

1. Title

Creating connections: A study of the impact and effectiveness of a visual arts teacher-curator pedagogy

2. Cover Page

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3. Abstract

With the easy availability of free online visual information and digital tools, visual arts teachers are now better provided to make use of these abundant resources, yet they also pose a challenge for teachers who want to plan and deliver a technology-enabled curriculum, particularly in the context of the COVID-19 pandemic. Hong Kong is experiencing a rapid development in the museum establishment with the openings of the renovated Hong Kong Museum of Art, the M+ museum of visual culture, and the Hong Kong Palace Museum in 2019, 2020 and 2022 respectively. With all these state-of-the-art facilities, we would like to see members of our society become regular museum visitors and be culturally literate. Amidst these technological and social changes, I proposed a visual arts teacher-curator pedagogy and developed the present study to investigate the effectiveness of the pedagogy in Hong Kong's primary and secondary schools. The pedagogy set out to empower visual arts teachers to assume the role of a "digital museum curator" and to facilitate student learning using virtual exhibitions.

Design-based research was the methodology adopted for the study. Six teachers and 331 students participated in the study in the academic year of 2021-22. The first phase of the study focused on the training of teacher participants in the teacher-curator pedagogy. The second phase was the implementation stage. With the support of the investigator, the teacher participants developed two virtual exhibitions and relevant face-to-face, museum visit and online learning activities. The third phase was the evaluation stage. Data on the impact and effectiveness of the teacher-curator pedagogy was collected through teacher interviews and student questionnaires and interviews. The study, which examined the effectiveness of the proposed pedagogy, revealed a substantial improvement in student learning including: (1) motivating students towards self-directed and active learning, (2) stimulating artmaking ideas and skills, and (3) enhancing students' confidence through peer learning. Through the formulation of exhibition themes, the selection of connected artworks and the design of relevant learning activities, the study enhanced the autonomy and capacity of teachers. With a focus on using digital technology, the results of the study contributed to developing an effective pedagogical practice in general and one that promotes online learning in visual arts in particular.

4. Keywords

visual arts; thematic learning; curators; virtual exhibition; online learning

5. Table of Contents

1. Title
2. Cover Page
3. Abstract
4. Keywords
5. Table of Contents
6. Justifications
7. Theoretical Framework: Creating connections
 - Teachers as curators*
 - School-museum nexus*
 - Learning art in themes and context*
 - Blending direct and online learning*
8. Objectives
9. Methodology
 - Participants*
 - Teacher workshops*
 - Consultation*
 - The virtual exhibition platform*
 - Data collection and analysis methods*
10. Results and Discussion
 - Results of the student questionnaires*
 - Results of student interviews*
 - Results of teacher interviews*
 - Limitations and challenges*
11. Conclusion
12. References

6. Justifications

With the present easy access to online visual images, there has been a rapid expansion of free digital image collections, e-learning resources, and image-based social media. Visual arts teachers thus have greater opportunities to use digital artwork images in planning and delivering the art curriculum using these abundant resources. During the COVID-19 pandemic, the need for teachers to integrate digital technology and online learning activities into the traditional classroom has further been heightened. The opening of the M+ museum in 2021 and the Hong Kong Palace Museum in 2022 have set a new standard for cultural establishments in Hong Kong. However, these venues also beckon an audience that has an interest in cultural artefacts and the ability to understand, interrogate, and learn from them. Amidst these technological and social changes, I propose a visual arts teacher-curator pedagogy which uses online exhibitions to teach and a study to assess its effectiveness in Hong Kong's primary and secondary schools. This paper outlines the background, implementation, and the results of the study. Specifically, the aim of the study was to propose, experiment, and assess the effectiveness of the teacher-curator pedagogy guided by the following questions:

- (1) How long and frequent do students visit virtual exhibitions on their own?
- (2) What are the parts of the virtual exhibitions that students found useful?
- (3) What is the impact on student learning of this way of conceptualizing, organizing, and constructing visual arts learning through virtual exhibitions?

- (4) What is the impact on teachers' capacity of utilising technology, lesson planning, and engagement of students in learning?

