Research Trends in the Learning, Design and Technology Field

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AN ANALYSIS OF RECENT PUBLICATIONS

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Acknowledgements

CLAUDIA ARCOLIN

This OER has been created as final project for the class LDT 6003: Research in Learning, Design and Technology, in the MA in Learning, Design and Technology at the University of Texas at San Antonio. Throughout the course, graduate students explored the foundational aspects of research in the field of Learning, Design, and Technology, and identified relevant topics to stay abreast of research. For each selected topic, students conducted literature reviews and analyzed articles published post-2021, contributing to a comprehensive overview of most relevant trends.

Preface

BRUNA DAMIANA HEINSFELD

In an era dominated by technological advancements, the integration of digital technologies in educational settings has become more prevalent than ever. Digital technologies have ushered in a transformative era in education, offering new avenues for interactive learning and collaboration. From online platforms to interactive whiteboards, the possibilities are vast. However, the mere incorporation of these tools does not guarantee effective learning outcomes. The critical analysis of the implementation of digital technologies is vital to harness their full potential and address the challenges that may arise. Beyond the initial excitement surrounding technological integration, it is imperative to continually evaluate its impact on pedagogy, infrastructure, teacher training, privacy, and learning outcomes. Only through thoughtful and ongoing analysis can educational institutions leverage the true potential of digital technologies and ensure that they serve as catalysts for improved, inclusive, and effective learning environments.

It was not by chance that, in July 2023, UNESCO published a landmark report titled “Technology in education: A tool on whose terms?”. UNESCO’s report acts as a well-timed call to educators, leaders, and decision-makers, challenging them to critically assess the integration of technology in educational settings. Its central

tenet is clear: decisions about technology in education must pivot on a solid commitment to meeting the diverse needs of learners, emphasizing relevance, equity, evidence-based practices, and sustainability. After all, digital equity in education means ensuring that every student, regardless of any socio-economical, cultural, or ethnic characteristics, has not only equitable *access* to digital technology – including communication and information resources – but also to the *learning experiences* they provide and opportunities to *develop agency*.

Effective technology integration requires educators to evaluate how digital tools support diverse learning styles, cater to individual needs, and foster critical thinking and problem-solving skills. Access to digital technologies is not universal, and the digital divide remains a significant challenge. Critical analysis requires an examination of infrastructure limitations, ensuring equitable access for all students. Addressing issues of accessibility ensures that educational technology serves as an equalizer rather than a source of disparity. The transformative power of technology is only as effective as the educators who wield it.

Artificial Intelligence in Education (AIED) stands as a sentinel, personalizing learning experiences and automating administrative tasks. However, the promise of tailored education is accompanied by our responsibility to navigate numerous ethical considerations. Also in 2023, the U.S. Department of Education Office of Educational Technology published a policy report on AIED titled "Artificial intelligence and the future of teaching and learning: Insights and recommendations". Its core messages include a note on the risks of algorithmic discrimination and unfair automated decision-making. As well as education, artificial intelligence is not developed in a vacuum, reflecting both beliefs and practices already in place in society. Even though the use of educational technology is often associated with fairness and the amplification of opportunities, we cannot give ourselves the luxury of forgetting that social and mathematical fairness are two different concepts;

equality and equity are also not the same ideas. The ethical aspect of AIED is a pressing matter.

Technology, like any force, is a double-edged sword. Its potential for good is matched only by its capacity for unintended consequences. The responsibility lies not just in embracing the possibilities but in navigating the challenges with foresight and ethical integrity. As a doctoral candidate who embarked on this collaborative book project exploring the intersection of education and technology, I must say that the endeavor presented an exhilarating confluence of intellectual excitement and scholarly challenge. My scholarly orientation aligns prominently with critical perspectives and the application of critical theory to the realm of technology in education. In this vein, I recognize the undeniable importance of integrating technology into educational settings and do not advocate against such integration per se. Instead, I am committed to fostering a nuanced understanding through critical analysis of the development, diffusion, and implementation of digital technologies in educational contexts. It is within this critical framework that I believe the true potential for positive impact on learners emerges. By scrutinizing the socio-cultural, ethical, and pedagogical dimensions of technology in education, I aim to contribute to a thoughtful discourse that navigates the complexities of this integration.

This book, with which I had the pleasure to collaborate, figures as a collective effort to contribute to scholarly work in the field, presenting analysis of different articles on significant topics related to digital technology integration in education. The chapters that follow are not just narratives; they are a call to action for aspiring professionals in the field of learning, design, and technology. As you embark on this journey, remember that you are not just observers; you are architects of the future of education. Each chapter in this book aims to equip you with a comprehensive understanding of the trends in educational technology, their implications, and their potentialities.

Introduction

BRUNA DAMIANA HEINSFELD AND SKYLA ZAMORA

In today's rapidly evolving educational landscape, the integration of technology has become a fundamental aspect of teaching and learning. As we delve into the dynamic field of learning, design, and technology, it is essential to comprehend the multifaceted nature of educational technology trends that are shaping the way we educate and prepare future generations. This concise summary serves as an introduction to the diverse and impactful topics that form the foundation of our forthcoming book, providing valuable insights for undergraduate and graduate students embarking on their journey into this ever-expanding field.

Overview of Research Trends in Learning, Design, and Technology

Virtual Classroom, Educating Teachers to Technology, VR (Virtual Reality), AR (Augmented Reality), Artificial Intelligence, Adaptive Learning, Adaptive Testing, Microlearning, Gamification, Data Analytics, Learning Analytics, Technology and Inequities, Ethical Design and Technology, and Assistive Technology are all integral aspects of this transformative landscape. These topics collectively represent the dynamic forces driving educational innovation and this is the reason why understanding research on each of them is vital. The virtual classroom, for instance, transcends geographical boundaries, offering innovative ways to engage students collaboratively.

Simultaneously, the need to equip educators with the necessary technological skills underscores the importance of teacher training programs (Shelton et al., 2020). Virtual Reality (VR) and Augmented Reality (AR) have revolutionized the learning experience, immersing learners in interactive environments, while Artificial Intelligence (AI) personalizes learning experiences and streamlines administrative tasks (Ouyang & Jiao, 2021; Soler-Adillon, 2022).

Microlearning offers bite-sized, focused content, suited to modern learners' on-the-go lifestyles, and gamification fosters motivation and engagement through game design elements (Kapp, 2014; Taylor & Hung, 2022). Adaptive learning and testing tailor 3 content and assessments, enhancing student outcomes, and data analytics and learning analytics empower educators to make informed decisions, ensuring that instructional strategies are refined effectively (Siemens, 2013). However, as we embrace these technological advancements, it is crucial to address the digital divide and inequities in technology access to ensure that all learners benefit (Heinsfeld, 2022).

Ethical design considerations are also paramount to navigate the ethical implications of educational technology, emphasizing the responsibility of designers and educators in upholding ethical

standards (Broussard,2023). Finally, assistive technology plays a vital role in enhancing the learning experience for individuals with disabilities, promoting inclusivity in education (Park et al., 2018) As aspiring professionals in the field of learning, design, and technology, you are embarking on a journey that will shape the future of education.

Each of these topics represents a crucial aspect of this transformative landscape. Our book aims to provide you with a comprehensive understanding of these trends, their implications, and their potential to revolutionize education. By exploring these topics, you will be better equipped to harness the power of technology to create engaging, inclusive, and effective learning experiences for all.

Join us in this exciting exploration of educational technology trends that will be part of the future of education.

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Bruna Damiana Heinsfeld was born and raised in Rio de Janeiro, Brazil. She holds a B.A. in Language and Literature (UERJ), a graduate certificate in Planning, Implementing, and Managing Distance Education (UFF), and a master's in Education focusing on Digital Languages and Technology (PUC-Rio). After her master's, she completed her Ph.D. in Interdisciplinary Learning and Teaching, with a cognate in Learning Design and Technology at the University of Texas at San Antonio (UTSA). Besides her academic journey, she has a more than ten-year-long career in the instructional design field, also being a certified project manager specialized in e-learning projects. In her academic and industry careers, she collaborated with multicultural teams in numerous countries, such as Brazil, the United States, Serbia, Philippines, India, China, France, and Portugal. Her main research interests are critical perspectives on educational technology, and conceptions and discourses about technology in education.

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Tamara M. Tupper is currently pursuing her Master of Arts in Learning, Design, and Technology at the University of Texas at San Antonio, with a graduation date set for May 2024. Her career goal is to become an Instructional Designer. Tamara is a proud graduate of UTSA with a Bachelor of Science degree and a minor in Coaching, specializing in Physical Education. She holds five Texas Teaching Certifications in EC-12 Physical Education, EC-12 Special Education, 4-8 Generalist, 7-12 English Language and Reading, and 6-12 Family Consumer Science. Prior to graduate school, Tamara worked as an educator at San Marcos Consolidated Independent School District in Texas, where she created, taught, and managed three programs: Fashion Design I, II, and III, Parenting Education I and II, and Compensatory Home Educational Instruction (CEHI). Before that, Tamara was a teacher and coach in secondary school. Additionally, she has experience as a Volunteer Project Manager and Events Coordinator for girls softball competitive traveling team organization, girls recreational softball league, and a softball tournament facilitation. Tamara is an inspired educator who decided to change her career path from teaching to Instructional Design for eLearning, Education, Curriculum Development, and Learning and Development for Corporate Training.

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Dr. Claudia Arcolin, instructor for the class in LDT 6003: Research in Learning, Design and Technology, has edited this resource.

PART I

ASSISTIVE TECHNOLOGY

CHAPTER 1

Artificial Intelligence Enabled Personalized Assistive Tools to Enhance Education of Children with Neurodevelopmental Disorders | Review

TAMARA TUPPER

ARTICLE

Barua, P.D.; Vicnesh, J.; Gururajan, R.; Oh, S.L.; Palmer, E.; Azizan, M.M.; Kadri, N.A.; Acharya, U.R. Artificial Intelligence Enabled Personalized Assistive Tools to Enhance Education of Children with Neurodevelopmental Disorders—A Review. Int. J. Environ. Res. Public Health 2022, 19, 1192. https://doi.org/10.3390/ijerph19031192.

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SUMMARY AND REVIEW

SUMMARY

This article focuses on how personalized AI can enhance learning for learners who struggle with mental and learning disabilities. Mental Disorders (MDs) that could benefit from personalized AI for learning and development are:

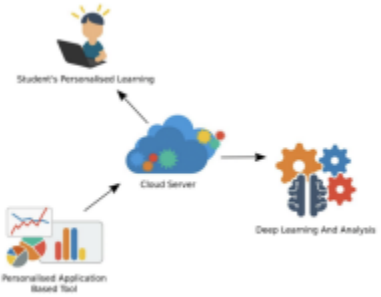
- Neurodevelopmental Disorders (NDDs) o Specifically: intellectual disabilities and specific learning disabilities like dyslexia, and attention deficit disorder (ADHD).
- Autism Spectrum Disorders (ASD)

- Mental Health Disorder o Specifically: anxiety, depression, stress, and psychotic disorders.

Providing timely and efficient interventions is essential to achieve better results for children. The review summarizes the range and effectiveness of AI-enabled tools that use Machine Learning Models (MLMs) to address educational challenges in students with several NDDs. Effective use of tools for improving social interaction and supporting education can be achieved. Further work on developing and evaluating assistive technologies in children with different types of disabilities needs to be done. The studies that have been done to date demonstrate the positive impact of AI tools on student learning outcomes, with teachers, parents, specialized educators, and therapy practitioners able to use these tools in their educational or therapeutic practices. Artificial intelligence techniques have been reported to enhance the independence of user actions, allowing children with learning challenges to achieve their individual educational objectives. It is recommended that future AI tools be developed with a focus on providing personalized training for individuals with NDDs, based on the limitations of existing AI tools.

RESEARCH METHOD

The research was done between the years of 2011 to 2021. The research is based on Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). The PRISMA Guidelines and Criteria aim to improve the transparency and quality of Systematic Reviews and meta-analyses. It helps to make it easier for others to assess the research's reliability by allowing researchers to report their findings clearly and consistently. The following charts best represent what information was gathered and the flow of how it was analyzed. (Barua et al., 2022)



(Barua et al., 2022)

DATA COLLECTED AND ANALYZED

Data collected was based on scholarly articles and types of AI tools used for addressing the learning disabilities of students with NDDs. The information was broken down into several sections specific to the needs of the students. The study included information about the types of NDDs studied: ADHD, Dyslexia, and ASD. Information collected:

- Definitions of Learning Disabilities, NDDs, that were studied: ADHD, Dyslexia, and ASD.
- Study the differences in neural adaptations between a "Normal" brain and a "Dyslexic" brain.
- Study the neuropathological differences between a "Normal" brain and a "Autistic" brain.
- Individual Educational Approaches to assist a child with ADHD. • Individual Educational Approaches to assist a child with Dyslexia.
- Teacher Educational Support for students with ASD.
- Challenges of Implementing Individual Learning Approaches in the educational system.
- Using AI in Therapies and Supportive Education for

students with mental disorders.

- Advancing Methods for using AI.

Studies were included if they met the following criteria:

- They describe the use of AI tools to help students with ADHD, Dyslexia, and/or ASD in their learning.
- They were published between the years of 2011 and 2021.
- They were published in a peer-reviewed journal.
- They were published in English.

They were excluded if:

- They described the use of AI tools to help students with other disorders apart from NDDs, ADHD, Dyslexia, and/or ASD.

FINDINGS

Most AI tools used for learning have reported positive outcomes for NDDs, ADHD, Dyslexia, and ASD. Using robots and alternative communication also aids in improving attention, mathematics, and social skills effectively for teaching students with ASD. These findings confirm the efficiency of artificial intelligence tools in personalized education.

- Improve social skills via storytelling.
- Real-time assistive tool that tracks activities and helps students sustain attention.
- Helps to send constant reminders to students to refocus on their work.
- Replaces writing activity with speech to allow students to

express themselves efficiently without tiring themselves.

- Helps students hear and process numbers easily for mathematics.
- Explores the use of machine learning methods to improve the effectiveness of the learning process.
- Helps students with reading and writing skills.
- Provides tailored interventions for difficulties encountered in literacy.
- Provides personalized game-based exercises to enhance specific cognitive skills linked to dyslexia.
- Converts natural language text to images to aid students in their learning.
- To teach students to recognize facial emotions.
- Encourages social interaction between user and peers/ educators.
- Helps students to recognize and express feelings. Software games help recognize behavioral and emotional clues and enhance social skills.

CRITIQUE AND LIMITATIONS

Ethical issues related to privacy, data protection, and informed consent should be addressed in view of the widespread use of assistive technologies for pupils who are adolescents. Compliance with the relevant regulations by educational technology companies is crucial. Respect for privacy and the secure use of student data used to train machine learning models are important to local ethics board requirements. To avoid data being compromised, safeguards must be in place before using an assistive tool, and educators should ensure that ethical considerations have been taken into account when collecting student data. Another

limitation of using these instruments in classroom settings is the cost associated with their installation, maintenance, and repair. Schools need to incorporate artificial intelligence technology into cloud-based intranets so it can be accessible and easy to integrate. This would be more cost-efficient since schools will have to pay the subscription at a reasonable monthly price, covering all aspects like installation, storage space, specifications, maintenance, and technological support.

IMPACT AND REFLECTIONS FOR THE FIELD

By providing personalized support, improving accessibility, and enhancing the learning process, AI can offer many benefits to students with learning disabilities. Consideration should be given to the fact that while artificial intelligence may offer a valuable tool for supporting learners with learning disabilities, it is best used with other educational strategies and human guidance. In addition, the effectiveness of AI-based solutions can vary according to a student's specific learning disability and individual needs. Institutions of higher education need to make sure their Artificial Intelligence solutions meet accessibility standards, and they should be working closely with disability services offices to address students' particular needs. Artificial intelligence should be used to complement, not replace, human support and accommodation for students with disabilities in higher education. AI is widely used in corporate settings, helping organizations improve their effectiveness, decision-making, customer service, and more. As organizations seek to remain competitive and efficient in a rapidly evolving business environment, artificial intelligence is a flexible tool that can be adapted to different corporate needs. However, the implementation of AI must be conducted responsibly concerning ethics and privacy concerns while ensuring that employees are adequately trained and encouraged to take advantage of this technology effectively.

IMPLICATIONS FOR PRACTICE

- Personalized Learning: AI-powered educational platforms can adapt to individual learners' learning needs and styles. To meet the specific learning disabilities of students, they can monitor their strengths and weaknesses to provide tailored teaching and exercises.
- Speech recognition software: speech recognition software can help students with mobility impairments, enabling them to type and interact with computers to complete assignments and access course materials.
- Gamification and engagement: AI can be used to design educational games and interactive content that are especially useful for students with learning disabilities, enabling them to learn in a more enjoyable and motivating way.
- EBooks and Text Adaptations: to meet the needs of visually or reading impaired students, Artificial Intelligence can adapt electronic textbooks for various formats such as acoustic books, braille, and large print.
- Collaboration tools: By facilitating group work and interacting with classmates and instructors, AI-powered collaborative platforms can help students with communication difficulties.
- Human Resources: AI can help recruit by automatically screening resumes, conducting initial interviews, and predicting employee turnover. In the areas of training and employee development, it also helps to support human resources.
- Document management and processing: Artificial intelligence can automatically classify, retrieve information from, and manipulate documents to increase

the efficiency of administration processes.

- Language translation and Localization: Translation tools using artificial intelligence help global companies communicate with customers and partners in various languages.
- Cybersecurity: By analyzing network traffic patterns and detecting anomalies that could indicate possible breaches, AI enables organizations to detect and respond to cyber threats.

RECOMMENDATIONS FOR FUTURE RESEARCH

Developing a unique cloud-based model or an application that enables the ability to personalize and interact with learners will use deep learning techniques to be useful for teachers and other adults who help them learn. The personalized model would be developed based on sizeable data consisting of input parameters, e.g., facial expression images, speech indications, bioindicators, and clinical information that includes Age, Gender, Genealogical History, and so on. AI will provide advantages of the cloud system, and cost-effective maintenance and technical support will be provided. Simplifies the workload of educators. It processes information and resources with ease. Data analysis using intelligent automation provides real-time personalized recommendations. While there are risks, like anything new, precautions can be implemented to allow students with NDDs to learn and grow by utilizing AI technology.

CHAPTER 2

Using a systems thinking approach to understand teachers perceptions and use of assistive technology in the republic of Ireland | Review

ZOCHIL CARBAJAL

ARTICLE

O'Sullivan, K., McGrane, A., Long, S., Marshall, K., & Maclachlan, M. (2023). Using a systems thinking approach to understand teachers perceptions and use of assistive technology in the republic of Ireland. *Disability and Rehabilitation: Assistive Technology*, *18*(5), 502-510.

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SUMMARY AND REVIEW

This paper describes assistive technology as tools and methods that not only boost the educational capabilities of typical students

but also cater to the requirements of students with specific disabilities or special education needs. Its objectives are to foster self- sufficiency among students with needs and alleviate the impact of potential educational hindrances that impede both learning and practical achievements. In this article, a systems approach is employed to gain deeper insights into the factors that shape teachers' viewpoints and utilization of assistive technology within Irish classrooms. Despite the promising potential of assistive technologies in educational settings, its adoption and implementation remain relatively new and face several challenges. These challenges encompass issues like limited resources for acquiring relevant assistive technology and insufficient training necessary for teachers to recognize and procure appropriate assistive technologies for their students. Teachers are often unprepared to integrate advanced assistive technology into their teaching environments.

