A LITERATURE REVIEW ON THE IMPACT OF INTERACTIVE LEARNING MEDIA IN DEVELOPING HIGH SCHOOL STUDENTS' CREATIVITY AND KNOWLEDGE IN THE 21ST CENTURY ERA

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Abstract: This study examines the impact of interactive learning media on improving the quality of education at the high school level. The main objective of this research is to explore how interactive media, such as educational games and simulations, can influence students' creativity, conceptual understanding, engagement in learning, and social skills. The method used is a systematic literature review of various relevant studies. The findings show that interactive media has a significant positive impact on students' creativity, encourages critical thinking, and enhances motivation and engagement in learning. The visualizations and simulations provided help students understand abstract concepts, especially in subjects like science and mathematics. This media also supports collaborative learning, strengthens social skills, and enhances educational inclusivity by accommodating various learning styles. However, challenges such as unequal access to technology in remote areas and a lack of teacher training in using technology need to be addressed. Therefore, this study suggests the importance of integrating technology into education by providing continuous training for teachers and improving accessibility to technology across schools. In conclusion, although interactive learning media has great potential to improve the quality of education, realizing its potential requires collective efforts from the government, schools, teachers, and policymakers to ensure that all students can benefit from this technology.

INTRODUCTION

The 21st century era is characterized by the rapid development of information and communication technology, which has a significant impact on various aspects of life, including education (Akhyar, 2022). One of the innovations that has gained attention is the use of interactive learning media. This media is designed to create a more engaging and immersive learning experience through various features such as animations, videos, simulations, and educational games (Wijayanti et al., 2022). Its ability to transform abstract concepts into more concrete forms makes interactive learning media an important tool in enhancing the effectiveness of learning, particularly at the high school level (Milidar, 2024).

In the context of learning, creativity and knowledge are two interrelated aspects that are essential in this era (Simanjuntak, 2019). Creativity allows students to think critically, solve problems in innovative ways, and adapt to various challenges (Alimuddin et al., 2023). Meanwhile, knowledge serves as the fundamental basis for understanding the world around them (Dewi & Winarno, 2024). The combination of creativity and knowledge is crucial for producing a generation that is not only academically intelligent but also capable of providing solutions to global issues (Fakrijal & Yusriman, 2024). Interactive learning media, with its innovative approach, is believed to facilitate the simultaneous development of these two aspects (Waruwu, 2024).

Several previous studies have examined the impact of interactive learning media on student learning outcomes. For example, a study conducted by (Priyadewi et al., 2024) titled "Development of Interactive Learning Media Assisted by Articulate Storyline 3 on the Excretory System Material in High Schools" showed that Articulate Storyline 3-assisted media is highly valid and practical for use in learning. This research utilized the ADDIE development model and produced media that received very high validation from content, media, and language experts, with a score of 1.0. Additionally, the practicality of the media was found to be high based on trials with teachers (93.7%) and students (92.1%).

Another study by (Lalisu et al., 2024) titled "The Impact of Interactive Learning Media on Student Learning Outcomes in Class X TJKT on Basic Computer Network and Telecommunications Engineering" also supports the effectiveness of interactive learning media. In an initial observation at SMK Negeri 1 Gorontalo, the learning process using lecture methods and print media, such as books and PowerPoint, was found to be less engaging for students, leading to boredom and a decline in learning outcomes. Using a nonequivalent control group experimental design, the study showed that the use of interactive media improved the average student score from 49.33 (pretest) to 83 (posttest) in the experimental class, with the percentage of students reaching the Minimum Completeness Criteria (KKM) increasing from 10% to 90%. In contrast, the control class using PowerPoint only achieved an average score of 74.67. These findings indicate that interactive learning media has a significant impact on student learning outcomes, with an improvement of 11% compared to conventional methods.

Furthermore, a study by (Fatkhulloh & Mardiyah, 2023) titled "Implementation of Interactive Learning in Islamic Religious Education (PAI) to Improve Student Understanding" highlights the importance of an interactive approach in teaching Islamic Religious Education (PAI). This research used a descriptive qualitative approach and triangulation techniques to test

the validity of the data. The findings show that the implementation of interactive PAI learning involved three main stages: introduction, implementation, and conclusion. Additionally, students' understanding improved through an interactive learning model that emphasized translation, interpretation, and extrapolation. Supporting factors, such as the involvement of the school principal, teachers, students, and community leaders, played a significant role in the success of this learning approach, although there were challenges related to individual, environmental, and student background factors.

