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Designing AR-Based Art Learning Media to Enhance Creative Processes and Products Top of Form

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Abstract

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This study aims to design an art education learning medium based on Augmented Reality (AR) that focuses on enhancing the processes and products of student creativity. AR technology is considered capable of creating interactive learning experiences by integrating visual and sensory elements, thereby promoting emotional and cognitive engagement in the creative process. Utilizing a Research and Development (R&D) approach, the AR-based media was developed based on constructivist theory and the 4P creativity model (Person, Process, Product, Press). Trials were conducted in limited groups and expanded to assess its impact on students' creativity in art learning. The results showed that AR-based art learning media increased active participation, encouraged artistic exploration, and resulted in more innovative creative outputs. This article concludes that implementing AR technology in art education opens new potentials in designing immersive and meaningful learning experiences that support the holistic development of creativity. The findings highlight AR's role in transforming traditional art instruction into dynamic and engaging pedagogical practices.

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1. Introduction

Arts education plays a very important role in fostering creative thinking skills, self-expression, and aesthetic appreciation. In the context of 21st-century learning, which emphasizes digital literacy, interpersonal collaboration, and complex problem-solving, the transformation of art learning methods becomes crucial and cannot be ignored. One technology that shows great potential in supporting more innovative arts learning is Augmented Reality (AR) (Aslan et al., 2019). This technology allows for the real-time insertion of digital objects into the real world through devices such as smartphones, tablets, or similar digital tools, thereby creating an interactive, dynamic, and contextual learning experience. Various research findings in recent years show that AR can create a much more engaging, immersive, and personalized learning environment for each student. In arts learning, the presence of AR-based media allows students to interact directly with the visual elements presented, observe three-dimensional objects from various angles, and explore art techniques and styles in new ways that were previously impossible in conventional, static classroom settings.

A study by Lampropoulus et al. (2022), shows that the application of AR in an educational context can significantly increase learning motivation and active student participation in visual arts learning. However, the application of technology in education should not only be oriented towards technical aspects or merely the sophistication of the hardware and software used. More importantly and fundamentally is how the technology can effectively support the achievement of pedagogical goals, especially in developing holistic creative processes and products.

Creativity is not just about producing something entirely new, but also reflects an original, flexible, adaptive, and valuable thinking process. In the context of arts learning, creativity can be observed from how students develop unique ideas, explore various types of visual media, and create works of art that have strong personal expressive meaning and social value.

The 4P creativity framework (Person, Process, Product, Press), first introduced by Rhodes, remains highly relevant today and can be used as an analytical framework in designing AR-based arts learning media. In this model, 'Person' refers to individual student characteristics such as talent, interest, and motivation; 'Process' includes the stages of creative thinking from idea exploration to realization; 'Product' refers to the tangible works produced by students; and 'Press' relates to the environment or atmosphere that supports or hinders creativity. In this context, AR technology plays a significant role in creating a 'press' or a supportive, conducive learning environment that allows students' creativity to develop maximally.

Thus, the need for arts learning media that can bridge technological advancements and pedagogical values is increasingly urgent and needs to be responded to immediately through concrete innovation (Durak & Canakya, 2020). AR as interactive learning media not only functions as a mere visualization tool but can also be a creative experimental space that triggers imagination and deeper exploration. The main objective of this research is to design, implement, and evaluate effective and innovative AR-based arts learning media to enhance students' creative thinking processes and the quality of their creative products. This study is expected to contribute significantly to the development of more innovative, relevant,

technology-based arts learning models that are adaptive to the demands of education in the current and future digital era.

2. Literature Review

2.1. Augmented Reality in Learning

The application of AR in education has been widely studied with results showing positive impacts on learning motivation and concept understanding. This technology presents a new approach to the learning process that is more interactive and contextual. According to Alzahrani (2020), AR provides a deeper and more meaningful learning experience through real-time visualization of complex data, allowing students to not only see information but also experience it directly in a digital form integrated with the real world. This makes the learning process more dynamic and engaging, as students can explore material independently and collaboratively. In arts education, AR offers vast opportunities to enrich students' visual experiences.