7. Theoretical framework: Creating connections

The study focused on the effectiveness and impact of a pedagogy that makes connections in four dimensions: (1) connecting the roles of teachers with that of curators, (2) connecting learning in schools with physical museums and virtual museums, (3) connecting contemporary Hong Kong artworks with the artworks of different cultures, places and times and creating a teachable theme, and (4) connecting face-to-face teaching with online teaching. The following table summarises the connections between the major components of the study, the focuses of investigation and the relevant theories or studies.

	Connections between	Focus of investigation	Relevant theories/studies
1.	Roles of teachers and curators	Effectiveness and impact of pedagogy	O'Neill & Wilson (2010) Garnet (2017)
2.	School and museum learning	Learning in formal and informal settings	Bell & Smith (2020) Sharples et al. (2015)
3.	Contemporary Hong Kong artworks and artworks of different cultures and times	Learning art in relation to themes and context	Sandell (2009) Hubard (2014)
4.	Direct contact teaching and online teaching	Effectiveness and impact of pedagogy	Liang & Chen (2012) Ke & Kwak (2013)

Teachers as curators

There are several similarities between visual art teachers and art museum curators. In the broadest sense, both groups deal with artworks and people, but with a different priority in focus. Both of them have to fulfil the missions of educating and engaging people in art, but serving different clients and using different vocabularies. While art teachers have to face specific groups of children of similar ages, art museum curators are dealing with a public and diverse audience. Art teachers have a good command of pedagogical knowledge and practice while art museum curators are knowledgeable about artworks, art history and aesthetics. However, there are overlaps in the roles performed by art teachers and museum curators. When mounting an exhibition, curators have to decide on its overarching theme, on the artworks to be included and how they are connected, and finally on the ways to convey a message and create meaning for the audience. Similarly, teachers have to think about which artworks their students will need to learn about when they are planning a teaching unit, usually with a group of artworks to serve as illustrations of concepts, ideas or skills that their students are going to master. Teachers' work is actually not unlike that of a museum curator as described by Hubbard (2014, pp. 104-105) : they have to "choose which works to show visitors and which to exclude" and "determine the processes through which viewers will engage with the works". The study thus explored and investigated the effectiveness and the impact of a teacher-curator pedagogy – when teachers assume the dual role of educators and curators in teaching.

The roles of both art museum curators and visual arts teachers have been changing over the last few decades. Traditionally, curators work with art objects and their main duties are to preserve, take care of, select and study the museum's collection. However, O'Neill and Wilson (2010) suggest that there is an "educational turn" in contemporary curating. "Educational formats, methods, programmes, models, terms, processes and procedures have become pervasive in the praxes of both curating and the production of contemporary art" and "curating

increasingly operates as an expanded educational praxis” (O’Neill & Wilson, 2010, p. 12). Now expected to be more aware of the experience of the audience, curators not only need to consider artworks and exhibitions from the critical, aesthetic and historical perspectives with which they have worked for a long time, but also from the perspectives of education, pedagogy and audiences. Similarly, the role of teachers is also shifting from being the source of knowledge and having the authority to instil knowledge to that of creating and providing the necessary tools for students to acquire knowledge (Garnet, 2017). This is also not unlike what curators do – they arrange art objects in a purposeful way and let museum visitors discover the meaning themselves. There is an affinity between the work of teachers and curators, and both will benefit from understanding and assuming some of each other’s work for their respective professions.

School-museum nexus

Schools and museums are two public entities with different functions; however, they share a common goal – to educate. There are many possibilities and advantages in connecting formal learning in schools with learning in an informal setting – the museum (Chong & Smith, 2017). In exploring innovative pedagogies that have the potential to provoke shifts in educational practice, Sharples et al. (2015, p. 11) proposed “crossover learning” during which “formal aspects of learning are interlinked with the informal learning experiences that occur during museum visits”. According to Sharples et al. (2015, p. 3), “crossover learning experiences exploit the strengths of both environments and provide learners with authentic and engaging opportunities for learning”. Knutson et al. (2011, p. 320) note that connecting learning that takes place in informal (museum) art education settings with formal (school) settings will contribute to the realisation of “a healthy art learning ecology”.

