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DEVELOPING VIEWING SKILLS IN ARTS APPRECIATION THROUGH COLLABORATIVE DIGITAL PORTFOLIOS AMONG STUDENTS

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Abstract:
This study investigated the impact of collaborative digital portfolios on enhancing students' viewing skills in art appreciation. Addressing the gap in traditional teaching methods, which often neglect the systematic development of visual literacy, the research examined how digital portfolios foster critical engagement with visual content. A mixed-methods approach was employed, combining a quasi-experimental quantitative design with a qualitative descriptive method. The quantitative phase involved 148 students divided into control (traditional method) and experimental (digital portfolio) groups, assessed through pretests and post-tests. The qualitative phase included interviews with purposively selected participants to understand their experiences. Results indicated that the experimental group achieved a significantly higher mean gain score (3.98) compared to the control group (0.56), as confirmed by an independent t-test ($p < 0.05$). Thematic analysis of student feedback revealed increased engagement, improved reflection, enhanced collaboration, and a deeper appreciation for visual content. Students found digital portfolios empowering, interactive, and creatively liberating. The study concluded that

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collaborative digital portfolios effectively cultivate viewing skills and visual literacy, aligning with 21st-century educational demands. These findings support the integration of digital tools in arts education to foster critical thinking, creativity, and inclusive learning environments.

Keywords: viewing skills, digital portfolios, art appreciation, visual literacy, collaborative learning

1. Introduction

Viewing skills have recently emerged as the fifth macro skill, alongside listening, speaking, reading, and writing, reflecting the growing importance of visual literacy in the 21st-century learning landscape. As digital media and visual content become central to communication and education, developing viewing skills empowers students to analyze images, symbols, and multimedia messages critically (Haleem *et al.*, 2022). These skills enable learners to navigate an increasingly visual world, fostering creativity, cultural awareness, and critical thinking. Moreover, the ability to interpret visual content complements traditional literacy, helping students synthesize information from diverse sources and make informed decisions in both academic and real-world contexts (Matusiak *et al.*, 2019). However, traditional teaching methods often overlook the systematic development of these skills (Hu, 2024). To address this gap, the adoption of innovative approaches is deemed essential. This research explores how optimizing modern technology can equip learners with the competencies necessary for thoughtful and critical engagement with visual media in the digital age.

Globally, developing students' viewing skills presents significant challenges in educational settings. Faloye, Obateru, and Alonge (2021) highlighted the insufficient ability of teachers to guide students in interpreting digital visual icons, which reflects broader issues in cultivating critical viewing skills in learners. Similarly, Kim (2020) emphasized that the effective use of data visualizations can significantly reduce cognitive load and improve decision-making, highlighting the importance of developing students' capacity to engage with visual content effectively. The study revealed that interactive visualization tools enhanced users' decision quality by optimizing working memory usage compared to traditional methods. Additionally, Hassan and Obeidat (2022) demonstrated that traditional teaching methods often fail to enhance students' visual thinking skills, with interactive digital videos proving far more effective in developing such competencies. These findings underscore the need for educational systems to integrate more dynamic and visually engaging instructional approaches to meet the evolving demands of visual literacy.

Another critical issue is the limited exploration of visualization accessibility and strategies for inclusive learning environments. Kim, Joyner, Riegelhuth, and Kim (2021) emphasized the discriminatory implications of relying solely on visual media, particularly for students with visual impairments, pointing to gaps in visualization accessibility research. Furthermore, Kaur and Kaur (2020) found that conventional teaching strategies do not adequately nurture students' observation skills, whereas visual thinking strategies (VTS) yielded significant improvements in problem-solving and observation abilities. Seethongsuk

and Yimwilai (2022) similarly demonstrated the effectiveness of VTS in enhancing learners' reading abilities and critical engagement with visual content. These studies collectively indicate that while visual media holds immense educational potential, there are pressing challenges in designing inclusive and effective methods for cultivating strong viewing skills among diverse learners.

In the Philippines, viewing skill development among learners faces notable challenges despite technological educational advancements. Corpuz-Bullecer (2017) emphasized that while many students possess foundational viewing skills, gaps remain in more critical areas like sensing character traits, often influenced by limited multimedia resources. Similarly, Alejo *et al.* (2019) found that language and communication students demonstrated above-average viewing comprehension at literal and inferential levels but lacked deeper analytical engagement, suggesting improved instructional strategies were needed. Guieb and Ortega-Dela Cruz (2017) highlighted that traditional teaching methods often fail to engage digital-native learners, with students preferring multimedia formats over textual materials for literary comprehension. These findings underscore the urgent need for more innovative, technology-integrated approaches to foster advanced viewing skills and ensure learners are better equipped to interpret visual content in today's information-rich landscape critically.

Parallel to this, a study by Enoch *et al.* (2023) on the effectiveness of visual thinking strategies for Grade 9 students in Davao City highlighted that while there was a positive impact on viewing skills, existing teaching methods often fail to systematically integrate critical viewing components, with traditional approaches overlooking the growing importance of visual literacy in today's digital age. Hernandez-de-Menendez *et al.* (2020) emphasize the transformative role of emerging technologies that could enhance students' viewing skills by fostering critical thinking and visualization. However, despite these promising technologies, there is still an overarching challenge of integrating them effectively into the educational system, where traditional pedagogies remain dominant. As visual content becomes a central part of learning, the need for students to engage critically with this content grows more urgent. Thus, this study on developing strong viewing skills in art appreciation through collaborative digital portfolios is vital, as it aims to address these gaps and harness technological advancements to cultivate critical visual thinking skills. The research will provide essential insights into how modern digital tools can be leveraged to improve viewing skills, making students more adept at interpreting and engaging with visual information in an increasingly complex world.

2. Research Questions

This study aimed to look into the impact of collaborative digital portfolios on improving college students' viewing skills in art appreciation. Specifically, it intended to answer the following questions.

