RESEARCH PAPERS

EFFECTS OF INFORMATION AND COMMUNICATION TECHNOLOGY ON ENGAGEMENT AND ART PRODUCTION FOR EIGHTH-GRADE STUDENTS

By

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ABSTRACT

The purpose of this research was to explore the impact of an online-learning component incorporating peer discussion groups on art achievement, digital literacy practice, student engagement, and student attitude of an eighth-grade visual arts classroom. Participants included 30 students in two 8th-grade art classes. Students in one class received face-to-face art instruction, while the other class completed additional assignments using online-learning components and peer discussion groups. Art achievement was measured with project scores from printmaking, ceramics, and cut paper units. Digital literacy practice and engagement were recorded with a teacher checklist and field notes. Student attitude was measured by a survey administered at the end of the study. The online-learning component group scored slightly higher on art projects than the face-to-face group. Results indicated that, using online-learning components did not have a significant impact on art achievement, but notably improved digital literacy practice, student engagement, and student attitude towards art.

Keywords: Eighth-grade, Online-learning, Art Instruction, Digital Literacy, Achievement, Engagement, Attitude.

INTRODUCTION

According to Radclyffe-Thomas (2008), implementing online-learning components in the art room is a topic that prompts heated discussion among educators. As an increased number of students across the United States access digital media outside of school and participate in online social networking communities, Wood (2004) noted many classrooms trail behind in their ability to incorporate such resources into successful instruction. Wilks, Cutcher, and Wilks (2012) asserted that, art instructors are hesitant to incorporate Information and Communication Technology (ICT) due to time constraints, limited equipment, and training.

Despite the obstacles, introducing alternative modes of digital communication in art is valuable because, it connects everyday life to learning about art. Digital technology in education encourages a deeper understanding of art materials via researching, responding, and reflecting in an online platform, while implementing familiar digital communication practices heightens engagement in learning, leading to higher quality art products.

Learning in the arts: National and state data

As there are no annual large-scale standardized tests for middle school art students, the National Center for Educational Statistics conduct a National Assessment of Educational Progress (NAEP) in visual arts and music for every 10 years. Based on NAEP (2009) scores, many middle school students had difficulty of analyzing and interpreting an artwork to apply their findings to their own art product. While researchers such as Siegesmund, Diket, and McCulloch (2001) remained skeptical of the validity of NAEP, art instructors are still tasked to create learning experiences that guide students to understand the works of art and connect a professional artist's work to their own.

School district priorities: Digital literacy practice

As Georgia school districts transition to the College and Career Ready Program Index, the Georgia Department of Education (GADOE) (2013) goal of being technologically

literate by eighth grade is still in place. The research school district drafted a three-year technology Plan (2012) and described its vision for technology in education as engaging students to develop skills for adulthood and training teachers to transform learning in every subject area.

To provide insight into the students' needs and current digital literacy practice, the research school district administered the technology Literacy Test offered through the GADOE Online Assessment System (OAS). Results for the GADOE (2013) assessment were categorized into four groups: advanced, proficient, basic, and below basic. Half of the schools in the district had less than 50% of students who met or exceeded the proficient category. From the performance, the school district has prioritized improving digital literacy practice among students.

Need for the research

Teachers are re-engaging art students through technology. Research conducted by NAEP (2009) and Siegesmund et al. (2001) provided evidence that middle school students exhibit low-level abilities to reflect on and react to an artwork. In response, teachers are tasked to re-engage students in researching works of art. As technology becomes more accessible and familiar to students and is also a priority of school districts (Wilks et al. 2012; three-year technology Plan, 2012), creating online-discussion groups that locate and validate resources could serve as one strategy to re-engage students in art making, improve digital literacy practices, and increase the quality of art projects.

Review of Literature

In the midst of the current information age, artists have begun incorporating digital technology in creating, displaying and sharing their work. Professional artists in all media create websites, participate in social networking, and find buyers; museums offer interactive exhibits to engage viewers in works of art; digital artists use ICT as a tool for creation; and visual culture is spread internationally through online communities. It follows that within the context of the art classroom, the tasks undertaken by a student should relate to the work of artists and designers.

