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A Study on the Design of a Teaching Project on STEAM Cross-Disciplinary Aesthetic Education

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Summary

In recent years, the education trend, STEAM, has developed in the U.S. It has spread quickly globally and affected educational reform, curricula, and teaching. Consisting of science, technology, engineering, arts, and mathematics, STEAM is a cross-disciplinary curriculum and teaching approach. Here, arts was added to the original STEM education to enhance creativity and design capability, while improving students' higher-order creative thinking to solve problems in real life scenarios (Maeda, 2013; Rolling, 2016). The main concept of STEAM is that it is learner-centered. Integrating the knowledge of cross-disciplinary subjects and designing an exploration and practice-based curriculum helps students develop their ability to formulate problem-solving strategies, think creatively, and innovate (Chen, 2017; Land, 2013; Liao, 2016). Taiwan currently enacts 12 year basic education, so the focus of the competences-based education in the 2019 New Curriculum Guidelines is the integration of learning and living and highlighting learners' whole-person development through actual practice (Ministry of Education, 2014). STEAM corresponds with the objective of the competences-based education. Its curriculum aims to cultivate students' skills in critical thinking, problem solving, and innovation, all of which are indispensable skills for contemporary talent.

Regarding the content of a STEAM curriculum, the philosophy of the cross-disciplinary aesthetic education (CDAE) in Taiwan includes activating, channeling, and integrating other subjects with the arts, to find elements in various subjects that can be combined with aesthetics to form cross-disciplinary subjects, and build art-based cross-disciplinary courses. With aesthetic experience as the common basis for all the subjects, students' aesthetic cognition and application

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can be improved by cross-disciplinary learning and practice (Yu, Chao, Lin, & Li, 2015; Chao, 2016). Cross-disciplinary aesthetic education can therefore help students transform their aesthetic experience into real life practice, building their aesthetic literacy.

In terms of designing STEAM teaching activities, Rolling (2016) mentioned many project-based learning (PBL) methods. The key feature is to design problems related to the real world, providing students with the opportunity to make creative choices and solve issues. Liao (2016) mentioned that PBL for STEAM can combine two or more subjects, such as arts, engineering, or technology; with art creation, students can integrate cross-disciplinary knowledge and solve problems creatively. Quigley, Herro, and Jamil (2017) believe that STEAM should focus more on its connection with real life scenarios, problem solving, and cooperative learning; the 6E learning model of STEM helps students develop their creative abilities through exploration-based practice activities (Burke, 2014). In summary, the focuses of STEAM and the teaching design of cross-disciplinary aesthetic education include integrating and connecting core issues of aesthetic experience with arts, the PBL model, exploration-based practice activities, and technology infusion.

This study aims to explore the education trend, STEAM, and the model for designing a teaching project on cross-disciplinary aesthetic education. This study adopted action research, with fifth graders of a gifted class as subjects. The design of the project on STEAM cross-disciplinary aesthetic education is based on the 6E learning model: engage, explore, explain, elaborate, extend, and evaluate (Burke, 2014), which is transformed into three phases of aesthetic education: Aesthetic Exploration and Experience, Aesthetic Creative Practice, and Aesthetic Enriched Innovation. The contents related to arts, engineering, and technology are integrated through art project-based learning. This study focuses on Historic Sites and Cultural Preservation, which is used to lead students to explore aesthetic issues, develop artistic creation, and apply the augmented reality (AR) art guide to cultural advancement. Students' thoughts on course activities, team study logs, feedback, opinions, study reflections, and the teacher's observations and reflections were collected throughout the course. The design and implementation outcomes of the teaching project on STEAM cross-disciplinary aesthetic education are comprehensively analyzed herein. The conclusions of this study are as follows:

1. The integration of PBL with the 6E learning model helps to develop exploration and practice on STEAM cross-disciplinary aesthetic education

The results show that at the stage of aesthetic exploration and experience, the approaches of questioning, mind mapping, and information scaffolding can help students discuss the core issues of the course step by step. In Aesthetic Creative Practice, aesthetic experience can be transformed

into art creation by discussion, design, practice, and modification. During Aesthetic Enriched Innovation, technology can be used to refine the work and apply it in innovative ways. On the whole, this study on the model for designing a teaching project on STEAM cross-disciplinary aesthetic education combines PBL with the 6E learning model for teaching design and strategy application, which is useful for developing cross-disciplinary practice activities and students' research and thinking skills.

2. Exploration and practice-based learning helps to cultivate students' aesthetic competence in everyday life

The results show that students not only acquire cross-disciplinary knowledge related to arts, engineering, and technology, but also enhance the attitude and habit of active learning by participating in activities related to aesthetic exploration and experience, such as field trips and expert interviews associated with a STEAM teaching project. Students' reactions show that their aesthetic learning experience, such as multi-field aesthetic experience and the sharing of artists' life stories, has affected their aesthetic cognition; their awareness of, and sensitivity to, beautiful things are improved, allowing them to internalize beautiful things and render it in their aesthetic literacy for life. This is the objective of the STEAM teaching project: Using art experience to assist students in competences-based learning and connecting it to real life scenarios for future practical application (Land, 2013).

3. Teamwork learning and project task design stimulate creative thinking and are useful for working out solutions

In addition to integrating the teamwork learning model, this study also coordinates project-based learning tasks, such as project discussion, field investigation, art creation, and technology infusion, to enable students to learn from cross-disciplinary aesthetic courses via discussion and sharing. The results show that students can experience and realize the advantages of teamwork learning, thereby learning interactive skills. It also corresponds to what Guyotte, Sochacka, Costantino, Kellam, and Walther (2015) and Hunter-Doniger, Howard, Harris, and Hall (2018) discussed: Small teams' creation activities can stimulate group creativity. Moreover, the project tasks are designed with culture as their main issue. During the research and creation process, students can discuss and work together to find solutions, allowing them to think creatively and develop strategies to solve problems (Hunter-Doniger et al., 2018; Liao, 2016).

4. Technology helps to integrate STEAM course learning and innovative application

During the implementation of project-based courses, students applied a number of technologies to their project-based exploration and learning, as well as to art creation, such as surfing the

Internet for research information and creation material, using Google forms to produce reality game questions for historic sites, and using PowerPoint and AR software to produce AR films for art guided tours. The results show that infusing technology into the STEAM course helps students integrate their learning content. In particular, in Aesthetic Enriched Innovation, technology plays a key role in integrating cross-disciplinary learning, which corresponds to the arguments of Gross and Gross (2016) and Keane and Keane (2016): The use of technology in teamwork learning in the STEAM course helps students present diverse innovative applications.