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A Survey on STEAM Education in Saudi Arabia: Early Childhood

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Abstract

The purpose of this study is to conduct a survey of recent work related to the perspectives of teachers working in early childhood education settings on STEAM education. In an attempt to reform education, Saudi Arabia has adopted STEAM education as a fundamental reform principle. As a result of the top-down nature of these initiatives, however, little is known about STEAM education in schools and informal settings. This paper examined the general education landscape and shared the findings of a study on the perspectives of early childhood educators in Saudi Arabia on STEAM education. Finally, we discussed the results and made some recommendations for the future.

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1 Introduction

The number of students majoring in STEM-related fields continues to increase in both developing and developed countries [1]. STEM education is defined in numerous ways. This study seeks to elucidate the perspectives of Saudi educators on incorporating STEAM and how it can be implemented in the classroom. It aims to shift the paradigm of education away from traditional lecture-based methods and toward more interdisciplinary approaches that facilitate meaningful learning experiences to meet the rising demand for skilled and creative individuals. This can facilitate students' acquisition of 21st-century skills [2].

Students in grades K–12 are typically taught using STEAM education, which is a science-based, multidisciplinary approach to education. STEAM stands for science, technology,

engineering, mathematics, and the arts. Children's natural curiosity and excitement for exploration and discovery are fostered by integrating these five critical disciplines into STEAM education. Simultaneously, students taught in this manner must demonstrate the capacity for critical and creative thinking in order to lay the groundwork for future academic success. To prepare today's children for a successful life and future, educators must adopt a new approach that integrates multiple content areas. Children in the twenty-first century require increased critical thinking training in order to overcome the obstacles they will face. Despite increasing global competitiveness, education is under increasing pressure to prepare students to address recent global issues. Concerns about a shortage of well-prepared students entering STEM-related careers in the United States prompted the establishment of STEAM [3-5]. Despite the numerous studies that have been conducted on STEAM in early childhood education, there is still a lack of research on the various aspects of integrated STEM. This review aims to provide a comprehensive analysis of the current state of research on this subject. It also explores the level of progress that has been made in the field over the past few years.

2 Literature Review

Saudi Arabia's efforts to modernize its educational system have been hampered by globalization. Saudi Arabia has made significant efforts over the last two decades to reform its educational system. King Abdullah bin Abdul-Aziz's Public Education Development Project (KAAPEDP) was launched in 2007 in response to the country's extensive economic and social development [6]. Tatweer, an Arabic term for development, was intended to supplant traditional Saudi education with a more innovative and technologically advanced model. This project placed a premium on technology-enhanced learning environments and the qualifications of classroom instructors [7]. In 2015, with the aid of the National Association for the Education of Young Children (NAEYC), the Saudi Ministry of Education produced the Saudi Early Learning Standards (SELS) [8] addressed preschool-aged children (ages 3–6) with the goal of providing educators, parents, and other caregivers with the most up-to-date information on best practices for that age group. Seven standards for children's learning at all ages were outlined in the document. Teaching measurement and geometry concepts place a premium on spatial awareness and form dimension. The following subthemes within cognition and general knowledge have a clear connection to STEAM content [9]. (See Table 1).

Table 1: STEAM content and its connection to cognition and general knowledge.

subtheme	General and cognition knowledge
Science & Mathematics	Students are introduced to topics such as biology and physics in the science curriculum. In mathematics, students will learn numbers, geometry, measurements, and quantity.
Creative Arts & Technology	The goal of the creative arts program is to give kids a safe place where they can work on improving their bodies, minds, and actions. In the technology section, the objective is to introduce students to the world of technology and develop their proficiency with interactive and multimedia equipment.

There are several age-appropriate behaviors included in the SELS statement's cognition and general knowledge requirements. Additionally, these activities assist kids in acquiring a strong

foundation in science, technology, engineering, the arts, and mathematics by fostering critical thinking and problem-solving skills. However, these conceptions express the primary domains of scientific thought as developing activities. It doesn't offer any guidance to educators on how to categorize content integration as a STEAM investigation [9].

1 Contribution & Methodology

The goal of this study is to shed light on recent studies conducted on the topic related to Saudi teachers' perspectives on STEAM's role in early childhood education in light of substantial changes to the Saudi educational system's policy and philosophy in recent years. There is a dearth of research on STEAM in early childhood education in Saudi Arabia, despite the fact that multiple studies on Saudi teachers and their perceptions of critical STEAM content have been undertaken [10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22]. The goal of this review is to provide comprehensive knowledge of the various aspects of STEAM education. It also explores the level of advancement that has occurred in the field over the past few years.

2 Method

The sources included studies in which all peer-reviewed and published journal articles in English between the years 2018 and 2022 were chosen for eligibility. To be declared eligible for the study, it was found imperative to provide empirical research findings regarding the learning outcomes. The populations studied in the study were all related to STEAM education. The studies where the subjects were not related to STEAM education were dismissed. However, excluding such articles proved to be a limitation of this study. The articles that focused on STEAM education practice rather than the learning outcomes of the curriculum were also excluded. This also included the articles that emphasized the design methodology based on STEAM education to provide enhancement in early childhood settings.

