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Redefining Classroom Pottery: Cement-Based Composites as Eco-Friendly Substitutes for Clay

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ABSTRACT

This article addresses the challenges in Visual Arts Education (VAE) of acquiring suitable materials for pottery instruction. It investigates the viability of cement-based composites as an alternative to clay in classrooms. The research involved 75 undergraduates and 33 VAE teachers and employed qualitative methods such as interviews, questionnaires, workshops, and field notes to gather and triangulate data. The study identified a significant gap, indicating a deficit in hands on experiences in pottery instruction at secondary education level. Thus, the *Creinnomic* Media Kit was designed and developed using the Addie Model to bridge this gap and to specifically enhance teachers' content knowledge and instructional effectiveness in using cement-based composites. Framed within Ausubel's Meaningful Learning Theory which emphasizes the importance of hands-on learning, the study demonstrated that cement-based composites are practical, versatile and cost effective for pottery instruction. Data analysis, including thematic, document, and content analysis, confirmed the practicality and effectiveness of cement-based composites in pottery instruction. Notably, the composites supported traditional pottery techniques such as casting, pinching, and slab construction, with finished products demonstrating durability and aesthetic qualities comparable to traditional clay pottery, without the need for firing and glazing This research contributes valuable insights into the potential of alternative materials to overcome resource constraints in VAE, promoting meaningful learning and creativity even when traditional materials are unavailable. This research provides essential insights for future advancements in VAE curricula, advocating for the integration of innovative teaching practices that utilize alternative materials to enrich the learning experience and foster student creativity.

Keywords: Alternative Materials, Sustainability, Meaningful Learning, Hands on Experiences, Cement Composite Pottery

INTRODUCTION

The importance of hands on experiences and meaningful learning in Visual Arts education are central to this research. Hands on experiences defined as experiential or learning by doing, is a pedagogical approach that immerses students in practical experiences, fostering a deeper connection with the subject matter. Meaningful learning occurs when new information aligns with existing knowledge or concepts (Hoffman, J. et al., 2021). Therefore, the aim of this research is to provide a scaffolding for the use of alternative materials in the teaching of traditional crafts namely pottery at the lower secondary levels. In tandem with the aims of the Secondary School Visual Arts Curriculum (DSKP), the teachers of Visual Arts are allowed to make changes to the suggested activities in the DSKP when deemed necessary. In doing so, the students will not be deprived of hands on experiences and meaningful learning. Direct purposeful experiences can be encouraged through the use of alternative material for

pottery. The objectives of this research are to identify alternative materials suitable for pottery, provide teaching skills on use of alternative materials in pottery and to help tap and develop students' creativity through hands-on activities. This is in order to fill the gap that exists in the teaching of pottery in secondary schools. Sourcing for materials and raw materials for pottery often As a result, most often only theoretical aspects are taught as teachers are unable to provide practical experiences. Pupils should be exposed to the endless possibilities of incorporating the basic skills learnt alongside new techniques to enable meaningful learning while at the same time create new pieces of art. Siti Zuraida Maaruf, (2021) asserts craft kits should be incorporated in the teaching and learning of art especially in the area of traditional craft in the classroom. Through the use of alternative materials in pottery, it is intended that pupils will able to showcase their talent and creative traits should they be taught to think out of the box.

LITERATURE REVIEW

The increasing interest in sustainable materials for educational purposes has led to a surge in studies exploring alternatives to resources. However, a critical examination reveals a significant gap in research specifically addressing substitutes for clay in pottery education. While numerous studies highlight the advantages of alternative materials, including their cost-effectiveness and environmental benefits, the literature falls short in evaluating their practicality and effectiveness in hands-on educational contexts. This gap is particularly pronounced in the case of cement-based composites, which, despite their growing popularity in construction, remain underexplored in educational settings. In relation to strengths and weaknesses of current studies, the existing body of literature showcases the potential of cement-fiber composites as sustainable building materials, yet it largely neglects their application in arts and crafts education. For instance, studies by Sandanayake et al. (2020) emphasize the versatility and eco-friendliness of cement-based composites, particularly when combined with natural fibers and industrial wastes such as paper, corn husk, bagasse, coir, wood shavings, sawdust, jute, sisal, banana stem, date palm fronds, cotton, and wool. These materials are highlighted for their renewable and sustainable nature, making them ideal for producing lightweight concrete. However, despite these promising findings, the research falls short in evaluating the suitability of these materials as clay substitutes in pottery education, leaving a critical gap in understanding their potential in educational contexts.