RESEARCH METHOD

This study utilized a research design that combined quantitative and qualitative methods. The participants consisted of both primary and secondary school teachers, along with special needs assistants. A total of 305 participants completed the quantitative survey, while only ten individuals agreed to participate in the semi-structured focus groups. These participants were gathered through a snowball sampling and through diverse online platforms. A survey was used to gather information about their experience and requirements related to their capacity to integrate and support assistive technology in the classroom. In the qualitative study, an interpretative phenomenological analysis approach was utilized, and the research was conducted and adhered to the guidelines of the Consolidated Criteria for Reporting Qualitative Research. The design involved teacher groups posing open-ended questions within a semi-structured interview format.

Qualitative data was collected through surveys, while semi-structured focus groups were used to yield qualitative data. Focus groups were chosen for this study because it promotes social learning and fosters the exchange of ideas and concepts. These discussions were to understand the perceptions, experiences, and needs relating to teachers' ability to integrate assistive technology into the classroom.

DATA COLLECTED AND ANALYZED

The data collection methods employed in this article involve survey questions and focus group discussions. The participants were invited to complete an online survey, which also extended an invitation to participate in a focus group discussion regarding their experiences with assistive technology in the classroom. Consent was obtained both through the online survey and verbally. The survey gathered information from participants regarding their teaching role, years of experience, knowledge of assistive technology, school ratings and support in assistive technology. At the beginning of the focus group session, participants were briefed on the study's nature and randomly divided into two groups. The focus groups centered around five key themes following a semi-structured format. The interviewer utilized a funneling technique, gradually narrowing down the discussion by introducing broad themes and diving into more specific questions as the conversations progressed. The following themes are as follows: (1) Discuss/describe your experiences with assistive technology in school in general; (2) Imagine no barriers exist- now discuss what the ideal school/classroom would look like for assistive technology to become an easy part of the day; (3) Discuss the type of supports in place in education that you know about assistive technology; (4) Describe any experiences they have had to-date with these supports; (5) Describe the supports you or other teachers would require using assistive technology successfully. Quantitative

surveys were subjected to statistical analyses to gain insights into demographic and categorical data. Thematic analysis was utilized to examine the semi-structured focus groups, allowing for the exploration of prevalent topics related to lived experiences. A systematic process of thematic analysis was undertaken, involving the identification and categorization of codes, followed by the reconstruction of codes into an orderly narrative.

FINDINGS

The survey's objective was to gather information about teachers' use of assistive technology, their perceptions of their own assistive technology needs, and their training requirements. According to the survey findings, 56% of the teachers reported having limited or no knowledge of assistive technology use in their classroom. Additionally, 51% of teachers expressed some level of comfort in using assistive technology with their students. The survey analysis further revealed that primary school teachers demonstrated higher levels of knowledge regarding assistive technology compared to secondary school teachers. Moreover, a statistically significant correlation was observed between knowledge of assistive technology and feeling comfortable using it with students. The survey results also highlighted that 91% of teachers expressed a desire for professional development in assistive technology, with 53% of them preferring to receive training during school hours. It is evident that teachers require support and training in providing assistive technology for several types of impairments or disabilities. Specifically, 79% of teachers expressed a need for training in assistive technology for students with autism spectrum disorder, while 54% required training for students with speech and language impairments.

LIMITATIONS

By exploring the needs of teachers regarding the use and provision of assistive technology in Irish classrooms, this study aimed to expand the existing body of evidence, the research findings indicated that teachers expressed a sense of unpreparedness in addressing the evolving assistive technology needs within their classrooms, highlighting their need for assistance in supporting students effectively. The study unveiled a general lack of knowledge and understanding of assistive technology among the teacher groups, with 85% of respondents expressing a desire for additional support, while only a third of participants felt adequately knowledgeable about assistive technology. The qualitative findings revealed that teachers had concerns about their own confidence utilizing assistive technology, primarily originating from a lack of training. While this study yielded valuable data, it is important to acknowledge its limitations. The sample relied on the willingness of teachers to participate, potentially excluding those with different perspectives and experiences, which failed to have a sample that equally represented teachers from diverse demographics. Consequently, there may be alternative views and insights that were not captured in the study. Secondly, the study does not provide information on the relative importance of each element within the system. Gaining insight into which factors carry more targeted and effective approaches to assistive technology implementation.

IMPACT AND REFLECTIONS FOR THE FIELD

During this research, it became evident that teachers require adequate training, supports, and guidance to effectively assist and engage students who rely on assistive technology, only to be confronted with the challenge of figuring it out on their own once in the classroom. This prompts us to inquire about the extent to

which assistive technology is being addressed in universities, and if to is indeed being addressed, how is it being incorporated and highlighted in the curriculum and educational programs?

IMPLICATIONS FOR PRACTICE

This research features the importance of comprehensive training programs for educators in the realm of assistive technology. Effective and targeted teacher training is crucial to optimize the learning and inclusive potential of children with physical and/or intellectual needs. However, the current assistive technology systems fall short in supporting teachers to actively participate in this process. The absence of clear, consistent, and accessible national policies regarding training and access to assistive technology products hampers teachers' abilities. Teachers require the necessary skills, resources, and knowledge to effectively utilize assistive technology solutions.

RECOMMENDATIONS FOR FUTURE RESEARCH

The recommendation followed by the research involves the development of an assistive technology system that fosters seamless interaction among policies, practices, personnel, and products. This integrated system aims to facilitate smooth and successful engagement for individuals, including teachers and students, within a broader educational context that values and recognizes the importance of children using assistive technology. The goal is to ensure that these students have equal access to a high-quality education, on par with their peers.

CHAPTER 3

Special Education Teachers' readiness and self-efficacy in utilization of assistive technologies for instruction in secondary school | Review (By Jacqueline Cardenas)

ARTICLE

Surajudeen, T. B., Ibironke, E. S., & Aladesusi, G. A. (2023). Special Education Teachers' readiness and self-efficacy in utilization of assistive technologies for instruction in secondary school. *Indonesian Journal of Community and Special Needs Education*, *3*(1), 33-42.

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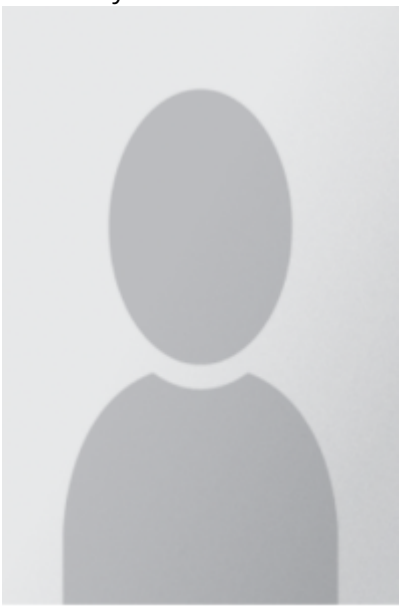

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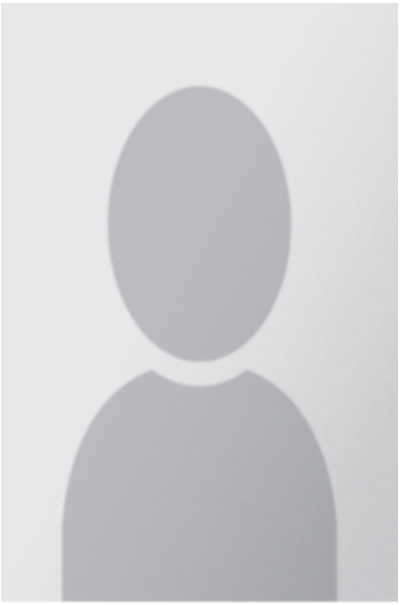

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SUMMARY AND ANALYSIS

SUMMARY

This article's goals are to test the readiness and self-efficacy of special education teachers to use assistive technology in their classrooms.

RESEARCH METHOD

This study is descriptive research that uses surveys from a small group of the population of special education teachers to draw conclusions for the entire group.

DATA COLLECTED & ANALYZED

The data for this study was collected through the form of a researcher-designed questionnaire, which were completed by special education teachers at all of the special secondary schools in Oyo State. The teachers were also stratified by qualification, gender, and ICT level. The questionnaire was also designed in a way to produce very clear answers from the teachers.

FINDINGS

This study found that this sample of special education teachers were in fact ready to incorporate the new assistive technology in their classroom with their students.

CRITIQUE AND LIMITATIONS

I think that with any study that uses a small sample out of a huge population, it is hard to make assumptions about the entire group. Any assumptions or findings have to be stated carefully when making statements about all special education teachers and their readiness for assistive technology.

IMPACT AND REFLECTIONS FOR THE FIELD

I believe this study can have a very big impact on the support that special education teachers receive for the advancements that assistive technology will bring to their classrooms. It may also help encourage funding to supply the assistive technology needed by special education teachers.

IMPLICATIONS FOR PRACTICE

I think that with any new technology, training or prior knowledge should be given to ensure the technology will be used to its full potential. I'd say the same applies for assistive technology. Of course, everything is case by case and some teachers will need training while perhaps others may be more tech savvy.

RECOMMENDATIONS FOR FUTURE RESEARCH

My recommendation for future researchers in this field is to conduct a similar study with a sample size that expands various regions to get a sample with more diverse backgrounds and different experiences.

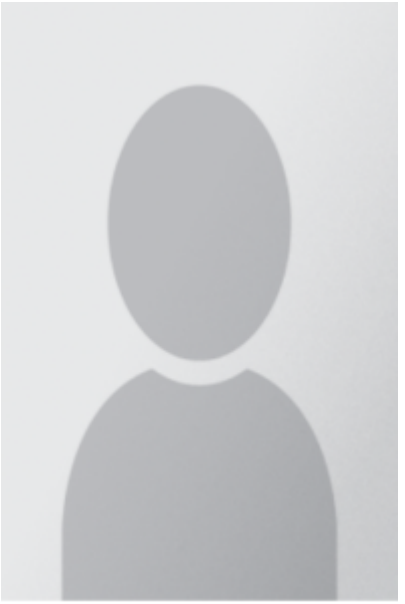
CHAPTER 4

The need for and barriers to using assistive technologies among individuals with Autism Spectrum Disorders in China | Review by Sasha Casiano

ARTICLE

Deng, L., & Rattadilok, P. (2022). The need for and barriers to using assistive technologies among individuals with Autism Spectrum Disorders in China. Assistive Technology, 34(2), 242– 253. https://doi.org/10.1080/10400435.2020.1757787

AUTHOR



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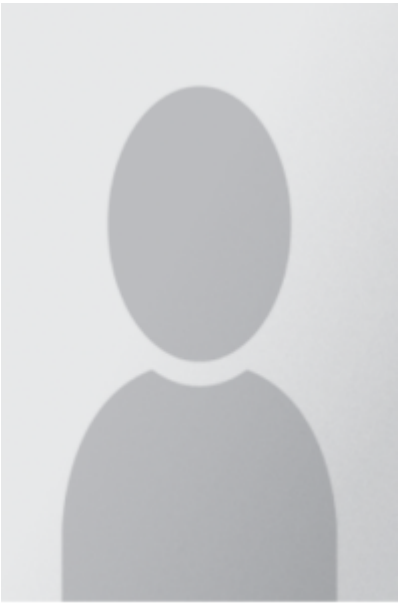

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SUMMARY AND REVIEW

SUMMARY

In this article, we take a look at students on the Autism Spectrum Disorder and how assistive technologies can create barriers for them. It's not just barriers we have to consider, it's also the use and need of assistive technologies to help ASD students. As a large number of people are affected by Autism Spectrum Disorder, barriers have arisen to accessing support. With assistive technologies and the help from therapeutic recommendations along with social skills to support students with ASD. As the barriers for ASD students, affordability, public exposure, confidentiality and side-effects can affect the use of assistive

technologies. We will dive deeper into the discussion of ASD students and the needs and challenges they face with assistive technologies.

RESEARCH METHOD

The research consists of trying to understand the needs of the ASD community for using assistive technologies in China. Along with the understanding the needs, the research wanted to provide suggestions for future implementations of assistive technologies for ASD students. In doing so they came up with 3 questions to help guide the research.

1. What are the major barriers related to the lack of use and awareness of assistive technologies for ASD in China?
2. What are the current technology needs of the parents and professionals in order to benefit ASD children in China?
3. What characteristics and types of assistive technologies can future research and development focus on to meet these needs?

DATA COLLECTED AND ANALYZED

The methods they use to collect data consist of several different approaches. The first was collecting information from literature searches about the different barriers ASD students had. This was a preliminary search to help identify the need for assistive technologies. Then data collections were surveys by online questionnaires and semi- structured interviews. The questionnaires were conducted anonymously including questions about age and genders, the awareness of assistive technologies. Also included was a scenarios-based question investigation of the willingness to using assistive technology. The semi-structured

interviews consist of parents and ASD professionals who have close relationship with ASD children. They had a number of close-ended questions and open-ended questions. These questions differed for each person and lasted 45 minutes.

FINDINGS

After interviewing, the research found several areas of information regarding ASD students in the fields of monitoring, therapeutic recommendation, social skills, affordability, and concerns of public exposure and confidentiality. The most common barrier they found was the high price of assistive technologies. Many parents have to work full-time or on the other hand 32% of mothers are unemployed, and cannot afford the cost without knowing the effectiveness of assistive technologies. They found many parents cannot afford to work a full-time job and be a caregiver to ASD children, so many times the grandparents are the caregivers. So technology can assist in monitoring and informing parents along with facilitating timely referrals for the healthcare services of their daily life. Some parents felt their child would gain social interactions by placing their child in public school so they can interact with the other classmates instead of stay alone. They hoped technology would give a variety of social skill trainings to help their child increase their social skills. Lastly, parents were concerned about their child wearing something that would make them more noticeable in public, as they already have concerns of their child "blending in". If others were to visually notice an abnormality and judge would lead to a mute mode in public spaces and put learning to interact in social places behind.

CRITIQUE AND LIMITATIONS

The research was taken place in Child in an urban area with people who have a lower awareness of assistive technologies. Since the

community was urban, the want for their child to blend in would be greater due to the dense population in the community. The study should continue in China but outside an urban setting into a suburban community. Along with being in a suburban community, the study should continue outside of China to surrounding countries. Another limitation is the study was conducted with families who had different severity of symptoms on the spectrum. The questions were generic and did not take into consideration the different individuals on the broad spectrum. Future research should be conducted to individuals on the same scale of the spectrum to help tailor to their support appropriately with assistive technologies.

IMPACT AND REFLECTIONS FOR THE FIELD

The research did not specify the targeted age group of ASD children. It assumed they targeted all age groups, which would create a general assumption of research. If the research was more specific to students in elementary or middle or high or adult hood the results would differ. Many parent of ASD students who are in elementary are still adjusting to the changes and needs of their child compare to a parent who has an high school child.

IMPLICATIONS FOR PRACTICE

I found this research to be 100% applicable in real-world settings. Students with ASD do differ in the classroom to the other classmates. And other classmates take time to learn and adjust with the ASD student. Giving the ASD student something that is different from their classmates can put more stress and separation. Therefore, giving the students with ASD assistive technologies would need to be more of a helpful tool than another reason for separation.

RECOMMENDATIONS FOR FUTURE RESEARCH

I feel like assistive technologies would greatly help ASD children if it provided help without creating a bigger barrier in social interaction and noticeable appearance. Maybe creating a tool for them to use AI to create real-world simulations of social interactions and teach the child how to approach and interact with other children in similar age. Targeting a skill each time the interaction is occurring to guide them. The article suggested the child wear AI glasses to help, but those can become more of a barrier than being helpful. Unless the glasses didn't cause a dramatic change in appearance of the child by not being so big and bold.

CHAPTER 5

Trends in the use of assistive technology: An exploration of emerging shifts in assistive devices used to support individuals in their lifestyle preferences and goals | Review by Sulema Castillo

ARTICLE

Clay, S. L. (2023). Trends in the use of assistive technology: An exploration of emerging shifts in assistive devices used to support individuals in their lifestyle preferences and goals. International Journal of Disability, Development and Education, 1–15. https://doi.org/10.1080/1034912x.2023.2166675

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SUMMARY AND REVIEW

SUMMARY

The article discusses an upward shift that was noted with the use of assistive technology and an emerging use of devices to support individuals in their lifestyles and preference goals. The article emphasized how assistive technology has the capability to provide the opportunity for individuals with disabilities to communicate, engage, and participate in communities of practices as well as in the capacity of affinity spaces. Students can also exercise the same capabilities as well within school communities to inclusive environments.

RESEARCH METHOD

The study uses data acquired from 2006 and 2015 from the Behavioral Risk Factor Surveillance System (BRFSS). The data gathered consists of behaviors, chronic conditions, and preventative services. Participants of the study were recruited through a random sampling technique from different geographical regions within the U.S. and some surrounding territories. The questions used for the study consisted of basic standard core questions and rotating core questions.

DATA COLLECTED AND ANALYZED

The article states that the data collected from 2006 and 2015 were analyzed using the BRFSS Web Enabled Analysis Tool that uses cross tabulations to produce frequencies and percentages in variables. For this study the common variable was AT (Assistive Technology and the independent variables were demographic characteristics, reported disabilities, access to healthcare and veteran status. In analyzing and comparing the change over time the weighted percentages of the BRFSS Web Enabled Analysis Tool were used and the univariate analysis of a chi-square test.

FINDINGS

In the 2006 study, 326,716 individuals participated and included 276,840 Whites, 25,353 Blacks and 24,523 Hispanics. The population who used AT were as follows; 25,211 Whites, 3,405 Blacks and 1,894 Hispanics. Of the 326,716 participants most individuals were female, married, college graduates, had higher income levels, employed, non-veterans, did not have a reported disability and had access to healthcare. In the population who used AT; 30,510, most individuals were female, married, high school graduates, had lower income levels, retired, non-veterans, had a

reported disability and access to medical care. In the 2015 study, 396,174 individuals participated and included 328,712 Whites, 33017 Blacks and 34,445 Hispanics. The population who used AT were as follows; 38,198 Whites, 5,496 Blacks and 2,997 Hispanics. In the general study population which consisted of 396,174 participants, most were female, married, college graduates, had higher income levels, employed, non-veterans, did not have a reported disability and access to medical care. In the population who used AT 7,810 of the participants most individuals were female, married, high school graduates, retired, non-veterans, had a reported disability and had access to healthcare. Similar to 2006, results from the cross tabulations revealed significant differences in the use of AT across race, all demographic variables, veteran status, reported disability access to medical care.

CRITIQUE AND LIMITATIONS

Although the study provided a 10 year trend in the use of AT, but according to the article there were some important limitations noted. The study used predetermined data from 2006 and 2015 BRFSS' which is considered outdated considering the most updated BRFSS is from 2018. Therefore, the comparison of the most updated data was not used to compare to the data of 2015. For future research the most recent data should be used in order to track AT on a more consistent basis, so trends can be accurately and effectively analyzed.

IMPACT AND REFLECTIONS

I found the statistics of this study very interesting. In the line of work that I do and capacity in which I assist students I would say 90% of the time AT is used. I work with a specific population of students in an Assisted Learning Environment and male population

numbers the female population and all have a reported disability, or Other Health Impairment.

IMPLICATIONS FOR PRACTICE

The study provided significant differences but considering how technology is becoming more and more prevalent perhaps minimizing the time frame to gather and compare data can be more beneficial in presenting the impact of the trends.

RECOMMENDATIONS FOR FUTURE RESEARCH

Since both years, 2006 and 2015 showed females using AT more could present the opportunity for further research among genders.

CHAPTER 6

A review: Accessible technology through participatory design | Review

BRUNA DAMIANA HEINSFELD

ARTICLE

Quintero, C. (2022). A review: Accessible technology through participatory design. *Disability and Rehabilitation: Assistive Technology*, *17*(4), 369-375. https://doi.org/10.1080/17483107.2020.1785564.

