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Research Article

Exploring the Potential of STEAM Education in Cosmetology Vocational Schools: A Pathway to Innovative Learning

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ABSTRACT

The implementation of the STEAM approach in cosmetology learning has now become a necessity. This must be done to answer the needs of SMK Cosmetology graduates who must be ready to become makeup artists who will be faced with client problems and adaptation to rapidly developing beauty technology. In this case, students majoring in cosmetology must be equipped with problem-solving skills, critical thinking and creativity. Through a thorough literature analysis, the author of this paper investigates the possibilities of introducing STEAM Education to cosmetology majors. While STEAM education has not been implemented in vocational education for cosmetology majors, there are seven articles about its application in vocational education at all levels. From the results of the article review, there is potential for implementing STEAM learning in Vocational Education majoring in Cosmetology because there is Science content in its curriculum structure. In addition, the implementation of STEAM in this major can be combined with a project-based learning model. An embedded approach can be used to execute STEAM education, with science-based content on anatomy and physiology serving as the foundational literacy that is created, with additional competences serving as support.

Keywords: Exploring; STEAM; Education; Vocational; School

1. INTRODUCTION

At various levels, education should be connected to the future of students, especially in the 21st century (Dey & Srivastava, 2023). An interdisciplinary approach in the world of education has been developed in recent years to equip students to face future challenges (Hadzieva et al., 2021). The STEAM (Science, Technology, Engineering, Arts, and Mathematics) approach is one multidisciplinary approach that highlights art and creativity as an effective teaching model in fostering critical thinking, problem solving, and innovation. According to a number of studies, including art into STEAM education is crucial when it comes to classroom implementation (Perales & Aróstegui, 2024). As technology advances, there is growing interest in incorporating art into STEM education (Shatunova et al., 2019).

Science, Technology, Engineering, Art, and Mathematics (STEAM) learning is a new 21st-century method to education that emphasizes an interdisciplinary approach that incorporates the five scientific subjects. The goal of this STEAM education is to provide children the future skills—creativity, communication, teamwork, and critical thinking—that are necessary to address global issues. This new learning approach not only emphasizes theoretical concepts, but also how this knowledge can be applied in the context of everyday problems and adapt to potential problems that will arise in the future. In addition, this learning approach links cross-disciplinary fields into one to solve problems in real contexts as a response to the effectiveness of using one field of science that is still lacking in solving real-world problems today (Barkah et al., 2024). STEAM as a learning approach allows students to develop their competence in integrating various disciplines to solve complex problems. Through the learning process carried out in class, students can understand the relationship between STEAM fields of science and then apply them creatively and effectively in various contexts of real-life problems. In addition, students can also be more adaptive to the rapid development of technology and social change in society. Students will solve problems more creatively by integrating art, which is inextricably linked to life (Land, 2013). Through a comprehensive multidisciplinary approach, the STEAM learning approach can also promote creativity and innovation. Students will be more inventive and creative in their problem-solving techniques if they approach problems from a variety of scientific viewpoints. On a deeper level, STEAM education can help kids become more collaborative and communicate better, two things that are critical in a professional workplace. highlights how students are encouraged to investigate and incorporate other viewpoints through the transdisciplinary method in STEAM education, which leads to more innovative and successful problem solving (Christine Liao, 2016).

The adoption of STEAM education offers a chance to confront the difficulties of contemporary industry within the framework of Vocational Secondary School Education. This method fosters the growth of critical thinking abilities, creativity, and teamwork, all of which are crucial in the age of technology and globalization. Teachers had a solid comprehension of the STEAM approach, with 76.85% comprehending and 86.39% being able to integrate STEAM disciplines, according to a study on the application of the STEAM approach in the Science Project in Vocational High Schools (Hayat et al., 2023). According to this survey, there is a chance that vocational high schools will adopt the STEAM method.

Learning in vocational school majoring in Cosmetology is one of the majors that needs to be equipped with an understanding of problem solving in the future. In addition, prospective cosmetology workers must also be adaptive to the rapid development of beauty technology. One step that can be taken is to implement STEAM learning in the cosmetology department as an effort to provide prospective make-up artists who are adaptive to technological developments and are able to solve problems as experts in the field of make-up. However, research on the use of the STEAM approach in the make-up department is still very little or even non-existent. Therefore, in this article, the author will try to explore the potential for implementing the vocational school learning approach in majoring in skin and hair beauty as the latest learning innovation.

