STEM in an Integrative Approach: Graduate Program at Kaye Academic College of Education

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Introduction

Traditionally, STEM education has been structured as a linear progression from basic to advanced topics, focusing on subject-specific mastery. However, contemporary research highlights the need for a more flexible, interdisciplinary approach that adapts to varying cognitive development patterns and real-world problem-solving demands. However, research suggests that cognitive development varies based on individual contexts and experiences (Back, 2017; Scott, 2015; OECD, 2019). In the 21st century, rapid technological advancements demand an adaptable, interdisciplinary education system that fosters critical thinking, research skills, and problem-solving abilities. STEM education plays a pivotal role in this transformation, preparing learners to integrate diverse fields and address global challenges.

Recognizing the importance of interdisciplinary education, the *STEM in an Integrative Approach* graduate program at Kaye Academic College of Education, now in its second year, equips educators with the knowledge and skills to integrate science, technology, engineering, and mathematics through innovative teaching methodologies. The program enhances student engagement and teacher motivation while contributing to societal, environmental, cultural, and economic progress, particularly in regions facing unique environmental and infrastructural challenges such as the Negev desert in Israel.

Program Goals and Objectives

To bridge the gap between STEM disciplines and real-world applications, the program aims to prepare educators for interdisciplinary teaching and research. It fosters awareness of STEM's societal relevance, focusing on sustainability and environmental issues in arid regions. Additionally, it promotes research on innovative learning methodologies that connect STEM education with pressing global and regional concerns. The program cultivates essential 21st-century skills such as critical thinking, creativity, problem-solving, and teamwork while addressing motivational, social,

cultural, and gender-related aspects of STEM education to promote inclusivity. It also emphasizes pedagogical innovation, encouraging educators to adopt modern teaching methods and take leadership roles in professional learning communities. Through connections with regional and international STEM initiatives, particularly within the STEM Ecosystem framework, the program strengthens global engagement and collaboration.

Strategies for Implementation

Situated in Be'er Sheva, the unofficial capital of the Israeli Negev desert, Kaye Academic College of Education provides a unique setting for STEM education. Given its geographical and cultural context, the program integrates STEM education with real-world environmental challenges, focusing on desert survival, sustainable resource management, and climate resilience. The curriculum is specifically designed to address regional challenges, incorporating studies on renewable energy solutions such as solar power, which is abundant in desert regions and critical for communities facing extreme climate conditions. Additionally, it explores water resource management through innovative conservation techniques, desalination, and ancient Bedouin water-harvesting methods that align with modern engineering solutions. Agricultural technologies also play a central role, with an emphasis on hydroponics, drip irrigation, and genetic engineering to enhance food security. The program further examines climate adaptation strategies, highlighting the intersection of environmental science and engineering in mitigating climate change and urbanization effects in arid environments. To achieve these objectives, the program employs the Problem-Based Learning (PBL) pedagogical model. Each cohort engages in real-world projects that integrate AI tools, including Large Language Models (LLMs) like ChatGPT, and hands-on "Makering workshops," where students construct physical models representing sustainable desert communities. This approach fosters active learning, innovation, and engagement, reinforcing the principle that knowledge is most effectively retained when applied to tangible, meaningful challenges.

Pedagogical Approach and Facilitating Tools

The *STEM in an Integrative Approach* program prioritizes experiential learning by integrating both formal and informal educational settings. It contextualizes modern technological advancements within historical problem-solving approaches, offering a

well-rounded perspective on STEM education. The program exposes students to best practices by drawing insights from science museums, technology incubators, and research institutions, ensuring that educators are familiar with effective teaching models.

Interdisciplinary collaboration is a key component, encouraging educators from diverse STEM backgrounds to co-design integrated lesson plans. The program also strongly emphasizes inclusivity, equipping educators with the tools to accommodate diverse learners while considering socioeconomic, gender, and cultural variables. Additionally, it fosters community and industry engagement through partnerships with the Be'er Sheva STEM Ecosystem, high-tech companies, and research institutions. These collaborations provide practical applications for STEM education, ensuring that students gain hands-on experience in real-world problem-solving.

Target Audience and Graduate Profile

The program is designed for teachers and educators with degrees in science, technology, engineering, mathematics, and related disciplines such as B.A., B.Sc., B.Des., and B.Tech. It also welcomes professionals from medicine, architecture, and environmental sciences who seek to incorporate STEM education into their fields. Those with a strong academic background and a passion for STEM education are encouraged to apply.

Graduates of the program develop a deep understanding of integrative teaching methodologies and gain proficiency in active, project-based learning. They enhance their ability to foster critical and creative thinking in students while addressing environmental and cultural challenges in diverse educational settings. Additionally, they acquire strong collaborative skills to lead multidisciplinary teaching teams and design interdisciplinary STEM curricula that engage and inspire students.

Conclusion

The *STEM in an Integrative Approach* graduate program at Kaye Academic College of Education plays a key role in shaping the future of STEM education. By fostering interdisciplinary teaching, pedagogical innovation, and collaboration with industry and global initiatives, the program establishes a strong foundation for excellence in STEM education. Dedicated to integrative methodologies and inclusive learning environments, it aims to inspire the next generation of STEM educators and learners.

In our presentation, we will explore the program's advantages and challenges, offering insights into its impact and potential areas for future development.

References

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