While school systems develop plans to support digital technology as part of learning, teachers are often ill prepared to take action. Both external and internal factors contribute to effectively incorporating ICT in the classroom. Barriers to ICT in art researched by Ritzhaupt, Hohlfeld, Barron, and Kemker (2008) and Wood (2004) include: lack of resources, time constraints, access and restrictions, and preference of tactile qualities of traditional media in the art studio to technology as a medium. However, Wilks et al. (2012) suggested that, barriers could be overcome via collaborative online-learning communities with art teachers that span a district, state, or International group of participants. Black's (2009) research also Illustrated ways schools could positively respond to limited resources and training by including students as part of instruction with digital technology.

While hardware, software, support, and training are external factors that influence ICT use, internal factors such as attitudes and beliefs of teachers are equally important. Phelps' and Maddison's (2008) research of visual art teachers in Australia indicated that, there is a wide degree to which art teachers are willing to Incorporate technology into their practice. Researchers cited limited teacher preparation programs, the absence of a tactile experience in digital art, and access to hardware and software as obstacles that kept them from using digital media as an art form. In addition, the researchers stated that, the most successful art teachers who incorporated ICT were self-motivated, learned by experience, tested the limits of their resources, found support, and did not heavily rely on formal training.

Exploring ICT barriers from a teaching standpoint also leads to consideration of the learner's perspective. To connect theory and practice, any discussion of improving the quality of art products must first begin with student engagement. As Dewey (1934) described, the way a person responds to and finds meaning in a work of art is deeply rooted in his/her experiences and culture. The heart of engaging middle school art students begins by using a variety of communication tools to introduce artists who employ themes that relate to students.

Middle school students can be apathetic about learning and do not always feel what they do in school connects to

topics that spark their interest. Pennisi (2013) investigated the effects of creating a curriculum with eighth-grade art student input to re-engage them in learning, and found that giving students the ability to make choices about ideas and art materials while fostering meaningful discussion about their work was the key to re-engaging students. Pennisi concluded that, it was the combination of formal and informal oral and written dialogue about their work that kept students focused and better able to articulate their purposes for their work.

Utilizing contemporary modes of communication to engage students has the potential to maintain interest in a topic and continue communication between class sessions. Leese (2009) investigated the use of an online-learning module with undergraduate students to increase engagement and foster communication about content in face-to-face class periods. Leese (2009) found that, when course content was delivered with traditional classroom instruction in a single semester, the average pass rate was 69%, but this number increased to 82% when the ICT component was used in a second semester (p.75). In the middle school art classroom, an online-learning module in addition to face-to-face instruction may also promote more continuous reflection on a topic, preparing them to execute higher quality products.

As students have greater access to technology, they develop skills to fit their needs and interests. ICT has the potential to connect learning about art to daily life, foster classroom community, and ease time constraints of the traditional classroom. Specifically, online-learning components add flexibility to the face-to-face classroom and allow students to complete assignments outside of class at their own pace. Radclyffe-Thomas (2008) asserted that, incorporating ICT in the form of discussion group's changes classroom dynamics as students search for and synthesize knowledge instead of looking at information that has already been collected. Beyond the classroom, as Rutland (2012) suggested, ICT teaches students to be responsible digital citizens, involves them in opportunities to solve real world problems, and incorporates skill sets employed by professionals.

In this context, as students utilize ICT to improve communication among members of a course and engage in learning about art, they are also improving their digital literacy practices. Ribble (2011) emphasized that, improving digital literacy is often overlooked when teachers assume that students already possess technology skills to locate and evaluate online resources. Visual digital communication is one facet of digital literacy that is particularly valuable in art, as students need the ability to interpret visual images and apply them to their art products. Brumberger (2011) examined the relationship between students who were repeatedly exposed to new technology with their ability to interpret visual digital communication. Responses to a survey administered to undergraduates (n = 485) indicated that majority of students had technology skills to navigate website, operate word processing programs, and create presentations, but were not proficient at evaluating resources, interpreting meanings, or creating visual digital communication as an art product. Brumberger's (2011) study underscores the need to provide students with strategies to think critically about and interpret technology resources to build digital literacy.

In the secondary art classroom, ICT guides students to create higher quality artwork as they develop critical thinking skills and solve problems. A successful art product is the result of thoughtful planning, execution, editing and reflection that develops from whatSandell (2012) described as combining form, theme, and context into teaching. Seney (2009) noted, students should be prepared with problem solving strategies, and online-discussion groups that research and evaluate resources could enable them to make connections to solve visual problems.

