Repositioning Visual Arts Project Management in STEAM Education Through Project-Based Learning among Secondary School Students In Sabah, Malaysia

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ABSTRACT

This study examines the repositioning of Project Management in Visual Arts within STEAM education through Project-Based Learning among secondary school students in Sabah, Malaysia. In the Malaysian education context, the growing emphasis on innovation, creativity, interdisciplinary learning and 21st-century competencies has not been fully translated into classroom practice, particularly in relation to Visual Arts as a structured project management process within STEAM learning. This study was conducted in response to the gap between national educational aspirations and actual pedagogical implementation, as well as the limited local empirical evidence on Visual Arts project management in under-resourced rural school settings. Using a qualitative case study design, the research was conducted in a rural secondary school in Kota Marudu, Sabah, involving 63 Form One students and three experienced Visual Arts teachers. Data were collected over eight weeks through the implementation of the ARTSCreaSTEAM Lab module, which incorporated project planning, idea development, collaborative production, problem-solving, presentation and reflection as key components of Visual Arts project management. Multiple data sources were used, including semi-structured interviews, classroom observations, document analysis, student artifacts, reflective journals, field notes and follow-up discussions. The data were analysed thematically using NVivo 12 Plus. The findings revealed that Visual Arts project management through Project-Based Learning enriched STEAM learning despite contextual constraints. Three major themes emerged: implementation challenges related to pedagogical competence, resource limitations, curriculum alignment, time management and resistance to change; positive learning outcomes reflected in stronger engagement, higher motivation, improved conceptual understanding, creative problem-solving and enhanced higher-order thinking; and meaningful student experiences marked by autonomy, collaboration, cultural expression, emotional connection and ownership of learning. The findings indicate that Project Management in Visual Arts is not merely a procedural component of art-making, but a pedagogically significant strategy for strengthening inclusive, creative, interdisciplinary and context-responsive STEAM education in Sabah and the wider Malaysian secondary school context.

Keywords: Project Management in Visual Arts ; STEAM Education ; Visual Arts Education

INTRODUCTION

The increasing demand for innovation, creativity and interdisciplinary problem-solving has reshaped the direction of contemporary education. In response to the needs of 21st-century learning, STEAM education has emerged as a holistic approach that integrates Science, Technology, Engineering, Arts and Mathematics. Unlike traditional STEM education, which tends to emphasize scientific and technical knowledge, STEAM recognizes the role of the arts in supporting imagination, design thinking, communication, creativity and human-centred innovation. Within this framework, Visual Arts is significant because it enables students to visualize abstract concepts, communicate ideas through creative forms and engage with learning in ways that are more meaningful, contextual and connected to real-world problem-solving (Zhang & Ma, 2024).

In Malaysia, national education aspirations have increasingly emphasized creativity, innovation, higher-order thinking, collaboration and student-centred learning. However, the integration of Visual Arts within STEAM education remains limited in classroom practice, particularly at the secondary school level. Visual Arts is often positioned as a separate or supplementary subject rather than as an interdisciplinary platform that can support scientific inquiry, technological exploration, engineering design and mathematical reasoning. This separation limits the potential of Visual Arts to function as a meaningful pedagogical bridge within STEAM education. As a result, students may have fewer opportunities to experience learning that combines creativity, conceptual understanding, collaboration and authentic problem-solving (Buruntong et al., 2025a).

This issue becomes more significant when viewed through the lens of Project Management in Visual Arts. In Visual Arts education, project management involves more than the production of artwork. It includes idea generation, planning, resource management, collaboration, experimentation, production, presentation, reflection and evaluation. These processes are closely aligned with Project-Based Learning (PBL), which emphasizes inquiry, active learning, authentic tasks, collaborative problem-solving and the creation of meaningful outcomes. When project management is intentionally embedded within Visual Arts and connected to STEAM education, it provides students with a structured yet flexible learning process that enables them to plan, design, test, revise, present and reflect on their ideas (Buruntong et al., 2026).

Although Project-Based Learning has been widely recognized as an effective pedagogical approach for promoting active learning and student engagement, its application in the context of Visual Arts project management within STEAM education remains underexplored in Malaysia. Existing discussions on STEAM often emphasize science, technology, engineering and mathematics, while the arts component is sometimes treated as an additional creative element rather than a central pedagogical process. This gap is particularly evident in rural and under-resourced school contexts, where implementation may be affected by limited facilities, lack of materials, time constraints, curriculum demands and insufficient teacher preparation in interdisciplinary pedagogy. In Sabah, these issues are especially relevant because rural schools operate within distinct geographical, cultural, infrastructural and community-based realities (Hawari & Mohd Noor, 2020).

At the same time, rural school contexts such as Kota Marudu, Sabah, also offer meaningful opportunities for contextualized STEAM learning. Students' local environments, cultural experiences, community practices, environmental issues, traditional designs and available materials can serve as rich sources of inspiration for Visual Arts-based STEAM projects. Therefore, repositioning Project Management in Visual Arts within STEAM education is not only a matter of improving classroom pedagogy, but also a way of making learning more inclusive, culturally responsive and relevant to students' lived experiences (Buruntong et al., 2025b).

Accordingly, this study examines how Project Management in Visual Arts can be repositioned within STEAM education through Project-Based Learning among secondary school students in Sabah, Malaysia. Specifically, the study investigates the contextual and implementation challenges of integrating project management elements in Visual Arts within STEAM education, evaluates its impact on students' engagement and learning outcomes and explores students' lived experiences in a Visual Arts-based STEAM-PBL environment. The study was conducted through the implementation of the ARTSCreaSTEAM Lab module, which incorporated key project management processes such as idea generation, project planning, collaborative production, problem-solving, presentation and reflection.

The significance of this study lies in its contribution to the discourse on STEAM education, Visual Arts pedagogy and project-based learning in Malaysia. By positioning Project Management in Visual Arts as a central pedagogical strategy, this study offers a more focused understanding of how Visual Arts can support interdisciplinary learning in secondary schools. It also provides practical insights for teachers, curriculum planners and policymakers who seek to promote more creative, inclusive and context-responsive STEAM education, particularly in rural Malaysian school contexts. Ultimately, the study argues that Project Management in Visual Arts should be recognized as a meaningful pedagogical mechanism for strengthening creativity, conceptual understanding, collaboration, higher-order thinking and future-oriented learning within STEAM education.

Research Objectives

This study is guided by the following objectives:

1. To investigate the contextual and implementation challenges of integrating Project Management in Visual Arts within STEAM education through Project-Based Learning among secondary school students in Sabah, Malaysia.

2. To evaluate the impact of Project Management in Visual Arts through Project-Based Learning on students' engagement, motivation, conceptual understanding, creative problem-solving and higher-order thinking skills within a STEAM learning environment.

3. To explore students' lived experiences in a Visual Arts-based STEAM Project-Based Learning environment, particularly in relation to autonomy, collaboration, emotional expression, cultural connection and ownership of learning.

Research Questions

Based on the objectives above, this study addresses the following research questions:

1. What are the contextual and implementation challenges of integrating Project Management in Visual Arts within STEAM education through Project-Based Learning among secondary school students in Sabah, Malaysia?

2. How does Project Management in Visual Arts through Project-Based Learning influence students' engagement, motivation, conceptual understanding, creative problem-solving and higher-order thinking skills in STEAM education?

3. How do students experience learning in a Visual Arts-based STEAM Project-Based Learning environment, particularly in relation to autonomy, collaboration, emotional expression, cultural connection and ownership of learning?

LITERATURE REVIEW

The transition from STEM to STEAM has received increasing attention in contemporary educational discourse as educators and researchers seek more holistic, creative, interdisciplinary and future-oriented approaches to learning. STEAM education integrates Science, Technology, Engineering, Arts and Mathematics as a framework that connects technical knowledge with creativity, imagination, communication and authentic problem-solving (Zhang & Ma, 2024; Sanz-Camarero et al., 2023)

Unlike traditional approaches that tend to separate knowledge into distinct subject areas, STEAM emphasizes the interrelationship between disciplines and encourages students to understand issues from broader, more applied and more meaningful perspectives (Mertala et al., 2024). Within this framework, Visual Arts plays a significant role because it enables students to interpret, visualize, organize and communicate complex ideas through visual, symbolic and creative forms (Ozkan, 2022).

In this study, Visual Arts is not viewed merely as a field of aesthetic expression, but as a pedagogical space through which students manage learning processes involving project planning, idea development, creative production, collaboration, presentation, reflection and evaluation. Therefore, the concept of Project Management in Visual Arts is important because it provides a systematic structure for implementing STEAM learning.

Through project management, students do not simply produce artistic outcomes; they also engage in decision-making, problem-solving, resource management, interdisciplinary thinking and evaluation of their own work. These processes are closely aligned with the principles of Project-Based Learning (PBL), which emphasizes

inquiry, authentic experience, collaboration and the production of meaningful outcomes (Nicolas & Ramos, 2022 ; Sánchez & Cortés, 2024)

Research by Chung & Li (2021) and Tuveri et al. (2024) has shown that Project-Based Learning supports student engagement, creativity, collaborative learning and higher-order thinking skills within STEAM environments In Visual Arts education specifically, PBL enables students to engage more actively with interdisciplinary tasks while developing both conceptual understanding and practical problem-solving skills Consequently, integrating Project Management in Visual Arts within STEAM education provides opportunities for students to experience authentic learning processes that combine artistic creativity with scientific and technological inquiry. (Buruntong et al., 2025a).

This literature review is organized around five major areas. First, it discusses the conceptual foundation of STEAM education and the importance of Visual Arts in interdisciplinary learning. Second, it examines Project Management in Visual Arts as a pedagogical process that supports STEAM learning. Third, it explains the potential of Project-Based Learning as an appropriate approach for integrating Visual Arts with STEAM. Fourth, it discusses the Malaysian educational context, particularly the aspirations and challenges surrounding STEAM implementation, Visual Arts education, secondary schooling and rural education.

Finally, it identifies the research gaps that justify the present study in the context of Sabah, Malaysia. This organization is aligned with the focus of the study, which examines the repositioning of Project Management in Visual Arts within STEAM education through Project-Based Learning among secondary school students in Sabah.

The Foundation of STEAM Education and Visual Arts Integration

STEAM education emerged from the need to expand the STEM framework, which traditionally focuses on scientific, technological, engineering and mathematical knowledge. Although STEM is essential for developing scientific literacy and technological competence, it has often been criticized for giving insufficient attention to creativity, imagination, human values, visual communication and design thinking (Zhang & Jia, 2024; Yin et al., 2021)

The inclusion of the Arts in STEAM allows learning to become more balanced because students are not only trained to seek accurate answers, but are also encouraged to explore multiple possibilities, view problems from different perspectives and develop creative and contextual solutions (Saseendran & Thomas, 2025). In this regard, Visual Arts contributes significantly by providing a medium through which abstract ideas can be translated into visible, tangible, discussable and evaluative forms (Zhang & Jia, 2024).

The integration of Visual Arts into STEAM enables students to develop visualization skills, spatial reasoning, symbolic interpretation and visual communication (Ramli et al., 2025; Zhang & Jia, 2024). Concepts in science, technology, engineering and mathematics are often abstract and difficult to understand through text, formulas, or verbal explanation alone.

Through activities such as sketching, modelling, concept mapping, visual design, painting, sculpture and prototyping, students are able to construct a more concrete understanding of the concepts they learn (Buruntong et al., 2025a). For example, concepts related to ecosystems, sustainability, structural design, mathematical patterns and scientific processes can be represented visually in ways that are easier to understand and communicate. In this sense, Visual Arts functions as a cognitive tool that helps students organize knowledge, make connections between ideas and communicate their understanding creatively (Zhang & Jia, 2024).

Visual Arts integration in STEAM also challenges the traditional separation between academic and creative subjects. In many school contexts, science and mathematics are often positioned as more academically important than the arts. This perception causes Visual Arts to be viewed as a secondary, recreational, or supplementary subject rather than as a meaningful contributor to intellectual development. However, STEAM challenges this

dichotomy by emphasizing that innovation requires both technical precision and creative imagination. Scientific knowledge alone is insufficient if students are unable to design solutions, communicate ideas effectively, understand human needs and evaluate the social and cultural implications of innovation. Therefore, Visual Arts should be positioned as an important pedagogical component in STEAM education rather than as a decorative addition to STEM (Thu et al., 2024).

In the context of this study, Visual Arts integration becomes more specific when it is linked to project management. Project Management in Visual Arts provides students with opportunities to experience the full cycle of active learning, beginning with problem identification, idea generation, action planning, material selection, artwork production, revision, presentation and reflection. This process allows Visual Arts to function as a structured form of learning that combines creativity with discipline, planning, critical thinking and problem-solving. Therefore, STEAM education that integrates Visual Arts through project management can provide students with a more meaningful, comprehensive and relevant learning experience that responds to the needs of 21st-century learners (Mohd Noor & Mohd Hawari, 2020).

Project Management in Visual Arts as a Pedagogical Process

Project Management in Visual Arts refers to a systematic process involving the planning, implementation, monitoring, evaluation and reflection of an art-based project (Buruntong et al., 2025a). In an educational context, project management is not merely concerned with completing an assignment; it also involves students' ability to understand project objectives, manage time, divide roles, select appropriate materials, solve technical problems, make creative decisions and evaluate the effectiveness of their final work (Kokotsaki et al., 2016). This process transforms Visual Arts into a complex and meaningful learning experience because students are not assessed only on the final product, but also on how they think, collaborate, adjust strategies and construct meaning throughout the process of art-making (Zhang & Jia, 2024).

In Visual Arts education, project management allows students to experience learning processes that resemble authentic practices in art, design, innovation and the creative industries (Thu, 2024). Artists and designers do not create work without planning; they identify problems, conduct research, develop preliminary sketches, select media, test approaches, receive feedback, make improvements and present final outcomes (Mertala et al., 2024).

When these processes are brought into the classroom, students begin to understand that art-making is not simply an expressive activity, but an intellectual process that requires critical thinking, organization, creativity and responsibility (Milara & Orduña, 2024). This is closely aligned with the goals of STEAM education, which emphasizes the integration of knowledge, skills, creativity and real-world application (Saseendran & Thomas, 2025).