1) What is the mean gain score of the students' viewing skills in art appreciation in the control group when exposed to the traditional teaching method?
2) What is the mean gain score of the students' viewing skills in art appreciation in the experimental groups when exposed to collaborative digital portfolios?

3) Is there a significant difference in the mean gain score of the students in the control and experimental group?
4) What are the students' perceptions of the effectiveness of collaborative digital portfolios in improving their art appreciation viewing skills?

3. Literature Review

Integrating collaborative digital portfolios into arts education represents an innovative approach to fostering strong viewing skills among students (SpacesEDU, 2020). Moreover, as mentioned in the study of Schraw and Richmond (2022), by curating and reflecting on their work within these portfolios, students develop critical thinking and metacognitive abilities, leading to a more profound appreciation of the arts. Viewing skills involve analyzing, interpreting, and critically engaging with visual art, are essential for deepening students' appreciation and understanding of artistic expressions.

3.1 The Significance of Viewing Skills in Arts Appreciation

Viewing skills are fundamental for students to engage meaningfully with various art forms, enabling them to analyze, interpret, and appreciate artistic expressions. According to the University of Birmingham (2024), visual literacy equips learners to understand and analyze the contextual, cultural, ethical, aesthetic, intellectual, and technical components of producing and using visual materials. The National Art Education Association (2024) emphasizes that teaching strategies for visual literacy, such as close readings of works of art and discussions about art and design, develop critical thinking, evidence-based reasoning, and meaning-making. Furthermore, Agtarap (2021) notes that when students make observations, they learn how to describe what they see, interpret images, and make deeper connections, enhancing their critical thinking skills.

Developing strong viewing skills allows students to decode visual information, recognize patterns, and make connections between artistic elements such as color, composition, and symbolism. These competencies are not limited to the arts but extend to other disciplines and everyday life, enabling individuals to interpret visual media, advertisements, and data visualizations more effectively. The National Council of Teachers of English (2021) highlights that students skilled in visual literacy can create meaning from images, improving their writing proficiency and critical thinking skills. Additionally, engaging with art fosters empathy and a broader worldview as students learn to appreciate the diversity of human expression. Edutopia (2016) noted that new research reveals that the arts may prime our neural circuitry for various activities, boosting crucial cognitive and social skills like spoken and written language, focus, self-control, and empathy.

3.2 Collaborative Learning in Arts Education

Collaborative learning has significantly enhanced students' engagement, motivation, and learning outcomes in arts education. For instance, Loes (2022) found that collaborative learning positively influences students' academic motivation across four years of undergraduate

education. Similarly, Kakungulu (2024) demonstrated that integrating creative arts into education enhances student engagement and learning by fostering deeper cognitive, emotional, and social involvement. Additionally, a study by Ni *et al.* (2022) highlighted how collaborative creativity in design education encourages students to experiment, take risks, and explore unconventional ideas, leading to more decadent interpretations and a more profound appreciation of art.

One of the key benefits of collaborative learning in arts education is its ability to foster creativity and innovation. When students collaborate, they combine their unique skills, experiences, and perspectives, creating more creative solutions and artistic expressions. For example, Ni *et al.* (2022) highlight how collaborative creativity in design education encourages students to experiment, take risks, and explore unconventional ideas. This collaborative environment nurtures a culture of innovation, where students feel empowered to push the boundaries of traditional artistic practices. Additionally, collaborative learning in the arts has been shown to enhance social skills and cultural awareness. A study by Bernaschina (2024) demonstrated that collaborative art projects in community settings improve students' artistic abilities and strengthen their social skills and cultural understanding. Students learn to communicate effectively, resolve conflicts, and appreciate diverse perspectives by working together on art projects. These experiences are particularly valuable in fostering empathy and inclusivity as students engage with peers from different backgrounds and cultures.

3.3 The Role of Digital Portfolios in Education

Digital portfolios have become a vital tool in arts education, offering students a dynamic platform to document, reflect upon, and showcase their learning experiences. Yang and Wong (2024) emphasize that these portfolios enable students to display their work, reflect on their progress, and receive constructive feedback from peers and instructors. This reflective process encourages students to critically assess their artistic choices, identify areas for improvement, and celebrate their achievements, fostering growth as artists and learners. Additionally, Sullivan (2018) notes that digital portfolios are particularly valuable in arts education as they promote the development of viewing skills, allowing students to analyze and interpret artworks more effectively.

One of the key advantages of digital portfolios is their ability to provide a structured and organized way for students to document their artistic journey over time. With easy access to past work, students can track their progress, observe patterns in their development, and set meaningful goals for the future. For instance, Seesaw (2022) emphasizes that digital portfolios empower students to take ownership of their learning by allowing them to capture and reflect on their progress, fostering a deeper understanding of their creative process. Similarly, Drieam (2023) notes that portfolios stimulate student-driven learning and responsibility, adapting to each student's personality, context, goals, and development. Additionally, a study by Fahey and Cronen (2016) highlights how online digital portfolios provide a platform to promote students' metacognitive skills and direct their learning, enabling them to curate and showcase their progress. Digital portfolios facilitate collaborative learning and peer feedback, aligning with the principles of social constructivism, which emphasize the importance of interaction and dialogue

in the learning process (McLeod, 2024). By sharing their portfolios with classmates, students can engage in meaningful discussions about their work, exchange ideas, and learn from one another, enhancing their teamwork and communication skills.

3.4 Enhancing Visual Literacy through Technology

Integrating technology into arts education has significantly enhanced students' visual literacy. Digital tools enable students to explore and analyze various artistic styles, fostering a deeper understanding of visual culture. For instance, a study by Hilton and Owen (2024) emphasizes that teaching digital literacy within the visual arts classroom empowers students to critically engage with digital media, enhancing their visual literacy skills. Similarly, the National Art Education Association (NAEA) (2022) highlights the importance of visual literacy in education, advocating for its integration into arts education to prepare students for productive futures. Furthermore, a literature review by Alshammari *et al.* (2024) discusses the role of visual literacy and visualization in instructional design, highlighting the significance of visual communication in learning environments.