This technology allows students to view three-dimensional replicas of artworks, recognize artistic techniques and styles from various art movements, and even create visual compositions through interactive simulations. Not only that, AR also encourages creative exploration through sensory interactions such as touch, movement, and sound, thereby strengthening students' emotional and cognitive engagement. As shown by Jiawei et al. (2023), AR has been proven to enhance conceptual understanding and foster creativity through multisensory involvement in arts learning. Thus, the use of AR in arts education can be an effective pedagogical

strategy for developing students' aesthetic abilities and innovation in facing the challenges of 21st-century learning.

2.2. Creativity Models in the Context of Arts Education

Creativity in arts learning encompasses divergent thinking processes, media exploration, and authentic personal expression. This process not only involves creating something new but also how students interpret their experiences and emotions into visual forms. According to Ilha Villanova (2021), creativity consists of four levels: mini-c (personal insight), little-c (everyday creativity), Pro-C (professional creativity), and Big-C (eminent creativity). These four levels reflect the spectrum of creativity development from everyday personal experiences to extraordinary achievements at a professional level. In the context of arts education, Augmented Reality (AR) can play an important role in facilitating 'little-c' and 'mini-c', especially through empowering students in artistic exploration that is not limited by conventional media.

AR allows students to explore diverse visual forms and techniques interactively, providing freedom in expression and creating works based on their subjective experiences. Through an approach that touches emotional and sensory aspects, AR also increases students' self-confidence in expressing ideas. A study by Liu et al. (2021) shows that technology-based arts learning not only enriches the learning process but also supports the formation of original ideas, expressive color choices, and the use of diverse artistic techniques. Therefore, the utilization of AR in arts learning can strengthen the foundation of students' creativity from an early age and foster creative thinking skills continuously.

2.3. Citation style

Designing AR-based media requires an approach that combines three main elements: technology, pedagogy, and content, known as the TPACK (Technological Pedagogical Content Knowledge) framework. As stated by De Rossi and Trevisan (2018), teachers need to have a deep understanding of how to integrate these three harmoniously to create effective and meaningful learning. Without this understanding, the use of technology will only be a passive tool, not a driver of pedagogical change. In arts learning, AR design elements include the selection of relevant and aesthetic visuals, the integration of sound to enrich the sensory experience, interactivity to encourage active student engagement, and real-time feedback to strengthen the reflection and revision process.

A good learning experience greatly depends on the quality of the user interface (UI) and user experience (UX) an intuitive, visually appealing, and easy-to-use UI/UX design plays a crucial role in increasing user engagement and overall learning success. In addition, AR-based learning models also need to consider usability aspects, including ease of navigation and device responsiveness, as well as accessibility for students with diverse backgrounds, abilities, and special needs. This is important so that AR media can be truly inclusive and able to reach all students fairly and equitably in the context of transformative arts learning.

3. Methods

This study employs the Research and Development (R&D) method using the ADDIE development model, which comprises five systematic stages: Analysis, Design, Development, Implementation, and Evaluation. This approach was selected for its suitability in designing, developing, and testing the effectiveness of technology-based learning media. The research subjects were middle-level students engaged in visual arts learning, chosen based on their active participation in creative, project-based learning activities. Data collection was conducted through various techniques, including observation, interviews, questionnaires, and documentation of student artworks, in order to obtain a comprehensive understanding of the learning process and outcomes. During the analysis stage, the study identified the needs of arts education, student characteristics, and the potential for integrating Augmented Reality (AR) technology in this context. These findings informed the design phase, in which AR media development was guided by the principles of high interactivity, visual aesthetics, and user-friendly interface design. The learning content included perspective drawing techniques, color theory, and exploration of creative themes aligned with the curriculum.