Not only do online-learning components improve critical thinking skills, but also they encourage students to develop as communicators. Delacruz (2009) maintained a community of caring in a hybrid digital environment primed students to take risks, share their beliefs, research meaningful ideas, and constructively criticize their work. Freedman, Hennen, Kallo-Tavin, Kárpáti, and Papp (2013) investigated students participating in online visual culture groups with athematic interest such as street art,

conceptual art, or manga. Outcomes included: (a) critiquing artwork; (b) connecting virtual experiences to deepen meaning making in art; (c) collaborating to establish group codes of behavior. As students selected online-learning groups featuring topics that were personally meaningful, they were motivated to discuss their work and the work of others, building communication skills.

Purpose Statement

The purpose of this study was to explore the impact of an online learning component, which incorporates peer discussion groups, on art achievement, digital literacy practice, student engagement, and attitude in the 8th-grade visual arts classroom in a Southeastern school district.

Research Questions

Research question 1

Will achievement scores of eighth-grade visual arts students who participate in an online learning component, which incorporates peer discussion groups, be higher as compared to students who participate in a face-to-face classroom environment?

Research question 2

Will the digital literacy practices of eighth-grade visual art students who participate in an online learning component, which incorporates peer discussion groups, improve as compared to students who participate in a face-to-face classroom environment?

Research question 3

Will the engagement level of eighth-grade visual art students who participate in an online learning component which incorporates peer discussion groups, improve as compared to students who participate in a face-to-face classroom environment?

Research question 4

Will attitudes of eighth-grade visual art students who participate in an online learning component, which incorporates peer discussion groups, improve as compared to students who participate in a face-to-face classroom environment?

Definition of Variables

Online Learning Component (OLC)

An Online Learning Component is a collection of digital resources organized around a particular topic used as an extension of class activities. The teacher-researcher created a website with Online-Learning Components for each unit.

Face-to-Face classroom environment

The Face-to-Face classroom environment is the physical classroom setting. The face-to-face visual art classroom utilized pedagogy that was teacher-centered and included the use of certain technology (projecting images, watching videos of artists, listening to music) to support instruction.

Peer discussion groups

Peer discussion groups are small groups of students within a class who communicate about a topic. Students in the OLC class were placed into groups of approximately 3 peers to provide online support in the research process.

Art achievement

Art achievement is the evaluation of process skills exhibited in an art product. In this study, art achievement was measured using scores from art project rubrics.

Digital literacy practice

Digital literacy practice examines the appropriate student-use of technology as participants in digital communities. In this study, digital literacy practice was measured with a teacher checklist of behaviors and skills and field notes.

Engagement in art

Student engagement is the level of participation of students in the process of making a work of art. In this study engagement in art was measured with a teacher checklist and fieldnotes.

Attitude towards Art

Student attitude towards art is the collection of positive or negative thoughts and feelings towards making a work of art. Attitude towards art was measured with a student survey.

Methods

Participants

The 30 students who participated in this study attended art

classes in a new middle school in an urban Georgia school district (Infinite Campus, 2013). The school was inaugurated in the 2013-2014 school year, and the district lines from three surrounding school attendance zones were redrawn to build the student population. The two heterogeneous eighth-grade art classes were composed of students who were randomly assigned to one of the two groups.

As part of the curriculum, the teacher-researcher created printmaking, ceramics, and paper art units of instruction for both classes. The face-to-face class received contemporary instructional practices in visual art, while the OLC class utilized an online-learning component created by the teacher-researcher as an extension to face-to-face instruction. To provide a baseline for eighth grade student achievement in art, the teacher-researcher taught a drawing unit before the intervention and scored the OLC and face-to-face students using the same rubric. Demographics and art achievement scores are shown in Table 1.

As part of the school's technology initiative, the principal implemented a Bring-Your-Own-Device(BYOD) program in which students were allowed to bring their portable wireless devices such as phones, mp3 players, or tablets to enhance class instruction. Students were required to sign an acceptable use policy for the school district and were provided Internet access for their devices. The OLC group used technology devices to research and participate in peer discussion groups outside of the face-to-face class, while the face-to-face group did not access the online platform or participate in peer discussion groups to evaluate content.