AUTHORS

Christian Quintero is an Assistant Professor in the Engineering department at the Universidad Militar Nueva Granada in Colombia, who holds a Ph.D. in Design and Creation from the Universidad de Caldas, Colombia. Dr. Quintero's research is centered on the domains of disabilities, assistive technology, and experience design.

REVIEW

SUMMARY

The article titled "A review: accessible technology through participatory design" is authored by Christian Quintero, an Assistant Professor in the Engineering department at the Universidad Militar Nueva Granada in Colombia, who holds a Ph.D. in Design and Creation from the Universidad de Caldas, Colombia. Dr. Quintero's research is centered on the domains of disabilities, assistive technology, and experience design.

The article underscores the importance of collaboration among designers, researchers, and end-users in crafting technology solutions for a broad range of disabilities. It conducts an extensive review of existing literature, focusing on case studies illustrating the effectiveness of

participatory design in creating accessible technology. The benefits of participatory design, such as improved user satisfaction, enhanced usability, and increased accessibility, are emphasized. Additionally, the article delves into the challenges of implementing participatory design, including the need for clear communication and potential power imbalances among participants. In essence, the article offers a comprehensive view of the role of collaboration in shaping accessible technology and highlights the potential advantages of participatory design.

RESEARCH METHOD

The research approach in this article involves a literature review. The author systematically searched various digital databases, like JSTOR, ScienceDirect, Web of Science, Springer, IEEE Xplore, and ProQuest, employing keywords like accessibility, assistive technologies, and participatory design. This search process was conducted in November 2018, with search criteria based on citation counts and a publication timeframe spanning five years from 2014 to 2018. The author considered the first 100 results to avoid information overload, and abstracts were screened to identify pertinent papers for downloading and categorization using emerging thematic codes. Subsequently, these papers were analyzed to identify recurring themes and patterns related to participatory design and accessible technology. It's important to note that the review focused on papers written in English by researchers and practitioners in the fields of accessibility, assistive technologies, and participatory design.

For thematic analysis, the author used content analysis techniques, making use of Qiqqa, a free software designed for handling multiple PDF documents. This systematic approach to searching and analyzing peer-reviewed scientific papers through thematic coding and content analysis allowed the author to identify common themes and patterns related to participatory design and accessible technology. The themes that emerged from the analysis encompassed the advantages of participatory design, the challenges associated with its implementation, and the pivotal role of communication in participatory design.

FINDINGS

The key findings of this review article affirm that participatory design can lead to more accessible and user-friendly technology solutions for people with disabilities. The review of peer-reviewed scientific papers revealed that participatory design is associated with heightened user satisfaction, improved usability, and increased accessibility. The author concludes that involving end-users in the design process can result in more user-centric, innovative, and customized solutions, reducing the likelihood of equipment abandonment. The review also acknowledges some challenges related to participatory design, particularly the need for transparent communication among designers, researchers, and users, as well as the potential for power imbalances that may affect participation and decision-making.

CRITIQUE AND LIMITATIONS

One limitation of this study is its exclusive focus on peer-reviewed scientific papers in the English language, which may have excluded relevant studies in other languages or non-peer-reviewed sources. Additionally, the study lacks detailed information about the search criteria used to identify relevant papers, including the specific

keywords and search strategies. This absence of transparency makes it challenging for readers to assess the thoroughness of the search process and the comprehensiveness of the literature review. A constructive critique of this study is that it could have included a more in-depth analysis of the quality of the papers included in the review, such as assessing their methodological rigor and the strength of the evidence they provide. This would have offered a more nuanced understanding of the findings and their practical consequences.

IMPACT AND REFLECTIONS FOR THE FIELD ANF FOR PRACTICE

The implications of this article hold significance for the field of accessible technology and design. The evidence suggests that participatory design can contribute to the development of technology solutions that are more accessible and user-friendly for individuals with disabilities. These insights have practical applications for designers, researchers, and policymakers in various settings, including K-12 and higher education, as well as corporate and government contexts. For example, in educational settings, participatory design can be employed to create more inclusive and accessible learning technologies that better cater to the needs of students with disabilities. In situations where it may not be feasible to involve disabled students and their families in the design of assistive technology, educators can engage them in the decision-making process regarding the selection of technology. This approach ensures that the technologies used are more user-centric and effective, tailored to the specific needs of the students, thus enhancing their learning experience. Additionally, involving students in the design of online course materials and digital resources can ensure that these materials are accessible and usable for all students. Overall, the findings underscore the importance of involving users from the outset and considering

accessibility and usability, ultimately leading to more effective and inclusive solutions that better meet the needs of students with disabilities.

CHAPTER 7

Learning Analytics Intervention Improves Students' Engagement in Online Learning

PART II

ARTIFICIAL INTELLIGENCE

CHAPTER 8

Artificial intelligence in education: The three paradigms | Review

BRUNA DAMIANA HEINSFELD

ARTICLE

Ouyang, F. & Jiao, P. (2021). Artificial intelligence in education: The three paradigms. Computers and Education: Artificial Intelligence, 2, 100020. https://doi.org/10.1016/j.caeai.2021.100020

AUTHORS

Dr. Fan Ouyang 欧阳璠 and Dr. Pengcheng Jiao are research professors in the College of Education at Zhejiang University in China. Dr. Ouyang's research predominantly centers at the intersection of collaborative learning, learning analytics implementation, and pedagogy development, while Dr. Jiao works with analytical modeling and computational engineering.

REVIEW

SUMMARY

The comprehensive analysis present in the article "Artificial

intelligence in education: The three paradigms" is authored by Fan Ouyang and Pengcheng Jiao, research professors in the College of Education at Zhejiang University in China. Dr. Ouyang's research predominantly centers at the intersection of collaborative learning, learning analytics implementation, and pedagogy development, while Dr. Jiao works with analytical modeling and computational engineering.

"Artificial Intelligence in Education: The Three Paradigms" provides a thorough overview of the different approaches to incorporating artificial intelligence in education (AIED). The paper aims to examine the interconnectedness of AI with existing educational and learning theories and identifies three main paradigms of AIED: AI–directed, AI–supported, and AI–empowered. The AI–directed paradigm involves using AI to automate tasks and provide tailored feedback to students. The AI–supported paradigm enhances teaching effectiveness and supplements student learning with additional resources and support. The AI–empowered paradigm gives students control over their own learning process. Additionally, the paper highlights key challenges and limitations in AIED, such as the need for more research on its effectiveness, ethical concerns, and the necessity of teacher training and support. The authors argue that further research and collaboration are crucial to fully harnessing the potential of AIED and transforming traditional educational practices.

RESEARCH METHOD

Informed by a theoretical perspective, the authors conducted a systematic literature review to develop the three AIED paradigms, selecting relevant papers from academic databases including Web of Science, Scopus, Science Direct, Wiley Online Library, ACM, IEEE, Taylor & Francis, and EBSCO. The search was conducted using a combination of keywords related to artificial intelligence ("artificial intelligence," "AI," "AIED," "machine intelligence," "machine

learning," "intelligent tutoring system," "expert system," "recommender system," "recommendation system," "feedback system," "personalized learning," "adaptive learning," "prediction system") and educational theory ("theory," "theoretical," "theoretical framework," "behaviorism," "cognitivism," "constructivism," "connectivism," "complexity"), including at least one keyword from each group. The purpose of the research was to identify relevant literature published from 1990 to 2021, based on the educational theories that underpin AIEd. To address their research questions, the authors analyzed selected articles and categorized them based on the design and implementation of AI technologies, the role of AI in the learning an instruction processes, and the impact of AI technologies on education.

FINDINGS

Due to its nature as a position paper, the findings primarily focus on the classification and explanation of the three AIED paradigms: AI–directed, AI–supported, and AI–empowered. In the AI–directed paradigm, inspired by behaviorism, AI leads in cognitive learning, with students being passive recipients. In the AI–supported paradigm, based on cognitivism's emphasis on mental processes, AI assists teachers while students collaborate with AI. In the AI–empowered paradigm, consistent with constructivism's emphasis on active participation, AI empowers students to control their own learning.

The paper also discusses the challenges and limitations associated with each paradigm. The AI–directed paradigm poses the risk of

excessive reliance on AI, resulting in reduced student agency. The AI–supported paradigm may lead to AI replacing human teachers and struggles with personalization. Finally, the AI–empowered paradigm carries the risk of students being overly dependent on autonomy and lacking guidance. The authors argue that a combination of all three paradigms is necessary to fully tap into the potential of AIED, providing personalized, adaptable, and student–centered learning experiences.

IMPACT AND REFLECTIONS FOR THE FIELD AND FOR PRACTICE

The paper has significant implications for the field of education. Firstly, it offers a framework for understanding the different AIED paradigms and their potential impact on teaching and learning. This framework can guide educators and researchers in designing and evaluating AI–based educational interventions. Secondly, it underscores the need for further research into the effectiveness of AI in education and the ethical considerations surrounding its use. Such research can inform best practices across a range of educational settings, including K–12, higher education, and corporate training. Thirdly, it highlights the vital role of adequately training and supporting teachers in the implementation of AIED. Educators need the skills and knowledge to seamlessly integrate AI into their teaching methods and support students in utilizing AI tools. Finally, the paper suggests that AI has the ability to transform traditional educational practices by offering personalized, adaptable, and student–centered learning experiences and can impact various educational contexts, from K–12 classrooms to corporate training programs.

The research presented in the article has practical applications in educational settings. Among these applications, it is relevant to highlight that educators can use the framework outlined in this paper to design and evaluate AI–based educational tools. By

understanding the different AIED paradigms and their underlying theories, educators can select appropriate AI tools for their specific educational contexts. Additionally, the paper emphasizes the value of training and supporting teachers in implementing AIED. Educators must be equipped with the necessary skills and knowledge to seamlessly integrate AI into their teaching practices and assist students in utilizing AI tools effectively. This can be achieved through professional development programs and institutional support. Lastly, the paper highlights the need for further research into the effectiveness of AI in education and the associated ethical implications. Educators can contribute to this research by conducting their own studies and sharing their findings with the broader educational community.

LIMITATIONS AND FUTURE STUDIES

While this study offers valuable insights, the authors acknowledge that their search for relevant articles was limited to specific databases and keywords, potentially resulting in the omission of pertinent articles, and affecting the comprehensiveness of the findings. To address this limitation, future research could expand the search to include additional databases and keywords. Additionally, the paper primarily focuses on theoretical frameworks and does not delve deeply into the practical aspects of AI implementation in education. Future research could bridge this gap by conducting case studies or surveys to explore how AI is used in practice and what factors contribute to its success or failure. Researchers could also conduct more detailed analyses of specific AI tools and techniques to gain a deeper understanding of their effectiveness across diverse educational contexts. Lastly, while the paper acknowledges the ethical implications of using AI in education, these issues are not thoroughly explored. Future research could delve into these ethical concerns, including matters

related to privacy, bias, and the evolving role of human teachers in AI–enhanced learning environments.

CHAPTER 9

Education in the era of generative artificial intelligence (AI): Understanding the potential benefits of ChatGPT in promoting teaching and learning | Review

SKYLA ZAMORA

ARTICLE

Baidoo-Anu, D., & Ansah, L. O. (2023). Education in the era of generative artificial intelligence (AI): Understanding the potential benefits of ChatGPT in promoting teaching and learning. Journal of AI, 7(1), 52-62.

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ANALYSIS: SUMMARY AND REVIEW

SUMMARY

The article "Education in the Era of Generative Artificial Intelligence (AI): Understanding the Potential Benefits of ChatGPT, written by David Baidoo-Anu and Leticia Owusu Ansah, talks about the impact of generative AI like ChatGPT on education setting. It discusses potential benefits and limitations due to the hype of AI and how AI can revolutionize education. It highlights that AI should not replace instructors, but AI should still incorporate teaching methods together to create a well-rounded learning experience learning. As AI continues to change instantly and improves rapidly, we must prepare our teachers and students to implement AI tools in the classroom to their advantage correctly. This decision should be a collaboration of not only teachers but also well- rounded skills and viewpoints of policymakers, research, and technology experts to integrate technology into education and improve different methods such as tutoring, grading, language translations, interactive learning, and adaptive learning since Ai also has potential bias and concerns of data security usage in the classroom.

RESEARCH METHOD

The article covered three research questions to examine the potential benefits and limitations of using ChatGPT or AI tools in education settings. This was done by doing a systematic review of a collection of existing literature to get a well-rounded understanding of how ChatGPT can revolutionize teaching and learning. The three research questions are: 1) How interactive is Chat GPT in the education context? 2) What are the potential benefits of using AI tools and chat GPT? 3) What are the drawbacks of using AI tools and

chat GPT? No specific research was implemented, either qualitative or quantitative.

However, this article obtained research from peer-reviewed journals, newsletter articles, and social media that allows us to investigate the advantages and limitations of using AI tools such as ChatGPT in the classroom. This included different topics in different categories, such as personalized tutoring, automated essay grading, language translation, interactive learning, and adaptive learning. These topics were examined summarized, and the information synthesized to provide insight and evidence of using Chat GPT to influence teaching and learning in an educational setting. The study focuses on mixed reviews of using AI as educators. It provides an overview of various academic settings such as K-12, higher education, and corporate training to using generative AI.

DATA COLLECTED & ANALYZED

ChatGPT is a language model responsible for answering any question you ask. It responded based on the knowledge and patterns it had learned during its programming. ChatGPT does not have access to external resources in real-time other than the information given when trained. Its design responds, understands, and thinks like a human being but isn't one. However, validity and reliability are not all there since information is not updated in real time. The article uses ChatGPT response to understand how this generative AI tool answers. They asked how COVID-19 impacted educational pedagogies. Covid changed the name in the education of teaching pedagogies rapidly; teachers had to change their traditional learning into online learning and even hybrid. This provided a gateway to integrating more technology tech into the education field and understanding the power of LMS, engaging content, and using AI to their advantage. With this, they know the benefits of ChatGPT or using any related generative AI in teaching

and learning using different sources of articles such as the potential of interactive and adaptive learning Peng et al. (2019) and Chiang et al. (2021) can support students who have English as a second language. Studies also included (2016) proficiency in language translation. Chen et al. (2020) show it can cater to individual student needs. Using this insight, they summarized the benefits of ChatGPT or any generative AI in learning and teaching. They applied to now and how it has positively impacted education, even with their limitations and the hype of how educators might see ChatGPT.

FINDINGS

Four benefits were mentioned in this article: personalized tutoring, automated essay grading, language translation, and interactive learning, all with ChatGPT. Personalized tutoring allowed students to get personalized tutoring tailored to student misconceptions and was able to modify to their level of understanding. ChatGPT could also accurately grade essays and provide instant feedback similar to human graders. Language translation was also used in chat gpt to make learning material more accessible to a broad audience. Interactive learning was based on a conversation agent that supported students with a second language. It was able to understand student questions and respond accurately without an issue. Adaptive learning understands student progress and performance and adjusts the difficulty to keep the student challenged but not frustrated. As to all pros, there are cons; some limitations were that ChatGPT lacked human interaction and wasn't the same as a "real" teacher. There was no personal connection humanity rapport. In addition, they are limited to understanding they are based on stats data, but AI does not understand how people learn, which causes minor issues for explanation to student misconceptions. They also notice that generative models lack creativity. They create data and patterns from what they are given

but cannot create original information to personalize instruction to meet the learners' needs. It can help with information and assistance but does not fully comprehend everything. ChatGPT or any other AI tools are powerful but should be used to enhance teaching and learning as a combination of teaching practices to ensure human interaction and how people learn.

CRITICISM AND LIMITATIONS

Advancing in learning and technology is essential because our world is involved; however, AI has some limitations. Since AI gets data for our old research data, how do we know if it's accurate, valid, inclusive, and not silencing oppressed people of color? Our research has been based on white power and privilege, and sometimes, not all voices are heard, so is ChatGPT able to provide up-to-date information? Data privacy and safety concerns also are at risk for students depending on different tools. How can they ensure data security for everyone, especially in education?

IMPACT AND REFLECTIONS FOR THE FIELD

The integration of using ChatGPT or any AI tools is a transformative shift to technology and has consequences. To have this in our classroom, we must address challenges and explore different approaches to how this can be used to reshape education and its impact. Explore innovative opportunities, and this should be done with other skilled people, from policymakers, educators, and researchers, to ensure there are policies and regulations regarding ethical questions to protect student privacy and address bias. Including researchers in education can lead to innovations and effectiveness of pedagogical methods using education data and can develop new tools to support the learning experience using cutting-edge technology.

IMPLICATIONS FOR PRACTICE

To apply this research into practice, understand where ChatGPT gets its information from and how this impacts data privacy concerns. Using AI should not be for it to do the thinking for you but to help you leverage it as a skill to create innovative learning experiences and opportunities.

RECOMMENDATION FOR FUTURE RESEARCH

Future research is needed to shape our education system in an effective way to integrate generative AI tools into the field. Some recommendations would be the long- term impact of using AI tools on student learning outcomes and individualized learning support. Another would be strategies for educators from any background, such as K-12, higher education, and corporations, to improve their AI literacy and use it effectively.

CHAPTER 10

ARTICLE

Wardat, Y., Tashtoush, M. A., AlAli, R., & Jarrah, A. M. (2023). ChatGPT: A revolutionary tool for teaching and learning mathematics. Eurasia Journal of Mathematics, Science and Technology Education, 19(7), em2286. https://doi.org/10.29333/ejmste/13272

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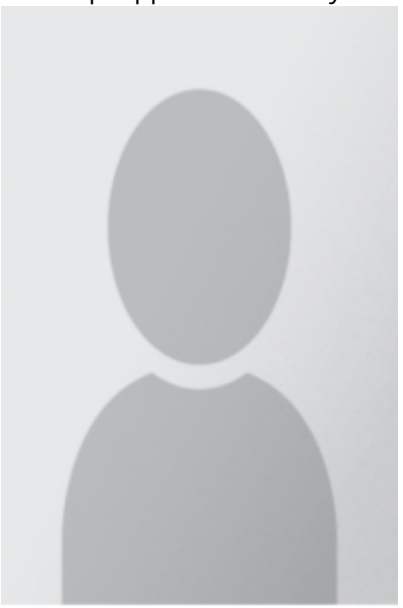

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ARTICLE: SUMMARY AND REVIEW

Artificial intelligence (AI) has emerged in the last couple of years, and it has been creeping into the education field rapidly. AI is a rapidly growing field within computer science that centers on

creating intelligent robots with the ability to think and write in a human-like manner. It is essential to comprehend this technology, which relies on large language models, and it is important to acknowledge its possible benefits, weaknesses and limitations in teaching and student learning. The research conducted in this article is to explore the perspectives of a variety of students and educators on the use of artificial intelligence, specifically ChatGPT, in the context of mathematics education. The goal of this study was to achieve two objectives: conducting content analysis of interviews and investigating user experience, all in the pursuit of ensuring the research's credibility and accuracy. The AI used in this research study is ChatGPT which is "a natural language processing system that can simulate human-like conversations" (Lin et al., 2023).

RESEARCH METHOD

In this research, a qualitative case study and an instrumental case study research design was utilized. When investigating a phenomenon within its specific context an instrumental case study proves valuable. This research approach employs triangulation of data collection methods to enhance the study's reliability. This study is divided into two main components: a user experience investigation, and the second section is a content analysis of interview investigation. The study involved 30 participants interviewed and chosen by their blogs written over the use of ChatGPT. This was done to establish the credibility of the findings. The collected interviews were analyzed using content analysis, a recognized method for examining textual data. Two coders evaluated the interviews and classified them according to the frameworks put forth by Erlingsson and Brysiewicz. For the user experience analyses, three experienced educators dedicated an entire week to testing various teaching scenarios. The user

experience was used to involve firsthand interaction with a system to pinpoint potential issues that users might encounter.

