Augmented Interactive Wall as a Technology-based Art Learning Media

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Abstract. Art plays an important role in stimulating the development of the individual right brain. Art learning can improve the intelligence of individual expression, increasing sensitivity and concentration, and fostering brilliant creativity. Formal education institutions in Indonesia have not provided an appropriate portion for art learning. This causes the development of visual art in Indonesia tends to be slow and hampered. This research will reveal the potential of the Augmented Interactive Wall as a medium for expressing ideas using digital technology. This is qualitative research using observation and interviews to obtain data. The result shows that collaboration between technology and art will produce innovations that will help individuals to explore and express their ideas better, and bring them into various forms of physical, social and cultural interactions.

1. Introduction

STEAM as an approach in education has been discussed since 1990. STEAM is a development of an educational approach that initially only refers to the fields of science, technology, engineering and mathematics (STEM). STEAM Education combines "A" for art with the aim that learners do not only achieve success in the technical field but also can be creative individuals and optimize critical thinking skills through exposure in the fields of art and design thinking [1]. Formal education institutions in Indonesia have not provided an appropriate portion for art education. Arts education has not been in line with other fields. This can be seen from the portion of art education which is still limited and has not become a priority through formal education institutions, both at the elementary and secondary levels. This causes the development of visual art in Indonesia tends to be slow and hampered [2].

Art plays an important role in stimulating the development of the individual right brain. Various studies suggest that art learning can improve the intelligence of individual expression, understanding humanity's sides, increasing sensitivity and concentration, and fostering brilliant creativity. From the aspect of emotion, art education can serve as a media to balance the sensitivity and social awareness of individuals [3].

Technology is chosen, utilized and socialized by the community because technology is able to open up possibilities for new experiences to be more flexible in expressing themselves. In the digital culture where various forms of visual stimulus become the main important instruments for interacting and conveying information, cross-curriculum collaboration has become the focus of STEAM education. The steps taken are prioritizing ways of thinking that involve art and giving art education a
portion that is parallel to other applied fields [4]. Art becomes interdisciplinary, collaborative, inclusive and fundamental [5].

In art learning, technology can help young learners visualize their ideas [1]. Hand skills to produce visual art with conventional approaches are important, but in the era of information technology, this should not be the only focus of art educators. Augmented Interactive Wall is used as a medium to collaborate STEAM and has the potential to be an effective learning media for young learners, who combine technology and art to balance the ability of social interaction and creativity at the same time.

The collaboration of art, science, and technology has inspired a variety of fundamental discoveries and has a significant impact on civilization. Art has a very important role as a basic need for human education, a means of communicating with other people as well as a cultural environment, developing attitudes and personality, and opening opportunities for other intelligence [6].

This research will reveal the potential of the Augmented Interactive Wall as a medium for expressing ideas using digital technology. Through the description of the patterns of visitor interaction using the Augmented Interactive Wall entitled Future World, which was exhibited at the Singapore Science Art Museum, this study aimed to see the potential of Augmented Interactive Wall as digital media to encourage young learners to express ideas through drawing activities.

2. Young Learners as Digital Natives

Digital natives are a generation born after 1980 when digital technology started to be used for various purposes. They all have access to connect with each other through digital technology and they all have the capability to use this technology. They learn, work, write, and interact with each other in ways that are very different from those of previous generations [7].

Bard and Soderqvist refer to individuals categorized as digital natives as netocrat, individuals who live in networks and are able to utilize information, symbols, and knowledge in them to build their individual identities[8]. Netocrat has cognitive strength, especially in abstraction abilities. They are able to create abstract concepts of daily activities and are able to provide value and meaning to the activities carried out. Netocrat also has a more integrative and holistic view of the dynamics of change. Living in a complex network, knowledge also develops very quickly, so that netocrat must be able to develop a system of management and processing of knowledge that is fast, precise and flexible [9]. That is why digital natives are very natural and adaptive in following developments in digital-based technology. But this understanding was not fully accommodated by instructors in the digital age who were generally born as digital immigrants. Often the learning provided by formal education institutions has not been able to overcome this acceleration, so the curriculum offered by formal education institutions lags far behind what is needed by young learners in the digital age [10].

