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Integrating Art and Science in Education: Cultivating Creative Expression and Inquisitive Thinking

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Abstract

STEAM education has gained increasing attention as an interdisciplinary approach that integrates the arts to enrich science learning and foster creative thinking. This study examines how combining artistic creation with scientific experimentation promotes students' creative expression, inquisitive thinking, and emotional engagement. The study utilized an art-based action research methodology, conducted over two months, with 20 first-grade students in China. Data were collected through the researcher's observation diary, students' artworks, oral reflections, and photographic documentation of the instructional process. Data analysis involved reflective observation and interpretation to examine how students engaged with scientific concepts through creativity. The findings suggest that integrating art and science through multisensory activities promotes creative expression, fosters inquisitive thinking, and enhances emotional engagement, engaging with scientific phenomena in exploratory ways.

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Introduction

STEAM education (science, technology, engineering, arts, and math) has gained increasing attention as an interdisciplinary teaching and learning model (Perignat & Katz-Buonincontro, 2019), with the arts acknowledged as a crucial element for improving interdisciplinary education worldwide (Henriksen et al., 2018). STEAM education differs from STEM education by integrating arts, thereby eliminating disciplinary borders and offering students a more comprehensive learning experience (Bequette & Bequette, 2012; Ghanbari, 2015; Repko & Szostak, 2020). Art goes beyond mere creative expression; it serves as a means of comprehending the intricacies of the world (Ljokkoi & Slotte Dufva, 2020). By integrating art and science, students can engage with and analyze scientific phenomena through a multi-sensory approach, facilitating enhanced cognition and reflection (Henriksen, 2014) and the examination of complex reality (Hiltunen, 2025). The interdisciplinary model demonstrates significant results in cultivating creativity and helps students cope with complex global challenges (Liao, 2016).

The relevance of STEAM education extends beyond improving students' academic achievement and problem-solving abilities. It fosters authentic learning experiences, critical thinking, and creative problem-solving skills (Chung & Li, 2021; Henriksen, 2014; Sederholm, 2015). Students construct knowledge through active exploration and reflection (Piaget, 1954). Artistic processes enable them to approach scientific issues from diverse perspectives and to build new cognitive relationships between art and science. Through artistic processes, learners approach scientific issues from multiple perspectives, forming new cognitive connections between artistic and scientific ways of understanding.

Recent advances in educational technology have broadened the scope of STEAM instruction globally. Cloud-based platforms, computer simulations, and augmented reality technologies are increasingly being incorporated into interdisciplinary educational settings, providing dynamic and multimodal methods for students to interact with scientific material (Papadakis et al., 2023a, 2023b). Artificial intelligence and educational robotics have been investigated as instruments to facilitate personalized, interdisciplinary learning (Lampropoulos & Papadakis, 2025; Lavidas et al., 2024). Despite ongoing improvements in STEAM education, there is an urgent need to investigate how embodied, material-based, and art-centered methodologies might enhance these digital developments, especially in early childhood education, where sensory engagement is vital.

Ruccius (1994) contended that the objective of arts education extends beyond merely supplementing other courses. Through its distinctive methodology, visual arts education has demonstrated to educators the essence of authentic constructivist, contextualized, supporting, and collaborative teaching and learning (Efland, 2002; Räsänen, 2008, 2012). It provides

students with a multidimensional learning platform that utilizes bodily knowledge, contextual knowledge, and practical experience to help them construct knowledge and reflect deeply on real-life situations (Brown et al., 1989; Van Dijk & Frens, 2011). STEAM education enhances this potential by providing students with the opportunity to explore new realms through creative and collaborative interactions that merge art and science (McGarry, 2018). In China, STEAM education has received growing scholarly attention. Researchers have examined teachers' perceptions and attitudes toward STEAM disciplines (Li & Chiang, 2019). Furthermore, Luo and Cong (2024) indicated that creativity plays a significant role in fostering interdisciplinary integration and regional equity.