Although various studies have demonstrated the effectiveness of interactive learning media in improving student learning outcomes, there are several research gaps that remain unanswered. First, the majority of studies use experimental methods with a quantitative approach, and there has been limited literature review that comprehensively summarizes the findings from various studies to provide a holistic picture of the impact of interactive learning media on students' creativity and knowledge. This literature review is essential to identify patterns, trends, and existing research gaps.

Second, many studies focus more on students' cognitive learning outcomes without further exploring the impact of interactive learning media on the development of students' creativity. Creativity is a key 21st-century competency that needs more attention in educational research. Third, the context of implementing interactive learning media is often limited to specific subjects, such as biology or computer network engineering. Literature reviews discussing the use of interactive learning media across various subjects at the high school level are still rarely found. This leaves a gap in examining how interactive media can be applied across disciplines to enhance students' creativity and knowledge.

Therefore, this study aims to fill these gaps by conducting a literature review on the impact of interactive learning media in developing students' creativity and knowledge at the high school level. This review will provide a holistic understanding of the effectiveness of interactive learning media and offer recommendations for its future development. Specifically, this study aims to identify the impact of interactive learning media in developing students' creativity at the high school level, analyze the effect of interactive learning media on improving students' knowledge, summarize findings from various previous studies to provide a comprehensive picture of the effectiveness of interactive learning media in the 21st-century era, and offer recommendations for the development and implementation of interactive learning media across various subjects at the high school level.

RESEARCH METHODS

The research method used in this study is a literature approach (Ferdiansah, 2024). The first step is problem identification, which focuses the research on the impact of interactive learning media on high school students' creativity and knowledge in the 21st century. Next, a literature search is conducted by collecting relevant sources such as books, journals, articles, and scholarly publications discussing the use of interactive media in education. The found literature is then selected to ensure its relevance and quality. Afterward, an analysis is carried out on the gathered data to identify trends, impacts, and gaps in previous research. Finally, conclusions are drawn based on the analysis of the existing literature, aiming to contribute to further research in the field of interactive education and explore innovations in the development of learning media to enhance students' creativity and knowledge.

RESULTS AND DISCUSSION

Interactive learning media has become one of the main innovations in modern education, especially in developing creativity and knowledge among high school students. In the 21st century, where technology is increasingly integrated into daily life, the use of interactive learning media has a significant impact on improving the quality of education. This study found that interactive learning media contributes greatly to the development of creativity, conceptual understanding, and active student engagement in learning.

1. **Enhancement of Creativity and Active Engagement**

   One of the main findings of this study is the increase in student creativity resulting from the use of interactive learning media. Media such as e-learning applications, simulations, interactive videos, and educational games create space for students to interact more intensively with the learning material. These interactive media not only allow students to memorize information but also provide opportunities for them to think critically, experiment, and find innovative solutions to various problems presented in the learning content.

   For example, the use of gamification features in learning applications gives students the chance to learn while playing, which in turn boosts their interest in learning and stimulates their creativity. By involving students in a fun and challenging learning process, interactive media enriches their experience and helps them think more creatively, as well as find new ways to solve problems. This media supports the

development of critical thinking skills, which are essential for facing challenges in an increasingly complex world.

As in the study conducted by (Ali et al., 2024) titled "Development of an Interactive Educational Game for Inheritance Calculation in Islamic Religious Education Using Scratch," the aim of the study was to develop and evaluate the effectiveness of an interactive educational game for learning inheritance calculation in the Islamic Religious Education subject using the Scratch platform. The research method used in this study was Research and Development (R&D) with the ADDIE model. During the development process, the game integrated learning content, gamification elements, and an adaptive system. Validation was conducted by media and content experts, while a trial was conducted with 60 high school students. The results showed that the feasibility level from media experts was very high (96%), and from content experts, it was also very high (97%). Additionally, the trial with students showed a significant improvement in understanding the material ($p < 0.001$) as well as learning motivation. This educational game proved effective in improving students' knowledge transfer skills, long-term retention, and critical thinking skills. Qualitative analysis also revealed positive impacts on the social-emotional aspects of student learning. This study makes a significant contribution to the development of innovative learning media for complex topics in Islamic Religious Education and opens opportunities for further research on the integration of gaming technology in religious education.