3. Digital Natives and Digital Game

In a study of media use by young learners ages 8 to 18 years old showed that on average boys spend almost one hour per day playing video game consoles and girls spend less than a quarter of an hour [11]. This certainly has a positive or negative impact. Young believes that warning signs or symptoms of game addiction can cause the following [12]:

1. Loss of interest in other activities or hobbies, especially games or hobbies involving physical and motoric abilities
2. Become less social and spend more time personally
3. Tend to be defensive about the need for games
4. Consider games as a psychological escape

From the point of view of art education, someone who is addicted to the game will have little time or even never express his emotions through art. This is in line with the condition of the quantity and quality of art learning in the formal education institution which is limited, causing a lack of visual arts activities in young learners. In fact, the nature of play (homo luden) in individuals will provide physical and psychological balance, that is one of the reasons why playing activity is always related to artistic activity. The research shows that the need to play is as important as the other two human
activities, thinking & working. The concept stated by Huizinga is now easier to understand where games become a part of the life of digital society. Humans are homo ludens. Integrity and self-recognition of a human being will become more transparent when he is playing [13].

Some research shows that games can bring a person into a deeper imagination, thus opening a person's opportunity to be more explorative. Games that successfully integrate fun and learning may have great potential to motivate young people to learn science, supporting the inquiry approach in the context of popular computer game activities. Games can trigger levels of engagement, encourage repetition and practice, and motivate participants with challenges and instant feedback [14]. The development of digital technology that drives the emergence of various game innovations has become attractive to young learners, because of their high involvement in all forms of digital media [11]. The game has several important characteristics because it can simulate natural and engineering phenomena. Positioning the game so that it can be a motivator for young learners to stimulate critical and creative thinking is a challenge for the game development industry [15].

4. Method

This study aims to reveal the potential of the Augmented Interactive Wall as a media that apply STEAM education, where users are encouraged to be able to express their ideas through interactive digital-based art media. This study took the Science-Art Museum - Singapore as a research location. The object chosen in this study is "The Future World", an integrated Augmented Interactive Wall displayed in Science Art Museum. In "The Future World" there are 3 interactive wall artworks, as follows:

1. “Graffiti Nature” - featuring colorful flora and fauna ecosystems,
2. “Sketch Town” – facilitating visitors to draw objects in the form of various means of transportation using crayons and paper and watch the object turn into a 3D animated object
3. Waterworld – featuring a water ecosystem filled with aquatic creatures

The existence of Sketch Town as an augmented interactive wall is the focus of research that will be discussed in this research, considering that this artwork offers space and various forms of complex interactions for visitors. Sketch Town is one of the most accessed artworks by visitors, which provides a unique opportunity for interaction with users.

The technique used to obtain data is observation and interviews. Observations were made to observe the features offered by Sketch Town as an Augmented Interactive Wall and how users interact with these interactive media. The interview was conducted to find out the user's response after interacting with Sketch Town. The response of the users studied relates to technical responses and aesthetic responses.

All data obtained were analyzed by the inductive approach, using interactive cycle models, which were carried out through a series of data reduction, presentation, and verification processes[16].

5. Sketch Town as Augmented Interactive Wall

The augmented reality system produces a composite display for users. Users see images that are directly in the form of real scenes joined by virtual scenes generated by computers. Virtual scenes add real environments with additional information [17]. In this study, Sketch Town is categorized as an augmented interactive wall, a digital projection that can interact with people around it. The terminology of augmented interactive wall stated in this paper refers to the characteristics of media and unique interactions, produced by Sketch Town as a digital technology-based work of art. Media categorized as an augmented interactive wall facilitates users to move, touch and provide various stimuli on a virtual display projected on one surface, and as computer feedback also gives a certain response to each stimulus given by the user. In the augmented interactive wall, a virtual scene is combined with real scenes.
The Augmented Interactive Wall displayed at the Art Science Museum is artwork created by the TeamLab studio. TeamLab, founded in 2001, is a collective art group, interdisciplinary ultra-technologists whose collaborative practice seeks to navigate the meetings of art, science, technology, design and display natural themes. Various specialists such as artists, programmers, engineers, CG animators, mathematicians, and architects joined to form teamLab.

