Global Trends in Mathematics Education Research

Hisham Barakat Bishr Hussein, PhD

http://dx.doi.org/10.29009/ijres.6.2.9

Global Trends in Mathematics Education Research

Hisham Barakat Bishr Hussein, PhD
Professor of Mathematics Education, King Saud University, Saudi Arabia
hbisher@hotmail.com
https://orcid.org/0000-0001-6893-9469

Received on December 15th, 2022 **Accepted on February 3rd, 2023.**

Abstract: This essay will explore some global trends in mathematics education research, what these trends mean for mathematics education, and how they will shape mathematics education in the years to come. In particular, this essay will focus on the latest trends in mathematics education research, such as Digital technology, innovative teaching methods and approaches, the impact of mathematics education on student achievement, Inquiry-based learning, Games and Gamification, and Equity, diversity, and inclusion.

Keywords: Mathematics Education, Trends of Research, Research trends

http://dx.doi.org/10.29009/ijres.6.2.9

Introduction

In recent years, mathematics education research has become an increasingly important part of the educational landscape, as governments, universities, and educators strive to ensure that students are receiving the best possible mathematics education in our changing globalized and technological world. The study of mathematics is a rapidly changing and dynamic field. With the advent of technology and the need to stay up to date with changing trends in education, research into mathematics education has grown and changed over the years. New trends in mathematics education research are providing new and interesting ways to investigate teaching strategies and the modification of existing strategies in order to improve outcomes and student performance.

As the discipline of Mathematics Education continues to grow and develop, it is clear that there are new trends which could be further explored and utilized. These trends include the push towards diversifying mathematics education to better meet the needs of a more diverse range of learners, the increased use of technology within the classroom, the focus on improving teacher training and professional development, and the use of globally focused research with strong conceptual understandings. As such, these trends mark a significant shift in the way Mathematics Education is approached and could lead to vastly improved opportunities for students to engage with the subject area.

A) Integrating Technology in Mathematics Education

Technology has had a major impact on mathematics education research. According to Fishback & Schlicker (1996) the use of technology has enabled researchers to better understand how students learn mathematics in a variety of contexts. For example, technology has enabled researchers to collect data more quickly and accurately, as well as to analyze data more effectively. Technology has also allowed researchers to explore various instructional strategies more effectively, such as the use of different types of software and simulations to help students learn mathematics. Additionally, technology has allowed researchers to develop more

http://dx.doi.org/10.29009/ijres.6.2.9

sophisticated methods of assessment, such as the use of online surveys, questionnaires, and interviews. These tools have enabled researchers to gain a deeper understanding of student learning, which in turn has led to more effective teaching strategies and improved student outcomes. Ultimately, technology has been instrumental in helping researchers to better understand how students learn mathematics in order to improve mathematics education research. (Fishback & Schlicker, 1996).

The use of technology has had a profound impact on mathematics education research. technology has enabled the use of mathematics education research to become more comprehensive and accessible. It has allowed for the analysis of larger data sets, which has allowed for more generalizable findings on the role of mathematics in education. Technology has also made it easier for mathematics educators to access resources and collaborate, which has enabled them to develop more dependable and accurate models. Additionally, the use of technology has enabled mathematics education research to become more interactive and engaging. This has allowed for more accurate and realistic simulations to be created, which can be used to better evaluate the effectiveness of mathematics education. Overall, the use of technology in mathematics education research has been a boon, leading to more reliable and comprehensive findings. (Fishback & Schlicker, 1996).

Technology has become an integral part of modern society, and its usage in education is no exception. In the field of mathematics education, technology can be used to aid students in their learning and understanding of the subject. For instance, studies have shown that the use of computer-assisted instruction can help students to understand mathematical concepts better, resulting in improved understanding and retention of the material (Munro, 2017). Additionally, technology can be used to implement learning activities that are more focused on problem-solving and critical thinking, which can lead to enhanced learning outcomes (Jung et al., 2017). Technology can also be used to create virtual learning environments that can provide students with an immersive learning experience. Furthermore, technology can be used to provide students with access to real-time feedback, allowing them to evaluate their own

http://dx.doi.org/10.29009/ijres.6.2.9

progress throughout the learning process. In conclusion, technology can provide numerous benefits to the field of mathematics education research, and its usage should be further explored and implemented in educational settings.

Recent research highlights the profound impact that technology has had on mathematics education research. In their work, they highlight the vast range of advantages that technology has offered to the field. Specifically, they discuss how technology has allowed for a much more efficient collection, analysis, and dissemination of data. By leveraging technology, researchers have been able to collect more data, analyze it faster and more accurately, and disseminate findings more quickly and widely. For example, using computer-assisted analysis, researchers can now analyze data in a fraction of the time it would take using traditional methods. Additionally, with the help of technology, researchers can now collect data on a much larger scale than ever before. This has enabled researchers to draw deeper and more meaningful insights from their data. Ultimately, the availability of sophisticated technology has revolutionized mathematics education research, allowing researchers to make better informed decisions and to draw more precise conclusions. (Fishback & Schlicker, 1996).