DATA COLLECTED AND ANALYZED

For the content analysis interviews, the participants underwent a careful selection process and were requested to assess their level of familiarity with chat bots using a scale ranging from one to five. A rating of one indicated a lack of familiarity, while a rating of five indicated an elevated level of familiarity. The participants were selected from different professional backgrounds, including math instructors, had an average score of 3.02, to ensure a broad range of insightful perspectives. After analyzing the interviews, it became evident that users viewed ChatGPT as a profoundly impactful tool with the capacity to transform education. However, they also expressed various concerns and offered feedback, which can be organized into four distinct themes: ChatGPT improved math capabilities, ChatGPT Accuracy-Hit & miss, ChatGPT solve mathematical problems and ChatGPT is ready to teach geometry. For the second component of the analysis, the ultimate objective was to improve the overall user experience, encompassing their expectations, interactions with the product, and their reflections on their overall experience. The three educators convened to review and deliberate upon the varied outcomes resulting from their engagements with ChatGPT. During this study, the researchers presented mathematical tasks and questions to ChatGPT, capturing its responses as snapshots, which were subsequently analyzed and discussed. This collaborative process led to the identification of ten distinct scenarios addressing various educational challenges.

FINDINGS

In the analysis's first component, the researchers covered content analysis interviews categorized into four themes. The first theme

that was identified was ChatGPT improved mathematics capabilities. Numerous participants emphasized that ChatGPT offers valuable instant feedback and assistance, particularly for students requiring immediate help with math problem solving. Nevertheless, a subset of participants voiced their concerns regarding accuracy and reliability. A few participants singled out that ChatGPT has the possibility of offering incorrect or incomplete solutions to mathematical problems. The second theme revolved around the accuracy of ChatGPT. Most participants found out that ChatGPT made earnest efforts to offer accurate and beneficial responses but fell short at times. To minimize potential inaccuracies, it is advised to provide ChatGPT with precise and well-defined input and to limit questions to those within its field of expertise. The third theme circulated around ChatGPT and its ability to solve mathematical problems. Several participants were impressed by the capability of ChatGPT tackling complex math problems. However, it is important to note that while ChatGPT can provide solutions, they may not always be the most effective or efficient. It is always advisable to cross-verify the results with an alternative source. The final themes centered on ChatGPT's capacity and readiness to address geometry. Most of the participants agreed that ChatGPT can provide personalized feedback but may have some limitations. However, a few participants did raise concerns, suggesting that ChatGPT might engage with math topics at a superficial level, lacking a deep understanding of mathematics.

The findings for the user experiences revolving around the three educators involved ten scenarios tackling diverse educational challenges. Scenarios 1 and 2 required solving mathematical equations using ChatGPT. While suing ChatGPT, the educators observed that two equations they input were incorrect due to improper simplifications and overlooking certain expressions. Scenario 3 and 4 focused on calculating limits of functions, revealing inaccuracies in the answers provided when substituting

limits. In scenario 5 and 6, ChatGPT's preparedness for geometry was assessed, uncovering its limitations and a lack of comprehension of fundamental geometric concepts.

CRITICISMS AND LIMITATIONS

The study had several notable limitations. Firstly, it focused solely on early adopters of ChatGPT in education, which restricted the generalizability of the findings. Secondly, the study relied solely on qualitative analysis and did not incorporate quantitative analysis, limiting a comprehensive understanding of the topic. Lastly, the sample size was relatively small, consisting of only 30 interview subjects and three educators.

IMPACT AND REFLECTIONS FOR THE FIELD

The study revealed the utility of ChatGPT as an educational tool; however, it emphasized the importance of establishing causation and developing guidelines for its safe usage. Future research could expand upon these findings by integrating ChatGPT into teaching methods, exploring the collaborative potential between human tutors and ChatGPT in achieving educational objectives, and investigating the potential transformative changes that may occur in the field of education. These avenues would allow future studies to build upon the insights gained from the present study.

IMPLICATIONS FOR PRACTICE

The study's implications span both theoretical and practical realms. Theoretically, it contributes ot the ongoing discourse surrounding the utilization of chatbots in education, underscoring the significance of incorporating diverse theories, including those ertaining to human relationship formation, into the development of chatbots.

RECOMMENDATIONS FOR FUTURE RESEARCH

In forthcoming research, it would be valuable to explore effective approaches for designing courses that prioritize the integration of chatbot usage and its impact on education. Additionally, it is crucial for future studies to acknowledge and tackle the limitations in this study.

CHAPTER 11

ChatGPT: A revolutionary tool for teaching and learning mathematics | Review (By Zochil Carbajal)

ZOCHIL CARBAJAL

ARTICLE

Wardat, Y., Tashtoush, M. A., AlAli, R., & Jarrah, A. M. (2023). ChatGPT: A revolutionary tool for teaching and learning mathematics. Eurasia Journal of Mathematics, Science and Technology Education, 19(7), em2286. https://doi.org/10.29333/ejmste/13272

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ARTICLE: SUMMARY AND REVIEW

Artificial intelligence (AI) has emerged in the last couple of years, and it has been creeping into the education field rapidly. AI is a rapidly growing field within computer science that centers on creating intelligent robots with the ability to think and write in a human-like manner. It is essential to comprehend this technology, which relies on large language models, and it is important to acknowledge its possible benefits, weaknesses and limitations in teaching and student learning. The research conducted in this article is to explore the perspectives of a variety of students and educators on the use of artificial intelligence, specifically ChatGPT, in the context of mathematics education. The goal of this study was to achieve two objectives: conducting content analysis of

interviews and investigating user experience, all in the pursuit of ensuring the research's credibility and accuracy. The AI used in this research study is ChatGPT which is "a natural language processing system that can simulate human-like conversations" (Lin et al., 2023).

RESEARCH METHOD

In this research, a qualitative case study and an instrumental case study research design was utilized. When investigating a phenomenon within its specific context an instrumental case study proves valuable. This research approach employs triangulation of data collection methods to enhance the study's reliability. This study is divided into two main components: a user experience investigation, and the second section is a content analysis of interview investigation. The study involved 30 participants interviewed and chosen by their blogs written over the use of ChatGPT. This was done to establish the credibility of the findings. The collected interviews were analyzed using content analysis, a recognized method for examining textual data. Two coders evaluated the interviews and classified them according to the frameworks put forth by Erlingsson and Brysiewicz. For the user experience analyses, three experienced educators dedicated an entire week to testing various teaching scenarios. The user experience was used to involve firsthand interaction with a system to pinpoint potential issues that users might encounter.

DATA COLLECTED AND ANALYZED

For the content analysis interviews, the participants underwent a careful selection process and were requested to assess their level of familiarity with chat bots using a scale ranging from one to five. A rating of one indicated a lack of familiarity, while a rating of five indicated an elevated level of familiarity. The

participants were selected from different professional backgrounds, including math instructors, had an average score of 3.02, to ensure a broad range of insightful perspectives. After analyzing the interviews, it became evident that users viewed ChatGPT as a profoundly impactful tool with the capacity to transform education. However, they also expressed various concerns and offered feedback, which can be organized into four distinct themes: ChatGPT improved math capabilities, ChatGPT Accuracy-Hit & miss, ChatGPT solve mathematical problems and ChatGPT is ready to teach geometry. For the second component of the analysis, the ultimate objective was to improve the overall user experience, encompassing their expectations, interactions with the product, and their reflections on their overall experience. The three educators convened to review and deliberate upon the varied outcomes resulting from their engagements with ChatGPT. During this study, the researchers presented mathematical tasks and questions to ChatGPT, capturing its responses as snapshots, which were subsequently analyzed and discussed. This collaborative process led to the identification of ten distinct scenarios addressing various educational challenges.

FINDINGS

In the analysis's first component, the researchers covered content analysis interviews categorized into four themes. The first theme that was identified was ChatGPT improved mathematics capabilities. Numerous participants emphasized that ChatGPT offers valuable instant feedback and assistance, particularly for students requiring immediate help with math problem solving. Nevertheless, a subset of participants voiced their concerns regarding accuracy and reliability. A few participants singled out that ChatGPT has the possibility of offering incorrect or incomplete solutions to mathematical problems. The second theme revolved around the accuracy of ChatGPT. Most participants found out that

ChatGPT made earnest efforts to offer accurate and beneficial responses but fell short at times. To minimize potential inaccuracies, it is advised to provide ChatGPT with precise and well-defined input and to limit questions to those within its field of expertise. The third theme circulated around ChatGPT and its ability to solve mathematical problems. Several participants were impressed by the capability of ChatGPT tackling complex math problems. However, it is important to note that while ChatGPT can provide solutions, they may not always be the most effective or efficient. It is always advisable to cross-verify the results with an alternative source. The final themes centered on ChatGPT's capacity and readiness to address geometry. Most of the participants agreed that ChatGPT can provide personalized feedback but may have some limitations. However, a few participants did raise concerns, suggesting that ChatGPT might engage with math topics at a superficial level, lacking a deep understanding of mathematics. The findings for the user experiences revolving around the three educators involved ten scenarios tackling diverse educational challenges. Scenarios 1 and 2 required solving mathematical equations using ChatGPT. While suing ChatGPT, the educators observed that two equations they input were incorrect due to improper simplifications and overlooking certain expressions. Scenario 3 and 4 focused on calculating limits of functions, revealing inaccuracies in the answers provided when substituting limits. In scenario 5 and 6, ChatGPT's preparedness for geometry was assessed, uncovering its limitations and a lack of comprehension of fundamental geometric concepts

CRITIQUE AND LIMITATIONS

The study had several notable limitations. Firstly, it focused solely on early adopters of ChatGPT in education, which restricted the generalizability of the findings. Secondly, the study relied

solely on qualitative analysis and did not incorporate quantitative analysis, limiting a comprehensive understanding of the topic. Lastly, the sample size was relatively small, consisting of only 30 interview subjects and three educators.

IMPACT AND REFLECTIONS FOR THE FIELD

The study revealed the utility of ChatGPT as an educational tool; however, it emphasized the importance of establishing causation and developing guidelines for its safe usage. Future research could expand upon these findings by integrating ChatGPT into teaching methods, exploring the collaborative potential between human tutors and ChatGPT in achieving educational objectives, and investigating the potential transformative changes that may occur in the field of education. These avenues would allow future studies to build upon the insights gained from the present study.

IMPLICATIONS FOR PRACTICE

The study's implications span both theoretical and practical realms. Theoretically, it contributes ot the ongoing discourse surrounding the utilization of chatbots in education, underscoring the significance of incorporating diverse theories, including those ertaining to human relationship formation, into the development of chatbots.

RECOMMENDATIONS FOR FUTURE RESEARCH

In forthcoming research, it would be valuable to explore effective approaches for designing courses that prioritize the integration of chatbot usage and its impact on education. Additionally, it is crucial for future studies to acknowledge and tackle the limitations in this study.

CHAPTER 12

Leveraging Education Through Artificial Intelligence Virtual Assistance: A Case Study of Visually Impaired Learners | Review

TAMARA TUPPER

ARTICLE

Mina, P. N. R., Solon, I. M., Sanchez, F. R., Delante, T. K., Villegas, J. K., Basay, F. J., Andales, J.- r, Pasko, F., Estrera, M. F. R., Samson Jr., R., & Mutya, R. (2023). Leveraging Education through Artificial Intelligence Virtual Assistance: A Case Study of Visually Impaired Learners. *International Journal of Educational Innovation and Research*, *2*(1), 10–22. https://doi.org/10.31949/ijeir.v2i1.3001

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ARTICLE: SUMMARY AND REVIEW

SUMMARY

The study focuses on an in-depth analysis of artificial intelligence to leverage learning for visually impaired students through AI virtual assistance. The investigation focuses on describing the challenges and difficulties encountered by visually impaired learners, highlighting the use of artificial intelligence virtual assistance, the adaptability of visually impaired learners, and enhancing the curriculum. The study participants were between ages of 15 to 23 with a variety of disabilities: intellectual, hearing impaired, and visual impairments. All participants had a form of visual impairment. Findings revealed five themes: (1) barriers in the learning process, (2) essentiality of AI virtual assistants, (3) achieving competence through technology, and (4) inclusive teaching and learning environment. These findings show that the pandemic presents challenges for visually impaired learners in the classroom, such as personal difficulties, lack of resources, and

adaptation to new learning modalities. However, virtual assistance through artificial intelligence enabled them to explore their potential and help them perform academic tasks that are generally difficult due to visual impairment.

RESEARCH METHOD

The qualitative case study method was used to explore emerging trends in this study phenomenon of balancing education through AI virtual assistance for visually impaired learners. The study focuses on Experiential Learning Theory, Anchored Instruction, and Theory of Learning. The experiential learning theory by David Kolb (1984) is based on the premise that the best way to learn something is to do it themselves, including visually impaired learners' experiences with AI virtual assistance to leverage education. The four stages of the mediational process of the theory are concrete learning, reflective reflection, abstract conceptualization, and active experimentation. Mediation helps explain how people can acquire new knowledge, learn from experience, and make choices. It applies to many psychology fields, particularly community learning, personality development, aggression, and observation studies, which seek to understand how individuals build up beliefs, attitudes, and behavior. In using artificial intelligence virtual assistance to enhance education, The Social Learning Theory by Albert Bandura in 1971 is crucial for modeling, observing, and imitating the behavior of visually impaired learners. Four processes are present through the process of the theory: attention, retention, reproduction, and motivation.

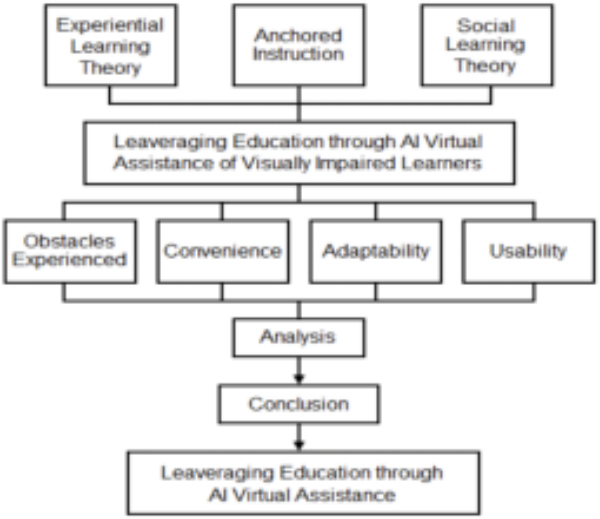

Figure 1. Theoretical Framework of the Study

DATA COLLECTED AND ANALYZED

The participants are high school students. A certificate to conduct the study from the school's superintendent and principals was secured. Upon approval, the participants were sent an invitation and a consent form to request permission to conduct the study before the interview, correctly indicating their willingness to participate and understanding all the rights of refusal and withdrawal. The informed consent form provided strict confidentiality. Data were obtained through semi-structured face-to-face and virtual interviews while maintaining the general safety and protocols. A panel of experts has verified guide questions. To confirm their suitability and the results of this study, they have undergone a thorough review and revision. Participants were encouraged to speak freely regarding the questions during the interview process. Audio tapes have been used for recording

during the interview. The study used a thematic data analysis, which is essential to investigate how virtual assistance through AI could be applied in education. The researchers transcribed voice recordings to improve the data's credibility. To fully understand the subject, material acquired in face-to-face and virtual discussions has been noted and carefully investigated. The researchers used the Braun and Clarke methodology to analyze the data, which is suitable for the qualitative study. The method has six steps to analyze the gathered data: transcribe, take note of items of interest, code across the entire data set, search for themes, review themes by provisional mapping themes and their relationships, define and name the themes, and finalize the analysis.

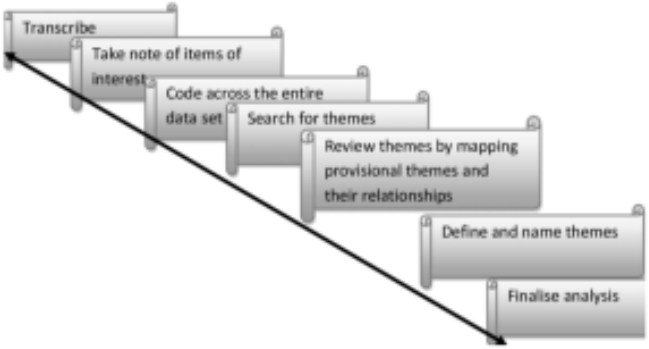

Figure 1. Thematic Analysis of the Study (Braun & Clarke, 2006)

FINDINGS

Four themes emerged from the analysis of the narratives of the visually impaired learners: (1) barriers in the learning process, (2) essentiality of the AI virtual assistant, (3) achieving competence through technology, and (4) inclusive teaching and learning environment. These themes captured the in-depth analysis of leveraging education through AI virtual assistance among visually impaired learners. Vulnerable individuals, including people with disabilities, were the most affected in this time of uncertainty.

Because of the pandemic, students with vision impairment were in a difficult situation. Due to the lack of experience and unfamiliarity with this technology, students with visual impairment could not use an AI virtual assistant.

- Barriers in the Learning Process: This was the first time they used the technology because of the pandemic, and they struggled with it at first but slowly learned how to use it. Apart from Google TalkBack, some students needed to familiarize themselves with other AI virtual assistants. They were uncomfortable using this technology since some had been slow encoders. Adaptation of new teaching practices in order to reduce the effect of pandemics on education institutions has been identified as one of the barriers for students with visual impairment. The dramatic changes in their daily rhythm and learning patterns greatly impacted them.
- Essentiality of the AI Virtual Assistant: For visually impaired students, AI virtual assistant has been a great help. This technology is competent in giving learners agility of updatable response with timely responses, can read what is written on the screen for the users, and describe a visual image with a voice command feature. An artificial intelligence virtual assistant is available to everyone, allowing learners to see, understand, navigate, and interact with learning material.
- Achieving Competence through Technology: The AI virtual assistant has been helpful to students in achieving an understanding of the lesson and achieving their potential. Participants have read and learned more quickly through the help of this technology. It has been instrumental in advancing progress for participants. AI has opened the visual world. The participants have accomplished a variety of tasks thanks to this technology.

- Inclusive Teaching and Learning Environment: The right of all students to a learning experience that respects diversity enables participation, removes barriers, and foresees and takes into account the different learning needs and preferences that should be recognized in inclusive learning and teaching. The technological barriers faced by visually impaired pupils and the legal means of overcoming these obstacles and promoting inclusive education must also be known to teachers. Comments by visually impaired students suggest that inclusive education can promote social acceptance and rights and overcome discriminatory practices against people with disabilities.

IMPACT AND REFLECTIONS FOR THE FIELD

The pandemic has presented challenges like personal difficulties, insufficient resources, and adaptation to new learning methods. However, learners can explore learning potential through AI virtual assistance. This technology enables students to fulfill their academic tasks that are generally difficult because of visual impairment, e.g., handling module material and communicating with teachers.

IMPLICATIONS FOR PRACTICE

This assistive technology has enhanced the potential for personal and professional growth for visually impaired people. The ability of learners with disabilities is enhanced and improved using adaptive technology devices. Unlike some disabilities, most visually impaired students are aware of the environment through touch and hearing. If these learners lack the ability to use assistive technology, they may have difficulty accessing technology and exploring the world they reside in. In this respect, assistive

technology has become a part of the core curriculum in junior high schools. To obtain an adequate knowledge of information technology programs, teachers need to participate in extensive training for teaching visually impaired learners.