While research by Singh et al. (2020), Cardinale et al. (2021), Solahuddin B.A. & Yahaya F.M. (2021) and Shinde et al. (2023), emphasize the environmental benefits and lightweight properties of papercrete, an innovative blend of re-pulped paper fiber and Portland cement, their studies are primarily focused on its application as a building material. The malleability and eco-friendliness of papercrete make it suitable for sustainable construction, but its potential to replace clay in pottery, where tactile and aesthetic qualities are crucial, remains largely speculative. This underscores a broader issue in the literature: a tendency to prioritize material properties over pedagogical effectiveness. The research by Dinesh et al. (2023) and El-Nadoury (2021) further expands on the use of supplementary cementitious materials such as rice husk ash (RHA), fly ash (FA), and plant fibers like those found in woodcrete and hempcrete. These studies advocate for the sustainability and cost-effectiveness of these materials, yet their educational applications remain underdeveloped. The focus remains predominantly on their use as building materials, with little consideration given to their potential as substitutes for clay in pottery education. One of the few studies to address the potential of alternative materials in an educational context is that of Rahmi (2019), who discusses the addition of styrofoam beads to concrete mixtures to create lightweight objects. While this research highlights the innovative use of styrofoam to enhance the properties of concrete, it does not explore the material's application in pottery education. The study provides a solid foundation for understanding the benefits of lightweight composites, however its focus is not on educational implications.

In light of the increasing focus on sustainability, there have been notable advancements in the development of eco-friendly materials. However, research in the integration of these materials into educational frameworks remains limited. Research on natural fibers and industrial wastes, as highlighted by Sandanayake et al. (2020) and El-Nadoury (2021), underscores the potential of these materials to reduce the environmental impact of construction. Yet, if these studies are researched

sufficiently, they may address how such materials can be utilized to enhance educational outcomes, particularly in the arts. The use of materials like rice husk ash, fly ash, and styrofoam in cement composites (Dinesh et al., 2023; Rahmi, 2019) presents promising avenues for innovation. However, the pedagogical implications of these materials remain largely unexplored. For instance, while the lightweight nature and malleability of papercrete are well-suited for construction, further research is needed to evaluate its effectiveness as a medium for pottery, where the tactile experience is paramount.

The novelty of the present study lies in addressing the underexplored area of using cement-based composites, particularly papercrete, as viable substitutes for clay in pottery education. This investigation is crucial as it not only expands the scope of sustainable materials in education but also offers practical solutions for enhancing hands-on learning experiences. The scarcity of research specifically concentrated on the educational use of these composites underscores the need for this study. Current literature provides a strong foundation in terms of material properties and sustainability but lacks a critical assessment of how these materials can be integrated into educational practices, particularly in visual arts education. In conclusion, while current research offers valuable insights into the sustainability and material properties of cement-based composites, it falls short in addressing their educational applications, particularly as substitutes for clay in pottery. The present study aims to fill this gap by critically assessing the viability of these materials in educational contexts, thereby contributing to a more nuanced understanding of how sustainable materials can be effectively integrated into visual arts education.

METHODOLOGY

The research plan/framework enabled the researcher to conduct the research systematically and efficiently which led to the targeted outcome. Figure 1, outlines the framework of the research process. This research is a Design and Development Research which follows the approach of Richey and Kline (2014) and is aimed at a developing a teaching aid which uses alternative materials supported by a module and kit for the teaching of pottery. The ADDIE Model was seen as best suited for designing and development of the *Creinnomic* Media Kit. This article will focus on the Implementation Phase of the *Creinnomic* Media Kit.