		Face- to-Face Class n = 15	Online-Learning Component Class n = 15
Race	Black	8	8
	Hispanic	1	2
	Multiracial	0	1
	White	6	4
Gender	Male	6	7
	Female	8	8
Students with Disabilities		4	1
Gifted		2	3
Mean art project score before intervention		90.1	93.4

Table 1. Demographic Data for Face-to-Face Class and Online-Learning Component Class

Intervention

Both the OLC group and face-to-face group attended class sessions for 65 minutes on alternate days. The eighth grade visual arts course took place over a semester of 18 weeks. Over an 8-week period, three units of instruction were delivered in the OLC and face-to-face classes. The first 3 weeks of the intervention were spent exploring a unit on identity through printmaking. The second unit of instruction covered 2 weeks and focused on the theme of fear and protection as students constructed ceramic gargoyles. The final unit incorporated the theme of stories as students made paper cut outs over 3 weeks. All students were provided the same big idea to consider, art materials, writing prompts, project rubrics, access to technology, and had the opportunity to bring their own technology devices if they so desired.

The printmaking, ceramics, and paper arts lessons provided a platform for students to meaningfully engage in making works of art and develop their digital literacy skills. Students were given opportunities to apply their knowledge of technology devices to researching and sharing content about art, and learning experiences were designed to promote student choice and create dialogue through written, verbal, and oral communications.

Evaluation Instruments

Art project rubrics, a teacher checklist of digital literacy practice, student survey, and fieldnotes were used to measure art achievement, digital literacy practice, attitude, and engagement in art. Rubric criteria examined planning, material techniques, concept design, and craftsmanship of art products.

Digital literacy practice examined knowledge and appropriate student use of technology in the visual arts classroom and was measured with a weekly teacher checklist. Items pointed to student behaviors demonstrated knowledge of working with information about art content, creating and sharing information about art resources, and using ICT responsibly. The digital literacy checklist was also used to measure students' engagement by the on-task behaviors and participation in each unit of instruction.

Student surveys were administered at the end of the class

period after the project was completed to better understand student attitude towards learning about art. Items addressed the behaviors and attitudes toward an online-learning component and instruction in the art room.

Fieldnotes were recorded throughout the study to document the art room setting, student interactions with technology, and discussions in the face-to-face class environment.

Data Collection

Qualitative and quantitative instruments were utilized to collect data on student art achievement, digital literacy practices, engagement in art, and student attitude toward art.

Art and Identity Project Rubric (AIP Rubric)

The AIP rubric comprised of categories and criteria used to score self-portraits in the printmaking unit. The rubric was developed by the teacher-researcher and validated by peer review with five teachers. Responses were analyzed by paired two-tailed t-tests comparing gains from each treatment. Results were interpreted by identifying patterns for students and discussing emergent themes in the data.

Fear and Protection Gargoyles Rubric (FP Rubric).

The FP Rubric included categories and criteria used to score ceramic gargoyles. The rubric was developed by the teacher-researcher and validated by peer review with five teachers. Responses were analyzed by paired two-tailed t-tests comparing gains from each treatment. Results were interpreted by identifying patterns for students and discussing emergent themes in the data.

Paper Cut Stories Rubric (PC Rubric).

The PC Rubric consisted of categories and criteria used to score student paper cuts from the stories unit. The rubric was developed by the teacher-researcher and validated by peer review with five teachers. Responses were analyzed by paired two-tailed t-tests comparing gains from each treatment. Results were interpreted by identifying patterns for students and discussing emergent themes in the data.

Digital Literacy teacher Checklist (DL Checklist).

The DLT Checklist was used to evaluate frequencies of eight behaviors linked to online research and using ICT responsibly. The checklist was developed by the teacher-researcher and validated by peer review with five teachers. Responses were analyzed by means and standard deviations comparing gains from each treatment. Results were interpreted by identifying patterns for subgroups of students and discussing emergent themes in the data.

Art and Technology Student Attitude Survey (ATSA Survey)

The ATSA Survey is a 10-item Likert-scale survey of student engagement with art and technology ranging from 1 (strongly disagree) to 4 (strongly agree). The survey was developed by the teacher-researcher and validated by peer review with five art teachers. Responses were analyzed by paired two-tailed t-tests comparing gains from each treatment. Results were interpreted by identifying patterns in subgroups of students and discussing emergent themes.

Field Notes

The teacher-researcher made notes throughout the study, recording details from specific incidences and student comments concerning classroom technology use, digital literacy practice, and student engagement. Results were analyzed by the teacher-researcher and prompted self-reflection during the study as teacher coded and identified emergent themes.

Results

Data collection for this study provided information to determine the benefits of using online-learning components consisting of peer discussion groups for eighth-grade art students. The OLC class were assigned tasks using technology to research art resources and participated in online discussion groups. The face-to-face class did not complete additional assignments or receive specific instructions on using technology in the art classroom.