Moreover, technology supports differentiated learning by accommodating diverse learning styles and needs. Digital tools provide additional resources and support for students with disabilities, ensuring that all learners have the opportunity to develop their visual literacy skills. This inclusivity aligns with the principles of universal design for learning (UDL), which emphasize the importance of providing multiple means of engagement, representation, and expression. Additionally, as discussed by Haas (2024), differentiated instruction strategies can be enhanced through technology, allowing teachers to tailor learning experiences to individual student needs. Furthermore, Edutopia (2015) highlights how integrating technology and literacy can support differentiated instruction, offering text and video annotation tools, teacher feedback, and formative assessment.

Despite the growing integration of digital tools in arts education, there remains a gap in understanding how these tools enhance students' viewing skills and visual literacy development. While research highlights the general benefits of technology in fostering creativity, engagement, and critical thinking, there is a limited exploration of how digital portfolios and collaborative platforms can directly influence students' ability to engage critically with and interpret visual art in a more structured, reflective manner. Additionally, while many studies have focused on individual student outcomes, fewer have addressed how peer collaboration and feedback through digital portfolios impact students' growth as artists and their capacity for self-assessment. This study aims to fill these gaps by investigating how digital portfolios and collaborative learning strategies can enhance visual literacy and critical viewing skills in arts education, ultimately providing students with a more holistic learning experience.

4. Material and Methods

4.1 Design

The research design for this study followed a sequential explanatory mixed-methods approach, which combines both quantitative and qualitative components to provide a comprehensive

understanding of the effectiveness of collaborative digital portfolios in enhancing viewing skills in art appreciation among college students. The mixed methods approach is an approach to inquiry that combines or associates both qualitative and quantitative forms (Creswell & Plano Clark, 2018). It involves philosophical assumptions, using qualitative and quantitative approaches, and mixing both approaches in a study. The quantitative component of the study employed a quasi-experimental design, which the American Psychological Association defines as an experiment in which units are not assigned to conditions randomly. The study primarily measures differences in students' viewing skills before and after exposure to collaborative digital portfolios. The use of pretest and posttest assessments enabled the comparison of mean score improvements, with a true experimental design employed if random assignment is used, to ensure the validity of the results and establish causal relationships between the teaching approach and the enhancement of viewing skills.

The qualitative component employed a qualitative descriptive design, which aims to delve deeper into the students' perceptions of the effectiveness of the collaborative digital portfolios in improving their viewing skills in art appreciation. According to Kim *et al.* (2017), qualitative descriptive design is a comprehensive summarization of specific events experienced by individuals or groups of individuals. Following the quantitative phase, interviews or focus group discussions were conducted to explore the specific aspects of the portfolios that students found beneficial, or if no significant improvement was observed, to identify potential factors contributing to the lack of progress. This qualitative data provided rich, subjective insights into how students perceive the value of collaborative digital portfolios in the context of art appreciation, which complemented the numerical data from the quantitative phase and offered a more holistic view of the intervention's impact. By combining both methodologies, this research design allowed for a thorough examination of the difference between using digital portfolios and developing viewing skills in the arts.

4.2 Participants

The research participants for this study consisted of 148 college students enrolled in art appreciation courses at a designated university. A non-random selection method was employed, with students divided into two groups based on the teaching method assigned: the traditional lecture-based approach and the experimental method using collaborative digital portfolios. The non-random selection method is a sampling technique in which the sample is chosen based on a specific reason (Mulisa, 2022). The participants were drawn from three sections, with the following groupings: Traditional Class A (23 students), Experimental Class A (19 students), Traditional Class B (27 students), Experimental Class B (30 students), Traditional Class C (28 students), and Experimental Class C (21 students). Each group was assessed on their viewing skills through pretest and post-test measurements to evaluate the effectiveness of the teaching methods.

For the qualitative phase, purposive sampling was utilized. Stratton (2024) defined purposive sampling as a population sampling process in which a researcher selects research participants based on their presence in a population of interest, characteristics, experiences, or other criteria. In this study, the researchers selected 10 students from the experimental group

who participated in the collaborative digital portfolio method. These students were interviewed to provide in-depth insights into their perceptions of how the method impacted their viewing skills. This approach allowed for a comprehensive analysis, combining objective data from the pretest and post-test measurements and subjective insights from the student interviews. Together, these data evaluated the influence of the teaching methods on students' art appreciation abilities.

4.3 Data Collection

The data collection process for this study was carried out through quantitative methods designed to address different aspects of the research. Pretest and post-test questionnaires were administered to students before and after implementing the teaching strategies. The pretest was conducted during the first meeting to gather baseline data. Subsequently, students in the control group received lecture-based instruction, while those in the experimental group learned through collaborative digital portfolios. After the instructional phase, a post-test was administered to both groups to assess changes in their viewing skills. The resulting data were analyzed to determine the statistical significance of the differences observed between the groups.

Prior to implementation, detailed lesson plans were developed to guide instructional delivery for both teaching approaches. These plans incorporated baseline data collection procedures and specific teaching strategies aligned with the study's objectives. An implementation plan was outlined to ensure consistent content delivery, monitor student engagement, and maintain uniformity across instructional sessions. The first meeting focused on administering the pretest and initiating the instructional methods. Students' participation and performance during the sessions were closely monitored and recorded to track progress throughout the study.

All participating students were college-level individuals of legal age. In accordance with ethical research practices, each student was provided with an informed consent form prior to participation. The form clearly outlined the purpose of the study, the procedures involved, and the rights of participants, including the right to withdraw at any point without consequence. Informed consent was obtained following appropriate ethical protocols to ensure transparency and protect the well-being of the participants. Participation in the study was entirely voluntary and conducted with respect for students' autonomy and privacy.

