may be carried out by developing a matrix, which allows for the omission of information that is not relevant while simultaneously concentrating on and coherently structuring the data (Miles et al., 2013).

FINDINGS

The participants' levels of motivation

We used a modified form of the IMMS to evaluate the effect that this educational experience had on the participants' levels of motivation. This version of the IMMS contained 20 questions and had an overall reliability score of 8.5. The value of Cronbach's Alpha was determined to be .772 when all of the IMMS questions from this research were taken into consideration. This value increased to .812 when Cronbach's Alpha was calculated based on standardized items. Scores of 0.7 or higher on the Cronbach's Alpha scale are recommended for use in research.

There were 19 pupils in the class, and 16 of them gave their permission to take part in the research. Twelve of the sixteen students who were questioned had a high level of motivation, three students exhibited to medium level of motivation, and one student showed a low level of motivation. The students were given a Likert scale that ranged from one (indicating poor motivation) to nine (indicating strong motivation) to score each question on.

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The data are coded in such a way that green represents very motivated and engaged individuals, blue represents moderately motivated and engaged individuals, and yellow represents low-motivated and neutral individuals,. Figure 1 Diagram of students' levels of motivation.

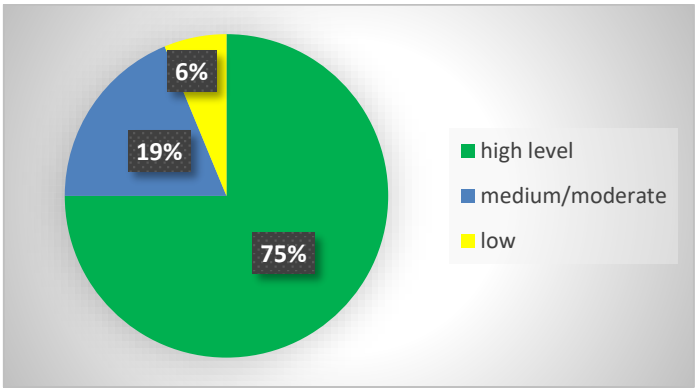

Figure 1 Diagram of students' levels of motivation

Students believed the AR was relevant, and the AR layout kept their interest, as shown by their replies to the IMMS, 15 students gave responses of seven or higher on the question "I could link the content of the exercise to topics I have studied in class or thought about in my own life," while one student gave a response of 6.5. Fourteen of the students gave a response of six or higher to the question "The way the enhanced material is placed on the pages helped retain my attention," and eight of the students gave a response of seven or higher. When asked, "There are adequate language and visual aids that showed me how this reading exercise may be beneficial to certain individuals who struggle with reading academic books," all of the students gave answers that were more than a six on a scale of one to ten. "The content of the exercise will be valuable to me in terms of learning and keeping the academic piece," was the question posed in question 14. Thirteen students replied with a score of seven or above, two students who responded with a six, and just one student who responded with a five and a half.

The Results of Focus Group Interviews

The results from the focus group interviews are presented in this part. These interviews confirm and expand on the findings from the post-survey. After the students' grades for the semester were sent in, the focus group interview was held with three of the students. The participation was entirely optional, and it enabled a follow-up survey to be conducted after the activity, from which qualitative data could be gathered. The interview was captured verbatim in an audio file, and only portions of it were transcribed. The relevant replies were transcribed and coded. During the course of the focus group, participants

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sometimes veered off topic to talk on tangents such as the design of the Aurasma user interface, the process of creating Auras for Aurasma or accessing an Aura. These digressions have been left out of the transcription since they did not directly relate to the investigation that was being carried out. The list of questions that served as a guide for the interview is shown in Table.

The findings obtained from the qualitative interviews provided support for the conclusions arrived at via the post-activity survey. To be more specific, (1) a preference for using AR help rather than reading plain printed material; (2) the assistance that AR provides with vocabulary acquisition and comprehension; and (3) the support that AR provides for reading as a tool for motivation.

The sample of interviews with the students was when asked if they preferred an electronic book over a traditional textbook, all three of the students said that they loved the digital text qualities of e-books, particularly the option to convert text to voice. On the other hand, two of the students said that even if augmented reality could convert text to voice, they would still choose to read print. One of the students exclaimed, "E-book! I'm afraid I'll end up throwing away the printed book, so I won't be carrying it with me wherever. The student continued by stating that augmented reality assistance for printed books would be desirable if an electronic version of the book could not be obtained. In particular, if the length of the printed books could be reduced by including previously written information that could be accessible via AR , such as quizzes and more in-depth content, this would be very beneficial.

One student voiced their apprehension about the possibility of reading e-books on their mobile device. Tablets were not available to them in any form. The students were unanimous in their opinion that reading e-books on a phone was very tough, however accessing AR via a phone was perfectly good as long as the AR application was optimized for phones. AR assistance was also beneficial, especially for art history, since it may simplify the process of learning new material.