Art project scores from printmaking, ceramics, and paper cut units from the OLC class were compared with scores of the face-to-face class to determine if the students' art performance improved during the course of the research study. Students were scored using rubrics. A comparison between face-to-face art achievement and OLC art achievement mean scores is provided in Table 2.

According to the insignificant difference in art

Project Unit	Online-Learning Component Group (n= 15)		Face-to-Face Group (n= 15)		Comparison of Means	
	Mean	SD	Mean	SD	t-value	p
Printmaking	92.22	6.57	90.87	7.74	0.51	0.62
Ceramics	92.59	9.77	91.48	11.48	0.29	0.78
Paper Cut	95.93	6.11	90.37	11.4	1.66	0.11
Total	93.58	7.49	90.91	10.21	1.4	0.16

*p <.05; **p < .01

Table 2. Comparison of Face-to-Face and Online-Learning Component Class Art Achievement Scores

achievement scores, OLC students did not make higher quality art products than students in the face-to-face classroom. While there was no significant difference in the OLC scores (M=93.58) when compared to the face-to-face class scores (M=90.91), students who used the online-learning component did increase their project scores throughout the study. Over the course of the printmaking, ceramics, and paper cut units, OLC students made greater gains (M = 3.71) in art achievement than students in the face-to-face class (M = -0.5).

Cohen's "d" was calculated to determine the practical significance of student art project scores in the OLC class and face-to-face class. The treatment had a small effect (d = 0.31). Students using online-learning components and peer discussion groups in addition to face-to-face instruction would be expected to score slightly higher than students who only received face-to-face class instruction.

A digital literacy and engagement checklist was completed each class period for face-to-face and OLC students to document digital literacy skills and on-task behavior. Students in the face-to-face class were not evaluated on posting online resources or comments in peer discussion groups and were not required to use their devices as a resource. Results of the digital literacy checklist provided evidence of the degree to which students changed their behavior as they acquired digital literacy skills with the online-learning component. Mean scores of the digital literacy checklist are presented in Table 3.

Using the online-learning component positively affected the students' ability to demonstrate digital literacy skills. When working with information about art content, students who participated in the OLC (M=70) located art resources from the Internet more effectively than students using

	Checklist Item	Online-Learning Component Group (n) = 15		Face-to-Face Group (n) = 15	
		Mean	SD	Mean	SD
1	Locates art resources online	70.00	22.00	35.56	20.77
2	Correctly posts art resources/ discussions in online platform	64.44	20.77		
3	Shares art resources with others in peer discussion groups	64.44	20.77		
4	Evaluates art resources posted by other students	81.11	20.77		
5	Applies knowledge of online resources to own artwork	82.22	30.52	64.44	32.04
6	Makes connections between discussions and resources to artwork of others (critiques and peer discussion groups)	82.22	30.52	64.44	32.04
7	Respectful and appropriate comments in peer discussion groups	99.00	0.52		
8	Uses ICT in face-to-face class as it relates to learning objectives	91.90	8.04	85.24	24.22
9	Considers copyright, fair use, and ethics	98.20	2.68	95.07	7.09
	Total	81.51	13.27	68.95	22.93

Table 3. Mean Scores of Online-Learning Component and Face-to-Face Class Digital Literacy Checklist

technology in the face-to-face class (M=35.56). Students in the OLC who located and posted ideas online also scored highly on their ability to connect the work of their mentor artist to their own art. In contrast, students in the face-to-face class who did not demonstrate locating resources online did not connect their work to an artist mentor well or use ICT as it pertained to in-class objectives. The scores of the OLC students and students who used technology in the face-to-face class were most similar considering copyright, fair use, and ethics. Similar scores may have resulted from fair use, copyright, and ethics information presented before the intervention to avoid violation of the Acceptable Use Policy of the research school. Based on the results, digital literacy skills were co-dependent. When students were unable to locate a resource online, they did not share it or connect that resource to their art work. Overall, students who were required to participate in online-learning components in art would be expected to demonstrate higher levels of digital literacy than those who did not.

Student engagement was also recorded as part of the digital literacy checklist and measured by students' on- and off-task behaviors. Behaviors included participating and completing projects, communicating with the teacher-researcher and peers, and using ICT and art materials as

they pertained to class objectives. Data were gathered each class period for the face-to-face and OLC classes and was analyzed using descriptive statistics, means, and standard deviations as shown in Table 4.