2. RESEARCH METHOD

This study uses a systematic literature analysis method to explore the potential for implementing STEAM education in vocational high schools majoring in cosmetology. This literature analysis was carried out with a systematic approach, namely through searching, selecting, evaluating, and synthesizing various relevant scientific sources. Using academic databases including Google Scholar, Sage Journal, Elsevier, and Pubmed, the literature search procedure was conducted using the keywords "STEAM Education in Cosmetology" and "STEAM Education in Vocational Schools." Articles that examine the application of STEAM in the context of vocational education and were published within the last 10 years are among the selection criteria. Literature evaluation was carried out by identifying the main theories, methodologies used in the research and interventions used. Furthermore, literature synthesis was carried out to determine a summary of the results and findings obtained in the study as an overview of recommendations regarding the implementation of STEAM in vocational education majoring in cosmetology. Through this systematic literature review research, it is hoped that it can reveal the potential for implementing the STEAM learning approach to be implemented in vocational high schools majoring in cosmetology. This literature synthesis will then be used to compile recommendations for STEAM implementation strategies that are in accordance with the characteristics of cosmetology vocational school.

3. RESULTS AND DISCUSSION

3.1 STEAM Education in Vocational School

Seven linked publications about the adoption of STEAM Education in Vocational Schools were found in an analysis of journals published during the last ten years that were downloaded from Google Scholar, Sage Journal, Elsevier, and Pubmed. To explain the form of research conducted by researchers, the author presents a table of methodology and interventions as listed in **Table 1**.

Table 1. Methodology and Interventions

Author	Methodology	Interventions
Rahim, et al (2024)	In order to assess how well project-based learning (PjBL) with a STEAM approach improves the cognitive, affective, and psychomotor skills of vocational students enrolled in a metal welding technology course, the study's methodology uses a quasi-experimental design with pre-test and post-test assessments.	1) 1) Project-based learning (PjBL) using a STEAM approach was implemented as an intervention in a metal welding technology course for sixty-four vocational students. 2) Higher mean N-gain scores in the cognitive, affective, and psychomotor domains demonstrated that the PjBL-STEAM strategy performed noticeably better than conventional teaching techniques.
Trisna, et al (2022)	The methodology of this paper is a systematic literature review.	1) The key interventions in the study were the integration of the STEAM method and the constructivism approach. 2) The study also used a literature review approach as the overall research method.

Hlukhaniuk et al (2020)	The key methodology used in this study was a combination of theoretical and empirical research methods.	3) Analysis, synthesis, conceptual analysis, literature review, observation, questioning, and analysis of student work products, as well as the use of project-based learning methods in their teacher training program.
Huang, et al (2021)	In order to build a research model for STEAM education and examine how the five components of STEAM education—perceived usefulness, perceived ease of use, learning behavior, teaching satisfaction, and learning effectiveness—can enhance the learning effectiveness of engineering higher vocational students, this paper's methodology makes use of the Technology Acceptance Model (TAM) algorithm.	1) Students were more satisfied with their teachers when STEAM education was used in upper vocational engineering courses. 2) There was a favorable correlation between the students' learning effectiveness and their perception of the value of STEAM education as well as their learning behavior. 3) Higher vocational engineering students can effectively strengthen their engineering thinking and design skills through STEM education.
Qian et al (2022)	In order to incorporate C-STEAM education ideas into a packaging design course, the researchers used a single-subject quasi-experimental design in their 9-week teaching trial with 45 art design students at a higher vocational institution.	1) The main interventions included teaching, demonstrations, and self-directed learning activities to help students apply C-STEAM concepts to package design, as well as incorporating C-STEAM education and local Shangshan culture into a nine-week "package Design" course.
Kummanee, et al (2020)	Analyzing documents and literature to synthesize the conceptual framework of a digital learning environment that incorporates STEAM gamification in order to create a vocational innovator. creating and refining the STEAM gamification concept for the digital learning ecosystem. An assessment of the developed model.	1) Biotic elements: parents/guardians, friends, teachers, and students. 2) Abiotic elements include databases, networks, hardware, software, and educational philosophies. 3) A 5-step STEAM education approach: defining problems, designing tools, producing instruments, testing and evaluating solutions, and presenting work. 4) 5 gamification elements: goals, rules, reinforcement, time, and feedback
Hayat, et al (2023)	The study combined a qualitative descriptive approach with a survey method. Using multistage purposive sampling, 48 respondents from 34 of 163 vocational schools made up the sample, whereas the population consisted of all SMK "IPAS Project" teachers in Central Java.	The survey consisted of two sections: 1) three open-ended essay questions concerning expectations, challenges, and attempts to overcome them, and 2) a five-point Likert scale questionnaire with explanations required of responders.