In recent years, the need to foster creativity, cognitive development, and interdisciplinary thinking in basic education has gained increasing attention. Art-integrated learning environments enhance children's observational skills, conceptual reasoning, and scientific thinking by engaging multiple sensory modalities and symbolic systems (Eisner, 2002; Winner et al., 2013). Responding to this need, the researchers employed an art-based action research (ABAR) method to create a learning environment that facilitates the intersection between scientific exploration and artistic expression. Specifically, the research focused on the design and implementation of an interdisciplinary course that combined basic chemistry experiments with visual arts activities for students, aiming to strengthen their sensory engagement, conceptual understanding, and imaginative thinking as part of broader cognitive growth.

The study is based on a two-month interdisciplinary curriculum involving first-grade students (N = 20) from a university-affiliated elementary school in China. The curriculum integrated chemical experiments with art education to create an interdisciplinary framework. Through this approach, students explored scientific topics through multisensory experiences and articulated their understanding using artistic expression. The following research question: How does integrating art and chemistry promote students' creative expression, inquisitive thinking, and emotional engagement? The article is a result of first cycle of action research continued in Finland (Zhang & Hiltunen, 2025; Zhang & Huhmarniemi, in press).

Theoretical Framework

Learning is increasingly recognized as a socially and culturally mediated process where meaning is formed through interaction, conversation, and shared experience (Danielson, 2022). In this context, art offers a symbolic and real place for learners to explore, express, and evaluate their experiences (Cappello et al., 2024). Art serves as an integrative inquiry method that connects perceptual experience with conceptual understanding, allowing students to convert observation into reflection and creative interpretation (Hetland et al., 2023). Through these processes, learners comprehend abstract concepts, perceive scientific phenomena, and

convey emotional and cultural significances related to their education (Filipe et al., 2024).

Wijnen-Meijer et al. (2022) and Filipe et al. (2024) reported that artistic reinterpretation of hands-on experimentation transformed scientific inquiry into creative meaning-making within STEAM education informed by constructivist and experiential learning traditions. The integration of art and science promotes epistemic engagement and reflective inquiry (Burnard & Colucci-Gray, 2020). It positions STEAM as a field where creative and scientific knowledge are developed collaboratively. Scholars Boice et al. (2021) emphasized the educational aspect of this integration, illustrating how collaborative teacher training fosters imaginative and inquiry-based learning environments. Meanwhile, Liston et al. (2022) illustrated how technological innovation and data-driven creativity broaden the fields of modern STEAM education.

In arts-based science education, emphasis is placed on how visual and performative techniques facilitate learners' exploration of scientific phenomena through multiple sensory and semiotic modalities (Henriksen et al., 2018; McGarry, 2018). McGarry (2019) further describes this process as multitextual literacy, where learners draw meaning from visual, linguistic, and performative modes of communication. Therefore, art provides an open and flexible arena for exploration and meaning-making through multimodal experience, allowing students to express personal responses to scientific ideas through creative processes (Paatela-Nieminen, 2021).

Constructivist approaches highlight meaning-making through experience, while arts-based pedagogies enhance this process by incorporating embodied, emotive, and aesthetic aspects of learning. Eisner (2002) contended that the arts cultivate specific cognitive modalities based on sensory perception and imagination. They enable learners to identify complex distinctions, use metaphorical reasoning, and articulate concepts that exceed verbal or numerical confines. Räsänen (2008, 2015) considered contemporary art education as a platform for ethical, aesthetic, and interdisciplinary exploration, allowing students to investigate ecological and scientific problems from cultural, symbolic, and personal perspectives. Students integrate intuitive play, material exploration, and reflective dialogue to build knowledge (McGarry, 2018).