There was a significant difference in the mean engagement scores of the OLC class (M = 97.2) and the face-to-face class (M = 93.93). Results indicate that, using the online-learning component and peer discussion groups increased the amount of time spent by students for using technology appropriately during class activities, as well as the amount of time spent for planning and executing a work of art. Increased engagement scores of online-learning students also demonstrate peer discussions and informal conversations with the teacher-researcher which were more focused on learning objectives than students in the face-to-face class.

At the end of the intervention phase, students in the OLC and face-to-face groups were administered the Art and

Technology Student Attitude Survey to complete. The survey consisted of 10 questions to assess the thoughts and feelings toward an online-learning component coupled with face-to-face instruction in the eighth-grade art classroom. The results of the Attitude Survey are presented in Table 5.

Data from the surveys were analyzed using means and standard deviations to show evidence of improving students' attitudes. When asked about learning with technology in art, students in the OLC group responded that they used technology on a regular basis and felt they learned new ways to use it in class. Regarding the online research process, students in the OLC group responded that they learned how to locate valid resources and thought more about ideas discussed in class as part of their work. OLC students strongly agreed that their artwork was of better quality when they researched artists online as compared to students in the face-to-face class. When asked about posting and communicating ideas online, students in the OLC group were equally divided on their preference to communicate online or in person, while more students in the face-to-face group responded that they liked to communicate in person. In the final category of student choice and motivation, the online group (M =

Online-Learning Component Group (n) = 15		Face-to-Face Group (n) = 15		Comparison of Means	
Mean	SD	Mean	SD	t-value	P
97.2	2.57	93.93	5.6	2.05	0.0*

*p <.05; **p < .01

Table 4. Eighth-Grade Student Engagement in Art Mean Scores

Survey Item	Online-Learning Group Component (n) = 15				Face-to-Face Group (n) = 15			
	Agree		Disagree		Agree		Disagree	
	Strongly	Some what	Some what	Strongly	Strongly	Some what	Some what	Strongly
1. I use technology every day in and outside of the art classroom.	42%	50%	8%	0%	46%	46%	0%	8%
2. Online instruction connects things I already know about technology to ideas in art.	42%	33%	16%	8%	15%	38%	38%	8%
3. Technology and online learning in art makes me more motivated to complete an assignment.	25%	58%	8%	8%	23%	46%	30%	0%
4. Online assignments in art make me think more about the ideas we discuss in the classroom.	17%	58%	17%	8%	15%	46%	30%	0%
5. My artwork is better when I have to find online resources to share with peers before I make something.	42%	33%	17%	8%	23%	23%	38%	15%
6. Online research in art makes me feel like I have more choice in what I learn about.	50%	33%	17%	0%	8%	38%	46%	8%
7. Online assignments in art taught me how to find resources online and know they are valid.	33%	58%	17%	0%	31%	23%	38%	8%
8. I like reading and responding to the ideas of other people online better than speaking to everyone in person.	17%	33%	33%	17%	8%	25%	42%	33%
9. Posting my ideas online makes me think carefully about the words, songs, and images I choose.	25%	50%	8%	17%	38%	31%	31%	0%
10. Using technology in art class helps me understand new ways to use it outside of school.	33%	50%	8%	8%	23%	38%	31%	8%

Table 5. Art and Technology Student Attitude Survey Results

50%) strongly agreed that online research gave them more choice in what they learned about as compared with the face-to-face group (M = 8%).

The results of the Student Attitude towards Art and Technology Survey show that students in the OLC group felt they learned to research artists online, made better art products when participating in online assignments, and had more choice in what they learned about in the art classroom. However, students also felt that interactions in the face-to-face classroom were still important means of communication. Overall, students who participated in an OLC as part of art instruction would be expected to have better attitudes toward art and technology than students in the face-to-face class setting.

The teacher-researcher also recorded field notes throughout the study to document student responses to the online-learning component and peer discussion group process. Data collected in the field notes were analyzed and compared regarding student technology access, quality of peer discussion responses, art project creativity, and student choice.

In the OLC group, several students had difficulty on accessing technology at home and were unable to complete assignments on time. When provided time in class to complete the assignment, students experiencing difficulty were still unprepared with their devices in two of the three projects. During in-class activities that required a device, 10 of 15 students were prepared on a regular basis. When students in the face-to-face class were given the option to use their devices, 8 of 15 students had difficulty locating appropriate resources online. Half of the students did not regularly bring a device when it was made optional. Students in the face-to-face class responded through informal discussions that they brought their devices to listen to music while they worked, but did not know appropriate artists to research and did not want any extra work. Students in the OLC class viewed technology as a source of ideas and tool to plan a work of art, while students in the face-to-face class viewed technology as an unrelated component or source of inspiration in planning a work of art.

