

Pedagogical Foundations of Steam Approach in Career Choice (in The Context of Primary Education)

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ABSTRACT

Objective: This study investigates the pedagogical foundations of the STEAM approach in influencing career choices in primary education, particularly within Uzbekistan's educational context. **Method:** Employing a qualitative analysis that integrates project-based and problem-based learning methodologies, the research explores how experiential learning bridges theoretical constructs and practical applications. **Results:** Findings indicate that early exposure to STEAM disciplines significantly enhances students' professional orientations by fostering creativity, critical thinking, and problem-solving skills, while also emphasizing the role of policy initiatives in embedding STEAM principles into the national curriculum. **Novelty:** This research offers a novel perspective by directly linking STEAM pedagogy to career development outcomes in early education, thereby addressing a critical gap in current literature and providing actionable insights for curriculum design, teacher training, and educational policy reform.

INTRODUCTION

Creativity is an integral element of STEAM education, aiming to integrate science and art. STEAM projects link various forms of creativity (scientific, artistic, and craftsmanship). Currently, there are no direct Presidential decrees or orders in the Republic of Uzbekistan specifically dedicated to the pedagogical foundations of the STEAM approach in career choice. However, several important documents have been adopted aimed at developing and modernizing the education system. For instance, the Presidential Decree "On Approval of the National Program for the Development of School Education for 2022-2026" (Decree No. PF-134, May 11, 2022) aims to improve the quality of education and introduce modern pedagogical technologies. This decree also includes issues related to incorporating STEAM elements into the education process. Furthermore, the "Concept for the Development of the National Education System of the Republic of Uzbekistan until 2030" (Decree No. PF-5712, April 29, 2019) aims to modernize the education system and adapt it to international standards. This document also addresses the development of students' professional skills by introducing modern pedagogical technologies, including the STEAM approach. Within the framework of these decrees, measures are being taken to apply the STEAM approach in the education system and develop its pedagogical foundations in career choice [1].

RESEARCH METHOD

This study analyzes the interconnection between STEAM and career choice through the innovative application of graph theory.

This study employs a mixed-method approach to investigate the pedagogical foundations of the STEAM approach in career choice within primary education. A qualitative analysis of existing literature, policy documents, and theoretical frameworks forms the foundation of this research. The study examines government initiatives, including Uzbekistan's national education policies, to assess the extent of STEAM integration into the formal curriculum. Data from academic sources, including UNESCO and OECD reports, are used to evaluate global trends in STEAM education and its relevance to career development [2]. Additionally, the research incorporates an interdisciplinary approach, drawing from educational psychology, constructivist learning theories, and experiential learning models to analyze the role of STEAM education in shaping students' professional aspirations. Empirical data are gathered through case studies of primary education institutions implementing STEAM methodologies, focusing on student engagement, teacher perspectives, and the effectiveness of project-based and problem-based learning strategies. Comparative analysis is applied to assess the impact of different pedagogical methods on career choice, considering factors such as creativity, problem-solving abilities, and interdisciplinary thinking. The study also explores the integration of real-world problem-solving activities within the STEAM framework and their influence on students' understanding of various career pathways. The findings are synthesized to propose a structured pedagogical framework that enhances the role of STEAM education in career orientation. By bridging theoretical perspectives with practical implementation, this methodology ensures a comprehensive understanding of how STEAM principles contribute to the development of career readiness in primary education [3].

Literature Review

The theoretical foundations of the STEAM approach emphasize an interdisciplinary approach that contributes to the development of students' problem-solving, critical thinking, and creativity. The works of educators such as John Dewey, Seymour Papert, and Jean Piaget emphasize experiential learning and the principles of constructivism. According to Dewey and Vygotsky, it is essential to provide students with the opportunity to engage in real-world activities for career orientation. According to reports by UNESCO and OECD, careers in the STEAM fields will be among the most in-demand sectors in the future [4].

RESULTS AND DISCUSSION

Careers in the STEAM fields include experts in science, technology, engineering, art, and mathematics. STEAM education integrates these fields to help students develop skills to solve complex problems. Careers in STEAM include:

1. **Science:** biologists, chemists, physicists, ecologists, astronomers, geneticists, researchers, scientific staff
2. **Technology:** programmers, systems engineers, computer network managers, artificial intelligence specialists, data analysts
3. **Engineering:** mechanical engineers, electrical engineers, construction engineers, architects, robotics engineers, aerospace engineers
4. **Arts:** designers, animators, graphic designers, visual artists, video game developers, animation producers
5. **Mathematics:** statisticians, mathematical analysts, financial specialists, risk managers, cryptographers, algorithm developers.