Creativity is important to these processes, which involve curiosity, introspection, and the ability to manage uncertainty and complexity. According to Craft (2005), possibility thinking represents the imaginative aspect of creativity that allows learners to transition from "what is" to "what could be". It emphasizes the ability to cope with uncertainty through inquiry, imagination, and reflective judgment. Creativity involves the generation of innovative ideas, as well as critical and inquisitive participation (Lukaka, 2023). Recent research in the field of

art education has advanced an ecological relational perspective on creativity. This perspective emphasizes that creative processes emerge through material, social, and cultural interactions. Researchers have highlighted that interdisciplinary and reflexive practices facilitate creative thinking and the integration of artistic and scientific knowledge (Samaniego, 2024). Creativity is increasingly conceptualized as transferable and situated, shaped by learners' motivation, environment, and cultural background (Gormley, 2025; Kadyirov et al., 2024; Lukaka, 2023). This suggests that creativity in art-based STEAM education is understood as a dynamic, socially situated, and ecologically embedded process of meaning-making. Creative learning is shaped by learners' relationships with their surroundings, including the cultural and spatial contexts in which they live and learn (McGarry, 2024).

Combining artistic methods with scientific investigation enhances learning through multimodal, embodied, and contextualized experiences (Eisner, 2002; Henriksen et al., 2018). In STEAM classrooms, creativity emerges as a practice-based and embodied experience, shaped by learners' engagement with materials, experimentation, and reflection (Samaniego, 2024). STEAM education is widely recognized as fostering creativity, critical thinking, and problem-solving abilities essential for resolving complex ecological and social issues (Kristanto & Mariana, 2023; Perignat & Katz-Buonincontro, 2019). Vervoort et al. (2024) emphasized the socio-emotional and ethical aspects of creativity, associating artistic processes with empathy, collaboration, and environmental responsibility. Similarly, Sternfeld et al. (2024) argued that integrating the arts with social-emotional learning fosters creative learning environments where emotional engagement and imagination enhance students' holistic development and creative potential.

Many studies on STEAM education have focused on curricular frameworks and educators' perspectives, often overlooking children's experiential engagement with art–science integration, particularly in relation to material exploration and embodied creation. As a result, representational outcomes are frequently prioritized over the processes of creative inquiry. The study was designed to examine how children engage with scientific concepts through multisensory and art-based experiences, and how creative expression facilitates meaning-making in interdisciplinary learning environments.

ABAR Methodology and Data Collection

An extended art-based action research (ABAR) study that integrates repetitive cycles of educational intervention, reflection, and analysis with the expressive potential of art. ABAR integrates the reflective processes of action research with creative practices to examine educational phenomena (Jokela et al., 2015, 2019; Jokela & Huhmarniemi, 2025). It involves cycles of planning, intervention, and reflection. The artworks produced by stakeholders frequently function as research data, as demonstrated in this study.

The study was carried out at a university-affiliated elementary school located in southern China. The interdisciplinary curriculum was developed by Zhang in collaboration with two teachers from the fields of science and art at the school. It was implemented as a component of the school's extracurricular program over a period of two months in spring 2024. The sample included 20 first-grade students (ages 6–7) who had also engaged in the program during the previous fall semester. In the spring sessions (Figure 1), the first author directed the implementation in collaboration with the school's instructional team. Students collaborated in small groups of three to four to conduct scientific experiments and engage in artistic activities.



Figure 1. A Sensory Journey of Interdisciplinary Experimentation, 2024. © Photograph by Xiaowei Zhang.

The teaching experiment consisted of three unique phases: (1) concept presentation via lectures and teacher-led scientific demonstrations, (2) collaborative experimentation using multisensory activities, (3) artistic creation and storytelling creation based on the students' interpretations of scientific phenomena. Sessions were held once or twice a week, depending on the phase. The objective was to enhance students' creative thinking and comprehension of science. The sequence of planning, implementation, data collection, and analysis clarifies the cyclical structure of the study design and the correspondence between educational interventions and research activities (see Figure 2).



Figure 2. The Cyclical Process of Art-Based Action Research (ABAR) in Interdisciplinary Education.