As museums in the 21st century continue to extend their virtual presence beyond physical setting by digital means, there is a new trend of museum learning characterised by the blending of physical and virtual environments (Falk & Dierking, 2018). Drawing on aligning the virtual and corporeal museum learning experience, Katz and Halpern (2015) pinpoints that “the move to integrate cultural institutions and museums into traditional face-to-face learning environments through online education is an area of new enriched learning and emerging technology” (p. 3). Among the heightened use of hybrid teaching models provoked by the COVID-19 pandemic (Oliveira et al., 2021), various blended strategies are adopted to enable learning with museums during the museum closure. For example, there are guided virtual tours (Bell & Smith, 2020), hybrid programmes that comprise of virtual gallery tour, online artmaking workshops for students and educational materials for schoolteachers (McNaughton, 2020), and remote teacher training programmes to support the use of museum offerings for classroom teaching (Noble, 2021). While museum field trips are not possible, teachers can make meaningful use of open-access virtual museums and educational materials to enable museum learning beyond time and space. By connecting school learning, which is usually more target-oriented, structured and tied to the government curriculum, with learning in the museum, the proposed pedagogy engages teachers to design learning activities that connect learning that takes places in two different contexts with online technology. It is foreseeable that the alignment of museum and classroom learning will further be bolstered amid the irreversible trend of “technology-mediated learning” (Bower, 2019, p. 1035).

Learning art in themes and context

In this study, the teacher participants were required to curate two thematic virtual exhibitions as trials of the teacher-curator pedagogy. The Visual Arts Curriculum Guide for Primary 1 to Secondary 3 (Curriculum Development Council, 2003) recommends that Hong

Kong schoolteachers use a thematic approach with a learning focus in visual arts curriculum planning. Besides providing numerous thematic unit designs as exemplars (pp. 76-110), the guide states that “[a]ll visual arts learning domains ... are to be integrated using themes or topics for a balanced and comprehensive curriculum design” (p. 20). In 2009, Sandell proposed the Form+Theme+Context (FTC) model as a way to address the increasingly visual world and the need to rebalance twenty-first century art education. According to Sandell (2009, p. 290), FTC is a “visual organizer that builds understanding, makes connections, and inspires deeper inquiry and creativity”. Theme is the overarching concept expressed by the artist. Context is the various conditions in which the work is created and received. “By enlarging the visual thinking process, FTC considerations can help students create and respond to art that is authentic, deep, and meaningful” (Sandell, 2009, p. 296).

A theme can focus on styles, forms, artists, techniques, expressions or art movements that are typical of traditional art historical methods. A theme can also be a framework that ranges from concerns of broader issues of human existence such as courage, life and death or social justice to everyday life, such as insects, a memorable object or a birthday celebration that binds the artworks together. Therefore, based on their own interpretation of artworks, teachers have to decide which works to include and to create the narratives showing how these works are related to the theme. Placing artworks in a thematic context with other artworks can bring out the focus of learning, highlight the critical feature to be learned, and communicate the theme effectively (Hubard, 2015). Students will be invited to consider the meaning of each artwork on its own as well as how the artworks are related to each other in realising the theme. A thematic approach can facilitate discussion of the artworks in focus and ensure the relevance of the subsequent learning in artmaking. The presence of a theme can be reassuring and promote an in-depth investigation of specific aspects of artworks; however, it can also limit the exploration of the multiple dimensionality of a work (Hubard, 2014). Hubbard (2014) suggests that educators should be aware of the rationale behind selecting particular themes and of the ways in which a theme frames the interpretation of viewers. The study thus investigated the ways in which teachers create themes and the impact of this method on student learning.

Blending direct and online learning

Teachers of all levels are increasingly using online learning activities to supplement in-person instruction that takes place in traditional classroom settings (Liang & Chen, 2012). There are many advantages to engage students in online learning that takes place outside the classroom in addition to direct contact teaching in schools. Online learning offers flexibility in learning that transcends time and distance (Liang & Chen, 2012). Because of the self-paced nature of online learning, students will experience the process of exploration and thus have a sense of acting independently (Andersson, 2010). The availability of online materials over an extended period means it is possible for users to review them, which often leads to a better retention of knowledge. Students are also better engaged in participatory learning and knowledge construction through interactive online learning, which often include media-oriented materials and assignments (Ke & Kwak, 2013). Online learning has the potential to reach a worldwide audience. The freedom of knowledge is facilitated by the ease of electronically distributing an online learning activity. Another related benefit of online learning is the improvement of students’ digital competence as they have more opportunities to deal with online resources (Janssen et al., 2013).

