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STEM Education for Students with Disabilities

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ABSTRACT

This study explores the benefits of STEM education for students with disabilities, emphasizing hands-on learning, inclusivity, and skill development. Based on teacher feedback from four regions of West Virginia, the findings highlight STEM's ability to enhance student engagement, collaboration, and confidence. Challenges such as resource limitations and class sizes are also discussed, alongside stakeholder recommendations to improve accessibility and effectiveness. The study underscores the transformative potential of inclusive STEM practices in fostering academic and personal growth for students with disabilities.

Keywords: collaborative learning, educational equity, hands-on learning, inclusivity, STEM education, students with disabilities, teacher feedback

INTRODUCTION

STEM education, which focuses on integrating science, technology, engineering, and mathematics, has emerged as a critical component of 21st-century learning. While its benefits are well-documented for all students, STEM education holds particular promise for students with disabilities. These students often face barriers in traditional educational settings and can thrive in inclusive STEM environments that leverage their unique strengths and support their individual needs. This paper explores the benefits of STEM education for students with disabilities, emphasizing its capacity to provide hands-on, engaging learning experiences, foster collaboration and inclusivity, and prepare students for future career opportunities. It also offers actionable recommendations for parents, community members, school leaders, and legislators further to enhance the effectiveness of STEM education for this population.

LITERATURE REVIEW

STEM education, focusing on science, technology, engineering, and mathematics, has emerged as a critical component of 21st-century learning. Research consistently demonstrates the transformative potential of STEM practices in enhancing engagement, collaboration, and skill development for all students. For students with disabilities, these benefits are particularly profound, as inclusive STEM environments leverage hands-on learning and experiential approaches to meet diverse needs (Yang et al., 2024; Dalgaard & Jensen, 2021). STEM education offers opportunities for kinesthetic learners to actively engage with materials actively, often resulting in improved comprehension of abstract concepts (Griffiths et al., 2021). For instance, activities like building simple machines or conducting scientific experiments allow students to visualize and practice concepts that are difficult to grasp through lecture-based instruction alone.

Inclusive STEM education fosters collaboration and social growth by encouraging teamwork and communication (Nasri et al., 2021). By working in structured groups, students with disabilities develop interpersonal skills and build relationships with peers. Moreover, STEM education provides pathways to career readiness, equipping students with critical thinking, creativity, and technological literacy (Yamamoto et al., 2022). However, these benefits can only be fully realized if teachers receive appropriate training, as Margot and Kettler (2019) emphasize the importance of professional development in bridging gaps in practice. Despite its promise, implementing STEM education for students with disabilities is often hindered by limited resources, large class sizes, and insufficient professional development for teachers (Ayeni et al., 2024). Addressing these barriers is critical to ensuring equitable access and maximizing the potential of STEM education for all learners.

RESEARCH METHOD

This study employed a qualitative research design to explore STEM education's perceived benefits and challenges for students with disabilities. The purpose of the study was to examine the ways STEM education impacts students with disabilities and to understand the experiences of teachers in implementing these practices. The problem this research addresses is the limited understanding of how inclusive STEM education practices can be optimized to meet the needs of students with disabilities in West Virginia public schools.

Three guiding research questions shaped the study:

- What are the perceived benefits of STEM education for students with disabilities as observed by teachers in grades 6-12 who participated in a STEAM instructional coaching program?

- What challenges do teachers face when implementing STEM education for students with disabilities in West Virginia public schools?

- How do collaborative and hands-on STEM practices influence the inclusion and engagement of students with disabilities in classroom activities?

Data were collected using an open-ended questionnaire distributed to teachers who participated in a STEAM instructional coaching program. The first 20 respondents who met the criteria were selected as participants. To qualify, teachers had to be employed in West Virginia public schools teaching grades 6-12 and have participated in the coaching program at least once. The questionnaire focused on teachers' experiences implementing STEM practices and their observations of how these practices impacted students with disabilities. Questions were designed to elicit detailed responses about the perceived benefits, challenges, and strategies related to STEM education. Data were analyzed thematically to identify recurring patterns and insights, ensuring a comprehensive understanding of teacher perspectives.