And the results of this investigation have been laid forth in this chapter for everyone to see. When it came to determining levels of motivation, the IMMS was used, and the findings indicated that the AR reading activity had a level of motivation that ranged from medium to high for a total of 12 students. The augmented reality support in the form of visuals and content questions was deemed helpful by both readers who struggled and readers who were considered to be typical. Additionally, readers who struggled had access to additional support in the form of vocabulary, while typical readers were not burdened with additional information. The augmented reality assistance offered by pictures and content queries was deemed beneficial by readers of all types, even those who had difficulty reading the material. In addition, the results of the post-activity survey showed that readers who were having difficulty were able to get further help, such as vocabulary, without encountering any barriers.

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In conclusion, the findings from the post-survey are supported and expanded upon by the focus group interview. The replies from the interviews provided support for the points expressed in the survey, including the following: (1) AR boosted motivation; (2) students would employ similar AR assistance in the future; and (3) students believed that the AR supports were beneficial in gaining a grasp of the topic.

DISCUSSION

The Impact of Augmented Reality on One's Confidence in Their Ability to Comprehend

When augmented reality was added to a printed text, both normal readers and readers who self-identified as having difficulty comprehending the material reported significant increases in their confidence in their ability to understand the material. It was discovered that providing usual and struggling readers with additional reading assistance in the form of scaffolding via the use of AR was useful. A student who is having difficulty learning is given access to a support system known as scaffolding, which is a component of direct and explicit teaching. This support system gradually disappears as the learner becomes more autonomous. Previous studies have shown that providing readers with scaffolded assistance is advantageous to them (Huang, Wu, & Chen, 2012). The AR supports were implemented in this research in such a manner that each student had the opportunity to choose the level of assistance they wanted to receive. A student has the option of spending extra time going through the vocabulary part again or spending no time at all on it.

The dismantling of support structures, often known as scaffolding, is an integral part of learning and achievement. In this particular research, a method consisting of three steps was used to build reading supports inside the text utilizing AR. The material included the following: (1) pre-reading help and information on chunking; (2) vocabulary definitions that could be consulted while reading; and (3) scaffolded comprehension questions that led readers back to the text if a question was missed. According to the findings of several studies, students who have trouble reading may benefit from personalized direct teaching. The research backs up the practice of explicit teaching, especially when it's employed for students who are struggling (Marchand et al, 2013).

To begin, it was discovered that the pre-reading AR, which offered chunking and access to essential phrases, was beneficial for all of the students who participated in the research. The vast majority of students felt that it was beneficial to have access to the terminology. The students were unanimous in their agreement that completing the comprehension questions allowed them to get a deeper understanding of the material. Second, for readers who are having difficulty, terminology might be a barrier to passage. Students may improve their reading comprehension and analytical skills by working to expand their

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vocabulary. According to Hall et al. (2014), the use of vocabulary acquisition scaffolding ought to increase a student's level of understanding of academic work. During the focus group interview that was a part of this research, one of the students reiterated the results of the previous student by saying, "I believe the vocabulary was the best use of the AR ". If I have to look up six terms on each page, it will take too much of my time; but, if the meanings are right there in the text, I will be able to look them up very fast (Student Response Focus Group 2016).

During the post-activity survey, another student remarked on the usefulness of vocabulary assistance by saying, "For me personally, my variety of vocabulary is really poor." I often looking up phrases on Google to make sure I am using them in the appropriate setting, so having keywords readily accessible on Aurasma makes my work more efficient and allows me to draw connections between those terms and the article. The percentage of struggling readers who found the vocabulary assistance useful was much greater than the percentage of usual readers. However, both regular readers and readers who struggled to comprehend the material believed that pre-reading questions and questions testing comprehension were equally useful. As a consequence, the findings of this research provide more evidence to corroborate what is already common knowledge in the area, namely, that students' vocabulary knowledge enables them to access, comprehend, and apply information (Templeton et. al, 2015).

Third, past research demonstrates that the use of direct teaching or the use of scaffolding is beneficial for students who have difficulty reading (Edmonds et al 2009). As a result, it should not come as a surprise that the readers who self-identified as having difficulty found the increased scaffolding useful. It is nonetheless significant to notice that the scaffolding was accomplished not via the teacher's engagement but rather through augmentation. In a prior research, conducted by (Brevik, 2019), it was shown that scaffolded information is important for reasons other than giving digital linkages to background knowledge. The information that was gathered for this research is intriguing since not only those who consider themselves to have reading difficulties but also regular readers thought that the additional assistance was useful. In addition, although other studies have shown the use of scaffolding, vocabulary, and the dumping of information, the findings of this study demonstrate that these things may be accomplished digitally by making use of AR. The majority of students, both those who were aware of their reading difficulties and those who were considered to be "normal readers," saw a rise in their level of self-assurance after using the AR scaffolding. This study highlights the fact that some students may feel confident in their ability to read required academic texts, but they may also feel that they are struggling readers. While some students may feel confident in their ability to read required academic texts, other students may feel that they are struggling readers. As a consequence of this, these students may have an inaccurate self-perception of their reading abilities, yet they are still in danger of

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not completing the assigned readings. The data show that employing scaffolding improves reading comprehension confidence in readers of all skill levels, not only those who struggle. This is not exclusive to readers who have difficulty. When a reader's self-assurance over their capacity to grasp the text is boosted, they are more likely to stick with difficult reading material. Additionally, with improved self-assurance brought on by an enhanced level of comprehension, every student has a higher opportunity to contribute more actively to the learning process in the classroom.