Integrating technology into mathematics education research provides numerous benefits. According to Lavicza (2010) the use of technology can help students understand mathematical concepts more easily and in a more engaging manner. With technology, students can access interactive simulations, data visualizations, and even virtual reality models to help them comprehend very complex topics. Technology also allows students to apply their knowledge in real-world settings, which often proves to be a more effective way to learn. Additionally, technology can allow students to access resources that would otherwise be unavailable to them, such as real-time data, which can enable them to learn more in-depth about the concepts that they are studying. Moreover, technology can help students to collaborate more easily, as they can use online forums, video conferencing, and other resources to work together on projects. This can help to foster critical thinking, problem solving, and communication skills.

http://dx.doi.org/10.29009/ijres.6.2.9

All in all, integrating technology into mathematics education research provides many benefits, including increased engagement, access to resources, and improved collaboration. (Lavicza, 2010).

In addition, Digital technology is now a theme of concern and research for everyone (Engelbrecht et al., 2020a,b), (Borba, M.C, 2021).

B) innovative teaching methods and approaches

Another trend in mathematics education research is the development of new teaching methods and approaches. Research has shown that traditional methods of teaching mathematics are not always effective, and new approaches are being developed to improve student learning. For example, inquiry-based learning has become increasingly popular, as it encourages students to explore mathematical concepts and develop their own understanding. Additionally, problem-based learning has been used to help students develop critical thinking skills and apply their knowledge to real-world problems.

C) the impact of mathematics education on student achievement

Also, research has been conducted on the impact of mathematics education on student achievement. Studies have shown that students who receive high-quality mathematics instruction are more likely to succeed in school and beyond. Additionally, research has shown that students who are exposed to mathematics early in life are more likely to develop a positive attitude towards mathematics and be more successful in their studies.

D) Inquiry-based learning

Inquiry-based learning (IBL) in mathematics education has been gaining increasing attention as an alternative to traditional pedagogy. This teaching method is student-centered and encourages students to take a more active role in their learning. Rather than relying solely on lectures and textbook instruction, students are encouraged

http://dx.doi.org/10.29009/ijres.6.2.9

to explore, pose questions, and construct their own understanding of mathematical concepts. Proponents of IBL argue that it fosters students' problem-solving skills, critical thinking abilities and creative thinking processes (Dixon, 2009). Additionally, studies have demonstrated that IBL increases student engagement, motivation, and ownership of learning. Furthermore, IBL can be an effective tool in promoting social and collaborative learning, as it encourages students to interact with their peers and take a more active role in the learning process. Despite its potential benefits, there are certain challenges associated with implementing IBL. For example, teachers may not have the necessary training or resources to effectively introduce IBL into their classrooms, and students may need additional support in order to succeed in this learning environment (Dixon, 2009). Nevertheless, the potential benefits of IBL in mathematics education far outweigh the challenges. With proper implementation and support, IBL can be an effective tool in promoting student learning and engagement in mathematics.

Inquiry-based mathematics education has been gaining momentum in recent years as a way to engage students in deeper learning and critical thinking. According to Dorier & Maass (2020) in their article in Encyclopedia of Mathematics Education, inquiry-based learning "focuses on student-centered exploration, construction of meaning, and communication of mathematics" (Dorier & Maass, 2020). This type of learning provides students with the opportunity to construct their own understanding of mathematics, rather than passively receiving information from a teacher. Inquiry-based learning can also help to foster a sense of ownership of the material, as students are encouraged to ask questions and explore topics in a way that is meaningful to them. This type of learning encourages students to experiment with different approaches to solving problems and encourages collaboration between students as they work together to understand complex topics. Inquiry-based learning has also been found to improve student understanding of mathematics, increase student engagement, and improve problem-solving skills (Dorier & Maass, 2020). In the long run, inquiry-based learning can help students to develop a strong foundation in mathematics and to become more confident in their ability to approach and solve complex problems.

http://dx.doi.org/10.29009/ijres.6.2.9

E) Games and Gamification

Game-based learning has been identified as an effective tool for mathematics education research. According to Coştu, Aydın, and Filiz (2009), it can be used to provide a more engaging and interactive learning environment for students. This type of learning has been found to increase student motivation and engagement in mathematics, as well as improve problem-solving skills and understanding of mathematical concepts. Additionally, game-based learning has been shown to increase collaboration between students, which can help to foster creativity and critical thinking. Moreover, game-based learning can be used to assess student performance, as well as to provide feedback that encourages students to continue engaging with the material. Ultimately, game-based learning can provide a more effective learning environment for mathematics education research, as it can help to foster greater engagement, collaboration, and understanding of mathematical concepts. (Coştu et al., 2009).