Project Management in Visual Arts also supports the development of 21st-century skills. Through Visual Arts-based STEAM projects, students need to communicate with group members, present proposals, listen to alternative viewpoints, make collective decisions and resolve conflicts that emerge during project work (Buruntong et al., 2025a). They also need to think critically when selecting appropriate visual strategies to represent scientific, technological, engineering or mathematical concepts (Zhang & Jia, 2024).

At the same time, they develop creativity by exploring materials, techniques, symbols, colours, forms and compositions to communicate ideas effectively (Thu et al., 2024). These processes show that project management in Visual Arts can serve as a strong platform for developing communication, collaboration, creativity, critical thinking and learner autonomy (Kokotsaki et al., 2016 ; Saseendran & Thomas, 2025).

In STEAM education, project management is especially important because interdisciplinary learning requires a clear structure. Without effective project management, the integration of Visual Arts with science, technology, engineering and mathematics may remain superficial. For instance, a project that merely asks students to draw a science-related theme without inquiry, design, experimentation or reflection does not necessarily represent meaningful STEAM integration.

In contrast, when project management is embedded in the learning process, students are encouraged to understand problems, connect concepts, conduct research, develop visual solutions, test ideas and explain the rationale behind their work. Therefore, project management helps ensure that Visual Arts functions as an active, intellectual and pedagogically meaningful process within STEAM education (Buruntong & Kindoyop, 2024).

The Potential of Project-Based Learning in STEAM Education

Project-Based Learning (PBL) is highly compatible with the goals of STEAM education because both emphasize active learning, problem-solving, collaboration, creativity and the application of knowledge in real-world contexts (Kokotsaki et al., 2021; Saseendran & Thomas, 2025). In PBL, students do not merely receive information from teachers. Instead, they are directly involved in investigating questions, planning solutions, producing outcomes and presenting their learning (Condliffe, 2021). This approach enables students to construct knowledge through experience, social interaction, trial and error and reflection (Krajcik & Shin, 2021). Since STEAM requires connections across multiple disciplines, PBL offers an effective pedagogical strategy for operationalizing interdisciplinary learning in the classroom (Milara & Orduña, 2024).

In the context of Visual Arts, PBL provides students with broad opportunities to explore ideas creatively and systematically. Visual Arts projects usually involve extended processes, including idea exploration, visual research, sketching, material selection, experimentation with techniques, artwork production, critique, revision and presentation (Zhang & Jia, 2024). These processes are highly consistent with the structure of PBL because both emphasize learning through process rather than merely focusing on final outcomes (Buruntong et al., 2025).

When Visual Arts is integrated with STEAM through PBL, students can explore real-world issues such as climate change, pollution, sustainability, community design, biodiversity and technology use through creative and interdisciplinary approaches (Thu et al., 2024). They do not only understand such issues theoretically, but also produce artworks, models, or prototypes that reflect their understanding, perspectives and proposed solutions (Zhang & Jia, 2024).

PBL can also enhance student engagement and motivation because it gives students a stronger sense of ownership over their learning (Condliffe et al., 2017). In traditional instruction, students often follow teacher directions in a linear manner and their work may be limited to predetermined answers or fixed outcomes. By contrast, PBL allows students to make choices, determine approaches, work collaboratively, solve challenges and see the results of their efforts in tangible forms (Kokotsaki et al., 2021).

In Visual Arts-based STEAM projects, students can see the relationship between academic knowledge and their everyday lives. For example, when students create works related to local ecosystems or design solutions for environmental issues in their community, learning becomes more connected to real experience and more meaningful at emotional, social and cultural levels (Hawari & Mohd Noor, 2020 ; Buruntong et al., 2025a).

In addition to increasing motivation, PBL supports the development of higher-order thinking skills. Students are required to analyse problems, synthesize information from different sources, compare alternatives, evaluate the effectiveness of ideas and justify the decisions they make (Krajcik & Shin, 2014). In Visual Arts, this process occurs when students select symbols, colours, forms, materials and techniques to communicate STEAM-related concepts (Zhang & Jia, 2024).

They also need to explain why particular visual choices are used and how their work represents their understanding of the concepts studied. In this way, Visual Arts becomes not merely a medium of expression but also a medium of thinking (Thu et al., 2024). PBL makes the artistic process more reflective, analytical and directly connected to students' cognitive development (Saseendran & Thomas, 2025).

International Perspectives on Visual Arts in STEAM

International literature generally indicates that integrating Visual Arts into STEAM education can enhance

creativity, conceptual understanding, visual communication, design-based problem-solving and student engagement (Zhang & Jia, 2024; Saseendran & Thomas, 2025). In various educational contexts, Visual Arts has been used to help students understand complex scientific and mathematical concepts through visual representation, models, sketches, animation and prototypes (Thu et al., 2024).

This suggests that Visual Arts is not merely a domain of personal expression, but also a method for constructing knowledge and communicating ideas more clearly (Henriksen, 2017; Buruntong et al., 2026). In STEAM education, the ability to transform abstract ideas into visual forms is an important skill because it helps students recognize relationships between concepts, structures, processes and outcomes (Zhang & Jia, 2024).

International perspectives also emphasize that the arts in STEAM should be integrated as a core component rather than treated as an additional activity after science or mathematics learning has been completed (Mertala et al., 2024). When art is used only as decoration or as a concluding activity, its potential as a tool for thinking is not fully realized (Henriksen, 2017; Buruntong et al., 2025b).

However, when Visual Arts is embedded from the beginning of the learning process, students can use art to explore questions, develop ideas, test possibilities, reflect on learning and communicate knowledge (Saseendran & Thomas, 2025). This approach positions the arts as an essential part of the entire learning cycle. In this regard, project management in Visual Arts is relevant because it ensures that each phase of learning, from planning to evaluation, is conducted systematically and meaningfully (Buruntong & Kindoyop, 2024).

A research by Oad et al., (2026) suggests that STEAM education with Visual Arts integration can support inclusive learning. Students have different learning styles, strengths and backgrounds. Some students may not excel in written tasks or formal calculations but may demonstrate deep understanding through visual forms, models, or creative products.

By providing multiple pathways for expressing knowledge, Visual Arts helps make STEAM more accessible to students with diverse abilities, interests, cultural backgrounds and experiences (Zhang & Jia, 2024). This is particularly important in rural schools and communities with unique social and cultural contexts, where students can connect learning with their identities, environments and lived experiences (Oad et al., 2026)

However, international literature also shows that the effectiveness of Visual Arts integration in STEAM depends on several key factors. These include teacher readiness, curriculum design, availability of resources, understanding of interdisciplinary pedagogy and institutional support (Milara & Orduña, 2024). Teachers need to understand not only their own subject content, but also how to connect that content meaningfully with other disciplines (Saseendran & Thomas, 2025).

If teachers lack training or confidence in implementing STEAM, arts integration may remain superficial and may not achieve its full pedagogical potential (Mertala et al., 2024). Therefore, international perspectives provide an important foundation for the present study, but these insights still require examination within the local context, particularly in Sabah, where geographical realities, resource limitations and cultural diversity may shape implementation in distinctive ways.

The Malaysian Context: Aspirations, Implementation and Challenges

In Malaysia, national educational aspirations increasingly emphasize creativity, innovation, critical thinking, collaboration, digital literacy and student-centred learning, as reflected in the Malaysia Education Blueprint 2013–2025 and its emphasis on higher-order thinking skills and 21st-century learning (Ministry of Education Malaysia, 2013). These aspirations are consistent with the goals of STEAM education, which promotes the integration of knowledge and skills across disciplines (Hawari & Mohd Noor, 2020).

However, the implementation of STEAM education at the classroom level continues to face various challenges, particularly in secondary schools. Although educational policy emphasizes the need to develop creative and

innovative learners, classroom practice is still strongly influenced by teacher-centred instruction, curriculum pressure, examination orientation and the traditional separation of subjects (Riduan & Othman, 2024). As a result, the integration of Visual Arts into STEAM has not yet been implemented consistently or comprehensively.

Visual Arts in schools is often perceived as less important than science, mathematics, or technology-based subjects. This perception influences how Visual Arts is valued, taught and integrated into interdisciplinary learning. In Malaysia, Visual Arts education has also been affected by subject-streaming practices and the perception that arts subjects are more suitable for lower-achieving students, which may marginalise the academic value of Visual Arts (Ponijan et al., 2019).

In some cases, Visual Arts is regarded mainly as a space for creative expression rather than as a field that can support scientific thinking, solution design, conceptual communication and the development of higher-order thinking skills. Such a view limits the potential of Visual Arts as a meaningful component of STEAM education. Therefore, repositioning Project Management in Visual Arts is necessary to demonstrate that the arts have clear pedagogical value in developing understanding, creativity, collaboration and problem-solving (Hawari & Mohd Noor, 2020).

The challenges of STEAM implementation in Malaysia are also closely related to teacher readiness. STEAM education requires teachers to design activities that connect multiple disciplines authentically, rather than simply combining them at a thematic level. Visual Arts teachers, for example, need to understand how artistic processes can be connected to scientific, technological, engineering and mathematical concepts. At the same time, teachers from other disciplines need to view the arts as a pedagogical partner that can strengthen learning rather than as an additional component with limited academic value.

Without sufficient professional training, teachers may struggle to design genuinely interdisciplinary activities, particularly because teacher exposure, training, facilities and confidence remain key concerns in STEM/STEAM implementation (Riduan & Othman, 2024). This may cause STEAM implementation to become limited, shallow, or dependent solely on individual teacher initiative.

These challenges become more significant in rural schools, including those in Sabah. Rural schools may face constraints related to technological facilities, art materials, equipment, learning spaces, access to teacher training and institutional support (Buruntong et al., 2025a). Nevertheless, rural contexts also offer unique pedagogical potential because students live in environments rich with natural, cultural, community-based and local experiences. These elements can serve as meaningful resources for Visual Arts-based STEAM projects.

For instance, issues related to biodiversity, environmental sustainability, local crafts, traditional design, community resources and ecological awareness can be used as starting points for project-based learning. Therefore, research in the context of Sabah is important because it can show how local challenges and opportunities influence the implementation of Project Management in Visual Arts through STEAM-PBL (Buruntong et al., 2025a).

Visual Arts, Cultural Identity and Contextual Learning in Sabah

A study by Buruntong & Kindoyop, (2024) shows that Sabah is characterized by rich cultural, ethnic, linguistic, environmental and visual heritage. In Visual Arts education, this diversity is a valuable pedagogical resource because students can connect learning with their lived experiences, cultural identities, communities and surrounding environments When Visual Arts is integrated into STEAM education, local elements such as flora and fauna, landscapes, traditional motifs, natural materials, community practices and environmental issues can become the foundation for meaningful project work (Buruntong et al., 2025a). This approach can make STEAM learning more connected to students' lives, especially in rural schools where students often have close relationships with nature and local communities (Morari, 2023).

Contextual learning can also increase students' engagement and sense of meaning. Students are more likely to understand a concept when they can see its connection to their own realities (Johnson, 2002). For example, a project on environmental sustainability becomes more meaningful when it is connected to rivers, forests, agriculture, biodiversity, or community spaces that students know personally (Buruntong et al., 2025a).

Through Visual Arts, students can represent such issues through artworks, models, posters, installations, or visual narratives that reflect their understanding of the relationship between humans, nature, technology and society (Hawari & Mohd Noor, 2020). This process not only strengthens their understanding of STEAM concepts, but also develops awareness of social and environmental responsibility (Perignat & Katz-Buonincontro, 2019).

In the context of Project Management in Visual Arts, contextual learning in Sabah provides students with opportunities to manage projects rooted in real experience. They may observe their environment, identify local issues, gather information, discuss ideas with peers, select suitable materials, produce artworks and present their messages or solutions to the school community (Kokotsaki, Menzies, & Wiggins, 2016).

This process makes learning more active and authentic because students are not only learning about concepts; they are also applying those concepts in contexts they understand (Thomas, 2000). In this way, Visual Arts becomes a medium that connects academic knowledge with students' cultural and social experiences.

However, this potential requires appropriate pedagogical support. Teachers need to help students recognize the relationships between culture, visual representation, science, technology, engineering and mathematics (Yakman & Lee, 2012). Without structured guidance, culturally based art projects may become activities focused only on producing artworks without meaningful interdisciplinary connections (Perignat & Katz-Buonincontro, 2019).

Therefore, project management and PBL play important roles in ensuring that the learning process has clear objectives, organized steps and meaningful reflection (Kokotsaki, Menzies, & Wiggins, 2016). In this study, Sabah is not merely the geographical location of the research; it is also an important contextual dimension that shapes how students experience, understand and make meaning from STEAM learning through Visual Arts.

Gaps in the Existing Literature

Although existing literature indicates that the integration of Visual Arts into STEAM education has strong potential, several important gaps remain. First, local empirical research examining Visual Arts integration in STEAM within Malaysian secondary schools remains limited, particularly in rural and under-resourced contexts. Much of the available literature is based on international contexts or general theoretical discussions. As a result, there is still insufficient understanding of how Visual Arts integration is implemented in the realities of Malaysian classrooms. Therefore, context-based studies, particularly in rural secondary schools in Sabah, are necessary to understand the challenges, processes and effects of implementation more deeply (Buruntong et al., 2025a).

Second, many discussions of STEAM use the term "arts" broadly without clearly distinguishing Visual Arts from music, drama, dance, or other artistic disciplines. This lack of specificity makes it difficult to identify the unique contribution of Visual Arts to STEAM learning. Visual Arts has distinctive characteristics, particularly in terms of visual representation, spatial reasoning, symbolic communication, design thinking and the production of objects or images that can be analysed. Therefore, studies that focus specifically on Visual Arts are needed to clarify how this discipline contributes to conceptual understanding, creativity, critical thinking and interdisciplinary learning. In the present study, the focus on Project Management in Visual Arts allows the role of Visual Arts to be examined more clearly and systematically (Buruntong et al., 2025b).