The data were collected by Zhang and included the researcher's observation diary, students' artworks, oral reflections, and documentary photographs of the teaching process. These sources were triangulated to examine how the integration of art and chemistry contributed to students' creative, cognitive, and emotional engagement. Each artwork was accompanied by a brief oral description from the students, which Zhang recorded and transcribed. The observational data captured verbal and non-verbal expressions, group collaboration, and spontaneous comments during the experimental activities. In addition to the students' final artworks, sequential photographs documented the work-in-progress stages, illustrating the students' evolving ideas and techniques. Students' oral descriptions were collected at two points: as spontaneous in-situ comments during the creative process and as reflective responses at the end of the activities.

All ethical procedures adhered to the national guidelines of the Finnish National Board on Research Integrity (TENK, 2023). The school principal and classroom teachers gave their approval for the study. Informed consent was obtained from parents after they were fully informed about the purpose and use of the research materials, and the children agreed to participate. All materials were anonymized as appropriate. All images containing identifiable facial characteristics were systematically obscured in accordance with privacy and data protection regulations.

Data Analysis

The analysis followed theoretical frameworks that conceptualize learning in art-based STEAM education as an embodied, imaginative, and reflective process (Eisner, 2002; Craft, 2005; Räsänen, 2015). It concentrated on how students engaged with materials and artistic processes to understand scientific concepts, experiencing creativity as an integral aspect of their education. Creativity was defined in this study as an emergent, social process of meaning-making, guiding the examination of how creative and scientific thinking were integrated in students' learning processes.

Inductive content analysis was used within an art-based methodology (Barone & Eisner, 2012), employing visual methodologies to investigate the aesthetic and narrative aspects of students' learning (Leavy, 2009). Visual, verbal, and observational materials were analyzed iteratively, concentrating on instances where creative and scientific thinking converged through exploration, debate, and reflection. The analysis was conducted in two steps. During the initial phase, visual and verbal resources, comprising artworks, transcribed oral reflections, and field notes, were analyzed. The data were subsequently coded inductively to identify emergent trends. During the second phase, preliminary codes were developed and classified into three interpretive dimensions: creative expression, inquiry-based reasoning, and emotional engagement. The analysis was focused on how students developed their understanding through sensory experiences and material exploration, demonstrating the transformative power of interdisciplinary learning. The students' artworks were examined using inductive visual coding to enhance the interpretive process, concentrating on repeating elements. Visual elements were analyzed in connection with students' oral reflections, reflective notebooks, and group presentations.

To ensure analytical reliability, 25% of the dataset was independently coded by another researcher, a specialist in natural sciences, providing an inter-coder agreement rate of 88%. The reliability and validity of the findings were enhanced through triangulation of visual, verbal, and observational data sources (Denzin, 2017; Patton, 2002) and informal member confirmation. Reflexivity was ensured during the study through reflective diary and regular peer discussions. This process allowed the researcher to critically reflect on their positionality, interpretive decisions, and underlying assumptions. To enhance transparency, selected students' artworks are included to exemplify the analytical reasoning and interpretation presented in this study.

Findings

Creative Expression: Transforming Scientific Observation into Symbolic Meaning

Students were able to interpret scientific facts using visual and symbolic language when art

was incorporated into chemistry experiments. Most students created imaginative compositions that connected scientific processes with natural, emotional, and narrative components, rather than literally portraying reactions. They used symbolic and metaphorical images to reinterpret the chemical experiments in the artworks (Figure 3). Some students represented the reactions as rhythmic compositions that resembled musical notes, while others saw test tubes as tree trunks that were bursting with vibrant colors. These creative imaginings show how students viewed scientific methods as dynamic, connected, and expressive systems, as opposed to fixed results. Through aesthetic reasoning, students organized sensory impressions into conceptual understanding and translated observation into visual metaphors of growth and rhythm. Artistic practice functioned as a mediating process through which scientific observation was reconfigured into relational and process-oriented understanding, enabling students to grasp chemical change as a dynamic phenomenon unfolding over time. In their creative process, they further experimented with composition, layering, and rhythmic repetition to express transformation, balance, and continuity, perceiving color change as a continuous and dynamic phenomenon.