RECOMMENDATIONS FOR FUTURE RESEARCH

Propose potential avenues for future research based on the gaps or unanswered questions identified in the analyzed article. AI virtual assistants can help people with visual impairments navigate life, education, and careers. The AI virtual assistants provide different features and functions that enable people with visual disabilities to live independently. Users can perform various tasks with voice commands thanks to virtual assistants such as Siri Apple, Google Assistant, and Amazon Alexa. Text-to-Speech and Speech-to-Text features enable users to have text content read aloud to them or convert their spoken words into text. In addition, turn-by-turn navigation can be provided by AI Virtual Assistants, making it more convenient for visually impaired users to travel independently. Voice-guided directions are provided by apps such as Google Maps and Apple Maps, which help them navigate public transport. Information from the Internet, reading news, or answering questions can be retrieved by virtual assistants. It helps people with visual impairment stay current and get the information quickly. Virtual assistants can control smart home devices, making it easier for visually impaired people to manage their environment, from adjusting the temperature to turning the lights on and off. Through enhanced independence, access to information, and the ability to operate their environment utilizing voice commands and additional available features, AI Virtual Assistants have greatly increased the quality of life for those who are visually impaired. These advances will continue to evolve, providing valuable assistance to the visually impaired community.

CHAPTER 13

Open AI in education, the responsible and ethical use of ChatGPT towards lifelong learning | Review (By Jacqueline Cardenas)

ARTICLE

Mhlanga, D. (2023). Open AI in education, the responsible and ethical use of ChatGPT towards lifelong learning. *Education, the Responsible and Ethical Use of ChatGPT Towards Lifelong Learning (February 11, 2023)*. Available at SSRN: https://ssrn.com/abstract=4354422 or http://dx.doi.org/10.2139/ssrn.4354422.

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ANALYSIS: SUMMARY & REVIEW

SUMMARY

This article's goals are to share a thorough analysis of the responsible and ethical usage of ChatGPT in education, as well as to encourage further study and debate on this important subject. The study found that the use of ChatGPT in education requires respect for privacy, fairness and non-discrimination, transparency in the use of ChatGPT, and a few other factors that were included in the paper. To sustain ethics and accountability in the global education sector, it is advised in this study that all these recommendations be carried out.

RESEARCH METHOD

This study uses qualitative and quantitative data from secondary resources that were collected by different researchers from previous studies.

DATA COLLECTED AND ANALYZED

Dr. David Mhlanga collected news outlets, blog posts, published articles, and books that all reviewed and analyzed OpenAI in Education and ChatGPT's ethical and responsible use in a learning environment. He sourced 55 articles from Web of Science, Google Scholar, and ResearchGate. He further narrowed those articles down to 23 publications that were included in this study. These articles are where Dr. David Mhlanga collected the information needed to conduct a thematic data analysis.

FINDINGS

This study found that with all of the advancements in the field of Artificial Intelligence, there is a need for responsible and ethical usage of ChatGPT in education. This study suggests policies should be put in place that will support users' privacy, fairness, non-discrimination, and transparency. While this study has completed a comprehensive evaluation on the ethical implications of AI in education, it calls for further research to be done.

CRITIQUE AND LIMITATIONS

I think that what limits this study is that the conclusion doesn't give more information on the specific policies it recommends or what those policies should look like enforced so that the ethical implications on AI in education are reduced or eliminated.

IMPACT AND REFLECTIONS FOR THE FIELD

I believe this study can have a very big impact on the ethical implications of AI and ChatGPT in education because the concerns that are brought up in this study are real problems occurring at schools today. This study is taking many researchers' findings, and creating his own conclusions based on that data. This is very helpful because reading this article is gaining knowledge of all of the research that Dr. David Mhlanga did.

IMPLICATIONS FOR PRACTICE

I think that all of the policies that Dr. David Mhlanga recommended can and should be implemented in schools if AI or ChatGPT will be made accessible for students in order to ensure their safety and privacy are secure.

RECOMMENDATIONS FOR FUTURE RESEARCH

My recommendation for future researchers in this field is to provide specifics on what policy recommendations can look like for AI and ChatGPT if they will be recommended. How they can be enforced and what they will entail.

CHAPTER 14

Designing game-based learning for High School Artificial Intelligence Education | Review (By Sulema Castillo)

EYG550

ARTICLE

Leitner, M., Greenwald, E., Wang, N., Montgomery, R., & Merchant, C. (2023). Designing game-based learning for High School Artificial Intelligence Education. *International Journal of Artificial Intelligence in Education*, *33*(2), 384–398. https://doi.org/10.1007/s40593-022-00327-w.

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Ning Wang | Research Associate Professor, skilled in LAMP, Python, Javascript, Java, C, and C++ with experience in AI, Machine Learning, and Native App Development (Android & iOS) with a Master of Science (M.S.) focused in Computer Science from University of Southern California Viterbi School of Engineering.

Ryan Montgomery | Learning Analytics Lead at The Learning Design Group at the Lawrence Hall of Science. Quantitative analyst with expertise in statistical analysis, computer modeling/ simulation, machine learning, and parameter-space optimization.

Chirag Merchant | Principal Software Engineer at USC Institute for Creative Technologies. Designing Game-Based Learning for High School Artificial Intelligence Education.

REVIEW: SUMMARY & ANALYSIS

SUMMARY

The article sheds light on the challenges when teaching AI to students. Through a cognitive study interview it was evident that high school students didn't have sufficient knowledge of AI when compared to elementary grade levels. The study uses the method of applying different game-based learning applications to the high school students, and it was evident that many struggled with execution. Game-based learning is more often seen in elementary

school, so therefore the basic concepts of AI are more relevant in primary grade levels. Although mastery of the basic concepts of AI at a high school level does not mean that the students will be able to adapt that knowledge to various subjects, the study supports that with continuous guidance and practice their skills will strengthen. Therefore, it is proved by the study that in order to help students bridge the gap in knowledge with AI concepts, the concepts should be introduced in the elementary curriculum. Early knowledge has proven to help support computational learning, as well as producing flexible learners who can later apply their knowledge to solve more complex AI driven problems without it seeming as a daunting task.

RESEARCH METHOD

The method used in the study was a cognitive interview study method. The students consisted of high school students in a private school, specifically from the Los Angeles metro area, with STEM knowledge. The initial interview responses were used to develop further questions that were then categorized into four sections, Search, Probabilistic Reasoning, and Machine Learning and the concepts of Bayesian Networks, Decision Trees, Clustering, and Linear Regression. The questions were taken from the most popular AI textbooks that are used in the curriculum for higher education. The questions were set up to assist the student, step by step, in finding the solution. The results of questions were then used to create the scenarios for a game-based learning environment that would then be used in the study. Lastly, once the game-based learning environment was applied, the students were given paper and pencil so they could solve AI problems during the test.

DATA COLLECTED AND ANALYZED

The data used and analyzed in this study were the results from game-based learning applications Students were tested in four areas of STEM. The results were broken down into levels of difficulty each student experienced tasks, as well as the basic knowledge a student attains with computer software execution.

FINDINGS

The game-based learning environment in study effectively addresses the need for scaffolding and guidance with AI in the high school population. AI systems and concepts proved a challenge when it came to software execution in computational skills. While the study only integrated basic AI computational skills, the learning environment created for the study posed a problem for students when having to interpret certain tasks and choosing the correct technology for those tasks.

CRITIQUE AND LIMITATIONS

A limitation of this study was the limited sample size. Limiting the study to specific demographic samples can create insufficient representation.

IMPACT AND REFLECTIONS FOR THE FIELD

The practical approach for this topic in the educational field would be to apply the basic knowledge and concepts of AI beginning in elementary school setting. Having the basics of AI integrated in the curriculum of elementary will provide students the foundation they can build on, as technology is continuously evolving. AI fosters critical thinking and problem solving abilities so that students can

learn different ways in approaching problems. AI knowledge will provide students the ability to collaborate more with their peers and to creatively think, “outside the box”. There are many benefits in becoming familiar with AI from a young age so by the time students reach high school they can be future career ready.

IMPLICATIONS FOR PRACTICE

Teaching the basic concepts of AI can promote inclusivity and diversity within students. AI knowledge can lead to very important gains in computational skills that can be applied to various areas of study, work and life.

RECOMMENDATIONS FOR FUTURE RESEARCH

Open the study to a larger group, such as K-12 and other countries, and see the affects the game-based learning environment created has on a more broad age group and population.

CHAPTER 15

Gender differences in information and communication technology use & skills: a systematic review and meta-analysis | Review (by Austin Dancer)

ARTICLE

Qazi, A., Hasan, N., Abayomi-Alli, O., Hardaker, G., Scherer, R., Sarker, Y., ... & Maitama, J. Z. (2022). Gender differences in information and communication technology use & skills: a systematic review and meta-analysis. *Education and Information Technologies*, 1-34.

AUTHORS

REVIEW: SUMMARY & ANALYSIS

CHAPTER 16

Artificial Intelligence education for young children: Why, what, and how in curriculum design and implementation | Review (By Sasha Casiano)

ARTICLE

Yang, W. (2022). Artificial Intelligence education for young children: Why, what, and how in curriculum design and implementation. *Computers and Education: Artificial Intelligence*, *3*, 100061.

AUTHOR

Weipeng Yang | Early childhood curriculum and pedagogical researcher with specializing in STEM education, technology integration, and socio-emotional wellbeing

The Education University of Hong Kong

ANALYSIS: SUMMARY & REVIEW

SUMMARY

In the article, *Artificial Intelligence Education for Young Children*, Weipeng Yang focused on providing research for AI in early childhood classrooms. The author focuses on the importance of AI in the modern-day classroom with children who have little to none experience with the digital world. Yang poses curriculum for having AI in the classrooms of younger children, along with innovating pedagogical model for teachers to use. The article explains the use of AI to engage young children in STEM activities

and understand the digital world. Yang explains an approach needed for young children to explores with AI technologies by identifying patterns, making predictions, and learning by making. Overall, Yang wants AI to be integrated in early childhood education as a learning tools for young children to become engaged with the digital world.

RESEARCH METHOD

In this article, Yang uses other articles and research to gather information about how AI can be used for younger children in school. Yang realized there was not many resources and programs that aim for early childhood education. AI tends to focus on the secondary and higher education students. Many students in early childhood education lack the knowledge of AI technology, along with the teachers who understand how to implement the technology inside their classroom. Therefore, he uses qualitative method to focused on the design and implementation of AI curriculum for young children ages 3-8 years old. It addresses the knowledge gap and the challenges in AI education to generate a list of considerations and further inform the curriculum of early childhood children. By doing so, the article focused on 3 questions about the development of the curriculum with AI integration. 1. Why is AI education needed for young children? 2. What is appropriate to learn in AI education during the early years? What is the subset of key AI ideas and concepts that can be learned by children? 3. How should young children learn about AI/What are the appropriate pedagogical approaches?

DATA COLLECTED & ANALYZED

Yang has done previous research over the field of AI with early childhood education since 2021. However, the author has not deepened his research to provide the why, what, and how. They

provided this research to inform educators in a new way to incorporate AI programs. Yang got his sources from searching AI articles as they pertain to early childhood education. Yang has done much research over this area throughout his career, so he has been collecting the data needed to complete this article. While they were collecting data from other articles pertaining to the same field, they focused on the why, what, and how. They interpret the dada to provide a clear understanding of why AI should be integrated in early childhood education. When they gathered information as to the "what", they focused on the curriculum and design of AI in the classroom. Yang also provided activities for teachers to use in the classroom that focused on AI main concepts. Lastly they gathered information on how to "teach" the information to younger students.

FINDINGS

The "why" of the research states the importance of AI in early childhood education to help establish digital inclusion to meet community diversity. AI inclusion has shown to improve student's creativity, language skills, and computational thinking. The "what" of the research was to teach younger students the basic functions of AI. This included knowing how AI would improve everyday human life, how computers can learn through data, and understanding that AI can be used to avoid bias. However, it was unclear as to why these three concepts were needed to be taught to early childhood students. Lastly, the "how" to teach AI in early learners is by creating "playful and hands-on AI exhibitions.

CRITICISMS AND LIMITATIONS

The weakness of this research article is the study was conducted in students who live in Hong Kong. The project focused on Hong Kong kindergarteners; they did not apply the study to a surrounding area

or country. Therefore, the data is very limited as it lacks cultural diversity.

IMPACT AND REFLECTIONS FOR THE FIELD

If this study was done for a higher education setting, the results would be dramatically opposite. Older students have been exposed and explored more AI learning than those who are younger. Some of the younger students are brand new to the concepts of "school" and already have a difficult time adjusting from home life to school life. Yang gave detailed information on how to implement for students who have little to none experience. I think Yang's research could be applied to the elder since they do not have much experiences with AI as well.

IMPLICATIONS FOR PRACTICE

Yang did an excellent job to connect his findings to the pedagogy of teaching. They included how to use AI in curriculum writing and how to present it to younger students. This is a great way for it to be directly given to teachers to use in their classrooms. As a kindergarten teacher, Yang provided instructions on how to introduce the topic and how to keep it going for a few weeks.

RECOMMENDATIONS FOR FUTURE RESEARCH

I feel like Yang should give more information on the progress the students are making when using AI in the younger classrooms. They stated how it was important but never showed data for students at the beginning of the year versus the end of the year, and compare it to a classroom of students who do not experience AI. Even continuing the data collection into the next grade levels to see the progress the students are making or what factors need to be altered.

CHAPTER 17

Academic and administrative role of artificial intelligence in education | Review (By Stephanie Zamarripa)

GDY315

ARTICLE

Ahmad, S. F., Alam, M. M., Rahmat, M. K., Mubarik, M. S., & Hyder, S. I. (2022). Academic and administrative role of artificial intelligence in education. *Sustainability*, *14*(3), 1101.

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REVIEW: SUMMARY & ANALYSIS

SUMMARY

The literature review addresses the many tasks both teachers and administrators have in education and how AI tools and applications are being used to help them. The article focuses on two main levels of Artificial Intelligence Applications (AIA) that assist in educational sectors. The first level is the Administration level , for example admissions, counseling, and library. The second is at Academic level such as assessments, feedback, and tutoring. It explained four areas: Artificial Intelligence Applications in Grading/ Assessment, Artificial Intelligence Applications in Admission, Artificial Intelligence as Virtual Reality (VR), and Artificial Intelligence Applications in Learning Analytics. The literature review concluded that using AIA has many benefits in the educational setting. Using AIA is helpful for both levels of the educational sector, teachers and administrative staff. AI applications are varied and prove to be time efficient.

RESEARCH METHOD

The literature review did not specifically conduct quantitative or qualitative research. It collected and analyzed data from other studies.

DATA COLLECTED AND ANALYZED

The study collected and analyzed data from other studies. The following was explained:

- Artificial Intelligence Applications in Grading/ Assessment
    - Using AIA for grading/ assessment is more varied than the traditional standard-based assessments administered in educational institutions. Using computer-based applications allows for rapid testing in a large number of students that are impartial and unbiased. Grading is also made easier by minimizing tasks assigned to the teacher allowing them to also minimize their workload.
- Artificial Intelligence Applications in Admission
    - Today many universities utilize web-based service systems that help a lot with the admission process. An example is the use of Chatbot, which is a computer-based information technology system that answers questions, provides information, finds suitable answers, and provides relevant links. Chatbots use key phrases and predispositioned written scripts to interact with students and parents to answer mundane questions. This has reduced the workload in admission departments.

- Artificial Intelligence as Virtual Reality (VR)
    - Virtual Reality (VR) is defined as "the computer-supported setting that enhances the real-world experience through the provision of multi-aesthetic stimuli (e.g., visual, audio, motion). There are many examples of VR applications being used in all kinds of education, businesses, and entertainment. VR helps deliver lessons through interactivity and high involvement. In some cases, using VR for experiments can be cost efficient and safer than traditional instructional methods. VR can provide a virtual environment where learners can develop their skills without fear of failure.
- Artificial Intelligence Applications in Learning Analytics
    - AI applications are being used to collect and analyze data that allows institutions to address issues and challenges. Some data collected and recorded was from student use of social media, LMS, MOOC etc. Everything is tracked and analyzed to create prediction models for students that can help identify a learner's needs. These learning analytics are useful for both educators and administrative personnel. Educators can have a more customizable and personalized approach to their student's needs to enable differentiated learning. At an administrative level it can provide departments with statistics, risk, intervention, support services etc.

FINDINGS

The literature review found evidence of AIA having a positive impact in education. Both levels of academic and administrative roles benefit using applications in educational institutions. Using applications is helping teachers and administrative works in multiple ways. The review states "AI systems use various techniques to collect and analyze accurate data for the prediction of a student's learning patterns and identification of their educational needs.

CRITIQUE AND LIMITATIONS

The article identified three limitations: (a) the scope of the study is limited to AIA (b) it cannot be generalized as it was not a quantitative study (c) it does not discuss the study's negative or ethical concerns in education or in society. The study discusses many points that involve helping both teachers and staff complete tasks in a faster, more efficient manner that give them extra time to do others. However, I would like to have seen how this affects a students learning and academic growth and to what extent.

IMPACT AND REFLECTIONS FOR THE FIELD

The review mentions many ways AIA is helping in many areas of educational institutions. Some practical applications I noticed include use of virtual content or smart content such as digitalized books, video lectures and notes. These are things I have already witnessed in primary, secondary, and university settings. Personally, I have used data information from some computer-based assessments we have administered to students. Previously I have used MAPS growth assessment, and although it is a standardized test it is a computer adaptive test that will adjust the level of our student's academic needs. Like the review mentioned,

the results are quick and in real-time, allowing for a quicker turnaround of interventions. The review also mentions intelligent tutoring systems as a personalized learning app where students complete academic activities through trial and error tasks. Several districts use the ST Math educational software program that helps students all the way up to middle school learn visual concepts in an interactive and playful way.

IMPLICATIONS FOR PRACTICE

This study can be beneficial in helping all kinds of educational institutions, policy-makers, teachers, and staff with AIA usage and implementation. It supports the use of AIA to enhance and better facilitate tasks in both administrative and academic levels. Data supports using AI systems to adjust and personalize the requirements needed for each student.

RECOMMENDATIONS FOR FUTURE RESEARCH

Future studies can be quantitative and include other AI applications that are used in education such as research in distance learning, tutoring, etc... This study can be extended by researching in other parts of the world. It can collect data from educational systems at campus and even classroom level. In relation to learning analytics, the review states that "it is a fact that the education sector has not used the data for improvement...". The "why" is something to look into.

PART III

GAMIFICATION

CHAPTER 18

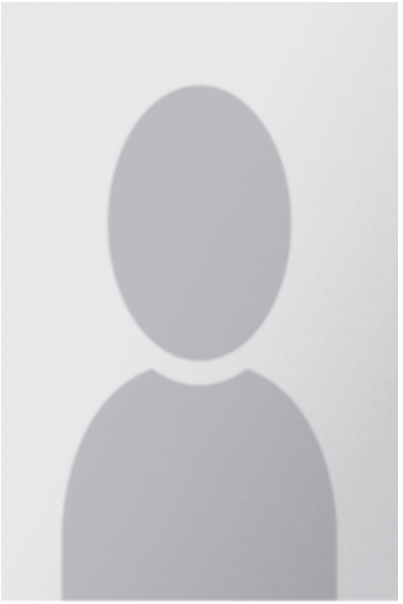
Enhancing Student Achievement, Engagement, and Satisfaction Using Animated Instructional Videos | Review

ZOCHIL CARBAJAL

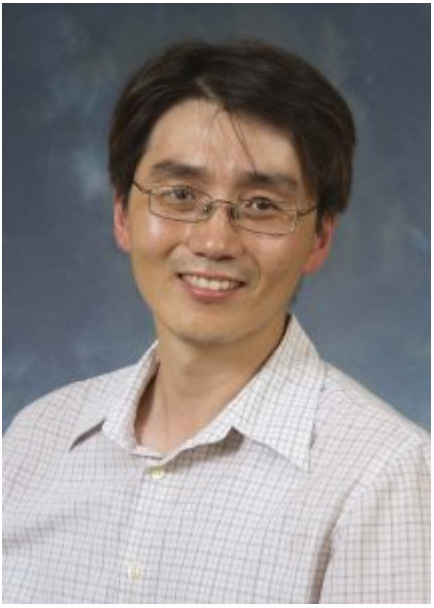
ARTICLE

Cookson, A., Kim, D., & Hartsell, T. (2020). Enhancing Student Achievement, Engagement, and Satisfaction Using Animated Instructional Videos. *International Journal of Information and Communication Technology Education*, *16*(3), NA. https://link.gale.com/apps/doc/A759563667/AONE?u=txshracd2604&sid=bookmark-AONE&xid=68168b08Links to an external site.