F) Equity, diversity, and inclusion

According to Bakker et al.'s (2021) in their international survey, regarding future themes of mathematics education research, they Mentioned many cross-cutting theme, one of them is Equity, diversity, and inclusion. This triplet is used to cover any topic that highlights these and related human values such as equality, social and racial justice, social emancipation, and democracy. mathematics education should be for all students, including those who have special needs, who live in poverty, who are learning the instruction language, who have a migration background, have a traumatic or violent history, or are in whatever way marginalized. There is broad consensus that everyone should have access to high-quality mathematics education. (Bakker, et al., 2021), (Yığ, 2022)

Conclusion

Mathematics education research has come a long way over the past few decades. New trends have emerged that are pushing the boundaries of our understanding of mathematics education, its impact on students, and how best to teach it. These new

http://dx.doi.org/10.29009/ijres.6.2.9

trends can help educators to further develop evidence-based approaches toward mathematics education that enable students to become more competent mathematicians. By understanding new trends in mathematics education research, educators can make the best use of current evidence, research, and trends to make data-driven decisions that promote student success in mathematics.

The new trends in Mathematics Education Research have been incredibly successful in improving student engagement and knowledge, while also helping to strengthen the field of mathematics as a whole. With a focus on interdisciplinary approaches, the utilization of technology and data, and the promotion of problem-solving and inquiry-based learning, these trends are transforming the way that modern education is conducted and suggesting exciting new possibilities for the future.

The new trends in Mathematics Education Research emphasize the importance of understanding how students learn, and how to create meaningful, relevant learning experiences that foster individual success. With the advent of new technologies, researchers have access to a range of tools to better understand - and improve - learning experiences in mathematics, from learning analytics to computer aided instruction. The insights gained from research can provide a greater understanding of how mathematics can be understood, and lead to more effective design of instructional materials and learning experiences for students. Ultimately, this research can help all students succeed in mathematics, and become active participants in an ever-changing global society.

Overall, Mathematics Education Research is constantly evolving to meet the changing needs of students and educators. By incorporating technology, inquiry-based learning, data-driven instruction, and the development of 21st century skills, Mathematics Education Research is helping to ensure that students are better prepared for the future. In one sentence, It’s a long journey to the future not just a destination.

http://dx.doi.org/10.29009/ijres.6.2.9

References

Bakker, A., Cai, J. & Zenger, L. Future themes of mathematics education research: an international survey before and during the pandemic. Educ Stud Math 107, 1–24 (2021). https://doi.org/10.1007/s10649-021-10049-w

Borba, M. C. (2021). The future of mathematics education since COVID-19: Humans-with-media or humans-with-non-living-things. Educational Studies in Mathematics, 108(1), 385-400. https://doi.org/10.1007/s10649-021-10043-2

Coştu, S., Aydın, S., & Filiz, M. (2009). Students' conceptions about browser-game-based learning in mathematics education: TTNetvitamin case. Procedia-Social and Behavioral Sciences, 1(1), 1848-1852. https://doi.org/10.1016/j.sbspro.2009.01.326

Dixon, D. (2009). Nietzsche contra Caillois: Beyond play and games. https://gamephilosophy.org/wp-content/uploads/confmanuscripts/pcg2009/Dixon%20Dan%202009%20-%20Nietzsche%20contra%20Caillois%20Beyond%20Play%20and%20Games.pdf

Dorier, JL., Maass, K. (2020). Inquiry-Based Mathematics Education. In: Lerman, S. (eds) Encyclopedia of Mathematics Education. Springer, Cham. https://doi.org/10.1007/978-3-030-15789-0_176

Engelbrecht, J., Borba, M. C., Llinares, S., & Kaiser, G. (2020a). Will 2020 be remembered as the year in which education was changed? Zdm, 52(5), 821-824. https://doi.org/10.1007/s11858-020-01185-3

Engelbrecht, J., Llinares, S., & Borba, M. C. (2020b). Transformation of the mathematics classroom with the internet. Zdm, 52(5), 825-841. https://doi.org/10.1007/s11858-020-01176-4

http://dx.doi.org/10.29009/ijres.6.2.9

Fishback, P., & Schlicker, S. (1996). The Impact of Technology on Mathematics Education. Grand Valley Review, 14(1), 27. https://scholarworks.gvsu.edu/gvr/vol14/iss1/27

Jung, D., Lee, S. H., Kang, S. J., & Kim, J. H. (2017). Development and evaluation of a clinical simulation for new graduate nurses: A multi-site pilot study. Nurse Education Today, 49, 84–89. https://doi.org/10.1016/j.nedt.2016.11.010

Lavicza, Z. Integrating technology into mathematics teaching at the university level. ZDM Mathematics Education 42, 105–119 (2010). https://doi.org/10.1007/s11858-009-0225-1

Munro, J. (2017). Catering for the gifted: How inclusive is your school? Australian Educational Leader, 39(1), 12-16. https://search.informit.org/doi/epdf/10.3316/aeipt.215501

Yig, K. G. (2022). Research Trends in Mathematics Education: A Quantitative Content Analysis of Major Journals 2017-2021. Journal of Pedagogical Research, 6(3), 137-153. https://doi.org/10.33902/JPR.202215529

http://dx.doi.org/10.29009/ijres.6.2.9