Third, the relationship between Visual Arts, project management, STEAM and PBL has not been widely explored in an integrated manner, particularly in Southeast Asian and Malaysian contexts. Studies on PBL often emphasize active learning and problem-solving, while studies on STEAM tend to emphasize disciplinary

integration. However, fewer studies examine how project management in Visual Arts can serve as a pedagogical mechanism that connects these two approaches. This is important because without a project management structure, STEAM-PBL implementation may not achieve the depth expected of interdisciplinary learning. Therefore, this study addresses this gap by examining how planning, production, collaboration, presentation and reflection in Visual Arts can support STEAM learning (Wu et al., 2025 ; Buruntong et al., 2026).

Fourth, relatively little attention has been given to students' lived experiences in Visual Arts-based STEAM learning environments. Many studies evaluate educational approaches based on achievement, products, or teacher perceptions, but fewer examine how students experience the learning process in terms of autonomy, collaboration, motivation, emotional expression and cultural connection. In PBL, students' voices are important because they are active participants who construct knowledge through experience. Therefore, this study pays attention to students' experiences in order to understand how they make meaning from learning, how they interact with peers and how Visual Arts helps them communicate understanding in creative and contextual ways (Tam, 2023 ; Buruntong et al., 2026).

THEORETICAL FRAMEWORK

This study is theoretically grounded in the New Product Development (NPD) theory, particularly Cooper's Stage-Gate Model (Cooper, 1990) and the later Agile–Stage-Gate perspective developed by Cooper and Sommer (Cooper & Sommer, 2020). These theoretical foundations are appropriate for the present study because the research focuses on Project Management in Visual Arts within STEAM education through Project-Based Learning.

In this study, students' Visual Arts projects are not treated merely as artistic classroom tasks or final creative products. Instead, they are conceptualized as structured project-based learning processes that involve idea generation, exploration, planning, development, testing, refinement, production, presentation and reflection (Kokotsaki, Menzies, & Wiggins, 2016).

Cooper's Stage-Gate Model provides the foundation for understanding project development as a systematic process that moves through several stages separated by review points or decision gates (Cooper, 1990). In its original context, the model was developed to guide new product development by ensuring that ideas are evaluated, refined and improved before progressing to the next phase.

Although the model originated in product innovation and industrial project management, its underlying logic is highly relevant to Visual Arts education. Visual Arts projects also involve the development of ideas into tangible outcomes through stages of investigation, design, production, evaluation and improvement (Hawari & Mohd Noor, 2020). Therefore, the Stage-Gate logic can be adapted pedagogically to help students manage creative projects in a more organized and purposeful manner.

Cooper and Sommer's Agile–Stage-Gate perspective further strengthens this theoretical foundation by introducing flexibility, iteration, feedback and continuous improvement into the project development process (Cooper & Sommer, 2020). This is particularly important in Visual Arts-based STEAM learning because creative work is rarely linear. Students may need to revisit their initial ideas, revise sketches, modify materials, respond to teacher and peer feedback, solve unexpected problems and refine their final products (Perignat & Katz-Buonincontro, 2019).

Therefore, the Agile–Stage-Gate perspective allows project management in Visual Arts to be understood as both structured and flexible. It provides an appropriate theoretical lens for examining how students manage creative projects within a Project-Based Learning environment, especially in a rural secondary school context where available resources, time and classroom conditions may require adaptation.

Based on these theoretical foundations, this study applies a researcher-adapted Visual Arts Project Management Framework. The framework was developed by adapting the staged decision-making structure of Cooper's Stage-

Gate Model (Cooper, 1990) and the flexible, iterative principles of the Agile–Stage-Gate approach (Cooper & Sommer, 2020). The adapted framework was designed specifically for Visual Arts-based STEAM education and consists of a sequence of project stages and review gates that guide students from initial idea generation to final production, presentation and reflection. This framework serves as the central theoretical and procedural model for understanding how students plan, manage, develop, refine and evaluate Visual Arts projects within the ARTSCreaSTEAM Lab module.

New Product Development Theory and Cooper's Stage-Gate Model

Cooper's Stage-Gate Model is one of the most influential models in New Product Development (NPD) theory (Cooper, 1990). The model proposes that successful innovation requires a systematic movement from one stage of development to another, with each stage separated by a gate or decision point. Each stage involves specific project activities, while each gate functions as an evaluative checkpoint where the project is reviewed before it proceeds further (Cooper, 1990). The model is useful because it provides structure, reduces uncertainty, improves decision-making and ensures that the development process is continuously monitored (Cooper, Edgett, & Kleinschmidt, 2002).

In the context of this study, the Stage-Gate Model is adapted to suit the educational and creative nature of Visual Arts project management. Students' creative projects are understood as developmental processes that begin with the generation of ideas and progress through exploration, planning, development, testing, production, presentation and reflection (Kokotsaki, Menzies, & Wiggins, 2016). Each stage requires students to make decisions, manage resources, apply knowledge, respond to feedback and improve their work. This makes the model highly relevant to Project-Based Learning because students are expected to work through a meaningful process rather than simply produce a final artifact (Thomas, 2000).

The Stage-Gate approach is particularly useful in STEAM education because interdisciplinary projects often involve complex connections between artistic, scientific, technological, engineering and mathematical ideas (Perignat & Katz-Buonincontro, 2019). Without a clear project structure, these connections may remain superficial or fragmented. By adapting Cooper's staged project logic, this study provides a clearer pathway for students to move from abstract ideas to concrete visual outcomes. The model helps ensure that Visual Arts is not treated merely as decoration or an end-product activity, but as a structured process of inquiry, design, experimentation, evaluation and communication (Hawari & Mohd Noor, 2020).

Cooper and Sommer's Agile–Stage-Gate Perspective

While Cooper's original Stage-Gate Model emphasizes structured progression, Cooper and Sommer's Agile–Stage-Gate perspective introduces greater flexibility into the project development process (Cooper & Sommer, 2020). This perspective is important because it recognizes that project work does not always move in a straight line. In many real project contexts, teams must revisit decisions, respond to feedback, test alternative solutions, revise products and adapt to changing conditions (Cooper & Sommer, 2020). This idea is especially relevant to Visual Arts education, where creativity often develops through experimentation, uncertainty, reflection and revision (Perignat & Katz-Buonincontro, 2019).

In this study, the Agile–Stage-Gate perspective supports the idea that Visual Arts project management should be both organized and flexible. Students need a clear project pathway, but they also need opportunities to revisit earlier ideas, improve their work and respond creatively to problems that arise during the project (Kokotsaki, Menzies, & Wiggins, 2016). For example, a student group may begin with one visual concept, but after testing materials or receiving feedback, they may realize that the idea needs to be modified. This process of revision does not represent failure; rather, it reflects authentic project development and creative learning (Thomas, 2000).

The Agile–Stage-Gate perspective is also highly relevant to the context of secondary school students in Sabah, Malaysia. In rural or under-resourced school settings, teachers and students may face constraints related to time, materials, facilities, technology and curriculum demands (Riduan & Othman, 2024). A rigid project model may

not fully suit these realities. However, an agile and adaptive approach allows students and teachers to adjust their project plans according to available resources and classroom conditions. Therefore, Cooper and Sommer's perspective strengthens the framework by making it more responsive to the practical realities of Visual Arts-based STEAM learning (Buruntong et al., 2025).

Researcher-Adapted Visual Arts Project Management Framework

The researcher-adapted Visual Arts Project Management Framework developed in this study consists of a sequence of stages and gates that guide students through the full cycle of project-based Visual Arts learning. The framework begins with idea generation and ends with reflection and documentation, showing that Visual Arts project work involves both creative production and systematic management. This framework is adapted from Cooper's Stage-Gate logic and Cooper and Sommer's Agile–Stage-Gate perspective, but it has been redesigned to suit the context of Visual Arts education, STEAM learning and Project-Based Learning.

The framework begins with the generation of ideas, themes, issues and artistic inspiration. This initial phase encourages students to identify possible project directions based on STEAM-related themes, local contexts, environmental issues, cultural references, or creative interests. The first review gate involves an initial suitability check, where students and teachers examine whether the proposed idea is appropriate in terms of theme, project stage, curriculum needs and available resources. This gate ensures that students' ideas are not only creative, but also feasible and aligned with the learning objectives.

The next phase involves preliminary exploration, including the development of ideas, early sketches, visual studies and initial STEAM recognition. At this stage, students begin to connect artistic concepts with STEAM-related knowledge. They explore possible visual forms, materials, concepts and interdisciplinary links. The second gate involves selecting the best idea and reviewing its feasibility. This step allows students to compare different ideas, assess their strengths and weaknesses and choose the most suitable project direction before moving into more detailed planning.

The planning phase involves determining project objectives, materials, techniques, time allocation, roles, processes and documentation. This phase is central to project management because it requires students to organize their work systematically. They need to decide what they want to produce, how they will produce it, what materials they need, how tasks will be divided and how progress will be documented. The third gate functions as a decision point where the teacher and students evaluate whether the project is ready to be implemented. This stage reflects Cooper's gate-review principle, where a project must be reviewed before it proceeds to development.

The development phase involves the creation of early artworks, prototypes, sketches, or experimental techniques. Students test their ideas through visual experimentation and begin transforming abstract concepts into tangible forms. This phase reflects the iterative nature of Visual Arts learning because students may need to try different methods, adjust their designs, or improve technical aspects of their work. The fourth gate involves a progress review, where students examine project advancement, problems encountered, improvements needed and critical processes. This gate is aligned with the Agile–Stage-Gate perspective because it allows students to revise and improve their work before producing the final outcome.

The testing and refinement phase involves technical testing, material testing, artwork evaluation, reflection and improvement. At this stage, students assess the quality, function, meaning and effectiveness of their project. They may review the suitability of materials, the clarity of visual communication, the strength of STEAM integration and the overall impact of their work. The fifth gate functions as a final review before presentation or exhibition. This ensures that students' projects have undergone sufficient evaluation and refinement before they are shared with others.

The final production phase involves the completion of the final artwork, project presentation and appreciation or critique activities. At this stage, students communicate their project outcomes, explain their creative decisions

and demonstrate their understanding of STEAM concepts through both visual and verbal presentations. The final stage also includes teacher and student reflection, documentation of the project process, evaluation and consideration of the project's transferability or usability in other contexts. This stage is important because it encourages students to reflect on what they have learned, how they solved problems, how they collaborated with peers and how their project could be improved or applied beyond the classroom.

Table 1 presents the summary of the stages and gates in the adapted framework.

Table 1:Stages and Gates in the Adapted Framework

Component	Focus	Function in Visual Arts Project Management
Idea Generation	Idea, theme, issue and artistic inspiration	Encourages students to identify project themes and creative directions related to STEAM learning.
Gate 1: Initial Suitability Review	Theme, project stage, curriculum needs and resources	Ensures that the project idea is appropriate, feasible and aligned with learning objectives.
Stage 1: Preliminary Exploration	Early ideas, sketches, artwork studies, visual research and initial STEAM recognition	Allows students to explore concepts, visual possibilities and interdisciplinary connections.
Gate 2: Idea Selection and Feasibility Review	Selection of the best idea and feasibility check	Helps students choose the most suitable and workable project idea.
Stage 2: Project Planning	Objectives, materials, techniques, time, roles, tasks, process and documentation	Guides students to organize project implementation systematically.
Gate 3: Implementation Decision	Confirmation of project suitability for implementation	Determines whether the project is ready to proceed to the development phase.
Stage 3: Project Development	Early artwork, prototype, sketches and experimental techniques	Enables students to develop, test and refine creative ideas through visual experimentation.
Gate 4: Progress Review	Progress, problems, improvements and critical processes	Supports feedback, revision and improvement during project development.
Stage 4: Testing and Refinement	Technical testing, material testing, artwork assessment, reflection and improvement	Allows students to evaluate and refine the quality and effectiveness of their work.
Gate 5: Final Review Before Presentation	Final check before presentation, exhibition or submission	Ensures that the project is ready to be presented and assessed.
Stage 5: Final Production and Presentation	Final artwork, presentation, exhibition and appreciation	Enables students to communicate their outcomes and explain their creative and STEAM-related decisions.
Final Reflection	Teacher and student reflection, process documentation, evaluation and usability	Encourages reflection on learning, collaboration, challenges, outcomes and future improvement.