AUTHORS



Cookson, April



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ANALYSIS: SUMMARY AND REVIEW

The article "Enhancing Student Achievement, Engagement, and Satisfaction Using Animated Instructional Videos" discusses a project that focused on improving student achievement, and satisfaction in an online general psychology course in a community college. The project utilized animated instructional videos and collected data through surveys, tests, and an online behavior evaluation rubric. The results indicated a significant increase in scores from pre-test to post-test, and students expressed a preference for the videos over the textbook readings. Students also believed that the videos aided in their retention of the material.

The researcher used a quantitative approach to gather and analyze data, conducting five data collection sessions over eight weeks. The methods used to collect data for this project included a pre-test, post-test, pre-survey, post-survey, and a behavior observation rubric.

The data collected for the project was analyzed using several methods. A statistical t-test was performed to examine if there were significant differences in scores between the pre-test and post-test. The researchers used the observational rubric to monitor the students' activities during the non-digital and digital lessons for six weeks. The pre-test and post-test surveys were utilized to monitor students' perspectives on the digital videos and their influence on the learning process. The data in the project was analyzed and presented as percentages to assess students' levels of engagement and satisfaction with both non-digital lessons and digital lessons. In addition, descriptive data obtained from open-ended questions on the post-survey were analyzed and reported to provide further clarification to the quantitative findings.

Concerning ethical considerations, the article does not discuss any anonymity, informed consent, voluntary participation, or confidentiality although students who took the course knew about all the data collection, they were doing throughout the course on

the first day. However, what we do observe is that participants' identities were kept confidential to the public. Nonetheless, it raises the question of whether it is important to the students that their responses are confidential when submitting them to the research to feel like they can be honest about their opinions.

CHAPTER 19

Assessing the benefits of gamification in mathematics for student gameful experience and gaming motivation | Review

ZOCHIL CARBAJAL

ARTICLE

Alt, D. (2023). Assessing the benefits of gamification in mathematics for student gameful experience and gaming motivation. *Computers & Education*, *200*, 104806.

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ANALYSIS: SUMMARY AND REVIEW

The article is a research investigation that examines how game design elements can increase student's motivation in learning mathematics. The implementation of gamification is proposed to boost student motivation and improve learning results. Numerous scholars argue that the process of learning mathematics can often be challenging, potentially leading to repeated failures and diminishing motivation. A significant challenge in math instruction is encouraging students to

construct their own mathematical understanding via problem-based learning activities. The study examines four distinct conditions of mathematics learning activities: problem-based digital gamification, non-problem based digital gamification, face to face game-based learning with a problem-based activity and face to face game-based learning with a non-problem-based activity. Furthermore, the present research centers around four key aspects of the gameful experience: the sense of play, the element of challenge, the feeling of accomplishment, and the level of immersion.

RESEARCH METHOD

The study used a mixed-methods approach to investigate the effectiveness of problem-based digital gamification activity in enhancing students' gameful experience and gaming motivation. 779 students took part in the study, with 384 of them being 7th graders and the remaining 395 being 8th graders from six different schools. Two research groups and two control groups were sampled from each school. The research groups engaged in problem-based digital gamification activities, while the control groups participated in face-to-face game-based learning activities. To assess variables like accomplishment, challenge,

playfulness, and immersion, the study utilized a Gameful Experience Questionnaire. This questionnaire followed a 5-point Likert-style format, where 1 represented strongly disagree and 5 indicated strongly agree. All four groups were exposed to distinct variations of game-based learning. Research group 1 participated in a digital activity centered around problem-solving on To-Be Education platform. Research group 2 was given math exercises related to their study material using a digital platform called ThingLink. Control group 1 engaged in problem-based gamified activities physically in the classroom, providing a more hands-on learning experience. Control group 2 worked with exercises mirroring those on the digital platform, but this time the game was conducted in the classroom without technology.

DATA COLLECTED AND ANALYZED

The analysis of the data was conducted using multivariate analysis of covariance and the partial least square-structural equation model via SmartPLS3 software. Multivariate analysis of variance is a tool that quantifies the difference between groups on several dependent variables while accounting for covariate variables. To assess the impact of the problem-based digital gamification activity on

enhancing the students gameful experience, a multivariate analysis was employed using the Wilks Lambda criterion. This allowed for the identification of differences among the four groups in terms of the linear combination of the four gameful experience dependent factors. The variables of gender and grade level were incorporated as covariate variables to control potential confounding effects on the dependent variables.

FINDINGS

This study had two main objectives, firstly to gauge the potential impact of varied game-based learning environments on students' perceptions of the gaming experience and their motivation and to actively engage in mathematical activities. Secondly, it intended to explore the relationship between a player's gameful experience and their motivation to play. The analysis revealed that the digital gamified problem-based activity outperformed the other three groups in students' gameful experience and motivation to game. These findings align with previous research, underscoring the benefits of digital gamification, which can enhance users' sense of playfulness, achievement, immersion, challenge, and motivation. Interestingly, the findings also question previous studies that

suggest gamification may not always encourage motivation to play and may even hinder it in some contexts. These results suggest that simply integrating game elements into serious digital learning may not necessarily increase student engagement, contradicting the belief strongly by many gamification researchers. The analysis did confirm the positive influence of players' sense of challenge on their perceptions of achievement, leading to a slight surge in their intrinsic motivation to play. However, it's worth noting that a sense of challenge and achievement isn't always linked to the activity's design.

LIMITATIONS

This study did encounter a few limitations. One such limitation was the reliance on self-reporting surveys to measure students' perceptions. Additionally, a pre-test was not given to students in the study which might have been more impactful to incorporate a pretest and post-test to further evaluate the studies. This type of test could have measured students' views and attitudes towards gamification both before and after the implementation of the intervention.

IMPACT AND REFLECTIONS FOR THE FIELD

It is crucial teachers initially prioritize learning outcomes and make sure they are focused on the knowledge and development skills students need before selecting an educational platform to bring into the classroom. Teachers also need to consider that gamification will vary in all grade levels and content areas. Gamification and technology mixed into one is an exciting but tricky item teachers need to learn and break down before bringing into the classroom. However, for teachers to successfully learn and try bringing gamification into the classroom there should be training in school districts to offer this support.

IMPLICATIONS FOR PRACTICE

This research builds upon prior studies by emphasizing the significance of incorporating constructive teaching approaches into gamification. The researchers collectively highlighted the necessity of closely aligning the design of gamified learning activities with learning outcomes. In recent years, the field of gamification studies has expanded dramatically, providing a wealth of educational platforms that teachers can utilize in various contexts.

RECOMMENDATIONS FOR FUTURE RESEARCH

Future research could potentially benefit from incorporating additional measures that focus more directly on observed behaviors as well as testing students before and after game-based learning. As the field of gamification continues to develop, there is potential for studies to be conducted involving several types of gaming in education, such as virtual reality, and how these games can effectively enhance student learning and engagement.

CHAPTER 20

Integrating Gamification and Instructional Design to Enhance Usability of Online Learning | Review

TAMARA TUPPER

ARTICLE

Ghai, A., & Tandon, U. (2022b). Integrating gamification and instructional design to enhance usability of online learning. Education and Information Technologies, 28(2), 2187–2206. https://doi.org/10.1007/s10639-022-11202-5

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ARTICLE: SUMMARY AND REVIEW

SUMMARY

eLearning, facilitated by modern technology, is among students' most well-known learning environments. A common issue among teachers when developing study materials is insufficient student involvement across eLearning systems. It is still quite common for learners to feel lost or bored during their learning process when they use advanced educational technologies. The primary goal of gamification in education is to further engage students through a game in which a scoreboard, leaderboard, and change feedback create a gamified atmosphere in a non-gaming context. Gamification in e-learning refers to processes and activities in a non-game setting to address educational issues by employing gamified design principles and elements. This results in increased ease of use, user engagement, knowledge retention, learning, usability, and an impact on system evaluation and usefulness. The student is more driven by game components such as progress charts and various levels compared to the initial appearance and feeling of learning content independently. The fundamental desire for collecting, coupled with a willingness to keep students interested, is met by the complexity of components like badges, points, and coins. The accumulation of points in the scoreboards can enhance a student's sense of competitiveness. It will drive them to perform better than their classmates and increase their

engagement and competition. An efficient adaptation to user needs is achieved by the personalization of eLearning, leading to a higher level of satisfaction. In the future, eLearning will become more customizable as it gains momentum.

RESEARCH METHOD

In this study, two current theories of consumer behavior are used to understand these concepts. The first theory used to conceptualize Instructional design is Mayer's Theory, while the second theory, the Self-determination theory, is used to conceptualize gamification. Mayer's theory describes a concept of multiple representations, suggesting that the simultaneous use of audio and image can improve elearning. It enables more effective information storage and processing throughout the learning process by means of multiple mediums rather than a single medium. This theory emphasizes that people only have a certain amount of information to grasp at any given period and that mental representations are actively generated to make sense of the incoming data. The theory of Self-determination (SDT), which encompasses the concepts of extrinsic and intrinsic drive, is one of today's most influential motivation theories. The term "extrinsic motivation" may describe our actions because it leads to specific results. In contrast, "intrinsically motivated" refers to something exciting or amusing. A mixed method approach has been used to obtain an appropriate sample size and minimize the bias due to the use of one methodology for studies. Both convenience and snowball sampling techniques have been used as nonprobability sampling techniques. The study has been carried out among scholars undertaking various graduate studies. In northern India, postgraduate courses are offered in various institutions and universities. Five State public and private Universities were taken as samples that switched to online learning and teaching thanks to COVID-19.

DATA COLLECTED & ANALYZED

An online link was created to address usability, gamification, and instructional design issues. The link was circulated through the university websites and among faculty groups in selected universities. A Google link was created, and a filter question was added to ask whether respondents have used gamification content for online learning. The link ended for respondents who answered 'No'. 413 responses have been submitted. After the review, several irrelevant and odd responses were deleted, with 382 replies remaining to be analyzed. The one factor test of Harman was applied to eliminate common method bias. With Varimax rotation, an exploratory factor analysis (EFA) was performed. According to the results, the variance was explained by a factor with a value of 31.46% below the recommended 50%, and this suggests that common methods are not biased. Out of 382 respondents 51.8% were males and remaining 48.16% were females. Of all the respondents, 38.49% were doctorates followed by 33.77% postgraduates, and 27.74% graduates. The age ranged from 25 to 30 with 20.95%, 31–40 with 64.92% and above 40 with 14.13%. 25.09% of the academicians were delivering e-learning modules from the last two years while 47.48% had online teaching load of 11–15 h (Ghai & Tandon, 2022c). A two-step approach to investigation was followed during the Data Analysis process. Confirmatory Factor Analysis (CFA) was performed to assess the reliability and validity of scale items, followed by Structural Equation Modelling (SEM) to test the hypotheses framed empirically. The SEM method was chosen because it contains several standard methodologies in one software package, such as correlation, multi-regression, and factor analysis. The primary objective of eLearning is to increase interaction between teachers and students, rapid feedback, and complete tasks within a short period of time, which can be accomplished with the help of appropriate use of gamification elements that increase its

usability. Obtaining reward points fosters competitive spirit and improves engagement. The study has made an important contribution to demonstrating the mediating effect of instructional design on gamification and usability in eLearning. The instructional design mediates the relationship, which indicates its significance to eLearning. Therefore, these findings increase the contribution of Mayer's theory to understanding instructional design and usability in eLearning. The emergence of a significant and positive impact on usability validates SDT theory, and gamification is considered an extrinsic motivator in eLearning. It also shows that SDT helps improve the gamification and eLearning domain by applying concepts, which makes complicated phenomena more straightforward to understand and helps improve learner control and motivation for studying various subjects.

FINDINGS

This research examines the complex linkages between gamification, instructional design, and usability of e-learning with educational institutions. This research makes a good effort to gather information to understand the role of learning design, which validates Mayer's and Self-determination theories. Including game elements, such as gaming fiction, reinforces learner interactions that improve academic performance. Other gamification aspects were added to the mix, such as game characteristics, motivation, and play mechanics. This conclusion is supported by previous studies that have emphasized the significance of these aspects in promoting education as it involves both online and offline learning. Therefore, it is necessary to include elements from gamification to make content thought-provoking and exciting. The results also point to a clear and significant correlation of gamification with the usability of eLearning. The Technological Acceptance Model (TAM) is a widely recognized theoretical framework influencing an individual's interest in using new technology. It has two main

factors: perception of ease of application and perceived usefulness. The diagram below demonstrates the thinking process of an individual deciding to use technology. This is an essential factor to consider with gamification, instructional design, and usability of eLearning. (Wang, 2014) This is the TAM model for gamification, instructional design, and eLearning. (Ghai & Tandon, 2022c)

CRITIQUE AND LIMITATIONS

Identify any limitations or weaknesses in the study and offer constructive criticisms. There are certain limitations in the study that could have been taken into consideration as an option for further research. Adding visual designs and gamification elements could extend the model. Students and graphic artists may be considered in future studies, given the data collected from the academic perspective only. To improve the generalizability of this model, it can also be applied to larger samples and in other developing countries. As moderators, it would have been good to validate demographic variables. I n future experiments to demonstrate the applicability of these models, additional dependence variables such as satisfaction and behavioral intentions may also be included.

IMPACT AND REFLECTIONS FOR THE FIELD

Consider practical applications and relevance to the field in different educational settings, for example K-12, higher education, corporate. Important aspects of education and training have greatly impacted how people's learning is carried out, such as gamification, instructional designs, or eLearning. Gamification uses game elements like points, badges, and rewards to motivate and engage learners. It has a significant impact on education and training. Gamification has the potential to improve learning enjoyment and engagement, as well as motivation. The process of

making, developing, and delivering learning experiences is known as instructional design. It focuses on learning needs, objectives, and effective teaching methods. Proper instructional design is essential for creating effective eLearning materials. Well-designed courses consider diverse learners' needs, including active learning strategies, and use technology to deliver effectively. Improved student performance, increased retention, and a more relevant experience are the result of good instructional design. The use of digital technology for training and educational content is called eLearning. eLearning has been a significant factor, particularly over the past few years. It allows for flexibility in terms of when and where people can learn. eLearning has become the mainstream way to acquire new skills and knowledge, thanks to increasing online courses, webinars, and virtual classrooms. For distance learning, and in particular, for self-paced learning, it is especially valuable. Gamification, instructional design, and eLearning have all contributed significantly to education and training. They can create a powerful and engaging learning experience if properly integrated. To meet the needs of learners and objectives in training, it is essential that these concepts are thoughtfully applied. These three elements are likely to play a more significant role in shaping the future of education and training as technology advances.

IMPLICATIONS FOR PRACTICE

This study focuses on improving the learning environment for eLearning students to enhance their knowledge retention. Because gamification can give instant feedback, college and university educators should be trained to formulate content to increase learner engagement, recall, and retention. Gamification of eLearning stimulates, motivates, challenges, and empowers students to achieve higher objectives willingly. The findings from this study shed light on the idea of gamified learning and how it is

an essential instrument for enabling motivation, engagement, and user experience. User experience in education and information technologies and impact on instructional design.

RECOMMENDATIONS FOR FUTURE RESEARCH

Gamification in education and corporate training continues to evolve, driven by technological advancements and a growing recognition of effectiveness. Gamification will become more personalized, customize content, and challenge each learner's needs and preferences. To assess learners' progress and adapt game elements accordingly, artificial intelligence and data analysis will play an essential role. It will be possible to integrate Virtual Reality (VR) and augmented reality (AR) into the gamification of learning experiences, creating more realistic and interactive simulations in education and company training. Short, bite-sized gamified content will become increasingly popular, allowing learners to access information and training modules in a convenient and easily digestible manner. Gamification will consider social factors and encourage learner collaboration and competition to improve the interactivity and enjoyment of learning. To assist teachers and trainers in developing effective gamification strategies, data analysis would be extended so that more comprehensive information on learning outcomes could be obtained. Gamification platforms will make it easy for educational institutions and organizations to use and manage interactive learning experiences easily by integrating them with the current Learning Management System. Gamification will continue to evolve in education and corporate training, offering more effective learning experiences adapted to the changing needs of learners and workforce demands.

CHAPTER 21

Gamification, Online Learning and Motivation: A Quantitative and Qualitative Analysis in Higher Education | Review (By Jacqueline Cardenas)

ARTICLE

Torrado Cespón, M., & Díaz Lage, J. M. (2022). Gamification, Online Learning and Motivation: A Quantitative and Qualitative Analysis in Higher Education. *Contemporary Educational Technology*, *14*(4).

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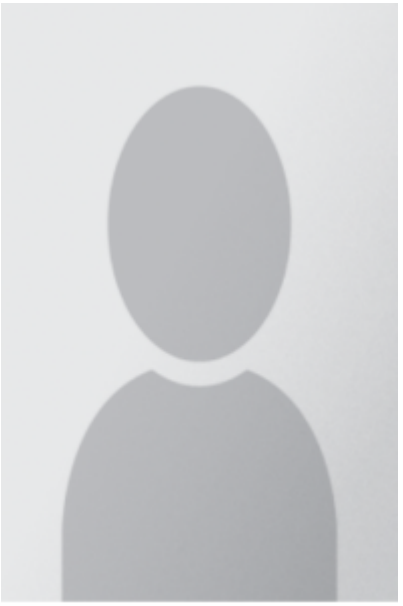

José María Díaz Lage | Departamento de Filologías Extranjeras y sus Lingüísticas
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REVIEW: SUMMARY AND ANALYSIS

This article's goals are to test the motivation and performance of online learners using gamification in higher education courses.

RESEARCH METHOD

This study uses qualitative and quantitative data. The quantitative data comes from an experiment of three groups of university students. One group is given no gamification, one is given gamification without reward, and the last group is given gamification with reward. The qualitative data comes from a

survey given to them before the course starts and another at the end of the course.

DATA COLLECTED AND ANALYZED

The quantitative data collected consisted of the students' scores from the three different groups were then compared and the data was analyzed to assess gamifications' affect on the students; motivation to do their work and engage in class. The qualitative data resulted from the students pre-questionnaire and post-questionnaire concerning the gamification used in their course. This also was analyzed and taken into consideration when determining the conclusion.

FINDINGS

This study found that gamification only produced good results in those students who had student-teacher contact, while those solely online did not benefit from gamification. Which gives the conclusion that gamification is a good tool but does not necessarily work for online learning, where the motivation to participate has to come from the student themselves.

CRITIQUE AND LIMITATIONS

I think that perhaps this experiment should be done in several courses of different subjects because it is a possibility that some classes are harder to take online than in person. Comparing the success rate of students in several classes online vs online with gamification could produce clearer results.