Following the instructional period, the final meeting was devoted to post-implementation data collection. The post-test was administered during this session to assess any measurable improvement in viewing skills resulting from the instructional interventions. Quantitative data from the pretest and post-test were analyzed using statistical tools to identify significant differences between the groups. In addition, qualitative data were collected through student feedback to gain insight into their experiences with the collaborative digital portfolios. Quantitative and qualitative findings were integrated to analyze the teaching methods' effectiveness comprehensively. This structured and ethically guided data collection process ensured a reliable and holistic evaluation of the research questions.

4.4 Data Analysis

The researchers employed quantitative and qualitative data analysis techniques to provide a comprehensive understanding of the effectiveness of collaborative digital portfolios in enhancing viewing skills in art appreciation among college students. In the quantitative phase, the instrument, pretest, and post-test survey questionnaires used in the study underwent a reliability test, and the statistical output was acceptable. It indicates good internal consistency with a Cronbach's Alpha of 0.713, suggesting that the scale is reliable for measuring. The tool mean score is 43.3, and the standard deviation is 6.01234 across 20 items.

On the other hand, statistical tools such as the Likert Scale were utilized to measure participants' responses systematically. To analyze these responses, the researchers calculated the mean of scores, which measures central tendency. The mean, the arithmetic average of a set of values, provides a valuable data summary by indicating the overall trend within a dataset (Gravetter & Wallnau, 2020).

Raw Score	Percentage (%)	Description	Descriptive Meaning
16-20	80-100%	Advanced	The level of pretest and post-test mean scores of students' viewing skills in art appreciation when using collaborative digital portfolios are highly developed viewing skills.
13-15	65-79%	Proficient	The level of pretest and post-test mean scores of students' viewing skills in art appreciation when using collaborative digital portfolios are well-developed viewing skills.
9-12	45-64%	Moderate	The level of pretest and post-test mean scores of students' viewing skills in art appreciation when using collaborative digital portfolios is moderately developed viewing skills.
5-8	25-44%	Basic	The level of pretest and post-test mean scores of students' viewing skills in art appreciation when using collaborative digital portfolios is emerging viewing skills.
0-4	Below 24%	Needs Improvement	The level of pretest and post-test mean scores of students' viewing skills in art appreciation when using collaborative digital portfolios is limited viewing skills.

In the qualitative phase, thematic analysis was employed to interpret textual data. Thematic analysis systematically identifies, analyzes, and reports patterns or themes within qualitative data (McLeod, 2024). This method allowed researchers to organize data into meaningful categories, providing deeper insights into participants' perspectives and experiences to collaborative digital portfolios in enhancing viewing skills in art appreciation. The statistical and thematic analysis combination ensures a well-rounded understanding of the data, integrating numerical trends with rich qualitative insights.

5. Results and Discussion

5.1 Mean Gain Score of Students in the Control Group

Table 1 presents the mean gain scores of students in the control group, which consisted of three classes, all of which were exposed to traditional teaching methods. Class A's pretest mean score

was 16.13, while the post-test mean score decreased to 14.08, resulting in a mean gain score of -2.05. Class B showed an increase in performance, with the pretest mean score of 12.26 rising to a post-test mean score of 15.59, yielding a mean gain score of 3.33. In Class C, the pretest mean score was 13.57, and the post-test mean score slightly decreased to 13.50, leading to a mean gain score of -0.07. When considering the overall performance of the three classes combined, the pretest mean score for the control group was 13.87 (SD = 3.36), which means students are proficient and have well-developed viewing skills in art appreciation. In contrast, the post-test mean score slightly increased to 14.44 (SD = 3.33), which indicates proficiency, and students have well-developed viewing skills in art appreciation, resulting in an overall mean gain score of 0.56.

Table 1: Mean Gain Score of Students in the Control Group (Traditional Method)

Control Group	N	Pretest Mean (SD)	Post-test Mean (SD)	Mean Gain Score
Traditional Class A	23	16.13	14.08	-2.05
Traditional Class B	27	12.26	15.59	3.33
Traditional Class C	28	13.57	13.50	-0.07
Overall	**78**	**13.87 (3.36)**	**14.44 (3.33)**	**0.56**

The results show varied outcomes across the different classes in the control group. Specifically, Class A and Class C decreased their scores after the post-test. This suggests that students in these classes did not show improvement, and their performance declined after the traditional teaching approach. On the other hand, Class B demonstrated a noticeable improvement, suggesting that traditional teaching methods had a more positive effect on this particular class than the others. Despite the mixed results in individual classes, the overall findings indicate a slight improvement in the control group. This improvement suggests that students, even without any intervention, were able to show some progress in their test scores.

The results from the control group in this study align with previous research findings suggesting that traditional teaching methods may have limited effects on student performance. Specifically, the mixed results across the different classes in the control group, where Class A and Class C showed a decline in post-test scores, while Class B saw an improvement—mirror findings from studies like Noreen and Rana (2019), which also indicated that traditional methods may not consistently lead to significant improvements in student achievement. In their study, the effectiveness of traditional teaching in mathematics was not as pronounced as that of more active, activity-based teaching methods.

Similarly, Halasa *et al.* (2020) found that innovative teaching approaches led to more significant improvements in student achievement than traditional methods. Kelkay's study (2023) suggests that while traditional methods may lead to some improvement, more engaging and interactive strategies are often more effective in boosting student performance. The slight overall improvement in the control group, with a mean gain score of 0.56, reflects this trend of modest progress (Arpilleda, 2021), supporting the idea that traditional teaching may be less effective than alternative approaches (Albay & Eisma, 2021).