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RESULTS

The results, derived from teacher feedback, highlighted three main findings:

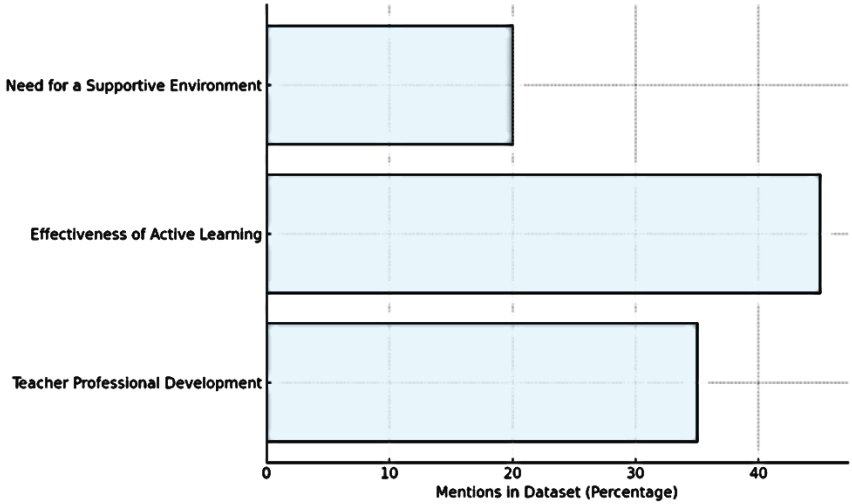
Teacher Professional Development: Teachers mentioned the need for specialized training as a critical factor. Participants emphasized that professional development focusing on inclusive STEM practices would enable educators to better support students with disabilities. Teachers expressed that training programs that address adaptive teaching strategies and classroom management of diverse learners are essential for successful implementation.

Effectiveness of Active Learning: Teachers overwhelmingly noted that active, hands-on learning activities significantly benefited students with disabilities. These practices helped students engage with complex STEM concepts through experiential learning, allowing kinesthetic learners to thrive. Teachers highlighted how project-based activities, such as building models and collaborative experiments, made STEM content accessible and engaging for students.

Need for a Supportive Environment: Many teachers emphasized the importance of a supportive classroom environment, including smaller class sizes, classroom aides, and access to adaptive tools. Teachers also noted that collaborative learning strategies, such as intentional grouping and peer support, fostered inclusivity and enhanced student confidence. Addressing resource limitations was highlighted as a priority for ensuring that students with disabilities can fully participate in STEM activities.

These findings are visually represented in Figure 1 below.

Figure 1
Three Key Findings



CONCLUSIONS

The findings underscore the transformative potential of STEM education for students with disabilities. By providing hands-on, experiential learning opportunities, STEM practices enable students to overcome barriers often encountered in traditional classroom settings. Activities like collaborative problem-solving and real-world applications help students develop critical

thinking and creativity while building confidence in their abilities (Yang, Vinh, Sharifnia, Amsbary, Clements, Lim, & Sarama, 2024).

However, the study also highlights significant challenges, including the need for more resources, smaller class sizes, and specialized training for educators. Addressing these issues is essential for maximizing the benefits of STEM education. For example, Whitney et al. (2020) point out that mental health challenges can hinder learning if appropriate supports are not provided. Additionally, Dalgaard and Jensen (2021) emphasize that inclusive learning approaches require tools and structures tailored to the needs of diverse learners.

The findings align with previous literature emphasizing the value of inclusive practices and equipping teachers with the tools and knowledge needed to support diverse learners (Margot & Kettler, 2019; Nasri et al., 2021). This study contributes to the growing body of research advocating for STEM education to promote equity and access for students with disabilities. It emphasizes the necessity of systemic changes to ensure all students can participate meaningfully in STEM learning experiences.

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IMPLICATIONS

The implications of this study extend to multiple stakeholders:

School Leaders: Administrators should prioritize professional development for teachers, focusing on inclusive STEM practices and adaptive teaching strategies. Hiring classroom aides and ensuring access to adaptive tools can help address the resource challenges highlighted by teachers.

Policy Makers: Legislators should advocate for increased funding to support inclusive STEM initiatives, including professional development programs, classroom resources, and smaller class sizes. Policies promoting partnerships

between schools and STEM-focused businesses can further enhance access to resources and expertise.

Teachers: Educators can implement intentional grouping and scaffolding strategies to foster collaboration and engagement in STEM activities. Using templates, visual aids, and step-by-step instructions can make STEM tasks more accessible for students with disabilities.

Parents and Community Members: Stakeholders outside the school system can support STEM education by advocating for resources, volunteering in classrooms, and participating in STEM events. Community organizations can also provide mentorship and sponsorship for STEM activities.

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