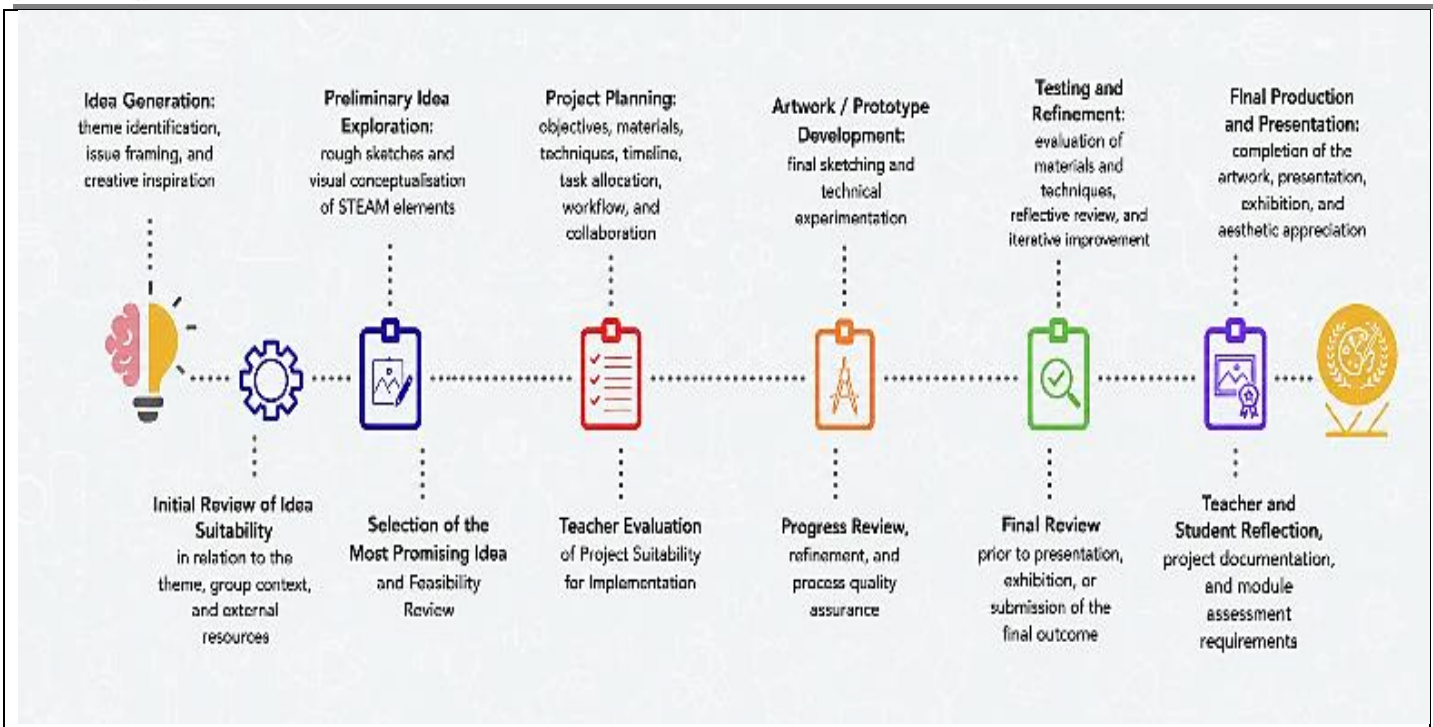

Figure 1 : Researcher-Adapted Visual Arts Project Management Framework based on Cooper's Stage-Gate Model and Cooper and Sommer's Agile–Stage-Gate Perspective

Figure 1 illustrates the researcher-adapted Visual Arts Project Management Framework used in this study. The framework was adapted from Cooper's (1990) Stage-Gate Model and Cooper and Sommer's (2020) Agile–Stage-Gate perspective. It consists of sequential project stages and evaluative gates that guide students from idea generation to final production, presentation and reflection. The stages include preliminary exploration, project planning, project development, testing and refinement, final production and reflective evaluation. The gates function as review points where ideas, feasibility, progress, quality and readiness for presentation are assessed. In the context of this study, the framework provides a structured yet flexible model for managing Visual Arts-based STEAM projects through Project-Based Learning among secondary school students in Sabah, Malaysia.

Application of the Framework in STEAM-PBL

The adapted Visual Arts Project Management Framework is applied in this study through the ARTSCreaSTEAM Lab module. The module guides students through a structured but flexible project cycle that integrates Visual Arts with STEAM concepts. Through this framework, students are not only required to create artworks, but also to manage their project development from initial idea to final reflection. This process supports the principles of Project-Based Learning because students engage in inquiry, planning, collaboration, production, feedback, revision, presentation and reflection.

The framework also helps operationalize the role of Visual Arts within STEAM education. Through idea generation and exploration, students identify themes and connect them with scientific, technological, engineering, or mathematical ideas. Through planning and development, they organize materials, roles, techniques and project processes. Through testing and refinement, they evaluate whether their visual products communicate ideas effectively and whether their creative solutions are meaningful. Through presentation and reflection, they articulate their learning and evaluate their project experience.

This framework is especially important because it positions students as active project managers. They are not passive recipients of teacher instruction, but participants who make decisions, negotiate with peers, respond to constraints and improve their work based on feedback. Teachers, meanwhile, function as facilitators who guide

students through each project stage and gate. This reflects the pedagogical intention of STEAM-PBL, where learning is student-centred, inquiry-driven, creative, collaborative and connected to real-world contexts.

In the context of Sabah, the framework is also suitable because it allows flexibility in responding to local school conditions. Students and teachers may adapt project materials, themes and techniques based on available resources and community contexts. For example, projects may draw on local environmental issues, cultural motifs, natural materials, or community experiences. This makes the framework not only pedagogically structured, but also context-responsive and culturally meaningful.

Theoretical Position of the Study

Based on the adapted framework, this study positions Project Management in Visual Arts as a structured and reflective pedagogical process within STEAM education. Cooper's Stage-Gate Model provides the logic of staged project progression, while Cooper and Sommer's Agile–Stage-Gate perspective supports flexibility, iteration and continuous improvement. The researcher's adapted framework translates these principles into a Visual Arts education context by organizing students' project work into stages and gates that support idea development planning, experimentation, production, evaluation, presentation and reflection.

This theoretical position strengthens the argument that Visual Arts should not be treated merely as an expressive or decorative subject. Instead, Visual Arts can function as a project-based learning platform that supports interdisciplinary understanding, creativity, problem-solving, collaboration and higher-order thinking. Through the adapted framework, students learn to manage creative processes in ways that mirror authentic project development. They learn not only what to produce but also how to plan, justify, evaluate, revise and communicate their work.

Therefore, the theoretical framework of this study provides a direct foundation for examining the implementation and impact of Visual Arts-based STEAM-PBL among secondary school students in Sabah, Malaysia. It explains how structured project management can support meaningful learning and how Visual Arts can be repositioned as a central pedagogical component within STEAM education.

CONCEPTUAL FRAMEWORK

The conceptual framework of this study explains the relationship between Project Management in Visual Arts, STEAM education, Project-Based Learning and students' learning outcomes. It positions Project Management in Visual Arts as the central pedagogical mechanism for integrating Visual Arts into STEAM education (Perignat & Katz-Buonincontro, 2019). Rather than viewing Visual Arts as a final product or supplementary activity, the framework conceptualizes it as a structured and iterative process that guides students through idea generation, exploration, planning, development, testing, refinement, production, presentation and reflection (Hawari & Mohd Noor, 2020).

This framework is informed by the researcher-adapted Visual Arts Project Management Framework, which was developed based on Cooper's Stage-Gate Model (Cooper, 1990) and Cooper and Sommer's Agile–Stage-Gate perspective (Cooper & Sommer, 2020). The Stage-Gate model provides a systematic project sequence, while the Agile–Stage-Gate perspective introduces flexibility, feedback, revision and continuous improvement (Cooper & Sommer, 2020). In this study, these principles are adapted to a Visual Arts-based STEAM-PBL environment, where students manage creative projects through structured stages and evaluative gates (Kokotsaki, Menzies, & Wiggins, 2016).

The framework consists of four main components: inputs, project management process, learning outcomes and contextual factors. The input component includes STEAM concepts, Project-Based Learning, teacher facilitation, student collaboration, available resources, local cultural and environmental contexts and the ARTSCreaSTEAM Lab module (Buruntong et al., 2025). These inputs provide the foundation for meaningful

interdisciplinary project work, particularly within a rural secondary school context in Sabah (Riduan & Othman, 2024).

The project management process forms the core of the framework. It begins with idea generation and preliminary exploration, followed by project planning, creative development, testing and refinement, final production, presentation and reflection (Thomas, 2000). Through these stages, students identify themes, develop sketches, plan materials and roles, test visual solutions, improve their work and communicate STEAM-related understanding through visual and verbal forms (Hawari & Mohd Noor, 2020).

The expected learning outcomes include stronger engagement, higher motivation, improved conceptual understanding, enhanced creativity, collaboration and higher-order thinking skills (Perignat & Katz-Buonincontro, 2019). These outcomes are produced not only through the final artwork, but also through the entire project management process (Kokotsaki, Menzies, & Wiggins, 2016). The framework also recognizes contextual factors such as teacher readiness, resource availability, curriculum flexibility, school support, students' prior learning experiences, time allocation and the rural Sabah context (Riduan & Othman, 2024). These factors may support or constrain the implementation of Visual Arts-based STEAM-PBL.

Overall, this conceptual framework presents learning as a dynamic interaction between structured project management, interdisciplinary STEAM learning, student-centred pedagogy and contextual realities. It shows that Project Management in Visual Arts can function as a bridge between Visual Arts and STEAM by transforming creative classroom activities into organized, reflective and meaningful project-based learning experiences (Buruntong et al., 2025).

Description of the Conceptual Framework

The conceptual framework begins with the input stage, which includes the ARTSCreaSTEAM Lab module, STEAM-related themes, Visual Arts learning content, teacher facilitation, student collaboration, available resources and local contextual elements. These inputs provide the foundation for implementing Project-Based Learning in the Visual Arts classroom. The ARTSCreaSTEAM Lab module acts as the instructional platform through which students are guided to engage with interdisciplinary themes and develop Visual Arts projects that reflect STEAM concepts.

The second stage is the project management process, which represents the main intervention of the study. This process follows the researcher-adapted Visual Arts Project Management Framework. It includes idea generation, preliminary exploration, project planning, creative development, testing and refinement, final production, presentation and reflection. Each stage is supported by evaluative gates that allow students and teachers to review project suitability, feasibility, progress, quality and readiness for presentation. These gates function as checkpoints that ensure the project remains aligned with learning objectives, available resources and STEAM integration.

The third stage is the learning process, where students engage in inquiry, discussion, experimentation, collaboration, problem-solving, visual representation, critique and reflection. This stage explains how learning takes place during the implementation of the project. Students do not merely follow teacher instructions; they actively construct understanding through hands-on project work, peer interaction, creative decision-making and reflective practice. Through this process, Visual Arts becomes a medium for exploring STEAM concepts, expressing ideas and developing interdisciplinary understanding.

The final stage is the output stage, which refers to the expected learning outcomes of the study. These include increased engagement, stronger motivation, improved conceptual understanding, enhanced creativity, better collaboration, greater autonomy, emotional and cultural expression and the development of higher-order thinking skills. Students' final artworks, project documentation, reflective journals, presentations and interview responses serve as evidence of these outcomes. The framework therefore allows the study to examine both the process and

impact of Project Management in Visual Arts within STEAM education. Table 2 presents the conceptual framework components.

Table 2: Conceptual Framework Components

Component		Elements		Function in the Study
Inputs	➡	ARTSCreaSTEAM Lab module, STEAM themes, Visual Arts content, teacher facilitation, student collaboration, resources, local context	➡	Provides the foundation for implementing Visual Arts-based STEAM-PBL.
Visual Arts Project Management Process	➡	Idea generation, preliminary exploration, project planning, creative development, testing and refinement, final production, presentation, reflection	➡	Guides students through a structured and iterative project cycle adapted from Cooper's Stage-Gate and Agile–Stage-Gate principles.
Learning Processes	➡	Inquiry, discussion, experimentation, collaboration, problem-solving, visual representation, critique, revision, reflection	➡	Explains how students construct knowledge and develop understanding through project-based learning.
Learning Outcomes	➡	Engagement, motivation, conceptual understanding, creativity, collaboration, autonomy, HOTS, emotional and cultural expression	➡	Represents the expected impact of Project Management in Visual Arts within STEAM-PBL.
Contextual Factors	➡	Teacher readiness, resources, curriculum flexibility, time, school support, rural Sabah context	➡	Influences the effectiveness and sustainability of implementation.

Table 2 illustrates the conceptual framework of the study. The framework shows how Project Management in Visual Arts functions as the central pedagogical mechanism for integrating Visual Arts into STEAM education

through Project-Based Learning. The framework begins with key inputs, including the ARTSCreaSTEAM Lab module, STEAM themes, Visual Arts content, teacher facilitation, student collaboration, resources and local contextual elements. These inputs support the implementation of the researcher-adapted Visual Arts Project Management Framework, which guides students through idea generation, preliminary exploration, project planning, creative development, testing and refinement, final production, presentation and reflection.

The framework further shows that the project management process activates meaningful learning experiences such as inquiry, collaboration, problem-solving, visual representation, feedback, revision and reflective practice. These processes are expected to contribute to positive student outcomes, including engagement, motivation, conceptual understanding, creativity, collaboration, autonomy, higher-order thinking and cultural expression. The framework also recognizes that contextual factors such as teacher readiness, resource availability, curriculum flexibility, time allocation, school support and the rural Sabah context may influence the effectiveness of implementation.

METHODOLOGY

Research Design

This study employed a qualitative case study design to examine the repositioning of Project Management in Visual Arts within STEAM education through Project-Based Learning among secondary school students in Sabah, Malaysia. A qualitative approach was considered appropriate because the study sought to explore the processes, experiences, challenges and meanings constructed by students and teachers during the implementation of Visual Arts-based STEAM projects. Rather than measuring learning outcomes statistically, the study focused on understanding how students planned, developed, refined, presented and reflected on their Visual Arts projects within an interdisciplinary learning environment (Lavarda & Bellucci, 2022).

The case study design was selected because it allowed for an in-depth investigation of a bounded educational context, namely a rural secondary school implementing the ARTSCreaSTEAM Lab module. This design enabled the researchers to examine the implementation of Project Management in Visual Arts as it occurred naturally within the classroom setting. It also provided opportunities to capture multiple perspectives from students and teachers, particularly in relation to project planning, collaboration, creative production, problem-solving and reflection. Since the study aimed to understand both the process and impact of Visual Arts-based STEAM-PBL, a qualitative case study design provided an appropriate methodological foundation (Priya, 2020).

The study was situated within an interpretive research paradigm. This paradigm assumes that educational experiences are shaped by context, interaction and meaning-making. In this study, students' learning experiences were understood through their participation in project-based activities, their interactions with peers and teachers and their engagement with Visual Arts as a medium for exploring STEAM concepts.

The interpretive orientation also allowed the study to examine how students made sense of project management processes, how teachers facilitated learning and how contextual factors such as resources, time, curriculum demands and rural school realities influenced implementation.

Research Context

The study was conducted in a public secondary school located in Kota Marudu, Sabah, Malaysia. The school was selected because it represents a rural educational context where the implementation of STEAM education may be shaped by resource availability, teacher readiness, infrastructure and local community conditions. Rural schools are important sites for examining STEAM-PBL because they often face implementation constraints, yet they also provide meaningful opportunities for contextualized learning through local culture, environment and community-based experiences.

The choice of this research context was aligned with the aim of the study, which was to examine how Project Management in Visual Arts could be implemented within STEAM education in a real classroom environment. The rural Sabah context was particularly relevant because students' surroundings, cultural background, local ecological conditions and available materials could influence the way they generated ideas and developed Visual Arts projects. Therefore, the research context was not treated merely as a location, but as an important factor that shaped the implementation and meaning of Visual Arts-based STEAM-PBL.