5.2 Mean Gain Score of Students in the Experimental Group (Intervention Method)

Table 2 presents the mean gain scores of students in the experimental group exposed to the digital portfolio intervention across three classes. The pretest mean score for Class A was 13.37, and the post-test mean score increased significantly to 18.21, resulting in a mean gain score of 4.48. For Class B, the pretest mean score was 12.47, and the post-test mean score increased significantly to 17.17, yielding a mean gain score of 4.70. In Class C, the pretest mean score was 12.52, and the post-test mean score increased to 14.71, yielding a mean gain score of 2.19. When considering the overall performance of all three classes in the experimental group, the pretest mean score was 12.76 (SD = 3.43), which means that students' viewing skills in art appreciation are moderately developed. The post-test mean score increased significantly to 16.71 (SD = 2.15), which indicates advanced students have a highly developed viewing skill in art appreciation, yielding an overall mean gain score of 3.98. This represents a notably higher improvement compared to the control group.

Table 2: Mean Gain Score of Students in the Experimental Group (Intervention Method)

Experimental Group	N	Pretest Mean (SD)	Post-test Mean (SD)	Mean Gain Score
Experimental Class A	19	13.37	18.21	4.48
Experimental Class B	30	12.47	17.17	4.70
Experimental Class C	21	12.52	14.71	2.19
Overall	**70**	**12.76 (3.43)**	**16.71 (2.15)**	**3.98**

The findings from the experimental group indicate a clear and significant improvement in student performance following the digital portfolio intervention. The mean gain scores for Classes A, B, and C demonstrate substantial increases in post-test scores compared to pretest scores. The overall mean gain score of 3.98 across the three classes reflects a noteworthy improvement in student achievement. In contrast, the control group, exposed to traditional teaching methods, showed much more minor changes, with an overall mean gain score of only 0.56. This stark difference suggests that the digital portfolio intervention significantly impacted student learning more than traditional methods, fostering more substantial academic progress. Thus, the experimental group's results highlight the effectiveness of the digital portfolio in enhancing students' understanding and performance.

The results from the experimental group, which utilized the digital portfolio intervention, align with previous research suggesting that innovative teaching methods, such as digital portfolios, can significantly improve student learning outcomes. The substantial mean gain scores across experimental groups indicate clear improvements in student performance, supporting findings from studies like Doğan, Yıldırım, and Batdı (2024), which demonstrated positive effects of portfolio assessments on academic success. Similarly, Tezci and Dikici (2006) found that digital portfolio assessments enhanced student performance in writing and drawing. This is also consistent with the importance of innovative instructional designs in cultivating students' skills and fostering better learning outcomes (Zhang & Guan, 2022).

The results also resonate that innovative learning significantly boosts student achievement (Tong *et al.*, 2022). Furthermore, as Taber (2019) points out, the test of new pedagogical methods, like digital portfolios, must carefully design control groups to ensure

valid comparisons. This study supports the conclusion that digital portfolio interventions lead to significant improvements, demonstrating their effectiveness as teaching innovations. Thus, the results of this study confirm that the digital portfolio intervention led to a significant improvement in student learning, demonstrating its effectiveness as a pedagogical tool.

5.3 Significant Difference in Mean Gain Scores Between Control and Experimental Groups

An independent samples t-test was conducted to determine whether the difference in mean gain scores between the control and experimental groups was statistically significant. The results in Table 3 reveal a t-value of -5.431 and a p-value of 0.000. Since the p-value is less than 0.05, the null hypothesis of no significant difference is rejected. This indicates that the digital portfolio intervention had a statistically significant effect on student learning outcomes, with the experimental group showing a marked improvement over the control group.

Table 3: Test of Significant Difference in Mean Gain Scores Between Control and Experimental Groups

Groups	Mean Gain Score	t-value	P-value	Interpretation
Control (Traditional)	-0.56	-5.431	0.000	Significant
Experimental (Intervention)	3.95			

The independent samples t-test results, which revealed a statistically significant difference in the mean gain scores between the control and experimental groups, support the expectation that the digital portfolio intervention would enhance student learning outcomes. The significant improvement in the experimental group, with a t-value of -5.431 and a p-value of 0.000, aligns with the findings of several previous studies on innovative teaching methods. For instance, Noreen and Rana (2019) demonstrated that activity-based teaching methods significantly improve student achievement in elementary mathematics, reinforcing the idea that active, student-centered interventions are more effective than traditional approaches. Similarly, Tezci and Dikici (2006) found that the digital portfolio assessment process positively impacted students' writing and drawing performances, further validating the efficacy of digital portfolios as a tool for academic improvement. Furthermore, Kelkay (2023) highlighted that experimental teaching methods, such as those that incorporate practical work, yield better student outcomes, which aligns with the current study's conclusion that the digital portfolio intervention outperformed traditional methods.

Moreover, the results of this study are consistent with broader research on blended learning and technology integration in education. Halasa *et al.* (2020) demonstrated that blended learning, combining traditional and digital approaches, can significantly increase student grades, supporting the effectiveness of digital interventions in enhancing academic achievement. In addition, studies like that of Doğan, Yıldırım, and Batdı (2024) emphasize the positive effects of portfolio assessments on academic success and attitudes, which are similarly reflected in the current study's findings. However, while the results confirm the anticipated positive impact of digital portfolios, they also highlight the need for continued exploration of such interventions, as noted by Zhang and Guan (2022), who stressed the importance of experimental instructional designs in fostering practical skills. Overall, the significant

improvement observed in the experimental group reaffirms the growing body of literature advocating for adopting digital tools and innovative pedagogies to improve student learning outcomes.

The study's results align with the principles of connectivism, a learning theory that emphasizes the importance of networked learning and collaboration in the digital age (Siemens, 2005; Downes, 2010). The significant improvement in student learning outcomes observed in the experimental group suggests that digital portfolios, which facilitate peer interaction and collaborative learning, foster knowledge construction and enhance student achievement. By providing a platform for students to share their work and receive feedback, digital portfolios create a networked learning environment where students engage with peers, refine their ideas, and deepen their understanding. This collaborative aspect of the intervention aligns with the connectivist view that learning occurs through individual effort and connections with others. In terms of real-world applications, these findings highlight the potential of digital portfolios to support collaborative learning, reflection, and the development of 21st-century skills, such as critical thinking and communication. Digital tools in education can enhance student engagement, improve learning outcomes, and prepare students for the collaborative nature of the modern workforce.