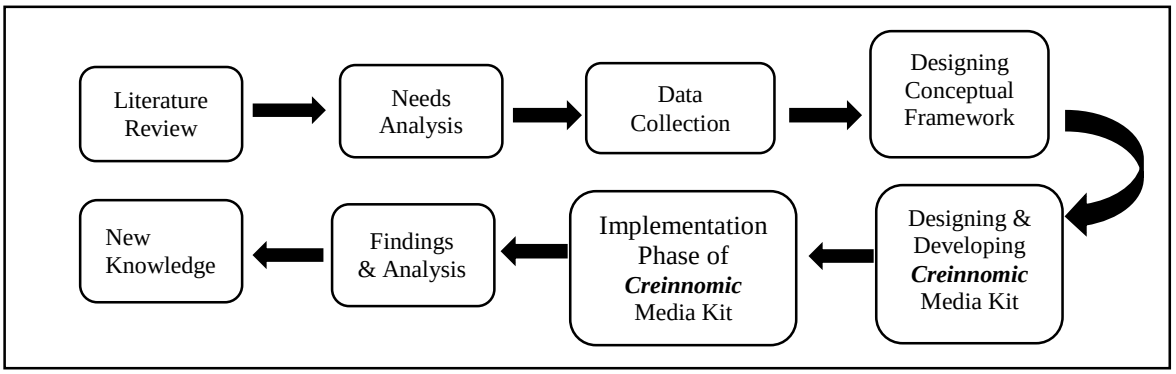

Figure 1: Framework of the Research Process

The implementation phase involved the conducting of workshops to educate the respondents on the use of cement-based composites namely, papercrete, woodcrete, styrocrete and concrete to produce pottery in a classroom environment. It was also to put to test the efficacy of the Creinnomic Media Kit as a teaching aid.

Sampling

The study utilized selective sampling. The participants had knowledge of Visual Arts Education and Malaysian traditional crafts. Key participants comprised seventy-five (75) undergraduates majoring in Art Education who were enrolled in the course "Creativity and Innovation in Visual Arts Education."

and 18 VAE teachers. Additional informants included thirty-three (33) VAE teachers, each with a minimum of five years of teaching experience in VAE, and seven (7) senior ceramics educators, all of whom had at least 20 years of experience teaching ceramics at higher education institutions. This sampling strategy was employed to ensure the validity and reliability of the data collected.

Location

The administration of questionnaires and the facilitation of workshops with the undergraduate participants took place at the Creative Studio of a local university. The workshop for VAE teachers was conducted at a secondary school in the Petaling Utama District, Selangor.

Data Collection Instruments

A variety of instruments were employed for data collection, including questionnaires, interviews, workshops, field notes, video recordings, and photographs, allowing for triangulation of the data. The findings of this research were derived from an analysis of the data collected through these methods.

Analysis of Findings

Thematic analysis and coding were applied transcription of interviews and data from questionnaires to identify sub-themes and themes, facilitating a comprehensive examination of the data. The analysis focused on the use of alternative materials in pottery instruction and their role in fostering creativity, innovation, and meaningful learning.

RESULTS

The literature review identified several cement-based composites that were sustainable and eco-friendly and which had the potential to replace clay in the teaching of pottery. With the help of significant others, papercrete, woodcrete, styrocrete and concrete were identified as most suitable composites to replace clay. The *Creinnomic* Media Kit, advocates the use of the above cement-based composites for pottery. The workshop sessions were used as a platform to test the feasibility of using the identified alternative materials in pottery production. The artefacts produced during the workshops demonstrated the effectiveness of cement-based composites as clay substitutes, particularly in terms of final product quality, cost-effectiveness, time efficiency, and suitability for large classroom settings. The specific aggregates mixed with cement influence the composite's properties, such as weight, appearance, texture, and applicable techniques. Unlike traditional clay pottery, cement-based pottery did not require firing and could be easily painted. Cement served as the main binding agent, with ball clay and wall compounds sometimes added to enhance malleability. These cement-based composites are highlighted for their cost-effectiveness and their ability to support large numbers of students, making them particularly suitable for classroom use. During the workshops, the focus group was introduced to the moulding and casting technique, chosen for its simplicity and efficiency compared to other pottery methods. This approach is particularly well-suited for beginners, as it requires less experience and skill. In contrast, techniques such as pinching and slab construction are more time-consuming and require a higher level of expertise, making them less suitable for novice participants. One anticipated challenge during the workshops was the monitoring of the curing and finishing processes of the artefacts. To address this, printed instructions and images of decorated artefacts were provided to ensure participants fully understood the expected outcomes. The subsequent discussion examines four types of cement-based composites which were tested during the workshops, analysing their composition and characteristics.