Overall the online-research process had a greater impact on student academic achievement than peer discussion groups. Independently, students gave a short phrase or one-sentence answer without elaborating on their ideas in the online discussion posts. However, while the posts were not often insightful independently, they primed students for more in-depth discussions in class facilitated by the teacher-researcher. As students researched popular culture and art history resources online, they easily connected the work of their mentor artist to their own work and voluntarily commented on other students' work during class sessions.

Students who researched artists in the OLC class showed higher levels of creativity than students in the face-to-face class. Creativity was defined as the extent to which a student exhibited novelty and elaboration. Students in the OLC class were exposed to a wider variety of artists as they researched a theme, and as a result, students in the OLC class produced work that was more novel and expressed a more distinct artistic voice than students in the face-to-face class. In the face-to-face class, only 4 of the 15 students consistently sought ideas from artists not presented in class. The four students in the face-to-face class who researched art resources on their own also scored higher in creativity than classmates in two of the three projects. Online research positively impacted student creativity in this study.

Significance/Impact on Student Learning

According to NAEP (2009), eighth-grade visual art students have difficulty analyzing a work and applying the results to their art. To address this need, teachers should engage students in arts research, equipping them with thinking skills to form new connections. As the research district emphasized the importance of integrating technology into education, this study sought to engage students in learning about art through online-learning components and peer discussion groups to increase art achievement and meet district goals of improving digital literacy.

The process of completing online-learning assignments created an opportunity for students to analyze works of art and apply the knowledge to their own artwork. At the conclusion of the study, students slightly increased student art scores, but not enough to significantly impact the problem of improving art achievement. The results suggest that students may not have been given enough time to

incubate their ideas, the online-learning components need to be modified for future use with eighth-grade art students, or the process of improving art achievement should be examined over a longer period of time.

While the online-learning components did not raise art achievement scores to a significant level, they positively impacted the problem of digital literacy practice. Results indicated that students who participated in the OLC demonstrated digital literacy skills more frequently than those in the face-to-face class. Increasing digital literacy practice is a skill that extends beyond the art classroom and teaches students to be effective communicators, researchers, and responsible digital citizens (Ribble, 2011). Having the ability to efficiently research a topic empowers students to have increased choice and flexibility in what they learn in the art classroom. In the larger context of middle school learning, students who participated in an online-learning component would also be better prepared to use digital literacy skills in content areas where teachers incorporate technology devices as part of instruction.

The engagement checklist and attitude survey indicated that students who participated in online-learning components experienced increased levels of engagement, felt the online-learning components provided more choice, and helped them create better quality art products. These findings are significant as they provide a potential strategy for art teachers to increase student engagement and attitude towards art. When given a choice, students became intrinsically motivated, engaged in online research, and located artists they found personally meaningful. The marked change in student attitude and engagement suggests that students would continue to improve their work over time and raise their art achievement scores to statistically significant levels.

Factors Influencing Implementation

Several factors influenced implementation of this study. The research school was in its first semester, and many students had never been part of a BYOD program. As a result, students did not bring their devices regularly to class in the initial phases of the intervention.

The platform students used to post online resources and participate in peer discussion groups was also problematic. Prior to the start of the school year, the school technology specialist informed the teacher-researcher of a pilot program for research school students to collaborate online more efficiently. However, as the school year began, the district delayed implementation of the program, forcing the teacher-researcher to redesign online-learning components in an alternative platform.

Implications and Limitations

This study also has implications for the research school and district. Based on the improvement of student engagement, attitude, and digital literacy skills, the research school and other BYOD schools in the district could be successful in implementing a similar program. Using technology to engage students in online research and apply their findings to a project could increase digital literacy test scores required by the district for eighth-grade students. The process of implementing online-learning components as part of art instruction could also be adapted in face-to-face instruction in schools with technology access.

Time is the primary factor that may impede teachers from creating online-learning components. While the teacher-researcher did not find adequately developed online-learning modules for art, there are online resources for other content areas. Alternatively, teachers in the same content area may collaborate and develop a set of learning modules for their school.