Thematic analysis of the interview data revealed five core themes that captured students' perceptions of the effectiveness of collaborative digital portfolios in enhancing their viewing skills in art appreciation. These themes were developed from patterns observed across students' reflections and experiences, offering insights into how digital portfolios shaped their engagement with visual art. The themes include empowers learning through reflection, gain insights through peer interaction and diverse perspectives, enhances engagement through visual interaction, collaborates and adapts in digital environments, and fosters authentic and creative learning experiences. These themes illustrate how students experienced deeper understanding, increased motivation, and a sense of ownership over their learning by integrating collaborative digital portfolios.

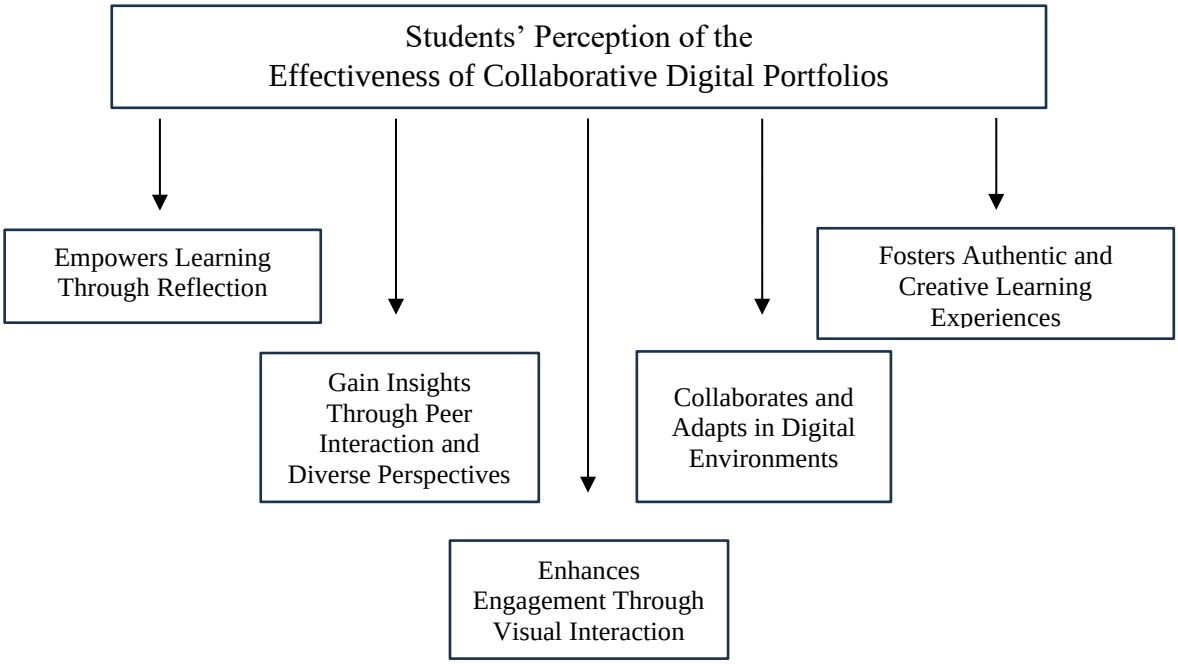

Figure 1: Themes describing the students' perceptions of the effectiveness of collaborative digital portfolios in improving their viewing skills in arts appreciation

5.3.1 Empowers Learning Through Reflection

This theme highlights how collaborative digital portfolios fostered a sense of ownership, pride, and self-awareness in students' learning journeys. In the context of art appreciation, reflection became a powerful tool that allowed learners to look back on their progress, recognize personal growth, and better understand their engagement with visual art. Students reported feeling more connected to their development and motivated to participate actively by organizing their work and documenting their creative process. The reflective nature of portfolio work encouraged metacognition and deepened students' appreciation for their efforts and learning styles. Student responses illustrate this theme clearly.

> "*It helps me na mas maging organisado ug mas makareflect ko sa akong learning journey po.*" Student 1, L 16-17

> "*Ganahan ko nga madokumentohan ang akong paglambo samtang nagalearn gikan sa akong mga kauban pud*." Student 3, L 16-17

> "*Ang portfolio nakahatag sense of pride nga ako gyud ang owner mismo sa akong learning journey sa art appreciation*." Student 3, L 52-53

> "*So, daghan kog na learn from... pagbuhat ug videos... mabutangan nako ug background sounds...*" Student 6, L 7-10

> "*It is fun and engaging in a way nga maka-learn ka ug something new...*" Student 8, L 7

"*Digital portfolios made me want to work harder in class and participate more...*" Student 10, L 28-29

These responses highlight how reflection, supported by digital tools, empowered students to take charge of their learning. Students' testimonials reveal that digital portfolios encouraged organization, self-awareness, and a deeper connection to their learning journeys—evident in their pride, motivation, and engagement. This aligns with Potter's (2024) insights on personalized learning through digital tools and Belmont and Fielding's (2023) view that creative platforms foster meaningful reflection and active participation. Moreover, the students' reflective experiences support Yaacob *et al.*'s (2021) research, which found that collaborative, reflective learning enhances critical thinking and peer feedback. In contrast, the control group's mixed performance under traditional instruction—where only one class showed improvement—parallels Noreen and Rana's (2019) findings that such methods may lack consistent impact. These qualitative insights and scholarly references reinforce the value of reflective, learner-centered strategies in achieving deeper and more consistent learning outcomes.