3 Gathering and examining information

The resulting Endnote files were then sent to Rayyan. Rayyan is a web application designed specifically to facilitate the process of systematic literature reviews. With the aid of Rayyan's blind review tool, the remaining articles were scrutinized by two authors using the inclusion criteria as a guide. After using the blind review tool to screen the candidate's articles, it was determined that 15 articles were accepted and included by both reviewers, whereas 30 articles were rejected or disregarded and excluded. This indicates that 30 of the 66 articles were not included. In addition, there were further disagreements, which led to the labeling of four more articles as "possible." Two of these four articles were included by the other reviewer, while the remaining two were excluded. It was determined that 86.5% agreement existed between the two reviewers. If the "maybe" articles were included with the "included" articles, the inter-rater agreement would reach 93.8%. The paper was rejected because of a thorough examination of the articles that could not be classified. After proper population and study type analysis, only three "maybe" articles were included among these. In the final stage of the reviewing process, only 19 articles were categorized (See figure 1).

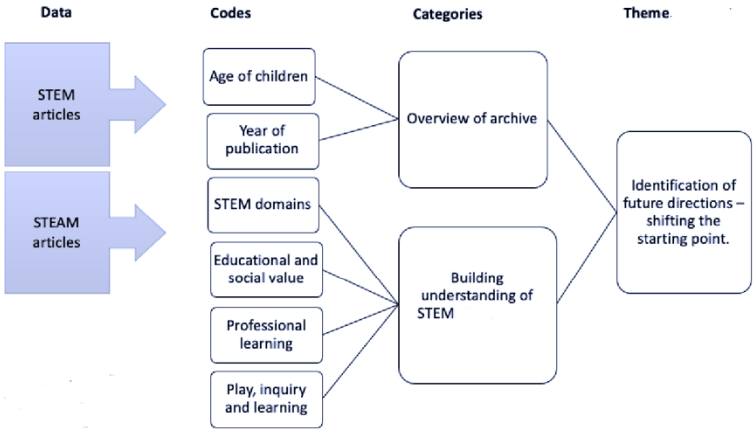

Figure 1: Flowchart Presentation for Selection Process

4 Results

The survey revealed that a number of studies focused [12,13,15,17,18,20] on enhancing the STEAM education-related perspectives of Saudi teachers. Additionally, these studies demonstrated that STEAM education enhances the cognitive development and learning capacity of young children. In addition, Saudi Arabian educators had modest views regarding the incorporation of STEAM subjects into the classroom and the planning and execution of lessons at a reasonable rate. This survey found that instructors lacked STEM knowledge, which was one of its key findings [12,13,14]. Several studies found [11,12,14,15,19,20,21] that there were constraints to incorporating STEAM activities and basic STEAM principles into the curriculum. In fact, according to [10,11,12,13], instructors were familiar with the acronym STEAM, but few knew how to implement it or what skills were necessary. Moreover, a previous study noticed that the majority of educators required additional training and professional development in order to integrate STEAM subjects effectively into their curriculum [11,12,13]. Our survey revealed that teachers lacked the knowledge necessary to implement STEAM principles in the classroom. The teachers' limited knowledge of STEAM's multidisciplinary nature [17] hinders their understanding of the acronym. Several studies showed [9, 11,12,13] that teachers who do not know all STEAM subjects must know at least two STEAM courses to aid the cognitive development of young children. To teach cross-idea STEM integration, emphasis must be placed on theoretical foundations, visual models, and practical integration skills [18, 23]. To teach STEAM-related topics, instructors must integrate multiple disciplines holistically and cognitively [9,11,12]. According to [9,11,1223], STEAM courses must integrate multiple disciplines and permit natural crossovers. STEAM concepts can be taught using interdisciplinarity, multidisciplinarity, and transdisciplinarity. Transdisciplinarity entails combining domains and the space between them to produce novel concepts. This method assists students in establishing connections between seemingly unrelated concepts. However, the lack of familiarity with STEAM education and its procedures hinders progress.

5 Conclusion

According to the findings of this review, many exciting opportunities exist for integrating STEAM education experiences with children and educators. In moving forward, we suggested that this has a greater bearing on early childhood learning and experiences. To empathize more, we reiterated the importance of the arts and play in assisting children to comprehend, explore, and represent their developing STEAM knowledge. The literature acknowledged that young children engage in STEAM experiences and learn through both everyday and planned activities. There is a need for educators to recognize these opportunities and have the aptitude and inclination to seek out, support, and cultivate STEAM education in young children. This review drew several significant conclusions, one of which was that training and professional development are extremely important to the STEAM education experience, prompting further consideration of how STEAM is conceptualized and defined.

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