IMPACT AND REFLECTIONS FOR THE FIELD

I believe this study can perhaps help learning game designers make their software more enticing for their online students, or prepare teachers to present it in a better way at the start of each course. Also, maybe a completely different design model is needed for university students vs grade school students.

IMPLICATIONS FOR PRACTICE

If gamification is used in higher education, i think more research has to be done so that students are getting the most out of their classes and that the gamification of their classes is actually going to benefit the students and not make their schoolwork more “busy”.

RECOMMENDATIONS FOR FUTURE RESEARCH

I think finding out how online higher education students can be motivated is a good way to start to design something that will get them motivated. Perhaps a questionnaire of what would help them stay engaged in class to get their opinions personally.

CHAPTER 22

Tailored gamification in education: A literature review and future agenda | Review

BRUNA DAMIANA HEINSFELD

ARTICLE

Oliveira, W., Hamari, J., Shi, L. et al. (2023). Tailored gamification in education: A literature review and future agenda. *Education and Information Technologies*, *28*, 373–406. https://doi.org/10.1007/s10639-022-11122-4.

AUTHORS

Dr. Wilk Oliveira

The article titled "Tailored gamification in education: A literature review and future agenda" was authored by seven scholars from Finland, Brazil, and the United Kingdom, with the corresponding author being Dr. Wilk Oliveira. Dr. Oliveira is a researcher at the Gamification Group within the Faculty of Information Technology and Communications at Tampere University in Finland. He holds a Ph.D. in Computer Science and Computational Mathematics from the University of São Paulo, Brazil, with an internship at Tampere University. His research encompasses the fields of Educational Technology, Gamification, Game-based Learning, User Experience, and Computing Education.

REVIEW

SUMMARY

In this article, a literature review and future agenda on tailored gamification in education is presented. It delves into the advantages and challenges of personalizing gamification design properties to align with individual students' needs, characteristics, and preferences. The

review highlights that 37 authors have conducted studies in the field of tailored gamification in education, hailing from different countries and carrying out research in various educational settings, including primary, secondary, and higher education. Furthermore, the review reveals that gamification can positively impact student motivation, engagement, and learning outcomes; however, personalizing gamification design properties presents complexities due to individual differences and a lack of standardization in approach. The review suggests that upcoming research should focus on developing a theoretical framework for tailored gamification design, examining the influence of cultural differences on gamification effectiveness, and analyzing the ethical implications of gamification in education. Overall, this review provides critical insights into the potential benefits and challenges of tailored gamification in education, while also bringing attention to the need for continued research in this area.

RESEARCH METHOD

The systematic literature review method was employed to identify relevant studies on tailored gamification in education. The authors searched four databases (ACM Digital Library, IEEE Xplore, Scopus, and Web of Science) using specific keywords to identify studies published between 2010 and 2020. Additionally, snowballing

techniques were used to identify additional studies. The review includes studies that investigated the effects of personalized gamification design on student motivation, engagement, and learning outcomes. These studies were conducted in various educational settings, such as primary, secondary, and higher education, and encompassed different subject areas, such as mathematics, science, and language learning. Various data collection methods, such as surveys, interviews, and observations, were used in the studies to gather data on student experiences and outcomes.

The authors utilized a standardized protocol to extract data from each study and employed a narrative synthesis approach to analyze the data. This approach involved summarizing and synthesizing the findings of the selected studies to identify patterns, themes, and gaps in the literature. Additionally, the authors employed a thematic analysis approach to identify themes related to the benefits and challenges of personalized gamification design in education, a content analysis approach to discern the frequency and distribution of different approaches and tools used to tailor gamification design properties, a descriptive analysis approach to summarize the characteristics of the selected studies, such as the study aims, participants, and data collection methods, and a critical analysis approach to evaluate the quality and rigor of the selected studies and identify limitations and future research directions.

FINDINGS

The review provides numerous insights, including the finding that personalized gamification design can have a positive impact on student motivation, engagement, and learning outcomes. For example, one study revealed that personalized gamification design increased student motivation and engagement in a language learning context. Another study highlighted that personalized gamification design improved student learning outcomes in a mathematics course. Such findings suggest that personalized gamification design has potential as a valuable tool to enhance student learning experiences. However, the review also reveals that personalizing gamification design properties presents challenges, given the complexity of individual differences and the lack of a standardized approach. For instance, one study found that personalizing gamification design properties based on students' personality traits was challenging due to the lack of a standardized personality assessment tool, while another study found that personalizing gamification design properties based on students' learning styles was challenging due to a lack of clear definition and measurement of learning styles. These challenges indicate that further research is necessary to develop a standardized approach to personalizing gamification design properties.

The review also identified gaps and limitations in the literature on tailored gamification in education. Most notably, the review reveals that most studies only consider students' gamer types to tailor systems, and many experiments do not adequately support their findings statistically, particularly concerning learning performance with tailored gamified systems. Additionally, there is a lack of research on the influence of cultural differences in gamification effectiveness and the ethical implications of gamification in education. To bridge these gaps, future research should aim to develop a theoretical framework for personalized gamification design, explore the impact of cultural differences on gamification

effectiveness, and investigate the ethical implications of gamification in education.

CRITIQUE AND LIMITATIONS

One possible limitation of the review is that it only includes studies published between 2010 and 2020, which may not encompass the most recent advancements in the field. Another limitation is that the review comprises studies published in just four databases, which may not cover all relevant research on the topic. As a result, future reviews should consider including studies published in other databases and more recent studies to offer a more comprehensive overview of the field. Moreover, the studies analyzed in the review differ in research design, participants, and data collection methods, making it challenging to compare findings and draw definitive conclusions about the effectiveness of personalized gamification design in education. Consequently, future research should utilize more rigorous research designs and standardized data collection methods to provide more compelling evidence regarding the impact of personalized gamification design on student learning outcomes. Lastly, the review does not clearly define personalized gamification design, leading to potential confusion and discrepancies in the literature. Therefore, future research should develop a standardized definition of personalized gamification design and a theoretical framework for designing and evaluating gamified educational environments.

IMPACT AND REFLECTIONS FOR THE FIELD ANF FOR PRACTICE

The review highlights the potential benefits of personalized gamification design in enhancing student motivation, engagement, and learning outcomes. This has practical implications for diverse educational settings, such as K-12, higher education, and corporate

training. For instance, personalized gamification design can play a significant role in creating more engaging and effective learning experiences for students in K-12 classrooms, including language learning or math courses. In higher education, tailored gamification design can increase student engagement and motivation in online courses or support personalized learning pathways. This may involve adapting game elements like points, badges, and leaderboards to align with students' interests and learning styles. In corporate training, personalized gamification design can enhance employee engagement and performance in various areas, such as sales or customer service, while also supporting personalized learning pathways, where students can learn at their own pace and receive personalized feedback. However, the review also underscores the challenges and limitations of personalized gamification design, such as the complexity of individual differences and the absence of a standardized approach. As a result, forerunning research should strive to develop a theoretical framework for personalized gamification design, analyze the influence of cultural differences on gamification effectiveness, and examine the ethical implications of gamification in education.

FUTURE STUDIES

Finally, the review opens numerous possibilities for future research in the field, including examining the effects of cultural differences on the effectiveness of personalized gamification design, developing a theoretical framework to guide research and practice, and analyzing the ethical implications of gamification in education. Additionally, as mentioned, future reviews should consider expanding the timeframe and databases to further explore the topic comprehensively. Lastly, a standardized definition and theoretical framework for personalized gamification design should be developed to promote consistency and understanding in the literature. Overall, this review provides a comprehensive

assessment of tailored gamification in education, highlighting the potential for future research to enhance the effectiveness and ethical implications of personalized gamification design in education.

PART IV

INTERACTIVE TECHNOLOGIES

CHAPTER 23

The role of desktop virtual reality as an accessible and equitable strategy to improve career opportunities for women in technology | Analysis by Zochil Carbajal

ZOCHIL CARBAJAL

ARTICLE

Onele, N. O. (2023). The role of desktop virtual reality as an accessible and equitable strategy to improve career opportunities for women in technology. Journal of Computer Assisted Learning, 39(1), 20–33. https://doi.org/10.1111/jcal.12742

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ANALYSIS: SUMMARY AND REVIEW

This research article explores into the utilization of desktop reality to enhance career prospects for women in the field of technology. Researchers discovered that males showed a greater inclination than females towards the selection of technology courses in both their academic pursuits and future careers. Additionally, female students who did choose to enroll in these courses experienced little to no interest and subpar academic performance. Achieving gender balance in education necessitates the creation of a teaching and learning environment that fosters students' learning potential by modifying strategies and practices. Virtual reality can aid learners in accessing resources, promoting interactions, and creating enjoyable experiences. However, it is important to note that gender differences in performance levels have been observed in the context of virtual reality's positive learning outcomes in certain educational fields. The goal of this study was to evaluate the effectiveness of desktop virtual reality in improving the academic achievement and learning interest of female students.

RESEARCH METHOD

This research employed a pre-test and post-test quasi-experimental design, involving 123 students studying electronic technology education at six selected universities. These universities were chosen based on the results of a pre-test conducted in electronic technology education classes. Out of the total participants, 108 students completed the study, with 41 females representing 38% and 67 males representing 62%, all ranging from 20 to 25 years of age. The universities were categorized into two groups: a virtual reality (VR) group and a non-virtual reality (non-VR) group. Each group consisted of three universities, one with 52 students and the other 56 students. Furthermore, six electronic technology teachers were enlisted and trained specifically for this study. All classes were equipped with a projector and a large screen to facilitate teacher demonstration and instruction. The class setups were identical, except for the VR class where each student had a laptop computer installed with ElectricVLab software. In contrast, students in the non-VR class did not have computers but accessed their information through PowerPoints and white board demonstration. Students using the ElectricVLab were able to perform the operations instructed by the teacher using the 128 electronic components, tools, and equipment in the software to navigate the virtual environment. The study spanned 16 weeks, with the initial week allocated for students and teacher training, as well as administering the pre-test. The following 12 weeks (about 3 months) were dedicated to teaching, while an additional 2 weeks were designated for students to practice constructing circuits in a physical electronic lab. The final week was reserved for the post-test.

DATA COLLECTED AND ANALYZED

For data collection in this study, two instruments were employed: a Vocational Interest Scale and a custom-made achievement test. The vocational interest scale is a 28-items and employed a five-point Likert scale to gauge interest levels. The achievement test compromised 20 questions, divided into four sections (A-D). Section a consisted of 10 multiple choice questions, section b included five short essay questions, section c contained four longer essay questions, and section d featured a practical question. Sections A to C were administered as paper and pencil examinations, while section D involved the practical construction of an
audio amplifier circuit. In section D students were scored based on their correct utilization of tools, adherence to the process, accuracy, and level of completion. To assess students' interest, their mean responses to the five-point Likert-type vocational interest scale were calculated. Both the pre-test and post-test were similar, with the question order varied and a 14-week gap in between to decrease the possibility of sensitization effects and any potential set response effect.

FINDINGS

In the virtual reality (VR) environment, female students achieved a mean score of 79.28% after receiving instruction, while male students achieved a slightly higher mean score of 79.65%. On the other hand, in the conventional classroom setting, female students achieved a mean score of 46.05%, while male students achieved a higher mean of 61.33%. These findings indicate that both male and female students in the VR group outperformed their counterparts in the non-VR group in student achievement. Within the VR group there was no significant difference in achievement between male and female students. On the other

hand, in the non-VR group, male students achieved significantly higher scores than their female classmates. In the VR group, female students displayed a substantial improvement in their mean interest level, increasing from 1.72 to 4.19. Similarly, male students in the VR group experienced an improvement, with their mean interest rising from 2.28 to 4.06. Conversely, in the non-VR group, female students demonstrated a small interest increase from 1.92 to 2.95, while male students saw their mean interest rise from 2.43 to 3.17. These findings indicate that both female and male students in the VR group exhibited a significantly higher mean interest in studying electronic technology education compared to those in the conventional learning group. However, within the conventional learning group, male students reported a significantly higher interest in studying electronic technology education compared to females, who displayed a lower mean interest.

CRITICISM AND LIMITATIONS

This study is subject to certain limitations that should be acknowledged. One limitation pertains to the variations in school locations and cultural contexts, which may have influenced the results. Additionally, the study's sample size of 108 participants is considered relatively small for making broad

generalizations. However, these limitations highlight an important observation: young people, particularly women, exhibit limited enthusiasm for enrolling in technical and vocational education and training courses.

IMPACT AND REFLECTIONS FOR THE FIELD

Compared to the conventional classroom method, the use of desktop virtual reality demonstrated a significant increase in both the interest and academic achievement of female and male students in electronic technology education. This suggests that virtual reality appealed equally to both female and male students. Virtual reality has the potential to uniquely motivate learners and enhance their educational outcomes. Students found the learning activities in the virtual reality environment meaningful and engaging, leading to increased interest in further learning. By leveraging virtual reality, it becomes possible to reduce the gender gap and increase female participation in the field of technology.

IMPLICATIONS FOR PRACTICE

Considering the study's findings universities may explore piloting virtual reality to address gender imbalance and promote gender equitable technology education to

improve academic achievement and inte est among both male and female students in electronic technology courses. Moreover, the use of virtual reality for teaching and learning can be incorporated into academic fields where its effectiveness has been demonstrated.

RECOMMENDATIONS FOR FUTURE RESEARCH

Virtual reality is not a solution that can solve all educational challenges or be universally applicable to all fields of study. However, traditional teaching methods may have limitations in conveying complex concepts or providing hands-on experiences, virtual reality can play a crucial role in enhancing the learning process and overcoming these challenges. For this to succeed, universities need to provide workshops, seminars, and lectures for staff and educators on the methods of virtual reality and present training in computer simulations. Furthermore, government and universities should have the funds available to provide educators and students with these interactive technologies.

CHAPTER 24

Analyzing Augmented Reality (AR) and Virtual Reality (VR) Recent Development in Education | Review

TAMARA TUPPER

ARTICLE

Al-Ansi, A. M., Jaboob, M., Garad, A., & Al-Ansi, A. M. (2023). Analyzing augmented reality (AR) and virtual reality (VR) recent development in education. Social Sciences & Humanities Open, 8(1), 100532. https://doi.org/10.1016/j.ssaho.2023.100532

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ARTICLE: SUMMARY AND REVIEW

SUMMARY

Augmented Reality (AR) and Virtual Reality (VR) technologies have revolutionized learning approaches through immersive digital experiences, interactive environments, simulation, and engagement. They may be able to bridge the gap between traditional classroom teaching and real-world experience, which will lead to tangible benefits for learners in terms of professional development. The objective of this major review is to bring about the development of augmented and virtual reality in education over the past 12 years. Hypotheses have been developed based on the previous work of AR and VR in education. The results were processed and assessed to reveal the state of the art for the development of AR or VR literature, applications, advantages, and future directions. Results show a growing adoption of Augmented

Reality and Virtual Reality in education, where wearable devices accounted for most of this development over the last few years. The results also reveal that in educational institutions, there is a gap between the speed of implementation and development of these technologies. More educational applications emerge in learning as virtual reality and augmented reality technologies rapidly develop and mature.

RESEARCH METHOD

By adopting the Scopus database, VR and AR in education or learning included 5122 documents of all times without any limitation. Additional methods for optimizing the research cycle were applied, including year of publication 2011 to 2022, document type: article 1454, review 252, and Conference Paper 35 documents in addition to notes, letters, editorials, and short surveys and sources type included conference proceedings 852, journals with 648 and books contained 283 documents. The focus of this study was 1536 documents, which have been used to date for further analysis. The various areas of science also exist in the context of virtual and augmented reality for education. More information is needed in terms of specificity that will help explain the various areas of science to be covered. It is important to mention that these different areas included education or learning. Discussing more about the usage and employment of virtual and augmented reality in various fields and markets is out of the scope of this research. The most dominant areas included computer science, social sciences, engineering, and medicine.

DATA COLLECTED AND ANALYZED

In view of its effective use for content analysis, Wordstat has been adopted by researchers. WordStat allows researchers to get more insight into word frequency and keyword distribution. To find the

most important keywords of Augmented Reality and Virtual Reality in education settings have been adjusted. To understand the word frequency of AR and VR in education, including the top 20 words, WordStat settings were adjusted. Apart from extending these abbreviations, the top five-word frequency was AR and VR. The final step of the analysis is to analyze topics related to Augmented Reality and Virtual Reality in education. To meet the criteria, 20 of the most important topics were included in the analysis settings, and 13 of them were selected based on the serial number. Seven of these topics were excluded, while the others explain coherence, eigenvalue, frequency, and number of documents where these words appeared.

FINDINGS AND LIMITATIONS

The educational use of Augmented and Virtual Reality technologies is becoming increasingly common. The student can interact with the environment in a more immersive way, increase their engagement, and understand concepts better. Technology will become even more accessible as costs for augmented and virtual reality hardware decrease. The way students learn and interact with the world in which they live is being revolutionized by AR and VR technologies in education. Students will have new opportunities to interact with 3D objects, explore the environment, and learn more about concepts thanks to AR and VR. Creating interactive simulations, allowing students to explore complex concepts in a safe and stimulating environment, can also be done with Augmented Reality and Virtual Reality.

In addition, it has been demonstrated that the introduction of Augmented and Virtual Reality into a classroom benefits students' engagement and learning. Higher levels of motivation and engagement have been found in students using AR or VR technology, as well as higher performance on academic tasks. This may be because virtual and augmented reality provides students

with a more immersive learning experience, enabling them to explore, discover, and interact with their environment. Other teaching environments, such as museums, libraries, and science centers, have also used AR and VR technologies. The students have the possibility to explore and interact with objects through Augmented Reality and Virtual Reality, which would not otherwise be possible in the real world. Young students who may not fully understand complex concepts with visual aids could benefit from this type of learning.

Although Augmented Reality and Virtual Reality are powerful tools to improve education, they also have some limitations. The high cost of hardware, which can make it difficult for schools and universities to implement this technology, is one of the main challenges of AR and VR. Their complexity is another limitation of AR and VR. It can be difficult, given the relatively new nature of these technologies, for teachers and students to use them without prior knowledge or experience. Ensuring the proper installation and maintenance of software and hardware can also be a challenge, which could result in technological problems or interruptions at class time. Students may also be distracted by some of the immersive experiences created by AR and VR, making it difficult to concentrate and retain information. The research on these technologies still has several limitations.

There is still much to be done in research on Augmented Reality and Virtual Reality for education, but there is still no thorough understanding of their potential. In addition, further research is needed to understand the impact of AR and VR technologies on student learning outcomes, given the complexity of their implementation in a learning environment. There may be a lack of technical knowledge in many schools and teachers for effectively implementing these technologies in the classroom. The appropriate criteria for evaluating the research on Augmented Reality and Virtual Reality in education are also lacking. Hence, the effectiveness of each implementation makes it difficult to assess

the benefits of these technologies accurately. There is much more to learn about the potential of Augmented Reality and Virtual Reality technologies for education.

IMPLICATIONS FOR PRACTICE

The potential for revolutionizing the education system and bringing more immersive, interactive learning experiences to learners lies in Augmented Reality and Virtual Reality technologies. The use of these technologies will allow students to experience different visual, audio, and simulation elements that can help increase their interest in the subject. In addition, they can also be used to develop more engaging and exciting virtual worlds that offer better learning experiences. The importance of AR and VR integration in education is emphasized by this research, which also includes the use of eLearning, mobile learning applications, and educational application platforms. The research suggests that these technologies, when used in conjunction with the support of constructivist learning and to reduce educational inequalities, can produce more immersive and engaging teaching experiences for students.