The integration of scaffolded resources and digital text affordances, such as text-to-speech (TTS) and integrated dictionaries, may be of more aid to readers who are having difficulty reading than what is already accessible. For instance, "Text-to-speech (TTS) engines may aid children who are having problems reading to improve their comprehension, fluency, and accuracy" (Keelor et al., 2020). Students can improve their word recognition and vocabulary when they hear terms used in appropriate contexts, and this does not inhibit their capacity to absorb the material. This argument is backed by the findings of the current study since, during the focus interviews, all three of the students declared a preference for the digital text capabilities of e-books, namely the TTS option. Consequently, this affirmation is true. A cross-tabulation was performed, utilizing the students' self-assessed reading difficulties as well as their preference for listening to books on tape. According to the findings, the vast majority of those who preferred listening to books rather than reading were either poor readers or were unclear if they were poor readers. Although not a large number of students participated in this study's audio component, those students who had difficulty reading were more inclined to utilize the audio component. As a consequence of this, it is strongly suggested that text-to-speech audio be included as part of the scaffolded reading help offered to readers who are having difficulty. Even though students participated in the focus group, demonstrated interest in TTS, and elaborated on its usefulness, the data analysis revealed that very few students used the audio function while the research was being conducted. This is although students demonstrated interest in TTS and elaborated on the usefulness of it. It's conceivable that the interface design was faulty; alternatively, the students could not have been aware of the audio capabilities or they might not have had headphones accessible to use it. Either way, it's plausible that the design was defective. Even though not everyone would make use of it, it is a vital element to give because the statistics showed that pupils who enjoyed listening to audiobooks had a larger chance of becoming challenging readers. The findings indicated that kids who favored listening to books rather than reading them were more likely to have reading difficulties. Having access to the audio aid will not hinder the reading experience of ordinary readers, but it may help people who struggle with reading enhance their understanding.

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The Impact That Augmented Reality Has On student's Perceptions of Their Motivation

The use of augmented reality in teaching has been demonstrated to increase levels of interest and participation, according to research on the topic (Green, Lea, & McNair, 2014). This study also discovered that the use of AR improved the levels of reported motivation (Estapa &Nadolny, 2015) and engagement shown by the participants (Vyas ,2015) .The responses that the students gave to the IMMS showed that all of them believed that AR was important, and the AR layout was successful in keeping their attention during the whole activity. The findings of the study indicated that there was a chance of an increase in both intrinsic and extrinsic drive. This was supported by the fact that both types of motivation seemed to be on the rise. Increased motivation and better learning retention are both results of the interactive aspect of augmented reality engagement (Wedyan et al., 2022).

Researchers Billinghurst and Denser (2012) investigated the use of AR in the classroom and found that it was of substantial value to students who had difficulty with traditional learning based on printed text. Specifically, the researchers found that AR was most beneficial to students who were unable to read the printed text. By bridging the gap between traditional static paper and digital material in a manner that was not before conceivable, AR makes it possible for educators to enhance their students' learning experiences. Those who like and benefit from traditional paper-based learning, as well as students who struggle with it, have the potential to be reached via enhanced print. This is because augmented print can communicate with a much larger number of pupils.

Throughout the course of this investigation, individuals who were struggling readers as well as ordinary readers showed a self-perceived motivated improvement in willingness to read class materials if AR assistance was provided. After the inclusion of the AR aid, there was an increase in students' stated levels of desire to read academic works.

CONCLUSION

The findings point to the fact that increased reading assistance for academic literature increases motivation, engagement, and confidence in one's ability to comprehend, as felt not just by readers who struggle but also by readers who are normal. This effect is seen in both groups of readers. Following an investigation of the data, we came to this conclusion. Students who took part in this study were asked whether they would use augmented reality reading assistance if it were made available for further books. Their responses indicated that they would. More research must be conducted since one's feeling of motivation, involvement, and self-assurance about one's degree of understanding has increased, making it all the more crucial to do so.

The study that is carried out along these lines of inquiry will advance in tandem with the development of new technologies. In addition, if educators

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communicate their demands to developers and designers, the technology may be influenced by their previous work and ideas. This might result in augmented reality apps that are designed for use in the classroom and include language that is based on print. Students who have trouble reading should be the focus of future research that investigates how to best create AR experiences for the classroom, as well as how AR learning games might boost students' understanding and retention of art history lectures taught at higher education institutions to students who have trouble reading.

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