Currently, teachers can find an unprecedented amount of free visual art resources through the internet (Etheridge, 2017). There are online resources created by public art museums, massive open learning courses (MOOC) such as Coursea, and websites of interest groups or

individual bloggers. There are also open access electronic platforms that feature millions of high quality digital images with search, download, personalise collection and share functions. For example, Google Arts & Culture (<https://artsandculture.google.com/>) is an online platform that provides extremely high-resolution artwork images, virtual gallery tours, contextual information of artworks and themed tours and stories. Pinterest (<https://www.pinterest.com/>) is an image-based social network that allows users upload, download and search images of their own interest. Bridgeman Image (<https://www.bridgemanimages.com/en-GB/>) is a commercial company that represents galleries, museums and artists worldwide for the licensing of their works. A search of their archives will yield hundreds of artwork images relevant to the key search word. All these online resources have made possible for teachers to think about artworks in terms of themes and the connections between and among them. However, the skills and capability of teachers to uncover, select, organise and utilise internet resources to create learning opportunities are also in great need of development. The study investigated the ways in which teachers can take full advantage of these resources and make meaningful use of them.

8. Objectives

The objectives of the study were:

- (1) To examine the ways in which visual arts teachers assume the dual role of educator and curator at primary and secondary school levels.
- (2) To investigate the ways in which teachers develop themes and design relevant teaching and learning activities to form a virtual exhibition.
- (3) To evaluate the effectiveness and impact on student learning of the teacher-curator pedagogy.
- (4) To evaluate the effectiveness and impact on teacher planning curriculum and delivering classroom teaching utilising the teacher-curator pedagogy.

9. Methodology

The study adopted design-based research (DBR) as the research methodology. DBR is “a collection of approaches that involve a commitment to studying activity in naturalistic settings, with the goal of advancing theory while at the same time directly impacting practice” (Barab, 2014, p. 151). The first reason for adopting DBR was the need to consider the complexity of various dependent variables and the uncontrolled conditions in real-life settings. For the present study, I transformed the intervention and the local school context into “an argument that has generalizable value to others who care about the underlying lessons” (Barab, 2014, p. 162). The second reason for using DBR was the need for a close collaborative partnership between the researcher and the participants (Anderson & Shattuck, 2012). For a study on pedagogy, the feedback from teachers and students is always one of the most important elements for refining the theory and evaluating its impact. The final reason for adopting DBR was the need for the design to evolve. DBR, as a method that allows continuous amendments of theory and design, “function[s] to help us understand and adjust both the context and the intervention so as to maximize learning” (Anderson & Shattuck, 2012, p. 17). The study was conducted in three phases: (1) prepared teachers to implement the teacher-curator pedagogy, (2) teachers curated two virtual exhibitions and implemented relevant classroom and student self-directed learning activities, and (3) assessed the data collected from student interviews and questionnaires and teacher interviews. The study took place in Hong Kong from June 2021 to August 2022.

Participants

Three primary and three secondary schools' visual arts teachers and their students participated in the study. The teachers were recruited through my personal connections and the Professional Learning Community (PLC) for Primary/Secondary School Visual Arts. The PLC group is formed by the Hong Kong Curriculum Development Institute, a government body which oversees curriculum development in school subjects from kindergarten to senior secondary levels. Schools in the PLC group are committed to releasing their teachers to attend 10 to 15 professional development workshops in a year during school time. Each teacher participant selected two primary five classes (age 11) or two secondary two/three classes (age 14/15) for the intervention. Altogether, there were 331 (167 primary and 164 secondary) student participants. Written consent of the participating schools, teachers, students, and parents of students were obtained prior to the commencement of the study.

Teacher*	Age	Years of Teaching Experience	School level	Classes (No. of Students)	
Vicky	45-49	22	Primary	P.5A (27)	P.5B (25)
Chloe	35-39	11	Primary	P.5A (30)	P.5B (31)
Kelvin	40-44	11	Primary	P.5A (27)	P.5B (27)
Tiffany	40-44	18	Secondary	G.8A (32)	G.8B (34)
Sonia	25-29	5	Secondary	S.2A (16)	S.2B (17)
Rachel	45-49	30	Secondary	S.3A (32)	S.3B (33)

*Teacher participants are assigned pseudonyms to protect their confidentiality.