CHAPTER 25

Systematic literature review and bibliometric analysis on virtual reality and education | Review

BRUNA DAMIANA HEINSFELD

ARTICLE

Rojas-Sánchez, M. A., Palos-Sánchez, P. R., & Folgado-Fernández, J. A. (2023). Systematic literature review and bibliometric analysis on virtual reality and education. *Education and Information Technologies*, *28*, 155–192. https://doi.org/10.1007/s10639-022-11167-5.

AUTHORS

Dr. Folgado

The article "Systematic literature review and bibliometric analysis on virtual reality and education" is authored by Mario A. Rojas-Sánchez, Pedro R. Palos-Sánchez, and José A. Folgado-Fernández. The authors are affiliated with universities in three countries, Costa Rica, Spain, and Portugal, namely Tecnológico de Costa Rica, Universidad de Sevilla, Universidade da Beira Interior, and Universidad de Extremadura. The corresponding author is Dr. Folgado-Fernández, whose recent research deals with virtual reality, digital experiences, and tourism.

REVIEW

SUMMARY

The analyzed paper presents a review of the literature on the utilization of virtual reality (VR) in education through a bibliometric analysis. The objective of the study was to identify the current knowledge base of VR in education and its integration into teaching and learning processes. The analysis was based on the assessment of articles published between 2010 and 2021, retrieved from the Web of Science

and Scopus databases. The findings revealed that VR in education has garnered significant academic interest, as evidenced by the assessment of 718 articles. The average number of citations per article was relatively high, indicating the impact and influence of VR in this field. Thematic trends, such as simulation as a learning tool, technology integration in teaching processes, and the design of technological environments, were also identified. Journal and author performance within the field were critically examined, with the most impactful journal being "Computers & Education" and the most cited document in the dataset being "Effectiveness of virtual reality-based instruction on students learning outcomes in K-12 and higher education: A meta-analysis" by Merchant et al. (2014). Overall, this study offers valuable insights into the research landscape of VR in education, highlighting prominent topics, trends, and key influential publications.

RESEARCH METHOD

The authors used bibliometric analysis as their main methodology, which involves the quantitative investigation of publications and citations to gain insights into the research landscape of a specific field. The study narrows its focus on the implementation of VR in education and aims to identify principal topics,

countries contributing to scientific production, and frequently used words in the literature. The authors analyzed articles published between January 1, 2010, and July 31, 2021, indexed in the Web of Science and Scopus Main Collection databases. These databases were chosen based on their quality indexes, long-term coverage, and the ability to download a considerable number of references simultaneously. The search procedures involved the application of inclusion criteria and the use of search strings to identify relevant literature on VR in education. Non-peer-reviewed documents, such as editorials, books, and proceedings, were excluded from the study. The collected data – 718 articles – were analyzed using various techniques, including descriptive statistics, citation analysis, and mapping analysis. Descriptive statistics provide an overview of the dataset, such as the number of papers, average citations per article, and trends over time. Citation analysis evaluates research performance and identifies influential articles and authors. Mapping analysis involves the construction of bibliometric maps to visualize the conceptual, intellectual, and social structures of the literature.

FINDINGS

The results of the study indicated a substantial

academic interest in VR in education. The average number of citations per article was relatively high, indicating the impact and influence of VR in this field. The most cited paper in the dataset at the time of the study was "Effectiveness of virtual reality-based instruction on students learning outcomes in K-12 and higher education: A meta-analysis" by Merchant et al. (2014), receiving 452 citations. The study identified several primary topics and trends in the application of VR in education, including the use of simulation as a learning tool, technology integration in teaching processes, and the design of technological environments. It also highlighted the increasing interest in e-learning using VR tools and the impact of the COVID-19 pandemic on the adoption of VR in education. Moreover, the journal "Computers & Education" emerged as the most impactful in the field of VR in education, reporting an h-index of 16. Additionally, the study reveals that the most productive countries in terms of research output on VR in education are the Republic of China and the United States of America.

IMPACT AND REFLECTIONS FOR THE FIELD ANF FOR PRACTICE

The authors underscored the potential of VR to enhance traditional classroom instruction by allowing students to engage with

educational content in a more tangible and experiential manner. In this regard, VR can serve as a powerful tool for simulating real-world scenarios, historical events, and scientific experiments, thereby enabling students to develop a deeper understanding of the subject matter. Additionally, the use of VR in curriculum can promote active learning, as students become active participants in the learning process, rather than passive recipients of information. The identification of prominent topics and trends, as identified in the study, can guide educators, researchers, and policymakers in designing effective VR-based instructional strategies and developing curricula. The insights gained from the study can inform the integration of VR technology in diverse educational settings, fostering innovation, engagement, and improved learning outcomes.

LIMITATIONS AND FUTURE STUDIES

While the article provides valuable insights into the literature on VR in education, it also has some limitations and weaknesses that should be acknowledged. First, the limited data sources, relying on two databases and one language, the Web of Science Core Collection and Scopus, and publications in English. The exclusion of other databases and languages could result in potential bias and incomplete representation of the literature. Additionally, the study primarily focuses on quantitative analysis. While the chosen methodology provides essential information on the subject, the lack of qualitative analysis limits the understanding of the content and quality of the included articles. As such, a more in-depth analysis of the methodologies, findings, and implications of the included articles could provide a more comprehensive understanding of the field. Expanding the data sources to incorporate additional databases and languages to ensure a more comprehensive representation of the literature on VR in education would be valuable to the field.

PART V

LEARNING ANALYTICS

CHAPTER 26

Learning analytics: State of the art | Review

BRUNA DAMIANA HEINSFELD

ARTICLE

Hernández-de-Menéndez, M., Morales-Menendez, R., Escobar, C. A., & Mendoza, R. A. R. (2022). Learning analytics: state of the art. *International Journal on Interactive Design and Manufacturing (IJIDeM)*, *16*, 1209–1230. https://doi.org/10.1007/s12008-022-00930-0.

AUTHORS

Dr. Morales-Menendez

"Learning analytics: State of the art" is authored by Marcela Hernández-de-Menéndez, Ruben Morales-Menendez, Carlos A. Escobar, and Ricardo A. Ramírez Mendoza. Three of the authors are affiliated with the Tecnológico de Monterrey, México, while Carlos Escobar is affiliated with the Global Research & Development of General Motors. The corresponding author is Dr. Morales-Menendez, Dean of Graduate Studies in the School of Engineering and Sciences at the Tecnológico de Monterrey. Dr. Morales-Menendez is a full professor, and his research includes the field of active learning techniques for engineering education.

REVIEW

SUMMARY

The article discusses the use of Learning Analytics (LA) in higher education, particularly in the context of the COVID-19 pandemic. It highlights the challenges faced by educational institutions, such as technical problems in virtual settings and the need for performance improvement. The article presents various forms of LA definition and the different stages

involved in the LA process. It also provides insights into the initiatives adopted by universities to implement LA projects, focusing on increasing student retention and improving academic issues. The paper emphasizes the use of technology and personalized learning to address high desertion rates and mentions specific software and models used by universities. Additionally, it outlines recommendations for institutions and schools regarding the use of LA, including the importance of collaboration, benchmarking, and capacity building. Overall, the article underscores the promising results achieved by educational organizations through the implementation of LA initiatives.

RESEARCH METHOD

The paper presents a review of LA initiatives in higher education, focusing on the practices adopted by 16 educational organizations. The research design involves a comprehensive analysis of the strategies and approaches employed by these institutions to implement LA projects. The participants in this review are the educational organizations themselves, including universities such as Arizona State University, Georgia State University, Rio Salado College, The Open University, and the University of Alabama, among others. These institutions serve as the focal point of the study, showcasing their initiatives and outcomes related to the use of LA.

Data collection methods primarily involve the examination of the practices and results

reported by the participating educational organizations. The paper also includes other bibliographic references and analyzes the results, challenges, and expectations of LA. The article delves into the specific approaches and technologies utilized by these institutions, such as predictive models, software tools, and in-house developed systems. It also highlights the outcomes and improvements achieved through the implementation of LA, emphasizing metrics like student retention rates and academic performance. Additionally, the review incorporates insights from policy documents, research findings, and specific examples of how LA has been integrated into virtual learning environments and academic settings. Even though the data collection methods used in the study are not explicitly stated, the paper presents a thorough examination of the initiatives, technologies, and outcomes related to the implementation of LA in higher education, as reported by the participating institutions.

FINDINGS

The authors highlight the benefits of LA, such as increasing the effectiveness of games in the classroom, improving engagement in MOOCs, modifying content to align with students' learning characteristics, predicting student

performance, increasing retention, improving learning design, and making evidence-based decisions. The evidence supporting these findings comes from various sources. For example, the authors reference a systematic literature review by Avella et al. (2016) that explores the methods, benefits, and challenges of LA in higher education. It also cites the work of Arroway et al. (2016) on LA in higher education and the use of predictive models at the University of Alabama, Georgia State University, and Sinclair Community College to identify at-risk students and provide interventions. The paper also mentions the use of LA at Northern Arizona University and Purdue University to improve student outcomes and retention. The authors detail the case of Georgia State University use LA to identify students at risk of dropping out and who LA provided targeted interventions to improve their academic performance. As a result, the university was able to increase its graduation rate by 22 percentage points over six years. Similarly, the University of Alabama was able to increase its retention rate by 5 percentage points over two years.

LIMITATIONS AND FUTURE STUDIES

A limitation of the study is that it does not provide a detailed analysis of the ethical and privacy concerns associated with LA.

The paper briefly mentions that privacy and control of information affect the adoption and deployment of LA systems, but it does not provide a detailed analysis of the ethical and privacy concerns associated with LA. This is an important issue that needs to be addressed, as LA involves collecting and analyzing sensitive data about students. Future research could also investigate the perspectives of students regarding LA. While the paper briefly mentions the lack of investigation regarding students' points of view, there is a need for more research to determine how students feel about the use of LA in educational institutions.

IMPACT AND REFLECTIONS FOR THE FIELD ANF FOR PRACTICE

The research findings of this paper can be applied in real-world educational settings by other institutions aiming to analyze student data to identify students who are at risk of dropping out and provide targeted interventions to improve their academic performance. This can include providing additional support, such as tutoring or counseling, or modifying the curriculum to better meet the needs of the students. LA can also be used to improve the overall effectiveness of educational institutions. By analyzing institutional data, institutions can identify areas where they are struggling and provide targeted interventions to improve their performance. This can include improving administrative processes, such as enrollment or financial aid, or modifying the curriculum to better meet the needs of the students. Overall, this paper highlights the potential of LA to improve student outcomes in different educational settings. The practical experiences shared in this paper provide valuable insights into the challenges and opportunities associated with implementing LA in educational institutions. As such, this paper is a valuable resource for educational institutions interested in implementing LA to improve student outcomes.

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CHAPTER 27

Learning Analytics Intervention Improves Students' Engagement in Online Learning | Review

TAMARA TUPPER

ARTICLE

Yılmaz, F. G. K., & Yılmaz, R. (2021). Learning Analytics intervention improves students' engagement in online learning. *Technology, Knowledge, and Learning*, *27*(2), 449–460. https://doi.org/10.1007/s10758-021-09547-w

ARTICLE SUMMARY AND REVIEW

SUMMARY

Student engagement is one of the main challenges encountered in digital learning. In an eLearning environment, learners may

encounter problems with behavioral, cognitive, and emotional engagement. Personalized metacognition feedback can help solve problems associated with student engagement, which can be generated from Learning Analytics (LA). Two key components make up the personalized metacognitive feedback support used in this study: (a) Learning analytics reports created with data obtained from students' weekly learning management system usage (b) Recommendation messages prepared and personalized for each participant based on learning analytics reports. The students' engagement scale used as a preliminary and post-test has provided the data of the study. The study results have shown that student involvement was significantly higher in the experimental group than in the control group. The research findings showed that providing students with personalized metacognition feedback using Learning Analytics in eLearning would increase their engagement. Various suggestions have been suggested for teachers, administrators, and researchers based on the findings from the research.

Research question: *Is there a statistically significant difference in experimental and control group students' engagement scores arising from the personalized metacognitive feedback support based on learning analytics? (Yilmaz & Yilmas, 2021)*

RESEARCH METHOD

In this study, the experimental design has been used with a pretest and posttest control group. The experimental and control groups were divided randomly among the participants. The experimental group had 33 students and the control group had 35 students. There were 63% females and 37% males in the first cohort of 68 students. Participants were randomly assigned to the experimental and control groups at the beginning of the research process. Participants were then informed of the procedure and scales had been used as a preliminary measure. The trial was initiated for 12

weeks after the pretest had been performed. Learning Analytics metacognitive feedback was administered to the experimental groups of students. Students in the control group were not provided with this support. The student engagement scale was used as a posttest at the end of the application process. Therefore, the pretest and posttest in the experimental and control groups were compared, and the hypotheses of the study were tested.

The study was conducted on students enrolled in the Computing II course at a university during the spring term. The course was taught through online learning, and the students were introduced to the electronic spreadsheet program as part of their coursework. The research used Moodle as the Learning Management System (LMS). The teacher would add weekly lecture videos, e-books, and exercises related to the subject to Moodle every week. Additionally, a weekly quiz was uploaded for students to test themselves on the subject matter. The LMS environment also had a forum tool that allowed students to communicate and collaborate with each other and the teacher. In the forum environment, students shared information and discussed the course exercises.

The study utilized personalized metacognitive feedback support, comprised of two fundamental components: (a) Learning Analytics reports generated from data collected through students' weekly LMS usage and (b) personalized recommendation messages based on the learning analytics reports. Learning Analytics reports helped students identify which weekly learning content they were most and least engaged with, and recognize their areas of success and failure. This created awareness and helped students develop metacognition, which involves understanding one's own learning process. With the Learning Analytics reports, students could see which of the weekly learning content they were more engaged with and which content they were less engaged with, and they could recognize the issues they have succeeded and failed. This lead to awareness for students by means of Learning Analytics reports. Thus, efforts were made to develop a student's awareness

of their own learning process, which is contained in the definition of metacognition.

DATA COLLECTED AND ANALYZED

Metacognition is a valuable strategy for assessing one's own cognitive process. This strategy involves three stages: planning, monitoring, and evaluation. In the planning phase, a student determines appropriate learning strategies for themselves and plans for their own learning process. In the monitoring phase, they keep track of whether they are acting in accordance with their planned strategies and if things are going as planned. In the evaluation phase, the student evaluates their own learning process, identifies areas of success and failure, and makes new plans to address any learning deficiencies. This approach to learning has been shown to be effective in improving student engagement and can be facilitated using personalized metacognitive feedback generated from learning analytics data.

The personalized metacognitive feedback support, which included recommendation messages based on learning analytics reports, helped increase students' awareness of their own learning process. This led to improved student engagement and metacognitive awareness. At the end of the 12-week experimental process, the posttest student engagement scale was administered to both the experimental and control groups. In the study, the normality of the scores obtained from the students' engagement scale was examined, and a Kurtosis and Skewness normality test was performed. The results of the test showed that the data had a normal distribution. Therefore, parametric tests were used for data analysis. In line with the first research question of the study, the engagement scale scores of students were compared.

FINDINGS AND LIMITATIONS

In the study conducted by Yılmaz and Yılmaz (2021), the challenge of student engagement in digital learning was addressed. The study found that personalized metacognitive feedback generated from Learning Analytics (LA) can help solve problems related to student engagement. The personalized metacognitive feedback support used in this study was comprised of two key components: (a) Learning analytics reports created using data obtained from students' weekly Learning Management System usage and (b) personalized recommendation messages prepared for each participant based on learning analytics reports. The study found that providing students with personalized metacognition feedback using LA in eLearning significantly increased their engagement.

The study examined whether the scores obtained from the students' engagement scale showed normal distribution by performing a Kurtosis and Skewness normality test. The data was found to have a normal distribution, and parametric tests were used to analyze it. The first research question of the study focused on comparing the students' engagement scale scores. To achieve this, the students' engagement scale pretest of both experimental and control groups was kept constant, and their posttest scores were compared using ANCOVA. The study aimed to test the effectiveness of providing learning analytics-based metacognitive feedback, which was the independent variable of the research.

Based on the research findings, it is recommended to use similar personalized metacognitive feedback designs in similar eLearning environments and contexts to improve student engagement. It is important to include Learning Analytics reports in the feedback to provide students with a visual representation of their learning performance and process. However, it is also important to note that simply providing Learning Analytics reports may not be effective for students who have not developed self-directed learning skills, as they may not know how to use the information

provided. Therefore, it is suggested that teachers and administrators provide additional support and guidance to help students understand and use the feedback effectively.

According to the researchers, students who have not developed self-directed learning skills may not know what to do as a result, even if they examine the learning analytics reports (Karaoglan Yilmaz & Yilmaz, 2020b; Karaoglan Yilmaz, 2021; Schumacher, & Ifenthaler, 2021).

It is crucial to provide personalized recommendations and guidance to learners along with the learning analytics reports in the feedback. However, it is essential to ensure that these recommendations and guidance are not in the form of directly giving information or telling the solution. Instead, it should encourage learners to reflect on their learning process and guide them towards finding a solution on their own. The importance of providing metacognitive support to learners through feedback is highlighted in this study. Feedback messages should guide, motivate, and reinforce an individual's learning. In this study, personalized feedback was provided to learners in the form of learning analytics reports on their performance. In future research, feedback could be given based on the average performance of the class or the best-performing learners in the class. This approach would provide students with valuable insights into their own learning process and help them develop metacognitive awareness. It is important to design feedback messages that serve as effective guidance for learners, and learning analytics can be a valuable tool in achieving this goal.

It is important to note that the research conducted in this study has some limitations. The study was limited to a sample of 68 university students, and further research is necessary to determine the generalizability of the research findings. Additionally, similar research can be carried out for different courses and for students at different levels of education. It is important to consider that the self-directed learning skills of university students are generally more developed than those of middle and high school students.

Therefore, it may be necessary to provide additional external support for secondary and high school students in online learning environments. Further research can help to determine the effectiveness of personalized metacognitive feedback support using Learning Analytics in different educational contexts and for different student populations.

IMPACT AND IMPLICATIONS FOR THE FIELD

In online learning systems, the teacher may find it challenging to provide personalized feedback to each learner due to the considerable number of students. As a result, learners may encounter issues such as feeling lost or not knowing what to do, which can ultimately lead to decreased engagement over time. These problems can be especially problematic in a digital learning environment, where learners may struggle with cognitive, behavioral, and emotional engagement. If left unaddressed, these difficulties may ultimately lead to student failure in online learning.

In online learning environments, learners may face challenges with engagement and may require external support and guidance. To address this issue, metacognitive feedback can be provided to students. The purpose of metacognitive feedback is to provide learners with information about their current learning process and to offer recommendations and guidance to improve their learning outcomes. However, it can be challenging for teachers to determine the current status of each student, particularly in online learning environments with many students. In such cases, learning analytics can be a useful tool.

Learning Analytics (LA) enables teachers to obtain insights into students' engagement and learning progress, thus helping them to provide personalized metacognitive feedback to students. This feedback can aid learners in identifying their strengths and weaknesses, as well as areas for improvement. LA reports generated from data collected through students' weekly learning

management system usage, coupled with personalized recommendation messages, can help learners develop metacognitive skills and improve their engagement in online learning.

Overall, the use of LA and personalized metacognitive feedback can benefit both learners and teachers in online learning environments, enabling learners to achieve better learning outcomes and teachers to provide more effective support and guidance.

PART VI

ADDITIONAL RESOURCES

CHAPTER 28

Creating A Project Design Process

TAMARA TUPPER

CHAPTER 29

Utilizing Resources

TAMARA TUPPER

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