The research on the development of an interactive educational game for inheritance calculation in Islamic Religious Education using the Scratch platform shows very promising results, both in terms of media feasibility, improvement in understanding the material, and the positive impact on students' motivation and social-emotional skills. The use of the Research and Development (R&D) method with the ADDIE model in this study provides a strong foundation for the development and evaluation of the product. The ADDIE model, which consists of five stages—analysis, design, development, implementation, and evaluation—enabled this research to produce an educational game that is not only effective in delivering the material but also engaging for students.

One of the main findings from this study is the very high feasibility of the developed media. Validation conducted by media experts (96%) and content experts (97%) indicates that the developed educational game meets the expected quality

standards, both in terms of interface design, graphic quality, and relevance to the taught material. This is important, as high-quality learning media can improve the comfort and effectiveness of the learning process for students.

The trial involving 60 high school students showed a significant improvement in understanding the inheritance calculation material after using the educational game. The significant improvement ($p < 0.001$) demonstrates that this game is effective in helping students understand concepts that were previously considered difficult, such as inheritance division in Islamic law. This proves that interactive media, such as educational games, can address challenges in learning complex material that requires deep and practical understanding.

Additionally, the use of gamification elements in the game has been shown to increase students' motivation to learn. Gamification provides an enjoyable and challenging learning experience, which in turn stimulates students' interest in continuing to learn and explore the material being studied. With elements such as quizzes, challenges, and a points or rewards system, students feel more motivated to actively participate in the learning process, which can increase their engagement.

Moreover, this study also shows that this educational game has a positive impact on students' social-emotional skills. Through the collaborative features within the game, students are encouraged to work together to solve tasks or challenges, which helps develop communication and teamwork skills. This social-emotional impact is crucial because it supports students' character development in addition to their academic progress.

However, despite the very positive results of this study, there are several challenges to consider. One of them is the gap in access to technology, which can be a barrier in some schools, especially in remote areas or those with limited facilities. Therefore, the development of this educational game needs to be accompanied by efforts to improve technological infrastructure in schools so that all students can benefit from it.

Overall, this research demonstrates that the development of interactive educational games using the Scratch platform can be a highly effective innovation in Islamic Religious Education, particularly in understanding complex material such as inheritance calculation. This research also opens up opportunities for further

development in using gaming technology to enhance the quality of religious education, both in formal school settings and in self-learning outside the classroom.

Additionally, interactive learning media encourages students to be more actively involved in learning. Students are not only passively receiving information but are given the freedom to explore topics in greater depth through various features such as quizzes, collaborative tasks, and online discussion forums. This active involvement motivates students to keep learning, collaborate with their classmates, and test their understanding through challenging and engaging activities.

2. Enhancing Conceptual Understanding Through Visualization and Simulation

One of the significant advantages of interactive learning media is its ability to present material in the form of visualizations and simulations, making it easier for students to grasp abstract or complex concepts that are often challenging to understand through conventional teaching methods. Technology-based learning that incorporates animations, interactive graphics, and 3D models enables students to "see" and "experience" concepts that would otherwise remain intangible with verbal or text-based explanations alone.

For instance, in science or mathematics lessons, students can use applications that allow them to perform virtual experiments or visualize scientific phenomena such as chemical reactions or mathematical computations. With such media, students not only learn theories but also see how these theories are applied in real life, making it easier for them to comprehend and retain the concepts. This approach is particularly beneficial for improving students' understanding of more complex topics.

A study titled *The Effect of Using the Olabs-Based Virtual Laboratory Application on Students' Learning Outcomes* by Iim Halimatul Mu'minah from Universitas Majalengka was motivated by the significant changes in the education sector due to the COVID-19 pandemic in 2022. During this period, in-person learning shifted to online formats, posing challenges for both educators and students. Educators needed to adapt to technology, while students often felt disengaged with less effective teaching methods.

As a solution, this study explored the use of Olabs-based Virtual Laboratory technology as a medium for teaching science. The research employed a quasi-experimental design with a pretest-posttest control group design. Using purposive

sampling, Class VIIB was assigned as the experimental group using the virtual laboratory, while Class VII C served as the control group using conventional teaching methods, with each group consisting of 29 students.