5.3.2 Gain Insights Through Peer Interaction and Diverse Perspectives

This theme emphasizes the value of collaboration in fostering a deeper understanding of visual art. Students were exposed to different viewpoints and ideas by engaging with peers, which enriched their work and broadened their perspectives. Peer interaction allowed them to explore new approaches and techniques, ultimately enhancing creativity and more comprehensive learning. Collaborative digital portfolios facilitated this exchange of ideas, where students could reflect on how others approached similar visual tasks, helping them expand their artistic thinking and improve the quality of their work. The exchange of diverse perspectives enhanced individual skills and encouraged a sense of community and shared learning. Student responses highlight the significance of peer interaction in this process.

"*Nakakat-on ko sa lain-laing mga perspective to improve my work*." Student 1, L 18-19

"*Ang among final output mas nindot ug kompleto tungod sa input sa matag usa*." Student 3, L 20-21

"*Pinaagi sa collaboration makita sa students ang different perception despite na parehas nga visual ang nakadisplay*." Student 4, L 35-37

"*I was excited kung unsa ang porma or giunsa pag-edit sa laing grupo…*" Student 8, L 46-48

"*Nakat-unan gikan sa ilahang mga style, ideas...*" Student 9, L 15-16

"*Working together help us learn from each other…*" Student 10, L 7

"*We encountered people sharing their outputs…showcasing their skills…makagama gyud ta ug teamwork…*" Student 7, L 7-8

In line with these findings, the theme of gaining insights through diverse perspectives and peer interaction closely complements the quantitative results, underscoring the effectiveness of collaborative and innovative teaching strategies in enhancing student outcomes. The qualitative responses illustrate how peer collaboration within digital portfolios fostered creativity, broadened perspectives, and built a sense of community, which aligns with the substantial mean gain scores observed in the experimental group using this intervention. This supports Doğan *et al.* (2024) and Tezci and Dikici (2006), who found that portfolio-based assessments improve academic performance in creative fields. Likewise, Feridouni Solimani and Ahmed Mohamed (2024) demonstrated how collaborative ePortfolios enhance comprehension through active participation and shared reflection, echoing students' appreciation for learning from each other's ideas. Additionally, Li and Wang (2024) emphasized that interactive, innovative practices not only improve academic achievement but also promote motivation and well-being. Collectively, these findings reinforce the limitations of traditional teaching, reflected in the modest improvement of the control group (Arpilleda, 2021) and confirmed by Kelkay (2023) and Halasa *et al.* (2020), further supporting the value of alternative, engaging learning approaches.

5.3.3 Enhances Engagement Through Visual Interaction

This theme explores how collaborative digital portfolios served as a tool for increasing engagement through visual interaction. By incorporating dynamic elements such as designs, sounds, and multimedia, students experienced a more interactive and immersive way of engaging with art. This approach enhanced their ability to analyze and appreciate visual art and encouraged active participation and reflection. The shift from traditional lectures to a more interactive, hands-on method allowed students to engage with art in a more personalized and stimulating way, fostering a deeper connection to the content. Student responses reflect how visual interaction enhanced their engagement with learning.

"*The collaborative digital portfolios nagasuporta sa active and interactive viewing*." Student 2, L 32-33

"*Kini nga process nakapalig-on sa among ability sa pag analyze sa mga visual, nga dili kaayo makita sa tradisyonal nga lecture*." Student 3, L 37-38

"*Mas interactive ug reflective ang pagkat-on tungod sa collaborative digital portfolios*." Student 5, L 12-13

"*Mas daghan ka ug mabutang sa imohang digital portfolios just like mga designs, just like sa sounds…*" Student 6, L 45-47

"*Mas ma-enhance ang atong skills by interaction between artists and viewers.*" Student 7, L

"*Daghan kaayog mga visual na materials na makapukaw sa atensiyon sa estudyante…*" Student 9, L 31-32

Correspondingly, enhancing engagement through visual interaction aligns closely with the quantitative findings, reinforcing the value of innovative, interactive tools like digital portfolios in boosting student engagement and learning outcomes. The qualitative data highlights how students experienced increased attention, active participation, and deeper reflection through multimedia and interactive design elements, directly supporting the significant mean gain scores seen in the experimental group. This finding resonates with studies by Doğan *et al.* (2024) and Tezci and Dikici (2006), which confirmed that digital portfolios improve academic performance in creative tasks. Similarly, Godsk and Møller (2025) emphasized that educational technologies supporting interaction and active learning foster higher student engagement, while Hussein (2024) and Bajaj (2024) discussed how integrating multimedia and personalized digital experiences leads to more participatory, motivating, and effective learning environments. These scholarly insights affirm that shifting from traditional lectures to visually interactive, technology-enhanced methods, as reflected in students' responses, improves academic outcomes and transforms the learning experience into a more immersive, personalized, and engaging process.

5.3.4 Fosters Authentic and Creative Learning Experiences

This theme emphasizes how collaborative digital portfolios allowed students to explore their creativity in ways that mirrored real-world experiences. The flexibility of the digital medium allowed students to experiment with various design elements, fostering an environment where creativity could flourish. By engaging with digital tools, students enhanced their artistic skills and developed a deeper understanding of the creative process. This authentic approach to learning encouraged students to take risks, think outside the box, and gain a sense of ownership over their work, resulting in a more meaningful and personalized learning experience. Student responses strongly support that the digital portfolio process nurtured creativity and authentic learning.