According to **Table 1**, seven studies about the use of STEAM education in vocational schools at all educational levels have been published from different nations. The research methods used are diverse, consisting of quantitative, qualitative and literature review. The interventions provided by researchers are also diverse in finding facts about the implementation of STEAM Education in vocational schools. All of these articles are also published from various countries.

The integration of STEAM Education into the PJBL learning paradigm was found to be highly beneficial in enhancing students' vocational abilities in the cognitive, emotional, and psychomotor domains in one of the quasi-experimental studies (Rahim et al., 2024). This study was conducted on students in the welding technology subject. The PJBL - STEAM learning approach compared to traditional learning in the cognitive, affective, and psychomotor learning outcomes domains sequentially obtained N-Gain Scores (0.763), (0.772), and (0.759).

In the meantime, a systematic review study by Trisna et al. (2023) on the topic of STEAM integration in constructivist learning discovered that using this combination of integrated learning in graphic design vocational education can boost the creativity of learning outcomes. According to this study, STEAM education can boost students' engagement and enthusiasm for the subject matter. Additionally, students can benefit from this multidisciplinary approach to learning by developing their capacity for creativity, invention, and critical thinking. Implementation carried out in an integrated manner with a constructivist approach, STEAM learning can help students develop problem-solving skills and make creative and active conclusions. Research by (Hlukhaniuk et al., 2020) aims to find innovative learning methodologies in organizing STEAM learning for creative projects for workforce and technology teacher training. In the article, Hlukhaniuk conveys the importance of STEAM as a framework for training prospective vocational teachers. This is due to the fact that the STEAM approach fosters creativity, critical thinking, and problem solving by utilizing cross-disciplinary sciences. Furthermore, as part of its curriculum, students work on projects that enhance their motivation and comprehension of the significance of the topics that form the foundation of STEAM Education. According to the study's findings, STEAM education can help future vocational instructors improve their creative potential and build both general and specialized competences.

In their research on vocational students majoring in Engineering, (Huang & Liu, 2022) found that STEAM can improve the effectiveness of learning in achieving learning outcomes. Several factors that cause student satisfaction in STEAM learning include perceptions of usefulness, ease of use and learning methods. Of the three factors, the majority of students are very interested in perceptions of usefulness and learning methods. In the integration of STEAM with Chinese culture known as C-STEAM in research (Qian et al., 2022) on art design learning in vocational education in Chinese universities resulted in increased student creativity and increased learning outcomes in the cognitive, emotional, and behavioral domains, and more creative performance. The C-STEAM curriculum by highlighting local culture can increase student creativity, learning engagement, and motivation.

In order to create vocational innovators, Kummanee et al. (2020) synthesized the design, evaluation, and conceptual framework of the digital learning ecosystem that is a part of gamification. A digital learning ecosystem, a STEAM learning approach, and gamification components are the three key components of the learning ecosystem with a gamification-based STEAM learning approach to generate innovators in vocational education, according to the study. The five steps of the STEAM Education approach include problem definition, engineering tools to solve problems with technology and mathematics, creating tools to solve problems, testing and assessment, and student presentations of work or solutions. Meanwhile, the elements of gamification consist of five stages including goals, roles, reinforcement, time and feedback. The majority of vocational high school teachers already grasp the idea of science learning, but they are still unsure about how to teach using the STEAM approach, according to research by Hayat et al. (2023) on the potential for STEAM implementation in science project learning in the independent curriculum. This can be seen from the practice of STEAM learning which is not implemented in a structured and systematic manner. Hayat also recommends the use of the LMS platform to bridge the implementation of STEAM in order to be able to save time and overcome teacher gaps and constraints.

Based on the description of several articles above, the implementation of STEAM learning in vocational education at all levels of education can be done to provide the best learning experience for students. At the vocational high school level, students can continue to adapt to future demands and gain the skills necessary in the workplace by combining STEAM with different learning modalities. In addition, the adaptation of the STEAM approach can also be integrated into the vocational education curriculum that applies in Indonesia and in several Asian, African, and European countries. The form of implementation carried out can be adjusted to the vocational education policy in each country.