Participants

The participants consisted of 63 Form One students and three experienced Visual Arts teachers. The Form One students were selected because they were at an early stage of secondary education and were still developing their attitudes toward learning, creativity, collaboration and interdisciplinary classroom activities. This level was also suitable because students were not yet under heavy pressure from major national examinations, allowing greater flexibility for project-based and exploratory learning activities.

The three Visual Arts teachers were involved as facilitators of the ARTSCreaSTEAM Lab module. They played an important role in guiding students through the stages of Visual Arts project management, including idea generation, exploration, planning, development, testing, refinement, presentation and reflection. The teachers also contributed to the study through interviews, classroom facilitation, reflective journals and follow-up discussions. Their participation provided valuable insights into the pedagogical challenges, implementation processes and classroom realities involved in integrating Project Management in Visual Arts within STEAM education.

Participants were selected using purposive sampling. This sampling method was appropriate because the study required participants who were directly involved in Visual Arts learning and the implementation of the STEAM-PBL module. The students and teachers were selected based on their relevance to the research objectives, particularly their involvement in project-based Visual Arts activities within the selected school context.

Research Intervention: ARTSCreaSTEAM Lab Module

The main intervention in this study was the implementation of the ARTSCreaSTEAM Lab module, which was designed to integrate Visual Arts with STEAM education through Project-Based Learning. The module provided a structured yet flexible learning pathway that enabled students to manage Visual Arts projects from initial idea generation to final presentation and reflection. It was implemented over an eight-week instructional period, allowing students sufficient time to engage in project planning, collaborative production, testing, revision and reflective evaluation.

The module was guided by the researcher-adapted Visual Arts Project Management Framework, which was developed based on Cooper's (1990) Stage-Gate Model and Cooper and Sommer's (2020) Agile–Stage-Gate perspective. Through this framework, students moved through a series of project stages and evaluative gates. These included the generation of ideas, preliminary exploration, project planning, development of early artworks or prototypes, technical and material testing, refinement, final production, presentation, appreciation and reflection. This structure allowed students to experience Visual Arts not only as a creative activity, but also as a managed project-based learning process.

Within the module, Visual Arts was connected to STEAM-related themes such as nature, sustainability, environmental awareness, community design and scientific concepts. Students worked collaboratively in groups to identify issues, develop creative responses, use available materials, apply visual thinking and communicate their understanding through artistic products. Teachers acted as facilitators who supported students' project decisions, guided interdisciplinary connections, provided feedback and encouraged reflection throughout the project cycle.

Research Procedures

The research was conducted in three main phases: pre-implementation, implementation and post-implementation. These phases were designed to ensure that the study was carried out systematically and that data could be collected across different stages of the project-based learning process.

During the pre-implementation phase, the participating teachers were given orientation and briefing sessions on the ARTSCreaSTEAM Lab module, STEAM concepts, Project-Based Learning and the adapted Visual Arts Project Management Framework. The purpose of this phase was to prepare teachers to facilitate interdisciplinary project activities and to ensure that they understood the stages and review points embedded in the framework. Initial classroom observations were also conducted to understand existing teaching practices, classroom interaction patterns and students' baseline engagement before the module was implemented.

During the implementation phase, students participated in Visual Arts-based STEAM project activities over eight weeks. They worked in groups and followed the stages outlined in the adapted project management framework. At the beginning of the project, students generated ideas, selected themes and explored possible links between Visual Arts and STEAM concepts. They then planned their projects by identifying objectives, materials, techniques, time allocation, group roles, documentation processes and expected outcomes. During the development stage, students produced sketches, prototypes, visual studies and experimental artworks. They also tested materials, revised ideas, responded to feedback and refined their project outcomes before preparing for final presentation.

During the post-implementation phase, data were collected from students' final project outcomes, reflective journals, teacher observations, interviews and follow-up discussions. Students presented their completed Visual Arts projects and explained the ideas, processes, challenges and STEAM-related concepts embedded in their work. Teachers and students also reflected on the learning process, including collaboration, problem-solving, project management, creative decision-making and the relevance of Visual Arts within STEAM education.

Data Collection Methods

Multiple qualitative data collection methods were used to ensure a rich and comprehensive understanding of the implementation and impact of Project Management in Visual Arts within STEAM-PBL. The use of multiple sources also strengthened data triangulation and supported the trustworthiness of the findings.

Semi-Structured Interviews

Semi-structured interviews were conducted with the three Visual Arts teachers and a purposive sample of students. The interviews explored participants' perceptions, experiences, challenges and reflections related to the ARTSCreaSTEAM Lab module. For teachers, the interviews focused on their experiences in facilitating Visual Arts project management, integrating STEAM concepts, managing classroom constraints and supporting student learning. For students, the interviews explored their experiences in planning, developing, collaborating, creating, presenting and reflecting on their Visual Arts projects.

The semi-structured format allowed the researchers to use guiding questions while also giving participants space to elaborate on their experiences. This approach was suitable because the study aimed to understand participants' lived experiences and meaning-making processes rather than obtain fixed or predetermined responses.

Classroom Observations

Classroom observations were conducted throughout the implementation period to examine how the Visual Arts project management process unfolded in practice. Observations focused on student engagement, teacher facilitation, peer collaboration, project planning, creative development, problem-solving, material use, feedback processes and reflection. The observations also enabled the researchers to identify how students moved through

the stages of the adapted framework and how they responded to the evaluative gates embedded in the project cycle.

A structured observation guide was used to ensure that the observations remained aligned with the research objectives and conceptual framework. Particular attention was given to indicators of STEAM integration, Visual Arts project management, student autonomy, collaboration, higher-order thinking and creative decision-making.

Document Analysis

Document analysis was used to examine materials produced throughout the implementation of the ARTSCreaSTEAM Lab module. The analysed documents included students' sketches, visual journals, concept maps, project documentation, final artworks, teacher reflective journals and researcher field notes. These documents provided evidence of students' project development, conceptual understanding, creative thinking and reflective engagement.

Students' artifacts were particularly important because they served as visual evidence of how students translated STEAM-related ideas into artistic forms. Teacher journals provided insight into instructional decisions, classroom challenges, student responses and pedagogical adjustments. Researcher field notes captured contextual details, spontaneous observations, classroom dynamics and emerging issues that may not have been fully captured through interviews or formal observations.

Reflective Journals and Follow-Up Discussions

Reflective journals were used to capture students' and teachers' reflections on the project process. These journals allowed participants to document their challenges, decisions, learning experiences and personal responses throughout the module. Follow-up discussions were also conducted to clarify emerging issues and gain deeper understanding of participants' experiences after project completion.

These reflective sources were important because the study examined not only project outcomes, but also the process of learning and meaning-making. They helped reveal how students experienced autonomy, collaboration, emotional engagement, cultural expression and ownership of learning within the Visual Arts-based STEAM-PBL environment.

Data Analysis

The qualitative data were analysed using thematic analysis with the support of NVivo 12 Plus. Thematic analysis was selected because it allowed the researchers to identify, organize and interpret patterns across multiple data sources, including interview transcripts, classroom observations, student artifacts, teacher journals, reflective journals, field notes and follow-up discussions.

The analysis followed a systematic process beginning with familiarization with the data. The researchers read and reviewed the data repeatedly to gain an overall understanding of participants' experiences and the implementation process. Initial codes were then generated based on recurring ideas, actions, challenges and learning outcomes. These codes were grouped into broader categories and later developed into themes that reflected the research objectives.

The coding process involved both deductive and inductive approaches. Deductively, the analysis was guided by the conceptual framework of the study, particularly the components of Project Management in Visual Arts, STEAM-PBL implementation, learning processes, student outcomes and contextual factors. Inductively, the researchers allowed new themes to emerge from the data, especially from participants' reflections, classroom interactions and visual project documentation. This combined approach ensured that the analysis remained theoretically informed while also being responsive to the realities of the classroom setting.

The analysis focused on three broad areas. First, it examined contextual and implementation challenges, including teacher readiness, resource limitations, time constraints, curriculum alignment and resistance to change. Second, it analysed the impact of Visual Arts-based STEAM-PBL on student learning outcomes, including engagement, motivation, conceptual understanding, creativity, collaboration and higher-order thinking. Third, it explored students' lived experiences, particularly in relation to autonomy, peer learning, emotional expression, cultural connection and ownership of learning.

Trustworthiness of the Study

Several strategies were used to enhance the trustworthiness of the study. First, data triangulation was conducted by comparing evidence from interviews, classroom observations, student artifacts, reflective journals, teacher journals, field notes and follow-up discussions. This allowed the researchers to examine whether similar patterns appeared across different data sources and participant groups.

Second, methodological triangulation strengthened the credibility of the findings by combining interviews, observations and document analysis. This approach reduced reliance on a single source of evidence and provided a more comprehensive understanding of the implementation process. Third, member checking was conducted with selected participants to confirm the accuracy of interview interpretations and emerging findings. This helped ensure that participants' views were represented fairly and accurately.

Fourth, the researchers maintained an audit trail through systematic documentation of research procedures, observation records, coding decisions, reflective notes and theme development. This supported the dependability and confirmability of the study. Researcher reflexivity was also practiced by recording reflections on classroom observations, interpretive decisions and possible researcher assumptions during the data analysis process.

Ethical Considerations

The study was conducted in accordance with ethical research principles. Permission was obtained from the relevant school authorities before data collection began. Informed consent was obtained from the participating teachers, students and students' guardians. Participants were informed about the purpose of the study, the voluntary nature of their participation, their right to withdraw and the ways in which the data would be used.

Confidentiality and anonymity were maintained throughout the research process. Pseudonyms or participant codes were used in reporting interview excerpts, observation notes and reflective data. All research data, including transcripts, visual documents, field notes and digital records, were stored securely and used only for research purposes. Since the study involved secondary school students, particular care was taken to ensure that participation did not disrupt normal learning or place students under unnecessary pressure (Merriam, 1998; Buruntong & Kindoyop, 2024).

RESULTS

This section presents the findings of the study based on the thematic analysis of semi-structured interviews, classroom observations, student artifacts, project documentation, teacher reflective journals, researcher field notes and follow-up discussions. The findings reflect students' and teachers' experiences during the eight-week implementation of the ARTSCreaSTEAM Lab module, which was structured according to the researcher-adapted Visual Arts Project Management Framework based on Cooper's Stage-Gate Model and Cooper and Sommer's Agile–Stage-Gate perspective.

The analysis focused on how Project Management in Visual Arts was implemented within STEAM education through Project-Based Learning, as well as how this approach influenced students' learning engagement, motivation, conceptual understanding, creative problem-solving, higher-order thinking, collaboration, autonomy and cultural expression. The findings are organized into three major themes: contextual and implementation challenges, positive learning outcomes and students' lived experiences in Visual Arts-based STEAM-PBL.

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Overall, the findings indicate that Project Management in Visual Arts provided a structured yet flexible pathway for implementing STEAM learning through Project-Based Learning. Although the implementation was influenced by several contextual constraints, particularly teacher readiness, limited resources, curriculum alignment, time management and resistance to change, the approach supported students in moving through key project stages such as idea generation, exploration, planning, development, testing, refinement, final production, presentation and reflection.

Theme 1: Contextual and Implementation Challenges in Project Management in Visual Arts

The first major theme concerns the contextual and implementation challenges that influenced the use of Project Management in Visual Arts within STEAM education. Although the ARTSCreaSTEAM Lab module provided a structured project management process, its implementation was affected by several pedagogical, institutional and material constraints. Four subthemes emerged under this theme: limited interdisciplinary pedagogical competence, inadequate access to resources and technology, time constraints and curriculum misalignment and resistance to change.

Limited Interdisciplinary Pedagogical Competence

One of the most prominent challenges was teachers' limited confidence in connecting Visual Arts project processes meaningfully with STEAM concepts. Although the participating teachers were experienced in Visual Arts, they found it challenging to design and facilitate project activities that moved beyond surface-level thematic links. This was particularly evident during the early stages of the project management cycle, especially during idea generation, preliminary exploration and project planning. Figure 2 illustrates the evidence of limited interdisciplinary pedagogical competence in visual arts-based STEAM project implementation .

Data Source	Evidence	Interpretation
Teacher interview	Teachers reported difficulty connecting Visual Arts processes with Science, Technology, Engineering and Mathematics concepts	Teachers had strong Visual Arts expertise but limited confidence in interdisciplinary integration
Classroom observation	Students generated visual themes but needed teacher guidance to explain STEAM connections	STEAM understanding did not emerge automatically from art-making activities
Student project planning sheets	Students identified themes and materials but provided limited explanation of STEAM elements	Students required scaffolding to connect visual ideas with interdisciplinary concepts
Teacher reflection	Teachers acknowledged the need for clearer guiding questions and examples	Teachers recognized the importance of structured pedagogical support

Figure 2: Evidence of Limited Interdisciplinary Pedagogical Competence in Visual Arts-Based STEAM Project Implementation

Teachers reported that some students could identify creative themes, but they required guidance to connect these themes with scientific, technological, engineering, or mathematical ideas. For example, students were able to produce visual ideas related to nature or the environment, but needed teacher scaffolding to explain how these ideas related to ecosystems, sustainability, design, structure, or problem-solving.

One teacher explained:

	"...This lack of confidence reduced the depth of STEAM integration, often resulting in superficial thematic connections..."
	(ST1/W3/12/102025)

This finding suggests that effective Project Management in Visual Arts requires more than expertise in art-making. It requires interdisciplinary pedagogical competence, particularly the ability to guide students in connecting creative processes with inquiry, conceptual understanding, problem-solving and reflection.

Inadequate Access to Resources and Technology

A second challenge involved limited access to resources and technology. Both teachers and students reported that the availability of art materials, digital tools, multimedia equipment, design applications and science-related resources affected the scope and quality of project work. This constraint was especially visible in the rural school context, where available resources shaped what students could realistically plan, develop, test and produce.

During the project planning stage, several groups had to adjust their original ideas based on the materials available in the classroom. Some students initially wanted to use digital tools or more advanced materials, but later shifted to manual techniques, recycled materials and locally available resources. While this encouraged creativity and adaptation, it also limited the depth of technological exploration within the STEAM-PBL process. Figure 3 illustrates the data evidence for inadequate access to resources and technology.