"*Gihatagan ko og broader na freedom sa akong creativity*." Student 1, L 53-54

"*Ang collaborative digital portfolios kay nag mirror sa real-world media experiences*." Student 5, L 31-32

"*I used elements, shapes, colors…to make a digital art*." Student 7, L 52-53

"*Try harder because everything can be learned… everything can be read...*" Student 8, L 81-82

"*Just like sa pagbuhat namo sa among projects.*" Student 6, L 10-11

"*Sharing ideas help us understand art better…*" Student 10, L 19

Likewise, the theme of fostering authentic and creative learning experiences complements the quantitative findings, highlighting how collaborative digital portfolios nurtured creativity, ownership, and real-world relevance in student learning. The qualitative responses reflect how students valued digital portfolios' freedom, personalization, and hands-on experiences. This outcome aligns with the significant mean gain scores achieved by the experimental group. This supports Tezci and Dikici (2006), who confirmed the positive impact of digital portfolios on creative skills, and resonates with Kelkay (2023) and Noreen and Rana (2019), who found that activity-based and experimental teaching methods yield better academic outcomes than traditional approaches. Additionally, Desmet and Sternberg (2024) emphasized the need for creativity-centered classrooms and authentic projects to cultivate transformational creativity, while Masudi (2024) and McCraney (2025) advocated for integrating technology and student-centered tasks to foster critical, creative, and practical skills. Together, these studies reinforce that fostering authentic, flexible, and creative learning environments improves academic performance and prepares students for meaningful, real-world applications.

5.3.5 Collaborates and Adapts in Digital Environments

This theme explores how collaborative digital portfolios facilitated teamwork and adaptability within a digital context. The process of creating digital portfolios required students to work together in virtual spaces, which brought both challenges and opportunities for learning. Through online collaboration, students had to adapt to new tools and platforms, improving their technical skills while fostering community and mutual support. Digital platforms allowed for efficient group work, smoother communication, and the ability to share progress quickly, even across distances. Ultimately, these experiences helped students develop problem-solving strategies, improve their digital literacy, and enhance their ability to collaborate effectively in a digital environment. Student responses illustrate the impact of digital collaboration on their group work and learning.

"*It made group tasks more efficient kay dali ra ang pag-apil sa matag usa namo.*" Student 2, L 16-17

"*Nakafeel ko ug connection tungod sa online collaboration*." Student 4, L 20-21

"*Nakatabang kini nga mas mafeel nako ang akong involvement ug commitment sa klase.*" Student 5, L 47-48

"*I overcame it by planning ahead po, pag-save og backup, ug pagpangayo og tabang sa mga classmate miss, kung kinahanglan na kayo*." Student 1, L 70-72

"*Bag-o and di pa kayo familiar sa akoa at first Miss*." Student 2, L 15

"*Kanang walay kasiguruhan sa paggamit sa platform pero nakakat-on ra ko sa kadugayan pinaagi sa pag-explore sa mga features*." Student 4, L 65-66

"*Mas nindot ang digital portfolios... pwede nimo siya ma-post, ma-share kay bluetooth, Facebook…*" Student 6, L 22-27

"*Ask ko kay Sir Dawa on how to build a digital portfolio*." Student 7, L 42

"*Nag set mi ug clear deadlines ug regular check-ins through group chats or video calls…*" - Student 9, L 60-61

"*We solve this problem by planning carefully and communicating well*." Student 10, L 37-38

These responses demonstrate how students adapted to digital environments, overcame challenges, and improved collaboration skills. Similarly, the theme of collaborating and adapting in digital environments aligns with the quantitative findings that show significant improvements in student outcomes following the digital portfolio intervention. The qualitative data illustrates how students developed teamwork, adaptability, and digital literacy through online collaboration — experiences that mirror the measurable gains in academic performance reported by Halasa *et al.* (2020) and Doğan, Yıldırım, and Batdı (2024). This supports the idea that digital platforms enhance academic success and essential collaborative skills. The findings also resonate with Thakur (2022), who emphasized how digital collaboration fosters engagement, motivation, and interactive learning, and Cress and Kalthoff (2023), who explored the importance of hybrid cooperation in producing innovative educational resources. Furthermore, the students' adaptability and teamwork reflect the principles of connectivism (Siemens, 2005; Downes, 2010), where learning is enhanced through networked digital environments. Together, these insights confirm that integrating digital tools in education improves academic outcomes and cultivates the collaborative, practical, and problem-solving skills necessary for the modern digital world.

Overall, the findings from this study align closely with the principles of Connectivism (Siemens, 2005; Downes, 2010), emphasizing the crucial role of collaboration, networked learning, and digital tools in enhancing students' engagement with art and refining their viewing skills. The themes—empowering learning through reflection, gaining insights through diverse perspectives and peer interaction, enhancing engagement through visual interaction, fostering authentic and creative learning experiences, and collaborating and adapting in digital environments—demonstrate how digital portfolios and collaborative tools facilitate learning in a connected environment. Students developed individual skills and built knowledge collectively through interactions with their peers, reinforcing the notion that learning is a social and networked process in the digital age. These findings show how connectivism principles were realized in practice, with students using digital platforms to reflect, share, and refine their understanding. This ultimately supports the growth of their viewing skills in art appreciation. By fostering connections and encouraging individual and collaborative engagement, this

approach aligns with the connectivist theory that learning occurs through networks and collaboration, especially in digital tools and peer interaction.

6. Recommendations

Educators should integrate collaborative digital portfolios into their instructional strategies to enhance students' viewing skills and engagement in art appreciation. School administrators are encouraged to support this innovation by providing training and resources for effective implementation. Additionally, policymakers should consider incorporating digital portfolios into arts education curricula to promote reflective learning and student collaboration. Lastly, future research should explore the long-term effects of digital portfolios on students' critical thinking and artistic interpretation across different educational levels and disciplines.

7. Conclusion

This study aimed to investigate the impact of collaborative digital portfolios on improving college students' viewing skills in art appreciation. The results showed that students in the experimental group achieved significantly higher mean gain scores than those in the control group, with statistical analysis confirming the effectiveness of the intervention. Qualitative data further revealed that students perceived digital portfolios as a meaningful tool that enhanced engagement, fostered creativity, encouraged reflection, and promoted collaboration in digital environments. These findings support existing research advocating for student-centered, technology-integrated teaching approaches and align with connectivist learning theories emphasizing networked, peer-driven learning. Overall, the study highlights the transformative potential of collaborative digital portfolios in cultivating visual literacy and critical thinking skills essential for success in the 21st-century learning landscape.

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Conflict of Interest Statement

The authors declare no conflicts of interest.

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