Figure 3. Students' Artworks, 2024. © Photograph by Xiaowei Zhang.

In order to make sense of chemical change, students used art to create a reflective environment in which they could visualize abstract concepts and integrate their imagination and senses. As a result, the artwork served as beautiful symbols of cognitive knowledge, allowing students to express their thoughts visually rather than verbally. However, a few students produced paintings that mainly illustrated the experiment itself, showing limited imaginative transformation, influenced by group dynamics and individual confidence. These creative activities show how art helps students reflect on materials and turn scientific observation into expressive knowledge, highlighting learning as a meaning-making process where imagination and material engagement work together to develop understanding through aesthetic reflection. This emphasizes how art acts as a cognitive process that transforms sensory perception into conceptual knowledge.

Inquisitive Thinking: Experimentation, Dialogue, and Reflection

The way students interacted with the experiment demonstrated their curiosity. They tested theories, tracked outcomes, and improved their methods because of their curiosity and perseverance. To comprehend color responses, students actively changed mixes, compared results, and spoke about adjustments to proportions and sequencing. Many students spoke of going through the same steps repeatedly in an attempt to "find the right color" or "see what happens if I change this." These actions demonstrate a readiness to deal with ambiguity and to acquire knowledge via experimentation, observation, and modification. The artistic framing of the activity shaped how inquiry developed by foregrounding visual variation, material choice, and open-ended manipulation. Working with color and composition encouraged students to attend to subtle changes, compare emerging outcomes, and explore alternative possibilities through repeated trials. Artistic experimentation thus supported inquisitive thinking by transforming uncertainty into an exploratory space, where questioning, testing, and revising ideas were guided by visual and material feedback. Another characteristic that distinguished students' curious thinking was collaborative discussion. They collaborated in small groups, observed each other's tests, shared ideas, and considered potential explanations for variations in results. Teachers saw students express their ideas aloud, ask questions, make predictions, and react to suggestions from their peers. Students were able to link action and reflection through this type of interaction, which demonstrated how thinking evolved through both discussion and embodied experimentation.

Students started to connect conceptual understanding with hands-on experimentation. Their investigation encompassed observation, interpretation, and group meaning-making, in addition to material manipulation. Interaction patterns showed that students gradually moved from simple observation to more intentional explanation as they learned through involvement and group discussions. In scientific learning, artistic experimentation can foster both cognitive flexibility and creative reasoning, as demonstrated by the iterative cycles of testing, reflection, and modification. There were additional differences between the groups. While some students enthusiastically embarked on new experiments, others paused and awaited advice from teachers or classmates. These differences imply that differentiated support is beneficial for inquiry-based learning, especially when it comes to assisting learners who lack the confidence to effectively navigate uncertainty.

The findings indicated that inquisitive thinking in this situation integrated reflection, teamwork, and curiosity. Instead of viewing the experiment as a set task, students viewed it as an open-ended investigation. By putting theories to the test, tracking results, and collaborating, they turned curiosity into knowledge and showed how scientific research can be advanced through artistic and social interaction. This illustrates a relational approach to learning, which is prominent in modern art and design education, and which holds that

knowledge grows through group investigation and mutual reflection.

Emotional Engagement: Experiencing Science Aesthetically

Students' emotional engagement with scientific phenomena emerged through their aesthetic and sensory involvement in the experimental process. Students experienced experimentation as an open-ended, visually and affectively engaging activity. The artistic framing of the task positioned scientific inquiry as something to explore, notice, and feel, inviting students to attend closely to color, texture, rhythm, and subtle visual changes. This sensory attentiveness fostered curiosity and sustained interest, creating an affective entry point into scientific exploration.