Papercrete

Papercrete is made by combining aggregates such as waste paper pulp with coarse or fine sand, water and cement or clay as a binder. These materials are readily accessible, and no specialized equipment is needed to create this composite. The focus group's papercrete artefacts were notably lighter than concrete ones, featuring a rough surface texture when fully dried. The texture was influenced by the type of paper used in the mixture. Recycled paper egg cartons and cardboard result in rougher finishes, while tissue paper and A4 paper produced smoother surfaces. Newspaper composites exhibited textures between these extremes. The drying time for the papercrete artefacts varied between three to seven days depending on the amount of water used in the mix. The focus group successfully produced thirty-two out of fifty papercrete artefacts, which they then painted and embellished creatively. However, many did not meet the specified requirement for contemporary-looking artefacts. Examples of papercrete pottery are shown in Figure 2.

Figure 2. Samples of Papercrete Potter

Woodcrete (Wood Cement)

The focus group also explored the use of woodcrete, a composite material made from equal parts cement, wood pulp or sawdust, and water. The results indicated that woodcrete could effectively replace clay, particularly when using moulding and casting techniques. By reducing the water content and adding superplasticizers such as wall compounds, the focus group produced a stiffer wood cement composite, which was well-suited for pottery methods like pinching and slab construction. Woodcrete not only is cost-effective and readily available but also offers practical benefits such as eliminating the need for firing and providing good fire resistance while absorbing minimal water. The material produces a textured finish, which varies depending on the wood-to-cement ratio and the size of the wood particles used. The unpainted wood cement pottery has a rustic aesthetic, and applying clear varnish can give it a more refined, designomic appearance. In this study, six out of fifty participants successfully created wood cement artifacts, which they then painted and embellished, showcasing the material's potential for creative expression. Interestingly, the visual characteristics of wood cement pottery closely resemble those of papercrete pottery.

Styrocrete (Styrofoam Concrete)

In the production of styrocrete pottery, it was found that a mixture that is of pouring consistency can be successfully casted. The curing of styrocrete pots take about 3-4 days depending on its size. An interesting textured effect was obtained when the styrofoam beads on the surface of the pot were dissolved with the use of thinner. They produced excellent results. The focus group had used wall compounds as superplasticizers. It was to enable better bonding of aggregates, reduce the quantity of water used, and to help prevent crumbling. Samples of styrocrete pottery are seen in Figure 3.

Figure 3. Samples of Styrocrete Pottery

Concrete

Concrete is primarily composed of cement, water, and sand. These components were mixed to create a workable paste that hardens over time. According to Sandanayake (2020), concrete offers several advantages, including its relatively low cost, high compressive strength, resistance to rust, ease of transport and casting, relative fire resistance, and durability against decay. In this research, concrete is recommended due to its ease of casting. Before hardening, concrete is highly pliable, making it ideal for shaping. The casting/moulding method was employed with cement pottery, particularly with fine sand concrete, which is suitable for creating small pots or planters. Once cured, the concrete produced a smooth surface, with the curing process for small pots taking approximately 2-3 days. It was crucial to maintain the correct cement-to-sand ratio to prevent cracking or crumbling. The strength of concrete is also influenced by environmental factors, particularly temperature and moisture. To mitigate the risk of cracking or crumbling, the artefacts were allowed to dry slowly, as uneven tensile stresses during the hardening process can lead to imperfections. The concrete underwent a curing process, where it was kept damp for a period after casting to minimize shrinkage as it hardened. The artefacts were placed in plastic bags and left to set for a week. The focus group successfully produced seven out of fifty concrete artefacts, which were then painted and embellished according to the participants' creativity. However, a few artefacts did not meet the requirement for contemporary designs, influenced by cultural factors. Figure 4 below displays samples of the concrete pottery.

Figure 4. Samples of Concrete Pottery

Findings from Post-Workshop Interviews

Interviews with four respondents revealed the following; i. have the knowledge of pottery production, but do not have the experience of glazing and firing, ii. do not know of alternative materials which could be used in the classroom besides air dry clay and plasticine, iii. have not attended any in house training on ceramics. Respondent 4 is of opinion that alternative materials help develop thinking skills, creativity and innovative skills during the process of material selection for crafting.

> Respondent 4: "… *bahan alternative ini ia dapat mempromotekan kepada aspek kreativiti dan inovasi… memberikan satu aspek perkembangan pemikiran kepada pelajar-pelajar untuk memikirkan bahan-bahan recycle yang sesuai dijadikan bahan kraf… ia membantu pelajar dari aspek problem solving skills".*
> These alternative materials are able to promote creative and innovative aspects… able to develop thinking in students to think about materials which can be recycled into …craft materials… it helps students from the aspect of problem-solving skills

The interviews also brought to light that the respondents were unaware about the use of alternative materials such as cement and other materials, to create pottery.