In the development phase, a media prototype was created using Unity 3D and Vuforia software, then integrated with existing instructional materials. The prototype underwent pilot testing with a small group of students to identify technical issues and assess preliminary effectiveness. Research instruments included a creativity questionnaire adapted from the Torrance Test of Creative Thinking (TTCT), observations of student engagement, and documentation of student artworks. Data

were analyzed quantitatively using descriptive statistics and t-tests, and qualitatively through thematic triangulation to explore student and teacher perceptions of AR media. By combining quantitative and qualitative approaches, this research aims to evaluate the effectiveness and feasibility of AR-based media in enhancing student engagement and creativity. The findings are expected to contribute to innovative visual arts instruction that leverages digital technology in an optimal and contextualized manner.

4. Results and Discussion

The use of AR-based arts learning media showed a significant impact on increasing learning engagement and the quality of students' art products. These findings demonstrate that the presence of interactive media combining technology and aesthetics can foster new dimensions in students' learning experiences. The three-dimensional visualization and interactive elements in AR media triggered the exploration of more complex and original ideas, creating a new space for the freer and more creative development of ideas. As noted by Liu et al. (2021) in their study on digital creativity, high emotional and sensory engagement is a crucial key in building students' intrinsic motivation to create.

Furthermore, the use of AR facilitated students' visual thinking processes more effectively. When students viewed three-dimensional forms in real space through a device screen, they not only understood proportion and perspective theoretically but also practically through direct manipulation of virtual objects. They could rotate, enlarge, and project objects in actual spatial scale, thereby triggering a

stronger and more concrete construction of meaning. This multisensory experience involved sight, movement, and sometimes sound, which enriched the connection between information and visual perception. This is in line with the findings of Jiawei et al. (2023), that visual-spatial integration in AR strengthens cognitive construction and supports mental representations that are more stable, deeper, and more easily recalled by students during the creative process.

Analysis of the resulting artworks showed an increase in form complexity, boldness in color usage, and diversity of chosen themes (Marshall et al., 2019). Students became more expressive in conveying ideas, no longer limited to conventional patterns or forms. Students' creativity was clearly visible in how they interpreted AR objects and incorporated them into their own compositions, creating more personal, authentic, and meaningful results. They were able to build visual narratives through elements previously only available theoretically in textbooks or drawing boards. The art products produced were not only more aesthetic from a technical perspective but also more reflective of personal expression and better able to capture the dynamics of students' emotions, experiences, and thoughts. This supports the idea that digital learning environments can strengthen the 'Person' and 'Product' aspects in the 4P framework, as they encourage the actualization of creative potential rooted in students' subjective experiences.

Aside from the artwork results, the learning process also showed interesting dynamics. Students showed higher initiative in exploring AR media features, asking questions, and sharing ideas with classmates. Communication patterns among students became more open and cooperative. Learning was no longer dominated by

a one-way flow from teacher to student but became more dialogic and reflective. Students actively gave each other feedback, discussed colors, compositions, and even story elements behind their works. Collaboration in creating technology-based artworks became an effective means to develop social skills as well as critical thinking abilities. This is consistent with the findings of Gallon (2019) that AR-based transmedia learning environments create a multidimensional exploration space that supports the integration of knowledge from various sources, including from students' personal and social experiences. The interaction built through AR media also broadened students' learning horizons. They were not merely passive learners but transformed into active creators who had control over their learning experiences.

Teachers in this study observed that the use of AR built a sense of ownership over the learning process, as students felt that what they created originated from their own exploration and decision-making. Self-confidence and satisfaction with the works produced also increased, as students felt capable of combining ideas, techniques, and media into a complete form. From a pedagogical perspective, participating teachers stated that AR media was very helpful in explaining abstract art concepts concretely. For example, concepts of one-point or two-point perspective, previously difficult to explain through flat drawings on a whiteboard, could now be visualized with real-time 3D object simulations. This made it easier for students to understand visual principles more applicably. Teachers also felt a shift in their role from instructors to facilitators of the creative process. They spent more time accompanying the exploration and reflection process, and providing dialogical and in-depth feedback. This had a positive impact on the quality of

interaction between teachers and students, as the classroom became more open, supportive, and mutually inspiring.