The integration of artistic practice transformed experimentation into a perceptual and emotional inquiry. As students worked with color, they became absorbed in observing tonal shifts, gradients, and unexpected transitions, often expressing excitement or anticipation about what might emerge next. This aesthetic engagement encouraged repeated testing and adjustment, as students sought to "find the right color" or to explore how slight changes in proportion or sequence would alter the visual outcome. In this process, uncertainty was experienced not as a source of frustration but as an invitation to continue experimenting. Emotional engagement thus supported a willingness to dwell in trial-and-error, extending both the temporal and cognitive space of inquiry.



Figure 4. Elemental Harmony: Science Meets Nature, 2024. © Photograph by Xiaowei Zhang.

Collaborative dialogue was similarly shaped by aesthetic engagement. As students observed one another's artworks and experimental traces, their interactions moved beyond checking procedural accuracy toward sharing impressions, reactions, and interpretations. Visual artifacts functioned as emotionally resonant reference points that stimulated discussion, comparison, and mutual suggestion. Students responded to peers' ideas by modifying their own experimental actions and artistic compositions, demonstrating how shared aesthetic experiences supported collective meaning-making. Through these exchanges, emotional involvement sustained attention and encouraged responsiveness to others' perspectives.

Through aesthetic and emotional engagement, students' inquiry gradually shifted from immediate observation toward more intentional explanation. Visual outcomes prompted questioning, hypothesizing, and re-testing, while emotional investment helped maintain motivation and openness throughout the exploratory process. The findings indicate that emotional engagement, fostered through artistic practice, played a critical role in supporting participation and perseverance by encouraging sustained attention to sensory change.

Discussion

The findings emerged from a specific classroom context; they address questions that are central to broader discussions in STEAM education. The analysis demonstrates how artistic practices can shape scientific inquiry by supporting meaning-making, exploratory experimentation, and sustained engagement, rather than functioning only as a supplementary or motivational component. By articulating the roles of creative expression, inquisitive thinking, and emotional engagement, insights were gained into how art–science integration can inform the design of inquiry-oriented learning environments across diverse STEAM contexts.

The results highlight how art-based, interdisciplinary learning enhances students' engagement with science by including aesthetic, cognitive, and emotional aspects of comprehension. The integration of scientific investigation and artistic creation transforms learning into an immersive process rooted in perception, imagination, and reflection. Learning functions as a relational and participatory process in which meaning is constructed through collaborative effort and reflection (Danielson, 2022; Hetland et al., 2023). In this educational framework, art serves as a symbolic and tangible language that allows learners to link sensory observation with conceptual interpretation, converting factual knowledge into reflective comprehension (Eisner, 2002; Filipe et al., 2024).

Students' artworks illustrated the transformation of perceptual experience into aesthetic representation. They articulated their understanding of chemical events through visual metaphors, including trees, rhythms, and natural cycles. These visual representations suggest

that aesthetic cognition and possibility thinking might foster interpretive and imaginative engagement with scientific knowledge (Craft, 2005; Eisner, 2002). Their playful application of color, composition, and rhythm clarified the construction of meaning through imagination and material interaction, demonstrating that creativity in STEAM education arises from the interplay between perception and conceptual reasoning (McGarry, 2018; Räsänen, 2015).

The students' inquiry processes demonstrated that learning in interdisciplinary situations evolves through cycles of exploration, interpretation, and reflection. As students experimented with mixtures, shared observations, and honed their concepts, they showed the iterative process of knowledge building described in constructivist and sociocultural theories (Burnard & Colucci-Gray, 2020). Their conversations illustrated that thinking was both embodied and social: comprehension developed through material manipulation and peer discourse. This finding suggests that inquiry in STEAM education becomes most effective when learners engage with uncertainty as a productive condition for meaning-making and deepen their understanding through collaborative reflection (Wijnen-Meijer et al., 2022). In this study, students engaged in open-ended exploration in which inquiry was framed as an interpretive process that encouraged imaginative reasoning and reflection.