Data was collected through essay tests, and the analysis was conducted using an independent sample T-Test. The results revealed a t-value of 3.021, exceeding the critical t-value of 2.045, and a significance value of 0.004, which is below the threshold of 0.05. This led to the rejection of the null hypothesis (Ho) and acceptance of the alternative hypothesis (H1), concluding that there was a significant difference between the posttest mean scores of the experimental and control groups (Mu'minah, 2022).

This research demonstrates that the use of the Olabs-based Virtual Laboratory application positively impacts students' learning outcomes, highlighting the effectiveness of integrating technology into education to enhance understanding of complex material.

This study reveals the positive impact of using the Olabs-based Virtual Lab application on students' learning outcomes. Post-pandemic online learning often posed challenges for both educators and students. Students frequently felt bored and demotivated due to teaching methods that were perceived as less interactive and engaging. As a response, this research focused on utilizing technology as a solution to these issues, specifically by employing the Olabs Virtual Lab application in science learning.

The findings show that the use of the Olabs-based Virtual Lab application in the experimental group significantly improved students' learning outcomes. Through this application, students could perform virtual experiments, enabling them to remain actively engaged in the learning process, even without access to physical laboratory facilities. This is particularly relevant in the context of science education, which requires hands-on involvement in experiments and observations.

Data analysis using the independent sample T-Test indicated a significant difference between the experimental group, which utilized the Virtual Lab application, and the control group, which relied on conventional methods. The t-value exceeded the critical value ($3.021 > 2.045$), and the significance level of 0.004 was well below the threshold of 0.05. These results confirm that learning with virtual laboratories provides a superior impact on students' learning outcomes. It underscores that the Olabs-based

Virtual Lab application enhances students' understanding of science concepts effectively.

The use of the Virtual Lab in this study also highlights that technology can serve as an effective tool for increasing student engagement and simplifying the comprehension of complex concepts through simulated experiments. Although online learning is often criticized for being less effective, this research demonstrates that with the proper application of technology, the learning process can become more engaging and yield better outcomes.

However, it is important to note that despite the significant effectiveness observed, challenges related to technology accessibility remain. Not all schools and students have equal access to the technological devices required to run the Virtual Lab application. Therefore, further efforts to improve technology accessibility and provide training for educators are essential to ensure that all students can benefit from the integration of technology into education.

Overall, this study makes a significant contribution to the use of technology in education, particularly in science learning. The Olabs-based Virtual Lab application has been proven to enhance students' learning outcomes while addressing issues of boredom and inactivity in online learning environments.

3. Collaborative Learning to Enhance Social Skills

In addition to fostering independent learning, interactive learning media also support collaborative learning. Through digital platforms, students can work together on tasks or projects, share ideas, and discuss the material they are studying. This collaborative learning enables students to develop essential social skills, such as effective communication, teamwork, and problem-solving in groups. These social skills are particularly crucial in the 21st century, where the workplace demands the ability to collaborate within diverse teams.

With features such as online discussion forums, video conferencing, and technology-based projects, students can collaborate without the constraints of time or space. This enhances their engagement in the learning process, provides opportunities to learn from one another, and helps them cultivate interpersonal skills that are invaluable in daily life and professional settings.

A study conducted by Abdul Muin, a graduate student in Geography Education at Universitas Negeri Jakarta, titled *Technological Information and Communication in Education* (2024), highlights the critical role of Information and Communication Technology (ICT) in education. ICT has transformed the landscape of education, serving not only as a supplementary tool but also as a foundational element in the learning process.

The use of ICT broadens access to educational resources, strengthens interactions between students and educators, and enriches teaching methods. With the internet and mobile devices, students now have the ability to access learning resources anytime and anywhere, making education more flexible and widely accessible. Online learning platforms and educational apps also facilitate adaptive and personalized learning tailored to each student's needs.

Moreover, ICT fosters a more interactive learning environment. Technologies such as video conferencing, online forums, and collaborative applications enable more intensive interaction between students and educators, which can enhance student engagement and understanding of the material. Despite its many benefits, the integration of ICT in education is not without challenges. Issues such as technological accessibility, the digital divide, and data security concerns remain significant barriers. The study concludes that the integration of ICT in education is indispensable, and with thoughtful and sustainable implementation, ICT will continue to play a pivotal role in shaping a more inclusive and progressive future for education (Muin, 2024).