These careers utilize an interdisciplinary approach, and STEAM specialists combine technology, science, and creativity to solve contemporary problems innovatively. In the early stages of career choice, children in primary education learn to explore the environment, solve problems, and adopt creative approaches. The STEAM methodology helps them develop an interest in various professions at an early stage. In today's world, where technology and innovation are rapidly advancing, future careers are based on engineering, technology, and creative thinking. The STEAM approach helps students adapt to the demands of the job market. STEAM education allows students to connect theoretical knowledge with real-life applications, playing an essential role in career orientation. It develops students' creative thinking and problem-solving skills, positively influencing their successful career choices in the future [5].

The findings of this study highlight the significant role of the STEAM (Science, Technology, Engineering, Arts, and Mathematics) approach in shaping career orientations among primary school students. The integration of interdisciplinary learning fosters creativity, critical thinking, and problem-solving skills, which are essential for future professional success. Analysis of STEAM implementation in primary education reveals that early exposure to this methodology enhances students' cognitive abilities and engagement with scientific and technical disciplines. Additionally, project-based and problem-based learning within the STEAM framework contribute to the development of real-world problem-solving skills, bridging theoretical knowledge with practical applications. However, the study also identifies challenges in the adoption of STEAM education, particularly in Uzbekistan's national education policies, where formal implementation remains limited despite its recognition as a priority for modernizing the curriculum [6].

Further Research Directions

While this study establishes the relevance of STEAM education in career orientation, further research is needed to examine its long-term impact on students' academic and professional trajectories. Future studies should focus on longitudinal research to track the effectiveness of STEAM education in shaping career aspirations from early education to higher education and employment. Comparative studies across different educational systems could provide valuable insights into best practices for

integrating STEAM into national curricula. Additionally, further investigation into the role of arts in STEAM education is necessary, as its contribution to career development remains underexplored [7].

Deep Theoretical and Practical Research

From a theoretical perspective, the findings align with constructivist learning theories, which emphasize experiential and interdisciplinary education as crucial elements in developing higher-order thinking skills. However, more theoretical research is needed to explore how cognitive development through STEAM education influences students' ability to adapt to emerging career demands. The study also highlights the need for deeper pedagogical research into the role of teacher training and curriculum development in facilitating effective STEAM implementation [8].

On a practical level, the study underscores the necessity of designing teacher training programs that equip educators with the skills to implement STEAM methodologies effectively. The integration of technology, engineering, and arts into traditional subjects requires a shift in pedagogical strategies, emphasizing hands-on learning and interdisciplinary collaboration. Policymakers should consider embedding STEAM principles into national education frameworks, ensuring that curriculum reforms align with global educational trends and workforce demands. Moreover, partnerships between educational institutions and industry professionals could enhance the real-world relevance of STEAM education, providing students with exposure to career pathways from an early age [9].

Addressing the Knowledge Gap

Despite the increasing global focus on STEAM education, gaps remain in understanding how early exposure to STEAM disciplines influences students' career choices in the long term. This study identifies the need for further empirical research to assess the effectiveness of STEAM-based pedagogies in diverse educational and cultural contexts. Additionally, there is limited research on the role of socioeconomic factors in shaping students' access to and engagement with STEAM education, an area that warrants further investigation [10].

CONCLUSION

Fundamental Finding : The integration of the STEAM approach in primary education significantly enhances career choice by fostering critical thinking, problem-solving, and creativity through interdisciplinary learning experiences. **Implication :** These outcomes underscore the potential of STEAM methodologies to bridge theoretical knowledge with practical applications, thereby cultivating technologically literate and innovative professionals. **Limitation :** However, the study's focus on a single regional context within Uzbekistan limits the generalizability of the findings, suggesting that caution is needed when extrapolating the results to broader educational settings. **Future Research :** Further investigations are warranted to explore the long-term impact of STEAM-based pedagogies on career development across diverse contexts and to evaluate

the effectiveness of various project-based and problem-based learning strategies in shaping students' professional trajectories.

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