Data Source	Evidence	Interpretation
Teacher interview	Teachers reported that limited access to art materials, digital tools, multimedia equipment, design applications and science-related resources affected the implementation of STEAM-based Visual Arts projects.	Resource limitations restricted the range of project activities that could be planned and implemented.
Student interview / reflection	Students stated that some original project ideas had to be changed because certain materials or tools were not available in the classroom.	Students' creative decisions were shaped by the availability of resources.
Classroom observation	Several groups revised their project plans during the planning stage and shifted from digital or advanced material-based ideas to manual techniques, recycled materials and locally available resources.	Limited resources influenced the complexity and direction of students' project development.
Project planning sheets	Students initially proposed the use of digital design tools, multimedia elements or specific materials, but later replaced them with simpler and more accessible alternatives.	The project management process allowed adaptation, but resource constraints reduced opportunities for deeper technological exploration.
Final project outcomes	Some final products demonstrated creativity through the use of recycled and local materials, but showed limited use of digital tools, testing processes or advanced STEAM-related applications.	Students were able to adapt creatively, but the interdisciplinary and technological depth of the projects remained limited.
Teacher reflection	Teachers acknowledged that resource limitations were more visible in the rural school context, where available tools and materials determined what students could realistically produce.	School context and resource availability played an important role in shaping the quality and scope of STEAM-PBL implementation.

Figure 3 : Data Evidence for Inadequate Access to Resources and Technology

This finding indicates that resource availability plays an important role in supporting Project Management in Visual Arts. The adapted framework allowed students to revise and adapt their projects, but limited resources still influenced the complexity of their creative and interdisciplinary outputs.

Time Constraints and Curriculum Misalignment

The third challenge was related to time constraints and curriculum alignment. Teachers highlighted the difficulty of balancing project-based learning with existing curriculum demands, assessment expectations and school timetables. Project Management in Visual Arts requires students to move through several stages, including idea generation, planning, development, testing, refinement, presentation and reflection. These stages require sustained time and continuity. Figure 4 illustrates the data evidence for time constraints and curriculum misalignment.

Data Source	Evidence	Interpretation
Teacher interview	Teachers found it difficult to balance project-based learning with curriculum demands, assessment expectations and school timetables.	Existing curriculum structures limited the implementation of extended STEAM-PBL activities.
Classroom observation	Testing, refinement, critique and reflection stages were shortened due to limited time.	Students could not fully engage with all stages of the project management cycle.
Student reflection	Students needed more time to test, improve and complete their projects.	Time constraints reduced opportunities for deeper learning and project refinement.
Project schedule	The project required multiple stages, but lesson time was insufficient.	The school timetable was not fully aligned with the needs of project-based learning.

Teacher interview	***"...The project required more time because students needed to generate ideas, plan, develop, test and present their work. However, the limited timetable caused some stages to be shortened..."*** (ST2/W2/8/102025)
Classroom observation	**"...During project implementation, the testing and refinement stages were carried out briefly due to insufficient lesson time...."** (CO12/W3/11/102025)
Student reflection	**"...We needed more time to improve our project and make changes after receiving feedback...."** (SR8/W3/14/102025)

Figure 4 : Data Evidence for Time Constraints and Curriculum Misalignment

However, the formal school timetable did not always provide sufficient flexibility for extended project work. Teachers noted that some stages, particularly testing, refinement, critique and reflection, had to be shortened due to time limitations. This affected the depth of students' engagement with the full project management cycle. This finding suggests that meaningful Visual Arts-based STEAM-PBL requires greater curriculum flexibility. If schools expect students to engage in authentic project-based learning, sufficient time must be allocated for exploration, experimentation, feedback, revision and presentation.

Resistance to Change and Traditional Mindsets

The fourth challenge was resistance to change. Some students initially found the STEAM-PBL approach unfamiliar because they were more accustomed to teacher-directed lessons, fixed instructions and clearly defined outcomes. In contrast, Project Management in Visual Arts required them to make decisions, negotiate ideas, solve problems, collaborate with peers and revise their work based on feedback.

Teachers also observed that some students initially perceived Visual Arts-based STEAM activities as less academically serious than conventional classroom learning. This reflects a broader mindset in which Visual Arts is sometimes viewed as supplementary rather than intellectually rigorous. As the module progressed, however, students became more comfortable with the project-based process and began to understand that Visual Arts could support meaningful STEAM learning.

This finding indicates that repositioning Project Management in Visual Arts requires not only pedagogical change, but also a shift in classroom culture. Students and teachers need time to recognize Visual Arts as a valid medium for inquiry, conceptual understanding, creativity and problem-solving.

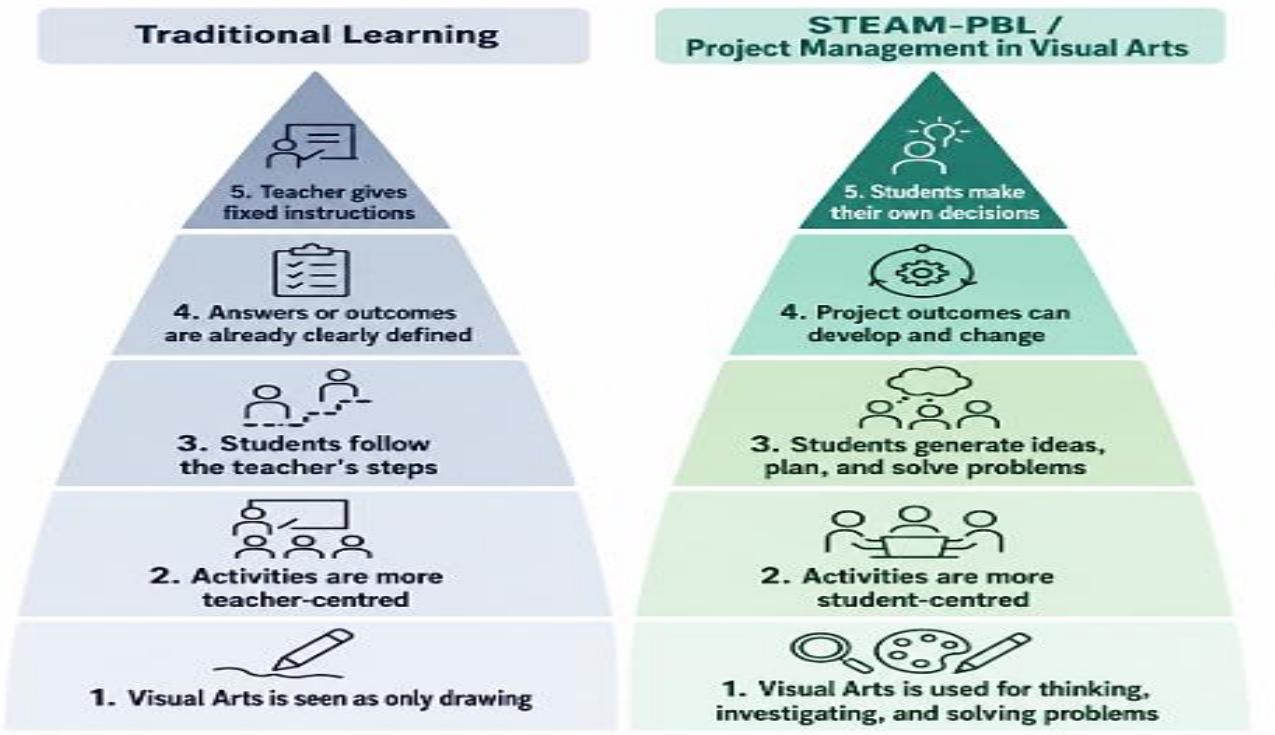

Figure 5 : Comparison between Traditional Learning and STEAM-PBL through Project Management in Visual Arts

Figure 5 illustrates the shift from traditional teacher-centred learning to STEAM-PBL in Visual Arts. While traditional learning focuses on fixed instructions and predetermined outcomes, STEAM-PBL encourages students to generate ideas, make decisions, solve problems and revise their work. This shift explains why some students may initially resist change, as they need time to adapt to a more active and student-centred learning process.

Theme 2: Positive Learning Outcomes through Visual Arts Project Management

The second major theme focuses on the positive learning outcomes that emerged from the implementation of Project Management in Visual Arts within the STEAM-PBL environment. Despite the contextual challenges, the findings show that the structured project management process contributed to stronger engagement, higher

motivation, improved conceptual understanding, creative problem-solving and enhanced higher-order thinking skills.

Enhanced Motivation and Engagement

One of the clearest findings was the increase in students' motivation and engagement during the ARTSCreaSTEAM Lab module. Classroom observations showed that students became more active when they were given opportunities to generate ideas, plan projects, experiment with materials, work collaboratively and produce visual outcomes related to STEAM themes.

Students who were previously passive in conventional lessons appeared more willing to participate when learning involved hands-on activities and creative decision-making. The project management process gave them a clearer sense of direction while still allowing room for personal expression and group creativity. One student stated:

	"...I usually find science boring, but when we created art about ecosystems, it made me see it differently… I wanted to learn more..."
	(IVS4/W3/12/102025)

This finding suggests that Project Management in Visual Arts can make STEAM learning more accessible and meaningful. By allowing students to engage with abstract concepts through visual and creative processes, the approach helped sustain their interest and participation throughout the project cycle.

Development of Creative Problem-Solving and Higher-Order Thinking Skills

The findings also indicate that students developed creative problem-solving and higher-order thinking skills throughout the project management process. Students were required to analyse project themes, generate possible ideas, evaluate materials, make design decisions, test visual solutions, revise their work and justify their final outcomes.

These skills were especially evident during the development, testing, refinement and presentation stages. For instance, when students encountered limitations in materials or technical execution, they had to modify their plans and find alternative solutions. Some groups changed their original design, replaced materials, simplified construction methods, or adjusted their visual approach based on feedback from teachers and peers.

Teachers observed that students gradually became more reflective and analytical. Instead of simply asking what to produce, they began asking questions about meaning, function, audience, suitability of materials and improvement. This finding shows that Project Management in Visual Arts supports higher-order thinking because it requires students to analyse, synthesize, evaluate and reflect throughout the project cycle.

Improved Conceptual Understanding through Artistic Representation

The third subtheme highlights students' improved conceptual understanding through artistic representation. Students' sketches, models, concept maps, visual journals and final artworks demonstrated their ability to translate STEAM-related ideas into visual forms. These outputs showed that students were not only producing artworks, but also using Visual Arts as a medium to communicate scientific, environmental, technological and social meanings.

For example, projects related to climate change, biodiversity, ecosystems and environmental awareness included visual metaphors such as polluted rivers, damaged forests, endangered species and contrasts between natural and human-made environments. During presentations, students were able to explain how their visual choices represented specific ideas and issues.

This finding suggests that Visual Arts can function as a cognitive and pedagogical tool within STEAM education. Through the project management process, students moved from initial ideas to visual development, testing, refinement and final explanation. Their artworks became evidence of both creative expression and conceptual understanding.

Theme 3: Students' Lived Experiences in Visual Arts-Based STEAM-PBL

The third major theme concerns students' lived experiences during the implementation of Visual Arts-based STEAM-PBL. The findings show that students' experiences were not limited to academic learning. They also involved personal, social, emotional and cultural dimensions. Three subthemes emerged: autonomy and ownership, collaboration and peer learning and emotional and cultural expression.

Autonomy and Ownership of Learning

Many students expressed that they valued the freedom given to them during the project. They appreciated being able to choose themes, materials, visual styles, techniques and design approaches. This flexibility increased their sense of ownership because the project felt personal and meaningful rather than simply being another classroom task.

This sense of ownership was particularly visible during the planning and development stages. Students took responsibility for their roles, monitored their progress, revised their work and showed pride in the final product. One student stated:

"...I felt like this was my project, not just homework. I wanted it to be the best..."
(IVS10/W3/17/102025)

This finding suggests that autonomy is a key element in Project Management in Visual Arts. When students are given opportunities to make decisions and manage their own learning process, they become more responsible, motivated and emotionally invested in their work.

Collaboration and Peer Learning

Another important finding was the strengthening of collaboration and peer learning. The group-based structure of the ARTSCreaSTEAM Lab module encouraged students to work with classmates who had different abilities and strengths. Some students contributed through drawing and design, while others supported research, material preparation, construction, writing, or presentation.

The project management process required students to divide roles, discuss ideas, negotiate decisions, solve problems and support one another. Informal peer teaching was observed when students helped their group members with techniques, explanations or presentation preparation. These interactions showed that learning occurred not only between teacher and student, but also among peers. This finding indicates that Visual Arts-based STEAM-PBL supports collaborative learning. Through shared project responsibility, students learned to communicate, compromise, contribute ideas and solve problems collectively.

Emotional and Cultural Expression

The final subtheme relates to emotional and cultural expression. Many students used their Visual Arts projects to connect STEAM-related ideas with personal experiences, local environments and cultural identity. This was particularly evident in projects that incorporated local flora and fauna, environmental issues, community life, traditional motifs and visual references familiar to students in Sabah.

Through art-making, students were able to express their concerns, memories, values and connections to their surroundings. For example, biodiversity-related projects often included local plants, animals, rivers, forests and landscapes. These visual elements reflected students' awareness of their environment and their emotional connection to local ecological and cultural contexts.

This finding suggests that Project Management in Visual Arts can make STEAM learning more culturally responsive and emotionally meaningful. In the context of rural Sabah, students' local environment and lived experiences became important sources of project inspiration and learning.

SUMMARY OF FINDINGS

Overall, the findings revealed that Project Management in Visual Arts through Project-Based Learning enriched STEAM education despite several contextual constraints. The first theme showed that implementation was shaped by challenges related to interdisciplinary pedagogical competence, resource limitations, time constraints, curriculum alignment and resistance to change.

The second theme demonstrated that the approach supported positive learning outcomes, including stronger engagement, higher motivation, improved conceptual understanding, creative problem-solving and enhanced higher-order thinking. The third theme showed that students' experiences were marked by autonomy, collaboration, cultural expression, emotional connection and ownership of learning.