This study reveals the significant role of Information and Communication Technology (ICT) in transforming the landscape of education. Before the COVID-19 pandemic, the use of ICT in education had already started to develop. However, with the dominance of online learning during the pandemic, the utilization of ICT became increasingly crucial. This study shows that ICT has transformed from merely a supporting tool into a core component of the learning process.

One of the greatest contributions of ICT is its ability to provide broader access for students to educational resources, particularly with the availability of the internet and mobile devices. This enables students to learn anytime and anywhere, a feat previously challenging to achieve in face-to-face learning systems. Moreover, online learning platforms and educational applications offer a more adaptive and personalized learning experience. Learning can be tailored to the needs and pace of each student,

creating opportunities for individuals to grow according to their unique learning styles. This is particularly important to ensure that education reaches students from diverse backgrounds, including those who may face challenges in participating in conventional learning.

A key highlight of this study is how ICT creates an interactive learning environment. Technologies such as video conferencing, online forums, and collaborative applications facilitate more intense communication between students and teachers. This not only enhances understanding of the material but also strengthens students' engagement in learning. More frequent and direct interactions help students feel more connected to the learning process and reinforce the social aspects of education.

However, despite its many benefits, the implementation of ICT in education is not without challenges. One of the biggest challenges is the issue of technology accessibility. Not all students, particularly those living in remote or underprivileged areas, have adequate access to technological devices and the internet. This digital divide becomes a significant barrier that needs to be addressed to ensure ICT can be utilized optimally by all parties. Additionally, issues related to data security and privacy must also be considered, given the vast amount of personal data collected through online learning platforms, which requires protection.

The researcher concludes that despite these challenges, the role of ICT in education is vital and cannot be ignored. With wise integration and proper management, ICT holds great potential to create a more inclusive, progressive, and accessible education system. Therefore, policies supporting equitable access to technology, training for educators in using technology, and attention to data security are essential to ensure all students can benefit from these technological advancements in education.

4. Impact on Learning Styles and Educational Inclusion

Research indicates that interactive learning media can adapt to various student learning styles, including visual, auditory, and kinesthetic. Visual learners benefit from images, graphs, and videos to comprehend material, while auditory learners can utilize podcasts or lecture recordings. Meanwhile, kinesthetic learners can engage in simulations or virtual experiments that allow them to interact directly with the lesson material.

By accommodating these diverse learning styles, interactive learning media enable all students, regardless of their learning preferences, to engage with education in the most effective way for them. This inclusivity reduces academic achievement gaps, ensuring that every student has the opportunity to learn in a way that aligns with their strengths and needs.

A study conducted by Erlina Damayanti et al. in 2024, titled *The Influence of Interactive Multimedia-Based Learning Media on Students' Learning Outcomes Based on Learning Styles*, examines the significance of learning media in enhancing student outcomes in schools. Learning media play a crucial role in fostering motivation, making learning more engaging, and supporting a more effective teaching and learning process.

With technological advancements, interactive multimedia-based learning media have gained prominence by integrating various elements such as text, animation, graphics, video, and sound. This study explores the impact of using interactive multimedia learning media on student learning outcomes, considering their individual learning styles: visual, auditory, and kinesthetic.

The methodology of this literature review involved searching research articles from 2012 to 2018 via Google Scholar, yielding 8,640 articles. After identification, screening, and selecting relevant articles based on inclusion and exclusion criteria, five articles were chosen that aligned with the study's objectives.

The findings demonstrate that the use of interactive multimedia-based learning media in vocational high schools significantly improves students' learning outcomes. The media's adaptability to individual learning styles ensures effective teaching strategies that cater to each student's unique preferences, emphasizing the vital role of interactive multimedia in modern education (Damayanti et al., 2020).

Erlina Damayanti et al. (2024) highlight the significant impact of interactive multimedia-based learning media on student learning outcomes, particularly when tailored to their learning styles. Students' diverse learning styles—visual, auditory, and kinesthetic—necessitate different media approaches to achieve optimal results. In this context, multimedia-based learning tools that combine text, animations, graphics, videos, and audio effectively cater to these varied needs.