3.2 STEAM in Cosmetology Learning

There are no publications that address the application of STEAM Education in the cosmetology department, according to the findings of the literature research exercise. Cosmetology experts in America are trying to think of a good form of implementation in the implementation of STEM in this cosmetology learning. This is because of the importance of including multidisciplinary learning in cosmetology learning. The demands of the industry and the labor market in the cosmetology sector necessitate the use of critical thinking abilities, problem-solving techniques, and technological adaption. Learning in the field of cosmetology is not only about how a makeup artist beautifies his client, furthermore a makeup artist is required to understand the material about skin, hair, and nail health. Additionally, it is expected of cosmetology students to be capable of performing skin and hair virginity in salons. Of course, from a scientific perspective, cosmetology learning already has potential in the implementation of STEM, because there is material on anatomy, physiology, chemistry of skin, hair and nails (Lachney et al., 2020).

If we look at the structure of the skin and hair beauty curriculum in the Merdeka Curriculum in Indonesia, in phase E, namely in grade 10, students study the learning content of anatomy and physiology. It is anticipated that students will be able to apply their understanding of anatomy and physiology, as well as their understanding of the body's organ systems, to beauty care by the end of phase E. Of course, this is related to science learning by focusing on its application in skin, hair and nail care. At the end of the article written by (Lachney et al., 2020), experts still have not found the right formula for incorporating educational technology into the implementation of makeup learning. This also makes the literature that writes about the implementation of STEAM makeup learning very limited. On the other hand, makeup learning is related to the art that is the basis for makeup, skin, hair, and nails. Likewise with mathematics learning, the implementation of STEAM is related to calculating the percentage of active ingredients for skin care or estimating the thickness of foundation that is suitable for various skin colors.

Secondary school students' critical thinking can be enhanced in practice by combining the project-based learning model with the STEAM approach to transdisciplinary learning (Indahwati et al., 2023). Makeup education can benefit from the application of project-based learning, which involves creating prototypes or other products. Creating e-modules to enhance students' critical thinking abilities is one of the best ways to integrate project-based learning (Oktarina, 2023.Pdf, n.d.).

Technical learning results and work character in vocational students can be enhanced by multidisciplinary learning that integrates science, technology, engineering, art, and mathematics through the IPAS Project in SMK in the autonomous curriculum (Hayat et al., 2023). Learning make-up involving anatomy and physiology which are also closely related to skin, hair and nail health is part of Science learning that needs to use a cross-disciplinary approach so that students gain real experience in providing services to their clients. In this case, STEAM education in makeup learning is also needed to develop creativity in solving problems for clients' problems, both regarding skin and hair health. In addition, makeup graduates are also required to be able to choose the form of skin and hair care that suits the character of the skin, face, and hair of the people who use their services. However, pupils must also be able to adjust to new technical advancements in the hair and facial care industry. Makeup graduates cannot offer their clients modern services if they lack flexibility.

Innovative learning through the STEAM learning approach can be implemented through a combination of various learning models including PJBL (Rahim et al., 2024). Science-related content can be a choice of material that will be combined with technological literacy, engineering, art, and mathematics. Furthermore, in the implementation of interdisciplinary learning, there are three approaches that can be taken, including silo, embedded, and integrated. Silo is an approach that separates all components of the subjects to be integrated. While embedded is an approach that emphasizes knowledge obtained from studying real-world problems and requires students to find solutions with the approach of one of the highlighted scientific fields, while others are complementary. The last approach is integrated, where all scientific fields do not have complete boundaries and are taught in an integrated manner in one complete unit (Winangun & Fauziah, 2019). In the context of STEAM learning in the Makeup Vocational School department in Indonesia which must be integrated into the independent curriculum, the most appropriate approach is embedded. Anatomy and physiology learning can be the core competency that is built, while other parts of STEAM can be complementary.

4. CONCLUSION

Based on the literature review conducted, it was concluded that the STEAM approach has the potential to be implemented in vocational education majoring in cosmetology and all vocational majors at various levels of education. In the cosmetology major, there is material on learning anatomy and physiology for student knowledge about health and care of skin, hair and nails which can be suitable learning content to be taught with the STEAM approach. The implementation of learning can be done by combining STEAM learning with a project-based learning model to carry out projects related to the health and beauty of skin, hair and nails. An embedded approach to STEAM-based learning can be used to teach the science content related to the anatomy and physiology of skin, hair, and nails. In this method, the science content becomes the primary literacy produced with the support of technology, engineering, art, and mathematics literacy.

RECOMMENDATIONS

Based on the findings in this study, the author recommends that researchers in the make-up department can conduct Experimental or Quasi Experiment research on the adaptation of STEAM learning in the make-up department to build adaptive, creative, and critical cosmetology graduates.

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All authors took part in writing this article with their respective portions. The first author played a role in compiling the article, then the second author provided evaluation and input on this article.

CONFLICT OF INTEREST

The author is completely uninterested in writing this piece.

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