Taken together, these findings support the central argument of the study that Project Management in Visual Arts should not be viewed merely as a procedural component of art-making. Instead, it can function as a meaningful pedagogical strategy for strengthening inclusive, creative, interdisciplinary and context-responsive STEAM education among secondary school students in Sabah, Malaysia. Table 3 presents the summary of Findings.

Table 3 : Summary of Findings

Theme	Subtheme	Key Findings	Implication
Theme 1: Contextual and Implementation Challenges	Limited interdisciplinary pedagogical competence	Teachers were confident in Visual Arts content but faced challenges connecting project stages meaningfully with STEAM concepts.	Teachers require interdisciplinary pedagogical training to support Visual Arts-based STEAM project management.
	Inadequate access to resources and technology	Limited access to materials, digital tools, multimedia equipment and science-related resources restricted project scope and quality.	Resource support is necessary for meaningful STEAM-PBL implementation, especially in rural schools.
	Time constraints and curriculum misalignment	Teachers found it difficult to complete the full project management cycle within existing school timetables and curriculum demands.	Curriculum flexibility is needed to support sustained project-based interdisciplinary learning.
	Resistance to change	Some students initially viewed STEAM-PBL as unfamiliar and less academically serious than conventional instruction.	Repositioning Visual Arts requires pedagogical and cultural change in classroom practice.
Theme 2: Positive Learning Outcomes	Enhanced motivation and engagement	Students showed stronger participation, interest and enthusiasm during hands-on project activities.	Visual Arts project management can make STEAM learning more accessible and meaningful.
	Creative problem-solving and higher-order thinking	Students analysed problems, generated ideas, tested materials,	Project management in Visual Arts supports analysis, synthesis,

		revised designs and justified creative decisions.	evaluation, reflection and creative problem-solving.
	Improved conceptual understanding	Students used artworks, sketches, models, visual journals and concept maps to communicate STEAM-related ideas.	Visual Arts functions as a cognitive and pedagogical tool for representing interdisciplinary understanding.
Theme 3: Students' Lived Experiences	Autonomy and ownership	Students valued freedom in choosing themes, media, materials and design approaches.	Student autonomy strengthens responsibility, motivation and ownership of learning.
	Collaboration and peer learning	Students worked together by contributing different strengths and supporting one another throughout the project cycle.	Visual Arts-based STEAM-PBL promotes communication, teamwork and peer-supported learning.
	Emotional and cultural expression	Students connected STEAM concepts with local environment, cultural identity, personal experiences and community meanings.	Project Management in Visual Arts can make STEAM learning more inclusive, contextual and culturally responsive.

DISCUSSION

This section discusses the findings of the study in relation to the research objectives, the literature on STEAM education and Project-Based Learning, the theoretical foundation of New Product Development and the researcher-adapted Visual Arts Project Management Framework. The discussion is organized according to the three major themes that emerged from the findings: contextual and implementation challenges, positive learning outcomes and students' lived experiences in Visual Arts-based STEAM-PBL. Rather than restating the findings, this section interprets their significance and explains how Project Management in Visual Arts may be repositioned as a meaningful pedagogical mechanism within STEAM education among secondary school students in Sabah, Malaysia.

The findings indicate that the implementation of Project Management in Visual Arts through the ARTSCreaSTEAM Lab module provided a structured yet flexible pathway for interdisciplinary learning. Through stages such as idea generation, preliminary exploration, project planning, development, testing, refinement, final production, presentation and reflection, students were able to experience Visual Arts not merely as an art-making activity, but as a managed learning process.

This is consistent with the theoretical position of the study, which adapts Cooper's (1990) Stage-Gate Model and Cooper and Sommer's (2020) Agile–Stage-Gate perspective to the context of Visual Arts education. The discussion therefore argues that the value of Visual Arts in STEAM lies not only in creativity or aesthetic production, but also in its capacity to support project planning, decision-making, problem-solving, collaboration, reflection and continuous improvement.

Repositioning Project Management in Visual Arts within STEAM Education

The findings support the central argument of this study that Project Management in Visual Arts should be repositioned as a core pedagogical process within STEAM education (Perignat & Katz-Buonincontro, 2019). In many school contexts, Visual Arts is often viewed as a subject concerned mainly with creativity, expression, or the production of artworks (Ponijan, Mat, & Leong, 2019). However, the findings of this study show that when Visual Arts is structured through project management and implemented through Project-Based Learning, it becomes a powerful medium for interdisciplinary inquiry, conceptual understanding, creative problem-solving and student-centred learning (Hawari & Mohd Noor, 2020).

This repositioning is important because STEAM education requires more than the simple addition of the arts into STEM (Yakman & Lee, 2012). Meaningful STEAM learning occurs when students are able to connect artistic processes with scientific, technological, engineering and mathematical thinking (Perignat & Katz-Buonincontro, 2019). In this study, Visual Arts became a platform through which students could explore STEAM-related issues, generate ideas, test materials, develop visual solutions, present their work and reflect on their learning (Buruntong et al., 2025). This suggests that Visual Arts project management can function as a bridge between creative expression and analytical thinking (Henriksen, 2014).

The researcher-adapted Visual Arts Project Management Framework strengthens this repositioning by giving students a clear structure for managing their learning (Cooper, 1990). The framework enabled students to move through a project cycle that reflected both the staged logic of Cooper's Stage-Gate Model and the iterative nature of Cooper and Sommer's Agile–Stage-Gate perspective (Cooper & Sommer, 2020). This is significant because creative learning is rarely linear. Students often need to revisit ideas, respond to feedback, modify materials and refine outcomes (Kokotsaki, Menzies, & Wiggins, 2016). Therefore, the adapted framework allowed Visual Arts-based STEAM learning to remain organized while also flexible enough to support experimentation, revision and contextual adaptation (Perignat & Katz-Buonincontro, 2019).

This finding is consistent with the literature reviewed earlier, which emphasizes the need to move beyond compartmentalized subject teaching toward more holistic, student-centred and interdisciplinary approaches (Thomas, 2000). It also responds directly to the research gap identified in the study, particularly the limited empirical evidence on how Visual Arts can be operationalized within STEAM education in Malaysian secondary schools, especially in rural and under-resourced settings such as Sabah (Riduan & Othman, 2024).

Contextual and Implementation Challenges in Visual Arts-Based STEAM-PBL

The first major theme revealed several contextual and implementation challenges, including limited interdisciplinary pedagogical competence, inadequate access to resources and technology, time constraints, curriculum misalignment and resistance to change (Riduan & Othman, 2024). These findings suggest that the successful implementation of Project Management in Visual Arts depends not only on the quality of the pedagogical framework, but also on the readiness of teachers, the availability of resources, the flexibility of curriculum structures and the broader school culture (Perignat & Katz-Buonincontro, 2019).

One of the most significant challenges was teachers' limited confidence in connecting Visual Arts project processes meaningfully with STEAM concepts (Yulianti et al., 2024). Although the participating teachers were experienced in Visual Arts, the findings showed that they required additional support in designing project activities that moved beyond surface-level thematic links (Hawari & Mohd Noor, 2020). This suggests that interdisciplinary pedagogy requires a different kind of professional competence. Teachers need to understand not only how to teach Visual Arts, but also how to guide students in connecting visual thinking with scientific inquiry, technological exploration, engineering design, mathematical reasoning and real-world problem-solving (Yakman & Lee, 2012).

This finding is important when viewed through the lens of Cooper's Stage-Gate logic (Cooper, 1990). In a project management process, each stage requires clear objectives, evaluation and decision-making before the project moves forward. If teachers are uncertain about how STEAM concepts should be embedded within Visual Arts projects, the early stages of idea generation, exploration and planning may become weak. As a result, students may produce creative work that is visually interesting but conceptually shallow (Perignat & Katz-Buonincontro, 2019). Therefore, teacher readiness is a critical condition for ensuring that the project management cycle leads to meaningful interdisciplinary learning (Riduan & Othman, 2024).

The issue of limited resources and technology also shaped implementation. In the rural Sabah context, students and teachers had to work within available materials, limited access to digital tools and restricted STEAM-related equipment (Buruntong et al., 2025). This finding reinforces the importance of contextual factors in the conceptual framework. Resource limitations did not prevent learning from taking place, but they influenced the

scale, complexity and depth of students' projects. Interestingly, the findings also suggest that limited resources encouraged students to adapt, improvise and use locally available materials (Musa et al., 2023). This reflects the value of the Agile–Stage-Gate perspective, where flexibility, adjustment and continuous improvement are necessary when project conditions change (Cooper & Sommer, 2020).

Time constraints and curriculum misalignment further demonstrate the tension between project-based interdisciplinary learning and conventional school structures (Thomas, 2000). Project Management in Visual Arts requires sustained time for planning, experimentation, critique, refinement, presentation and reflection (Kokotsaki, Menzies, & Wiggins, 2016). However, the existing timetable and curriculum demands limited the extent to which students could fully engage with each stage of the project cycle (Riduan & Othman, 2024). This suggests that if STEAM-PBL is to be implemented effectively, curriculum planning must provide sufficient flexibility for extended project work and process-based assessment (Perignat & Katz-Buonincontro, 2019).

Resistance to change was another important challenge. Some students initially viewed STEAM-PBL as unfamiliar because they were accustomed to teacher-directed instruction and fixed outcomes (Thomas, 2000). This reflects a broader educational culture in which learning is often associated with direct instruction, examination preparation and subject separation (Riduan & Othman, 2024). The findings therefore suggest that repositioning Project Management in Visual Arts requires not only a new teaching strategy, but also a cultural shift in how students, teachers and schools understand the value of Visual Arts within academic learning (Ponijan, Mat, & Leong, 2019).

Project Management in Visual Arts and Student Learning Outcomes

The second major theme showed that Project Management in Visual Arts contributed positively to students' learning outcomes, particularly in terms of engagement, motivation, conceptual understanding, creative problem-solving and higher-order thinking (Perignat & Katz-Buonincontro, 2019). These findings suggest that the structured project management process helped students become more active and invested in their learning (Kokotsaki, Menzies, & Wiggins, 2016).

The increase in student engagement indicates that Visual Arts-based project management made STEAM learning more accessible and meaningful (Hawari & Mohd Noor, 2020). Students were not simply asked to memorize concepts or complete isolated tasks. Instead, they were required to generate ideas, plan project directions, explore visual possibilities, develop creative products, respond to feedback and present their outcomes (Thomas, 2000). This process gave students a stronger sense of purpose and participation. The hands-on and visual nature of the project also helped students engage with abstract STEAM concepts in more concrete and personal ways (Henriksen, 2014).

This finding aligns with the literature on Project-Based Learning, which emphasizes authentic tasks, student agency, collaboration, inquiry and meaningful outcomes (Kokotsaki, Menzies, & Wiggins, 2016). In the context of this study, PBL became more effective because it was supported by a structured Visual Arts project management framework. Students were not left to work without direction; instead, they were guided through stages and review points that helped them manage their learning (Cooper, 1990). This supports the relevance of Cooper's Stage-Gate Model in an educational context, as the staged structure helped organize the learning process and provided checkpoints for monitoring project progress.

At the same time, the development of creative problem-solving and higher-order thinking reflects the importance of the Agile–Stage-Gate perspective (Cooper & Sommer, 2020). Students had to revise their ideas, adapt to material limitations, respond to teacher and peer feedback and improve their work before final presentation. These activities required analysis, synthesis, evaluation, justification and reflection (Anderson & Krathwohl, 2001). Therefore, the findings suggest that higher-order thinking was not developed through direct instruction alone but through the iterative process of managing, testing and refining creative solutions (Perignat & Katz-Buonincontro, 2019).

Improved conceptual understanding through artistic representation is another significant finding. Students' artworks, sketches, models, concept maps and visual journals showed that Visual Arts can function as a cognitive tool for representing STEAM-related ideas (Eisner, 2002). Through visual forms, students were able to communicate concepts related to ecosystems, biodiversity, climate change, sustainability and environmental awareness (Buruntong et al., 2025). This indicates that Visual Arts can help students translate abstract knowledge into visible and meaningful representations (Henriksen, 2014). In this sense, Visual Arts project management supports both creative expression and conceptual learning.

These findings reinforce the argument that Project Management in Visual Arts should not be treated merely as a procedural component of art-making. Instead, it should be understood as a pedagogical strategy that supports interdisciplinary learning (Yakman & Lee, 2012). The process of planning, developing, testing, refining and presenting visual projects created opportunities for students to engage with STEAM concepts in ways that were active, reflective and personally meaningful (Thomas, 2000)

Students' Lived Experiences: Autonomy, Collaboration and Cultural Expression

The third major theme revealed that students' experiences in Visual Arts-based STEAM-PBL extended beyond academic outcomes. Students also experienced greater autonomy, stronger collaboration, emotional connection, cultural expression and ownership of learning (Kokotsaki, Menzies, & Wiggins, 2016). These findings are important because they show that the value of Project Management in Visual Arts is not limited to cognitive development. It also supports affective, social and cultural dimensions of learning (Eisner, 2002).

Students' sense of autonomy and ownership was one of the most meaningful outcomes of the project. When students were given opportunities to choose themes, materials, visual styles and design approaches, they became more personally invested in their work (Thomas, 2000). This suggests that Project Management in Visual Arts can strengthen student agency by allowing learners to make decisions throughout the project cycle (Deci & Ryan, 2000). In the adapted framework, autonomy was not unstructured freedom; rather, it was guided through stages such as planning, development, testing and reflection (Cooper, 1990). This balance between structure and choice helped students take responsibility for their learning while still receiving support from teachers.

Collaboration and peer learning were also strengthened through the project management process. Since students worked in groups, they had to divide roles, negotiate ideas, combine different strengths and solve problems collectively (Kokotsaki, Menzies, & Wiggins, 2016). This finding is consistent with the principles of Project-Based Learning, where collaboration is central to knowledge construction (Vygotsky, 1978). In the context of Visual Arts-based STEAM, collaboration became especially meaningful because students contributed different abilities, such as drawing, researching, constructing, presenting, organizing materials and explaining concepts (Perignat & Katz-Buonincontro, 2019). This suggests that project management can create a learning environment where diverse student strengths are recognized and used productively.