For visual learners, engaging visuals like images and videos enhance comprehension and retention of the material. Auditory learners benefit from clear explanations and sound elements incorporated in multimedia learning tools. Meanwhile,

kinesthetic learners gain the most from interactive and simulation features that allow hands-on exploration and practice, thereby improving understanding and engagement.

Interactive multimedia-based learning not only makes the process more engaging but also more effective in improving student learning outcomes. The integration of various elements that stimulate multiple senses creates a holistic and immersive learning experience. This literature review underscores that aligning learning methods with students' learning styles significantly boosts their involvement and comprehension of the material.

Despite its effectiveness, challenges remain in implementing interactive multimedia. Unequal access to technology across schools and the need for adequate teacher training to optimize these tools are significant hurdles. To maximize the potential of multimedia-based learning, professional development for educators and equitable provision of technological infrastructure are essential, especially in underprivileged areas.

In summary, the research strongly supports the use of interactive multimedia-based learning media as a powerful tool for enhancing student outcomes, provided it is adapted to their specific learning styles. With proper implementation and support, this approach offers a promising avenue for more effective and inclusive education.

5. Challenges in Implementation

Despite the numerous advantages of interactive learning media, its implementation is not without challenges. One of the primary obstacles is the disparity in technological access (Caswanda et al., 2024). Many schools, especially those located in remote or underdeveloped areas, lack adequate infrastructure to support technology-based learning. This includes limited access to computers, unreliable internet connections, and difficulty in accessing digital learning platforms or applications.

Another significant challenge lies in teachers' readiness to adapt technology into their teaching methods. Some educators may feel underqualified to use technology or lack confidence in integrating interactive learning media into their classrooms (Mutia et al., 2023). Consequently, comprehensive and intensive training for teachers on how to utilize technology effectively in their teaching practices is crucial for ensuring successful implementation.

Although interactive learning media offers various benefits in improving the quality of education, its implementation still faces several challenges that need attention. One of the main obstacles is the disparity in access to technology (Rivaldi & Dompak, 2024). Many schools, especially those in remote or underdeveloped areas, still lack adequate infrastructure to support technology-based learning (Sabrina Nur Syifa et al., 2024). Some regions struggle to provide enough computers for all students and face issues with unstable internet access (San Mikael Sinambela et al., 2024). This makes it difficult for students in these schools to access digital learning materials, preventing the benefits of interactive learning media from being fully realized.

In addition to technology access issues, another challenge is the readiness of teachers to adapt technology into their teaching methods (Subroto et al., 2023). Not all teachers feel skilled in using technological devices or confident in integrating interactive learning media into the learning process (Hayati et al., 2024). This lack of knowledge or confidence can hinder the optimal use of technology in the classroom (Rusliana et al., 2024). Therefore, it is crucial to provide better and more intensive training for teachers so that they not only master the use of technological devices and applications but also effectively integrate them into their teaching strategies.

Adequate training will ensure that teachers can optimize the use of interactive learning media according to the characteristics of their students and the learning context (Mustopa et al., 2024). Furthermore, support from schools is also needed to provide sufficient facilities and resources so that technology can be accessed by all students. In this way, the implementation of interactive learning media can proceed more effectively and have a maximum positive impact on student learning outcomes.

CONCLUSIONS AND RECOMMENDATION

This study comprehensively examines the impact of using interactive learning media in improving the quality of education at the high school level. The findings indicate that interactive learning media, such as educational games and simulations, have significant potential to enhance students' creativity, conceptual understanding, active engagement in learning, and social skills. Interactive media can stimulate students' creativity, encourage critical thinking, and boost their motivation to learn. Moreover, the visualization and simulations provided by these media help students grasp abstract concepts, particularly in subjects like science and mathematics.

Interactive media also support collaborative learning, enabling students to work together, share ideas, and develop essential social skills. By being adaptable to various learning styles, these tools also promote inclusivity in education. However, the study also highlights several challenges, such as disparities in technology access, especially in remote areas, and a lack of teacher training and skills in using technology.

Therefore, integrating technology into education must be a key step in improving the quality of learning. Continuous training for teachers and efforts to enhance technological accessibility in all schools should be prioritized. Overall, while interactive learning media have great potential to revolutionize education, realizing this potential requires collective efforts from various stakeholders, including the government, schools, teachers, and policymakers, to address challenges and ensure that all students can benefit from these technologies.

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