> Responden 2: "… *kita tak pernah didedahkan, kepada bahan-bahan alternative dalam mana-mana kursus… jika ada ilmu bahan-bahan itu… Seramik dan kita boleh ajar tingkatan tiga …"*
> We have not been introduced to alternative materials in any of the courses…if we had the knowledge of them…ceramics and we will be able to teach the form 3…

> Respondent 3: *"…So satu bengkel bahan alternative akan sangat bermanfaat kepada kami, samada guru lama, guru baru, seharusnya kena hadir, bengkel seperti ini sebab benda ini kena memerlukan pengetahuan, perlu disebarkan…."*
> So… a workshop introducing alternative materials will be very beneficial for us, whether senior teachers, or new teachers, should attend workshops like this because this thing (the use of alternative materials) requires knowledge, and should be spread…

Alternative materials are seen as providing a much-needed solution to their main problem; the availability of materials which are used traditionally. This is reflected in Respondent 2's responses.

> Respondent 2: "… *Sebab kita memang susah nak dapat bahan, contoh nak buat seramik, susah nak dapat tanah liat. Tetapi jika adanya bahan alternatif, bahan yang lain daripada tanah liat. bagus juga. Juga kos pun penting… kelas saya besar."*
> Since it is difficult for us to source for materials, for example to make ceramics, it is difficult to get clay. But if there are alternative materials apart from clay, that's good. The cost is important too… my classes are big

The respondents too are of opinion that pupils do not get adequate hands-on experiences in pottery due to the difficulty in sourcing for clay. All the respondents were of opinion, materials and PCK of teachers were important factors in the teaching of traditional crafts such as pottery.

> Respondent 3: *"…Pertama sekali, kita tidak ada bahan, kedua, kita tak ada cara yang kita nak guna untuk buat. Ok Teknik maksud saya tekniklah"*
> Firstly, we don't have the materials, secondly, we don't know of other ways to produce ceramics. Ok technique what I mean is techniques

The VAE teachers were also of opinion that the use of various alternative materials and techniques in the classroom would certainly be an enjoyable teaching and learning experience for the students.

> Respondent 4: *"…pada pendapat sayalah apabila kepelbagaian bahan, ada juga teknik2 yang dipelajari … err kemungkinan murid pun akan , seronok dari segi kaedah pengajaran dan pembelajaran"*
> In my opinion, when there are a variety of materials, and also techniques which are learnt …err possibly students too will find it enjoyable in terms of teaching and learning

The findings of the interview revealed that many non-option teachers are teaching art and their only knowledge about art is drawing and painting. Non-option teachers have fallen behind when it comes to teaching VAE; in terms of PCK in art, lack of experience and confidence. The respondents stated that if workshops are conducted using alternative materials and diverse techniques, they would definitely benefit trained and non-option teachers and also enable them to be creative.

> Respondent 1: *"… Dia dapat Tarik minat cikgu cikgu yang bukan opsyen … Dia tahu lukis saje… Lagi boleh mencungkil bakat kreatif …"*
> It will interest teachers who are not of art option… they know how to draw only… furthermore, able to encourage creativity

Questionnaires of the VAE teachers revealed that, about half of the respondents (12/25) knew of some other alternative materials apart from clay to create pottery but were not suitable for large classes. Twenty-three (23) out of twenty-five (25) respondents stated that they did not fire the products made by the students. All of the respondents stated that they would use alternative material to make pottery instead of clay if they had the knowledge and knowhow. They were agreeable for the following reasons: (i) it could be used to replace when clay is difficult to source, (ii) able to produce different types of interesting pottery, (iii) provides exposure to students, (iv) it shows variations in art form (v) able to invent something new. Moreover, all the respondents supported the notion of allowing students to explore alternative material. They provided the following reasons for this: (i) the exposure will enable them to touch and feel the different types of alternative materials, (ii) encourage pottery-making, (iv) exploit the available materials and understand the characteristics of them, (v) and (vi) to encourage students to experiment with other materials. The feedback from the questionnaires of university students highlighted several issues:
(i) a lack of hands on experience in ceramics production (ii) an overemphasis on theoretical aspects of ceramics in the classroom, (iii) the occasional omission of traditional craft topics, (iv) reliance on traditional 'chalk and talk' teaching method (v) and the use of art lessons for other subjects deemed more important.