Through observing artworks displayed in the Art Science Museum, it can be seen that TeamLab tries to explore new relationships between humans and nature through art. Digital technology has enabled art to free itself from physical boundaries and surpass it. They tried to explore the boundless interaction between humans and nature as something fragile on one side, but on the other hand, offered a variety of verses.

Figure 1. The display of Sketch Town as an augmented interactive wall

As a digital artwork Sketch Town offers an interesting interaction. This artwork provides the user experience to create and express his ideas by doing the most basic art activities - coloring. In addition to providing the experience of interacting with a virtual display, users are also encouraged to create an interaction with other users. Experience a human-computer interaction that does not emphasize personal experience, but also a social experience. The interaction built by Sketch Town as an augmented interactive wall that combines art and technology is explained as follows.

1. Visitors are facilitated with several papers that already have images with certain image patterns. The theme of the image displayed is various means of transportation. Visitors can modify the image by coloring or adding new strokes using crayons or colored pencils. Visitors have unlimited possibilities to create shapes that are completely different from the initial image patterns on the paper.
2. Colored and modified images are inserted into a "box" scanner, which will scan and convert 2D images created by visitors into 3D image objects in the form of interactive visual media projected onto a wide wall surface.
3. 3D objects will be placed in a city simulation, each object can respond to visitors' gestures that are nearby. In this case Kinect 360 technology is used, a hardware used to capture human body movements.
Figure 2. Interactions built by art and technology through augmented interactive wall

Drawing and coloring activities in the early stages of interaction are intended to invite visitors to get the most basic experience of conventional visual arts activities - drawing. The role of art learning through visual arts activities is to encourage users to realize their ideas and imagination through hand scratches. Ring (2010) describes that drawing activities provide a very persuasive role as a tool for making meaning from individual experiences. In our world that is increasingly stimulated by visual things, this seems to be a very good proposition. Unfortunately, as a simple activity, drawing and coloring are starting to be abandoned by individuals who are growing up. Whereas among children, conventional drawing activities are less challenging as the level of gadget usage becomes higher.

The existence of a scanner that serves to capture colors from two-dimensional images produced by users, realizing the visualization of 2D image changes into 3D-based objects that can be projected on a wide wall. When the image has been projected in the form of augmented interactive wall, users get experience to interact with the work they produce. Together with the work of other users, their image objects will become part of Sketch Town as a whole so that Sketch Town develops into a user-created integrated collaborative work. Interactive game elements appear when users must avoid attacks by monsters that can destroy their image objects in an instant. This shows that human nature as homo ludens is an aspect of the Sketch Town development team's attention, so that this artwork can be a complete and comprehensive augmented interactive wall, which offers the element of learning and playing at the same time.

Some users also say that the competitive side within them arises when they interact with Sketch Town. Every time they see other users produce better and more interesting image objects, they will be encouraged to make their image objects with other versions that are better because instinctively they want to be the best object creators in Sketch Town. That is the reason why users are encouraged to repeat the process of interacting with Sketch Town more than three times, because they consider their first trial as a Sketch Town user not the best experiment so they repeat the interaction process.

6. Conclusion
Sketch Town as an augmented interactive wall has combined technology and art to provide unique experience for visitors. As a simple structured simulation, Sketch Town combines various forms of physical, social and cultural dimensions. Art Science Museum visitors who come from various countries with a multicultural background, are structured into one section (monoculture) that follows the rules set by Sketch Town as an interactive work of art. This is in line with Han's opinion which states that the digital world forms a new culture where users communicate with people from diverse cultures [1]. Sketch Town has proven to be able to bring new possibilities, that humans as homo ludens who always want to play, and as homo fabers who are able to create tools / technology in controlling their environment, and bring back the function of art to be an important part of technological development. Visitors are brought back to conventional art by doing coloring activities, invited to enter into a virtual world with new identities born of their art, and invited to interact socially with other visitors through the adaptive response given by simulation.
In the future, media that combines technology and art like this needs to continue to be developed and applied, in order to restore the passion of art activities without ignoring aspects of social interaction. Technology will be an intermediary to make human imaginations become reality. A long history has proven that the collaboration between technology and art has brought miracles to various aspects of human life. The collaboration of technology and art are two things that cannot be separated and will reach their full potential to bring brilliant changes to human civilization in the future.

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