Emotional and sensory involvement contributed significantly to meaning-making. Their feelings of joy, curiosity, and wonder suggested that emotional resonance affected both their motivation and their aesthetic choices. Their use of color, balance, and rhythm reflected feelings of tranquility or exhilaration, demonstrating the effects of directed attention and prolonged involvement. These experiences demonstrate that emotion is fundamental to cognition, influencing how learners perceive and assimilate complex facts (Vervoort et al., 2024). The interaction between emotion, perception, and thought can foster ecological and embodied awareness by connecting learners' inner experiences with the natural environment (Räsänen, 2015).

International discussions on STEAM education may be informed by evidence showing how children engaged creatively and emotionally with scientific phenomena through art-based processes. Whereas previous research has primarily focused on curricular design and teacher perspectives (Henriksen et al., 2018), this work turns attention to students' experiences and the cognitive value of aesthetic expression. Building on the ecological view of creativity proposed by McGarry (2024) and Filipe et al. (2024), it shows that creativity develops through interactions between learners, materials, and the environment. When perceptual, emotional, and cognitive forms of knowing intersect, interdisciplinary learning enables students to approach science as a dynamic and interpretive practice, rather than as a fixed body of knowledge.

Teachers can enhance interdisciplinary learning by fostering open and reflective classroom environments that facilitate the mutual influence between art and science. Facilitating time for observation, debate, and innovative reinterpretation fosters curiosity and empathy, enhancing children's comprehension of natural processes (Bequette & Bequette, 2012; Räsänen, 2015). Scientific research becomes a personal and imaginative endeavor, demonstrating how art-based methodologies can enhance cognitive growth and creative confidence in elementary school.

This research is a component of Zhang's extensive STEAM education initiative conducted in Finland and China, encompassing various schools and educational levels. The study uses art-based action research to provide contextual knowledge of the integration of aesthetic and scientific thinking through interdisciplinary practices in elementary education. By emphasizing students' creative processes and perspectives, the study enhances the global discourse on the integration of art, science, and ecology in education. It provides practical and methodological insights into the use of ABAR as an instructional strategy and mode of inquiry. Future studies will enhance this cross-cultural perspective to investigate the enduring effects of art and science integration on students' creativity, ecological consciousness, and scientific involvement.

Conclusion

Students' artworks and interviews with participating students from a STEAM project conducted at an elementary school were analyzed. The project constituted the first cycle of ABAR. The study was designed integrate art and chemistry teaching, allowing students to perceive natural occurrences through chemical experiments and express their reflections through visual storytelling. STEAM education promotes creative discovery and multisensory learning, helping students improve their comprehension of scientific concepts and engage in active cognitive development.

Students collaboratively presented distinctive visual representations of chemical processes, utilizing components such as colorful test tubes, natural objects, and auditory aspects. These activities enhanced creative expression through visual storytelling and interpretation, while educators promoted thorough observation and experimentation. Students exhibited imagination, inquiry-based reasoning, and affective involvement. Creativity was demonstrated through the use of original materials and metaphorical representation. Inquisitive thinking was demonstrated through questioning, prediction, and causal reasoning. Emotional engagement was evident through expressions of curiosity, persistence, and excitement during collaborative tasks.

The value of multisensory learning in STEAM education was demonstrated through evidence

showing how visual art extended beyond representation to deepen understanding and inform interdisciplinary instructional design. Future iterations of this study could benefit from the use of validated assessment tools to strengthen the empirical foundation of core concepts such as creativity, inquisitive thinking, and emotional engagement. The next cycles of ABAR will extend this inquiry to new contexts and materials. The research will investigate how interdisciplinary art and science initiatives enhance students' creativity, emotional engagement, ecological awareness, and scientific comprehension in elementary education. This initiative seeks to enhance theoretical and practical frameworks for integrating visual art education into science instruction. It explores the use of natural resources and culturally significant materials, addressing issues of sustainability, local relevance, and challenges in early childhood education.

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