ANALYSIS OF FINDINGS

Thematic analysis was used to derive at themes. Several themes emerged which supported the need to identify alternative materials in the teaching of pottery. Table 2 provides a description of codes used in the analysis.

Table 2 Description of Codes to Analyze Contents of Interviews

Code	Category	Verbatim Data from Interviews with informants (Inf.)
Pottery	Natural Materials: Clay	Inf.1*: 'Bagi saya, saya selalu pakai plastercine. Dia murah sikitkan. Tidak perlu bakar.'* As for me, I always use plasticine. It's a little cheap. Does not require firing.
	Alternative materials used by teachers: Plasticine Paper clay Play doh Paper mache	Inf. 2: '*stor ada tanah liat. Ajar Teknik buat aje selalu… … bengkel tak ada tanur …'* There is clay in the store. Teach the techniques always… there is no kiln in the workshop… Inf. 5: *'Saya pakai paper clay atau air dry clay tapi mahal. Tapi saya ada 1 kelas saje …jadi bolehlah tapi bagi sikit saje… buat benda-benda kecil…'* I use paperclay or air-dry clay but it's expensive. But I have only one class… so it's feasible but I give a small piece

continued

		… at least the pupils make something… teach to make bowls using pinching and coiling techniquesonly… make small things.. Inf. 4: '*saya guna buku teks… dan komputer untuk ajar cara buat… saya bukan opsyen seni'* I rely on text books…and the computer to teach techniques of production…I am not an art optionist Inf.3: *'paper mache sebab tidak dapat tanah liat…. At least budak buat sesuatu… ajar buat mangkuk saje Teknik picitan dan lingkaran'* Paper mache because I don't have clay… at least the students create something… just teach how to make bowls using pinching and coiling techniques. Only one informant used clay, only the techniques of production were dealt with as there was no kiln. The rest used a variety of other materials such as paper clay, plastercine and paper mache
PCK of teachers Who are teaching VAE in school	Knowledge of Ceramics	Inf. 1 *di university saya opsyen tekstil dan design* In university, my option was textile and design Inf. 2 *saya Pendidikan Seni Visual… belajarlah tapi bukan pandai sangat* Although I'm a VAE optionist … am still learning but not very good Inf. 5 *seramik* ceramics Inf. 4 *saya bukan opsyen seni, sejarah* I'm not of art option, History Inf. 3 '*tahu sedikit'* I know a bit