There were limitations to this study that should also be examined. The scope of the intervention using online-learning components lasted only 8 weeks. Had the intervention spanned the semester, the difference in art achievement scores for the online-learning component group may have been significantly different. Extending the period of time for the intervention would also be consistent with Leese (2009), Freedman (2013), Black (2009), and Pennisi (2013), whose studies continued over the course of a semester or year.

Another limitation involved researcher bias and reliability of results. In this study, the teacher-researcher designed learning modules, delivered instruction, evaluated students, and compiled the data. While instruments were peer-reviewed, the position of the teacher-researcher may

have rendered the study objective. Conducting research over several semesters may provide larger samples, yield more reliable results, and familiarize students with the BYOD program.

Therefore, additional research is required to validate the findings in this study. Further study could investigate other forms of online collaboration in art. For example, the research school district has discussed creating online accounts for students to share documents and create projects more efficiently. Another approach may determine the extent to which digital literacy skills acquired in the online-learning components transferred to learning in other disciplines.

Conclusions

The purpose of this study was to determine whether using an online-learning component incorporating peer discussion groups would improve eighth-grade students' art achievement, digital literacy skills, student engagement, and student attitude toward art.

Research question one examined whether achievement scores of eighth-grade visual arts students who participated in an OLC were higher as compared to students who participated in a face-to-face class environment. To determine the impact of the online-learning component on art achievement, the teacher-researcher compared printmaking, ceramics, and cut paper unit project scores from the OLC group with the face-to-face class. While the scores from the OLC class were higher than the face-to-face class, the results were not significantly different. The art achievement scores are not consistent with Leese (2009), who saw an increase in student achievement in students who participated in online-learning components between face-to-face class sessions. However, Leese's (2009) study lasted the entire semester, and participants were post-secondary students. Age and technology capabilities could have produced different results.

The second research question addressed whether digital literacy practices of eighth-grade visual arts students who participated in an OLC improved as compared to students in a face-to-face classroom. In this study, the teacher-researcher completed the Digital Literacy Checklist and recorded field notes. Results showed that students in the OLC class located art resources, applied their findings, and used ICT as it related to class objectives more effectively than students in the face-to-face class. Completing OLC units prompted students to research online, study artists they found interesting, and provided possibilities for student artwork beyond material presented in class. While a majority of students participated in online discussions, many responses were not as insightful as class discussions facilitated by the instructor. Half of students in the face-to-face class did not consistently bring their devices to class or use them as a reference for art making. Digital literacy results were consistent with Seney (2009), who advocated the need for students to be taught appropriate strategies to solve problems effectively. Brumberger (2011) found students had technology skills to navigate website, write documents, and create presentations, but they were not proficient at evaluating online-resources or interpreting their meanings until they received instruction.

The third research question focused on whether the engagement level of eighth-grade visual art students who participated in an online-learning component improved as compared to students who participated in a face-to-face classroom environment. The teacher-researcher kept an engagement checklist to determine the amount of time students spent participating in projects, communicating with the teacher-researcher and peers, and using ICT and art materials appropriately. There was a significant difference in engagement in art. Students in the OLC group were more engaged than students in the face-to-face group. Students in the OLC class asked more questions about artists they researched and shared their findings without being prompted in face-to-face class sessions, while students in the face-to-face group worked more independently. These results are consistent with Black's (2009) findings that students who collaborated and shared knowledge of technology were more engaged in learning. The results also agreed with Pennisi (2013), who found students who participated in a curriculum allowing student choice were more on-task and emotionally invested in learning about art.

The fourth research question inquired whether the attitudes

of eighth-grade visual art students who participated in an OLC improved as compared to students who participated in a face-to-face class. At the conclusion of the study, the teacher-researcher administered the Art and Technology Student Attitude (ATSA) survey, to students in the online-learning and face-to-face classes. Results indicated, students in the OLC group felt strongly that online assignments connected prior technology knowledge to concepts in art, their work was better when they researched artists, they had more choice in course topics, and they learned new ways to use technology outside school. Half of students responded that they liked posting ideas online better than discussing them in class. The findings corroborate the results of the digital literacy and engagement checklist. Students with more digital literacy skills were better equipped to choose resources they found personally meaningful that engaged them in learning. The student attitude data also agree with Freedman's (2013) results that students who chose to be part of online groups had positive attitudes toward learning about a topic as they found the content relevant.

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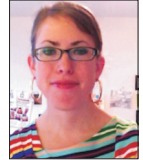
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