The finding on emotional and cultural expression is particularly important in the Sabah context. Students connected STEAM-related ideas with their local environment, cultural identity, personal experiences and community meanings (Musa et al., 2023). Projects that incorporated local flora, fauna, landscapes, environmental concerns and cultural references showed that students were not only learning abstract STEAM concepts; they were also making sense of these concepts through their own lived realities (Buruntong et al., 2025). This supports the literature that emphasizes the need for context-responsive and culturally meaningful education, especially in rural and underrepresented regions (Gay, 2018).

In this regard, Project Management in Visual Arts helped make STEAM learning more inclusive. Students who may not always express themselves confidently through written or verbal academic tasks were able to communicate understanding through visual forms (Eisner, 2002). This suggests that Visual Arts can provide alternative pathways for participation and meaning-making (Henriksen, 2014). In a culturally diverse and rural context such as Sabah, this is especially valuable because it allows students to see their environment, identity and community reflected in the learning process.

Alignment with the Researcher-Adapted Visual Arts Project Management Framework

The findings are closely aligned with the researcher-adapted Visual Arts Project Management Framework. The framework was developed by adapting Cooper's Stage-Gate Model (Cooper, 1990) and Cooper and Sommer's Agile–Stage-Gate perspective (Cooper & Sommer, 2020) into the context of Visual Arts education and STEAM-PBL. The results show that students benefited from both the structured and flexible elements of this framework.

The structured element was evident in the way students moved through clear project stages. Idea generation encouraged students to identify issues, themes and creative directions. Preliminary exploration allowed them to develop sketches, visual studies and early STEAM connections. Project planning helped them organize objectives, materials, roles, timelines and documentation. Project development enabled them to produce early artworks, models, or prototypes. Testing and refinement encouraged them to evaluate materials, revise ideas and improve outcomes. Final production and presentation allowed them to communicate their learning, while reflection helped them evaluate their experiences and growth (Thomas, 2000).

The flexible element was evident when students adapted their projects based on feedback, resource limitations, technical challenges and group discussions (Cooper & Sommer, 2020). This reflects the Agile–Stage-Gate perspective, where project development is not strictly linear but iterative and responsive. In Visual Arts education, such flexibility is necessary because creative ideas often evolve through experimentation (Perignat & Katz-Buonincontro, 2019). The findings therefore confirm that a project management framework for Visual Arts must not be overly rigid. It must provide direction while allowing room for creative change, contextual adaptation and student agency.

The alignment between the findings and the framework also strengthens the methodological coherence of the study. The ARTSCreaSTEAM Lab module was implemented over eight weeks using multiple sources of qualitative data, including interviews, observations, artifacts, journals, field notes and follow-up discussions (Creswell & Poth, 2018). These data sources captured both the process and outcomes of the project management cycle. Therefore, the findings support the usefulness of the adapted framework as both a pedagogical guide and an analytical lens for examining Visual Arts-based STEAM-PBL.

Most importantly, the framework helps explain why the approach produced meaningful learning outcomes despite contextual constraints. Even when students faced limited resources, time pressure, or uncertainty, the staged and iterative process helped them continue developing their projects (Cooper & Sommer, 2020). This suggests that the framework has practical value for rural schools because it provides a manageable structure while still allowing teachers and students to adapt to local realities (Buruntong et al., 2025).

Implications for STEAM Education in Rural Sabah

The findings have important implications for STEAM education in rural Sabah and the wider Malaysian secondary school context. First, they suggest that Visual Arts should be more explicitly recognized as a pedagogical component of STEAM education. Rather than treating Visual Arts as supplementary or decorative, curriculum planners and educators should recognize its capacity to support conceptual understanding, creativity, communication, problem-solving, collaboration and cultural expression.

Second, the findings highlight the need for teacher professional development in interdisciplinary project management. Teachers require support not only in STEAM concepts and PBL strategies, but also in managing Visual Arts projects through structured stages and review points. Training should include how to guide idea generation, facilitate project planning, support material exploration, provide feedback during development, assess visual products and help students reflect on their learning. Such training is particularly important for rural schools, where teachers may have fewer opportunities for professional exposure to STEAM-oriented pedagogy.

Third, the findings point to the importance of resources and infrastructure. While the study shows that meaningful learning can occur even with limited materials, resource constraints still affect the depth and scope

of project work. Schools need access to art materials, digital tools, flexible learning spaces and basic STEAM-related resources. For rural schools in Sabah, targeted support is necessary to ensure that students are not disadvantaged in accessing creative and interdisciplinary learning opportunities.

Fourth, the study suggests that curriculum and assessment structures need to become more flexible. Project Management in Visual Arts requires time for exploration, experimentation, revision, presentation and reflection. If school timetables and assessment systems remain too rigid, teachers may struggle to implement STEAM-PBL meaningfully. Assessment should therefore include process-based evidence such as sketches, journals, prototypes, documentation, presentations, peer feedback and reflective writing, not only final products.

Finally, the findings show that local culture and environment can be powerful resources for STEAM learning. In Sabah, students' engagement with local flora, fauna, community issues, environmental concerns and cultural references made learning more meaningful. This implies that STEAM education in rural settings should not be designed as a one-size-fits-all model. Instead, it should be context-responsive and should allow students to draw from their own surroundings, identities and lived experiences.

Implications of Study

The findings of this study offer three important implications for strengthening STEAM education in Malaysia, particularly in repositioning Project Management in Visual Arts as a meaningful pedagogical strategy within Project-Based Learning. These implications are relevant not only to Visual Arts education, but also to interdisciplinary curriculum design, teacher professional development and the implementation of context-responsive STEAM learning in rural secondary schools such as those in Sabah.

First, the study implies that Project Management in Visual Arts should be repositioned as a core component of STEAM education, rather than being treated as a peripheral or supplementary element. The findings show that when Visual Arts is implemented through structured project stages such as idea generation, exploration, planning, development, testing, refinement, presentation and reflection, students are able to engage more meaningfully with STEAM concepts. This process supports creativity, conceptual understanding, creative problem-solving, collaboration and higher-order thinking. Therefore, curriculum planning should recognize Visual Arts not only as a subject of aesthetic production, but also as a project-based pedagogical process that connects artistic inquiry with scientific, technological, engineering and mathematical thinking.

Second, the study highlights the need for teacher professional development in interdisciplinary project management and STEAM-PBL pedagogy. Although the participating teachers were experienced in Visual Arts, the findings revealed that they still required support in connecting Visual Arts project processes with STEAM concepts. This suggests that teacher education programmes should include training in Visual Arts project management, STEAM integration, Project-Based Learning, design thinking, process-based facilitation and reflective assessment. The researcher-adapted Visual Arts Project Management Framework, based on Cooper's Stage-Gate Model and Cooper and Sommer's Agile–Stage-Gate perspective, may serve as a practical guide for helping teachers structure, monitor and refine Visual Arts-based STEAM projects more effectively.

Third, the study suggests the need for more flexible assessment, institutional support and context-responsive implementation, particularly in rural schools in Sabah. Visual Arts-based STEAM-PBL produces multiple forms of learning evidence, including sketches, visual journals, project plans, prototypes, student artifacts, presentations, peer feedback and reflective writing. Therefore, assessment should move beyond final products and examination-oriented measures to include both process-based and product-based evidence. At the same time, schools need adequate resources, flexible learning time, suitable project spaces and access to basic art, digital and STEAM-related materials.

In rural Sabah, local culture, environment, community experiences, flora and fauna and environmental issues can also serve as meaningful sources of project inspiration. This implies that STEAM education should be implemented in ways that are inclusive, locally grounded and responsive to students' lived realities.

Overall, these implications indicate that Project Management in Visual Arts has strong potential to strengthen STEAM education in Malaysian secondary schools. By combining structured project management, creative inquiry, interdisciplinary learning and contextual relevance, Visual Arts-based STEAM-PBL can support a more meaningful, inclusive and future-oriented learning experience for students.

Limitations Of The Study

This study acknowledges several limitations that should be considered when interpreting its findings. First, the research was confined to a single qualitative case study conducted in one rural secondary school in Kota Marudu, Sabah. Although this context provided rich and in-depth insights into the implementation of Project Management in Visual Arts within STEAM education through Project-Based Learning, the findings may not be readily generalizable to other educational settings. Schools in urban areas, high-performing schools, or institutions with greater access to resources, technology, infrastructure and professional development opportunities may experience the implementation of Visual Arts-based STEAM-PBL differently. Therefore, the findings should be understood as context-specific rather than representative of rural secondary school contexts in Sabah.

Second, the study employed a qualitative research design that relied on semi-structured interviews, classroom observations, student artifacts, project documentation, teacher reflective journals, researcher field notes and follow-up discussions. This approach was appropriate for capturing participants' experiences, classroom processes and the meanings constructed throughout the implementation of the ARTSCreaSTEAM Lab module. However, the study did not include quantitative measures such as pre- and post-tests, achievement scores, standardized creativity measures, or statistical comparisons between groups. As a result, while the study provides valuable interpretive evidence on the pedagogical value of Project Management in Visual Arts, it does not offer statistical measurement of learning gains or direct causal claims regarding students' academic performance.

Third, the study was conducted over an eight-week implementation period. Although this duration was sufficient to observe students' engagement with the project management cycle, including idea generation, planning, development, testing, refinement, presentation and reflection, it may not have been long enough to capture the sustained effects of the approach. The development of interdisciplinary understanding, project management skills, creative problem-solving and higher-order thinking may require longer and repeated exposure to Visual Arts-based STEAM-PBL. A longer implementation period could provide a more comprehensive understanding of how students' learning, confidence, collaboration and conceptual development evolve over time.

Taken together, these limitations define the scope of the present study while also identifying important directions for future research. Future studies may expand the sample to include multiple schools across rural, suburban and urban contexts in Malaysia. Researchers may also employ mixed-methods designs that combine qualitative insights with quantitative measures of student achievement, creativity, motivation and higher-order thinking. Longitudinal studies would also be valuable for examining the longer-term influence of Project Management in Visual Arts within STEAM education. Such approaches would strengthen the evidence base and provide a broader understanding of how the researcher-adapted Visual Arts Project Management Framework functions across diverse educational settings.

RECOMMENDATIONS

Based on the findings of this study, three recommendations are proposed to strengthen Project Management in Visual Arts within STEAM education through Project-Based Learning in Malaysian secondary schools.

First, teacher professional development should be strengthened in the areas of interdisciplinary project management, STEAM pedagogy and Project-Based Learning. The findings revealed that although teachers were confident in Visual Arts content, they required further support in connecting Visual Arts project processes with science, technology, engineering and mathematics. Therefore, structured and continuous training should be provided to help teachers design, facilitate, monitor and assess Visual Arts-based STEAM projects. Such training

should include project planning, idea development, creative facilitation, scaffolding strategies, feedback processes, reflective practice and process-based assessment.

Second, Project Management in Visual Arts should be more explicitly embedded within STEAM-related curriculum frameworks. The findings indicate that Visual Arts is not merely an enrichment subject, but a pedagogical process that supports creativity, conceptual understanding, collaboration, creative problem-solving and higher-order thinking. Curriculum planners should therefore provide clearer learning outcomes, interdisciplinary project modules and practical guidelines for implementing Visual Arts-based STEAM-PBL. The researcher-adapted Visual Arts Project Management Framework may also be used as a guide for structuring students' learning from idea generation to planning, development, testing, refinement, presentation and reflection.

Third, schools, particularly rural and under-resourced schools in Sabah, should be provided with stronger resource and institutional support. The study found that limited access to materials, digital tools, technology and STEAM-related equipment constrained the depth of project work. Therefore, targeted support should include creative materials, digital technologies, multimedia tools, flexible project spaces and sufficient time allocation for project-based learning. At the same time, schools should be encouraged to use local culture, community issues and environmental contexts as meaningful resources for Visual Arts-based STEAM projects.

Taken together, these recommendations emphasize the need to align teacher development, curriculum planning and school support. Such alignment can strengthen the role of Project Management in Visual Arts as a structured, creative and context-responsive approach to STEAM education in Malaysian secondary schools.

CONCLUSION

This study examined the repositioning of Project Management in Visual Arts within STEAM education through Project-Based Learning among secondary school students in Sabah, Malaysia. Guided by New Product Development theory, particularly Cooper's (1990) Stage-Gate Model and Cooper and Sommer's (2020) Agile–Stage-Gate perspective, the study applied a researcher-adapted Visual Arts Project Management Framework to understand how students planned, developed, tested, refined, presented and reflected on their Visual Arts-based STEAM projects. Through the implementation of the ARTSCreaSTEAM Lab module, the study provides empirical evidence that Visual Arts can function not merely as a creative or aesthetic subject, but as a structured pedagogical process that supports interdisciplinary learning, creative problem-solving, collaboration and higher-order thinking.

The findings show that Project Management in Visual Arts enriched students' learning experiences despite several contextual and implementation challenges. These challenges included limited interdisciplinary pedagogical competence among teachers, inadequate resources and technology, time constraints, curriculum misalignment and resistance to change. Nevertheless, students demonstrated stronger engagement, higher motivation, improved conceptual understanding, creative problem-solving and enhanced higher-order thinking when they were guided through structured project stages such as idea generation, exploration, planning, development, testing, refinement, presentation and reflection. The findings also revealed that students' experiences were marked by autonomy, collaboration, emotional connection, cultural expression and ownership of learning.

Overall, this study argues that Project Management in Visual Arts should be repositioned as a meaningful and intellectually valid pedagogical strategy within STEAM education. Its implementation through Project-Based Learning supports holistic learning across cognitive, social, affective and cultural dimensions, particularly in rural and context-specific settings such as Sabah. The study also highlights the need for stronger teacher professional development, more flexible curriculum and assessment practices and better resource support for rural schools. Moving forward, Malaysian secondary education should embrace a more integrated and context-responsive model of STEAM learning in which Visual Arts, science, technology, engineering and mathematics

are treated as complementary forms of knowledge that can collectively prepare students for creativity, innovation, inclusion and future-oriented learning.

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