However, teachers also highlighted some challenges that arose in the implementation of AR media. Among them were the need for technical training for teachers, as not all art teachers had adequate technological backgrounds. In addition, school infrastructure such as hardware, internet connection, and the availability of suitable workspaces were also supporting factors that largely determined the success of AR implementation on a broad scale. Teachers stated that although AR media was engaging, if it was not accompanied by device readiness and user skills, the learning process could be disrupted. Therefore, there needs to be synergy between media development and continuous training, so that this technological innovation truly provides maximum benefits in the educational context.

From the students' perspective, a small portion still experienced obstacles in accessing the technology due to differences in digital device operation skills. This necessitates an inclusive learning approach, as well as technical support during the media usage process. In some cases, students needed more time to adjust to the AR interface, especially those who were not accustomed to using technology in their daily learning. Nevertheless, after several meetings, students showed positive development and were able to use the media smoothly. Even students who were initially technically behind showed significant improvement in creativity because they felt challenged to catch up with their classmates. Based on direct observation and assessment of the artworks collected during the learning process, a comprehensive understanding of the impact of AR use on the quality of arts learning

was obtained (Sunassee et al., 2021). Students works reflected diversity in terms of themes, techniques, and aesthetic approaches used.

Some students even managed to develop experimental works by combining AR objects, traditional media such as watercolors, and visual narratives they created themselves through digital tools. This shows that AR media does not replace conventional learning methods but can actually synergize to enrich the entire arts learning process and outcomes. The limitations in this study lie in the limited scale of implementation, involving only one educational level and not yet reaching variations in students' socio-cultural contexts. Furthermore, not all teachers or schools have equal access to AR technology, so generalizing the findings needs to be done carefully. This research also did not explore the long-term aspects of AR use on students' creativity development over a broader period. Therefore, further research with a larger scope and a more in-depth approach is needed to observe the dynamics of such development continuously.

Nevertheless, this study provides a strong foundation for the further development of AR media in the visual arts field. The findings show that when designed and implemented with an appropriate pedagogical approach, AR media can be a very effective instrument in encouraging learning engagement, building conceptual understanding, and improving the quality of students' creative works. The integration of AR technology into arts learning not only provides a more enjoyable and meaningful learning experience but also creates space for individual expression, experimentation, and deep creative dialogue. This opens up great opportunities for the transformation of arts education in the future, where

technology acts as a catalyst, not a substitute for the role of teachers or humanistic values in arts education.

5. Conclusion

Arts learning media based on Augmented Reality is proven to significantly enhance both the process and product of students' creativity. AR provides a more interactive, visual, and contextual learning experience, which directly strengthens students' creative thinking abilities in various aspects of learning. Within the 4P theory framework, AR creates an environment (press) that supports the development of students' personal aspects (person), facilitates the stages of creative thinking processes (process), and encourages the emergence of original and authentic works (product). This approach affirms that technology is not just a tool, but also a space for creativity to grow and develop more broadly and deeply.

The integration of AR in arts learning also emphasizes the importance of a student-centered pedagogical approach, and accommodates the potential of digital technology in building more meaningful, contextual, and reflective learning experiences. The development of AR-based arts learning media must consider the quality of content design, ease of use (usability), and its integration with the applicable curriculum so that its implementation can run effectively and sustainably. The results of this study provide important recommendations for educators and media developers to begin adopting and exploring the use of AR more broadly in arts learning. Further research is highly recommended with a larger scope and more diverse approaches to reach a wider and more inclusive educational context.

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