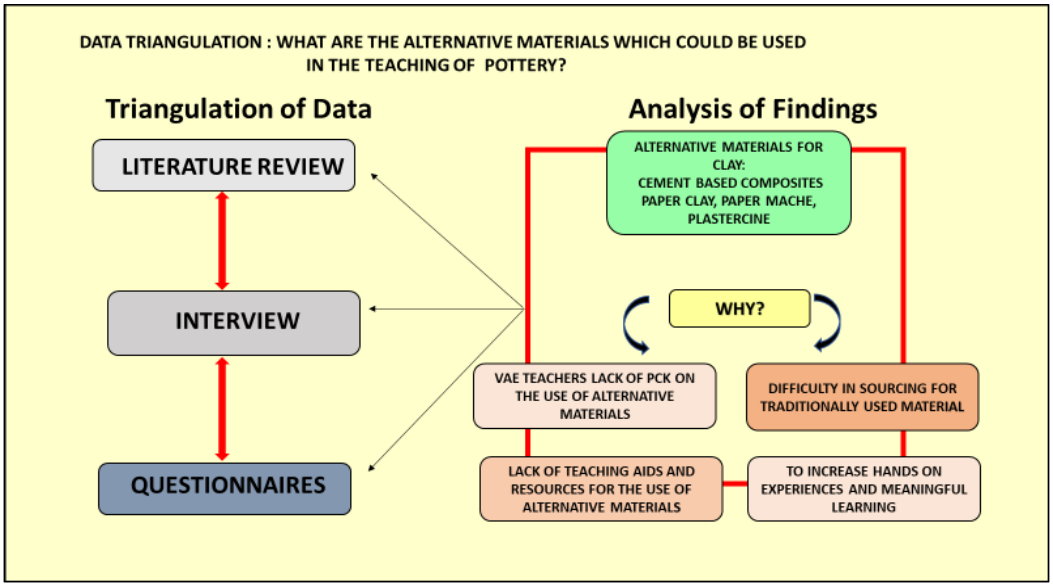

Figure 6. Triangulation of Data for Alternative Materials

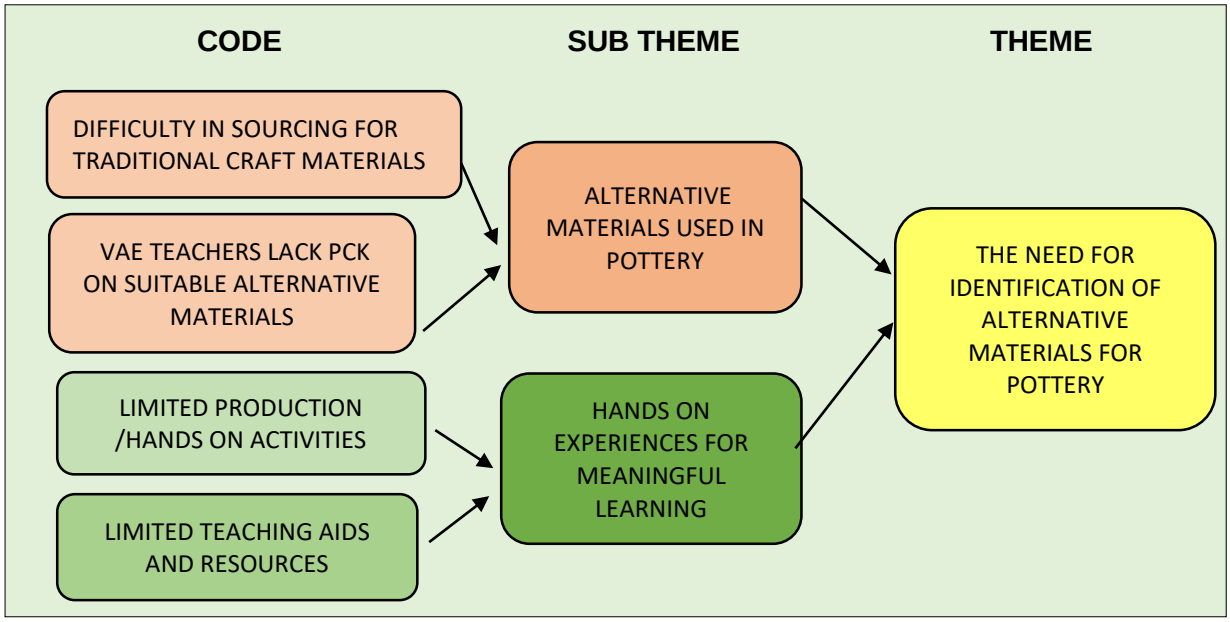

Figure 7. Codes, Sub-themes and Themes: The Need for Identification of Alternative Materials for Pottery

In conclusion feedback from the interviews and questionnaires with the teachers revealed the following about the teaching of ceramics; (i) the production of ceramics was hardly carried out, (ii) many schools did not have kilns, (iii) clay was difficult to source, (iv) plasticine and forms of air-dry clay were sometimes used but were expensive, (v) most often, only the theoretical aspects of ceramics were taught, (vi) lack of pedagogical knowledge in the area of ceramics, (vii) hardly any resources for the teaching of ceramics and (viii) were in favour of modules and kits. the findings from research point to the fact that the knowledge of alternative materials is vital in providing hands on experiences and meaningful learning when traditional materials are unavailable.

DISCUSSION

This study investigates the intersection of integrating alternative materials into the classroom, and achieving meaningful learning. The results indicate that the use of alternative materials, particularly cement-based composites, has potential for enhancing practical engagement in Visual Arts Education (VAE). However, this raises critical questions about the broader implications of material substitution in traditional craft education. Ausubel's (2000) Theory of Meaningful Learning, where new knowledge builds upon existing conceptual frameworks, aligns with the notion that students must experience hands-on applications to internalize their learning. The difficulty in sourcing traditional pottery materials, as echoed by respondents, underscores the limitations of purely theoretical instruction. Students often struggle with conceptualizing practical techniques when devoid of tactile experiences. Therefore, the integration of alternative materials in the curriculum can bridge this gap by providing tangible, hands-on engagement. This aligns with Ausubel’s framework but simultaneously challenges the purists' view of traditional craft preservation, particularly when alternative materials might not fully replicate the qualities of clay.

