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THEORETICAL FRAMEWORK ON TEACHING AND UPBRINGING IN MATHEMATICS WITH DIGITAL EDUCATIONAL RESOURCES (DERS)

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Abstract
Utilizing Digital Educational Resources (DERs) in math instruction is a significant subject in current educational discussions. This thesis explores the theoretical underpinnings, techniques, and possible effects of using Distributed Energy Resources (DERs) to improve the instruction and development of students in mathematics.

Keywords Digital Educational Resources (DERs), Mathematics Education, technology Integration, Active learning, Equity and Access.

INTRODUCTION

In order to develop successful frameworks for teaching and educating students in mathematics, it is necessary to integrate a variety of theoretical viewpoints with the ever-changing environment of digital technology. The purpose of this part is to investigate pertinent ideas and contemporary developments, with the goal of emphasizing the potential of DERs to improve the students' educational experience.

Piaget (1952) and Vygotsky (1978) are the two individuals who are credited with promoting constructivism, which places an emphasis on the active role that learners play in the construction of their knowledge via interaction with their environment and social relationships. Constructivist ideas may be aligned with the use of digital resources, such as interactive simulations, which can give possibilities for investigating, modifying, and finding connections between concepts (Bransford et al., 2000).

The socio-cultural theory developed by Vygotsky emphasizes the value of one's interactions with other people in the learning process. Individual and group understanding may be improved with the use of collaborative learning platforms and online forums that are provided by DERs. These platforms may encourage peer involvement, knowledge exchange, and scaffolding amongst students.

According to Gardner's (1993) theory of multiple intelligences, humans possess a variety of intelligences, such as kinesthetic, visual-spatial, and logical-mathematical intelligences. According to Ahn et al.'s research from 2020, DERs have the ability to cater to various intelligences by providing multimedia materials, games, and activities that appeal to a variety of learning styles and preferences.

The TPACK framework, which was developed by Mishra and Koehler in 2006, places an emphasis on the interaction between knowledge of technology (TK), pedagogy (P), and content (CK) in order to facilitate the successful incorporation of technology into educational settings. The purpose of this framework is to emphasize the need of teachers developing their technical pedagogical content knowledge (TPACK) in order to make effective use of digital educational resources (DERs) and to produce compelling learning experiences that are targeted to particular mathematical ideas and instruction methods.

Conceptual Understanding: A shift towards fostering deep conceptual understanding over rote memorization is supported by research indicating that comprehension of mathematical principles enhances problem-solving skills and long-term retention (Smith & Stein, 2018) .

Technology Integration: The proliferation of digital tools in education is documented extensively, with studies highlighting their potential to personalize learning and improve engagement (Johnson et al., 2016).

Problem-Based Learning (PBL): PBL approaches in mathematics are shown to enhance critical thinking and application skills, preparing students for real-world challenges (Duch, Groh, & Allen, 2001).

Flipped Classrooms: The flipped classroom model, where students engage with instructional material outside of class, has been found to foster higher engagement and better utilization of classroom time for hands-on learning (Bergmann & Sams, 2012).

Collaborative Learning: Collaborative learning strategies are associated with improved problem-solving abilities and higher achievement in mathematics, underscoring the value of social learning contexts (Gillies, 2014).

Data Science and Coding: Incorporating coding and data analysis into the math curriculum addresses the growing demand for data literacy and computational thinking skills, crucial for the 21st-century workforce (Wing, 2006).

Assessment for Learning: Shifting assessment practices from purely evaluative to formative can significantly enhance the learning process, providing timely feedback and identifying learning gaps (Black & Wiliam, 1998).

Culturally Responsive Teaching: Culturally responsive teaching practices in mathematics education can increase engagement and achievement among diverse student populations, making math more accessible and relevant (Gay, 2002).

The integration of distributed energy resources (DERs) should not be simply focused on replacing conventional techniques; rather, it should be aimed at complementing and improving such methods. The following are examples of effective teaching practices that make use of DERs:

Active learning: Utilizing DERs to facilitate inquiry-based learning and hands-on activities that promote deep understanding and engagement (Chen et al., 2018).

Differentiated instruction: Providing diverse learning pathways through DERs to cater to individual needs and learning styles (Graham, 2008; Rose & Meyer, 2002).

Scaffolding and feedback: Employing DER features for formative assessment, providing opportunities for self-reflection, and offering timely feedback to support students' learning journey (VanLehn, 2013) .

By incorporating these theoretical frameworks, modern trends, and deliberate pedagogical techniques, we are able to harness the potential of DERs to develop learning environments in mathematics education that are both interesting and successful. Continuous research, continued professional development for educators, and careful consideration of ethical and equitable concerns are all required as a result of this.

The landscape of mathematics education is undergoing fast change, which is being driven by an increasing focus on more profound conceptual understanding, learning that is guided by the student, and the use of technology. This section examines the most recent developments in this area, focusing on the ways in which digital educational resources (DERs) might be used to improve the learning experience and meet the ever-evolving pedagogical requirements.

By pushing students to go beyond the memorization of formulae and processes, a substantial movement is taking place toward the promotion of deep conceptual knowledge in mathematics. This shift is enabling students to genuinely comprehend the ideas that lie under the surface. Students are provided with the critical thinking and problem-solving abilities that are essential to apply their knowledge in a variety of circumstances via the implementation of this technique (Smith & Stein, 2018). DERs have the potential to play an important part in this attempt by:

Visualizing mathematical concepts:

According to Clements and Sarama (2016), the interactive simulations, animations, and graphical representations that are provided by DERs may assist students in visualizing abstract ideas, which in turn supports their understanding and recall of the information.

Facilitating inquiry-based learning:

Students are encouraged to ask questions, create connections, and construct their own knowledge via the use of DERs, which may offer platforms for students to investigate mathematical topics through interactive activities (Ahn et al., 2020). Interactive activities can be provided by DERs .

Providing opportunities for self-reflection and formative assessment:

According to VanLehn (2013), many digital educational resources (DERs) have elements that enable students to reflect on their own learning process, identify areas in which they may improve, and get quick feedback. This helps students develop metacognitive abilities and engage in self-directed learning.

Tablet computers, laptops, and interactive whiteboards are just some of the digital tools that have become more prevalent in the educational sector. These technologies have opened up previously unimaginable options for individualized and interesting educational experiences. Several studies have shown that the integration of technology, when carried out in an efficient manner, can:

Increase student engagement and motivation: Gamified elements, interactive features, and multimedia resources offered by DERs can make learning mathematics more engaging and enjoyable for students, fostering positive attitudes towards the subject (Kapp, 2012).

Personalize learning pathways: DERs can provide differentiated learning experiences by offering a variety of learning activities, adaptive exercises, and resources that cater to individual learning styles, paces, and needs (U.S. Department of Education, 2017).

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