The suggestion by a respondent to maintain traditional forms and designs even when using cement-based composites invites a critical reflection. While the intention is to preserve cultural heritage, the imposition of traditional guidelines on new materials may unintentionally limit creative exploration. For instance, strict adherence to traditional pottery thickness and techniques might compromise the potential advantages that alternative materials offer in terms of form and functionality. Thus, while meaningful learning occurs when students draw connections between traditional craft and new

materials, we must critically consider whether too rigid a focus on tradition might stifle innovation in sustainable arts education.

Moreover, the environmental implications of this approach merit further analysis. The use of industrial and agricultural waste products, such as bagasse and jute, introduces a sustainable dimension to pottery education, aligning with contemporary ecological awareness. This aligns well with the broader educational goal of fostering sustainability, yet it also calls for a reevaluation of how "tradition" is conceptualized in the art classroom. The integration of these materials serves not only as a response to resource scarcity but also as a pedagogical tool to instill environmental consciousness in students. This dual role expands the scope of VAE from craft preservation to active participation in sustainable living practices. The study's findings connect strongly to the educational theories on constructivism, which advocate for experiential learning as a way to build upon pre-existing knowledge. However, there are theoretical tensions that arise when new materials are integrated into traditional craft. While Ausubel's framework validates the use of alternative materials for meaningful learning, it also suggests that learning is context-dependent. Thus, the contextual shift from traditional materials to new materials may challenge the depth of cultural and historical understanding. This raises questions about how far the use of alternative materials can stretch before the connection to traditional craft becomes diluted.

IMPLICATION

The study found that there was a significant relationship between the availability of materials for pottery and hands on experiences provided to students. The introduction of alternative materials, such as cement-based composites, was explored as a means to bridge the gap in material availability. The research identifies novel insightful interpretations of cement pottery which could be brought into the VAE classroom, focusing particularly on how VAE teachers can benefit from these findings.

Implications for VAE teachers

a. The study demonstrates that meaningful learning occurs when students connect prior knowledge with new information, as articulated in Ausubel's (1968) Theory of Meaningful Learning. This was evident when focus group participants applied their prior knowledge of casting in the creation of cement composite pottery. The study, therefore, underscores the importance of integrating students' existing knowledge into new learning experiences to enhance the learning process.
b. A positive correlation was observed between the theoretical and practical aspects of learning when students were provided with hands-on experiences. The responsibility of offering these opportunities lies with educators and educational institutions. Given that the study has shown the viability of substituting traditional materials with alternative ones in the teaching and learning of traditional crafts, there is no justification for denying students these practical experiences.
c. The findings also suggest that the use of alternative materials can significantly enhance students' creative skills. In the context of cement composite pottery, factors such as the selection of molds, types of cement composites, and finishing techniques play crucial roles in determining the final product. VAE teachers should, therefore, allow students the freedom to make choices, thereby fostering and nurturing creativity. Given that creativity is inherently subjective, it is essential for VAE teachers to remain open to diverse interpretations from students.

Implications for Future Research

Future research could explore the long-term effects of using alternative materials on students' understanding of cultural heritage in pottery. For instance, longitudinal studies could investigate whether students who learn pottery through cement-based composites retain an appreciation for traditional clay pottery or if their learning experience shifts their focus to material innovation and sustainability. Moreover, further research could delve into the potential creative freedoms or constraints

imposed by alternative materials, examining whether they encourage more exploratory artistic practices or simply serve as substitutes for clay. This could contribute to a broader discussion on the evolving role of tradition in art education in the face of global sustainability challenges.

CONCLUSION

This study aimed to investigate the challenges that prevent VAE teachers from offering hands-on experiences in ceramics and to determine whether the identified alternative materials could alleviate these challenges in classroom settings. The research provides valuable insights, demonstrating that cement-based composites are excellent substitutes for clay and can effectively support traditional pottery techniques. The findings indicate that meaningful learning experiences can be facilitated through the use of these alternative materials. As VAE teachers increasingly recognize the importance of hands-on experiences in fostering meaningful learning, the adoption of alternative materials in the teaching and learning of pottery should be strongly encouraged in educational institutions.

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