Teacher workshops

Three whole-day workshops were conducted for the teacher participants in June 2021. The first workshop introduced the purposes, structures, and facilitation of the teacher-curator pedagogy. The second workshop discussed the formation of themes with artworks and the use of online art and museum databases. The third workshop addressed the operations of the virtual exhibition platform and related IT skills. During the workshops, there were experimental sessions for the teachers to develop, experiment, and refine their virtual exhibitions and design relevant classroom and online learning activities.

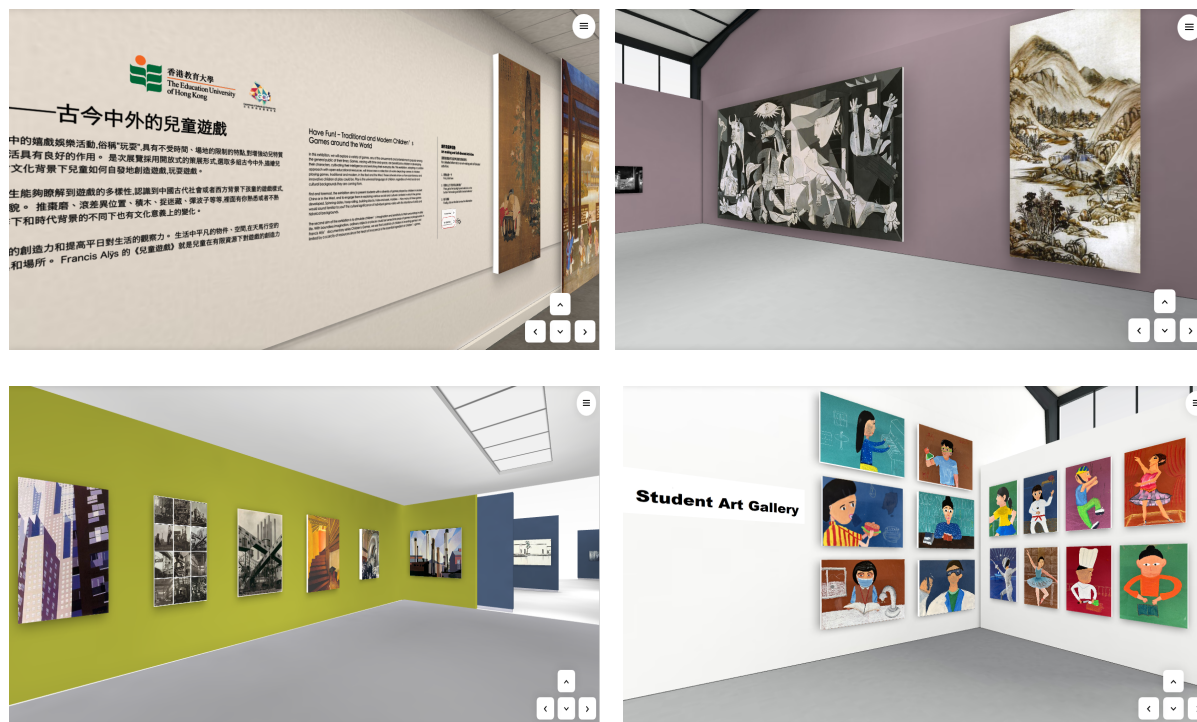
Consultation

Each teacher implemented the teacher-curator pedagogy in two teaching units with one in the first and the other in the second semester in the 2021-22 academic year. Each plan covered a learning cycle of four to six weeks. Teachers selected some of the featured artworks and introduced them in classes. For the remaining artworks, students were expected to visit the virtual exhibitions and complete online activities out of class time. The online learning activities incorporated various tasks for the students to complete such as answering a short quiz, downloading and uploading worksheets, discussing their views on artworks, and co-constructing learning materials. I met the teachers two to three times to advise them on the development of each virtual exhibition. Three group consultation meetings were held in the implementation period during which the teachers presented and advised on each other's virtual exhibition designs.

The virtual exhibition platform

An online exhibition platform – Kunstmatrix (<https://www.kunstmatrix.com/>) was provided to teacher participants to create 3D virtual exhibitions. The platform has two major creating and managing functions. "Art.Depot" is a space where users can upload artworks, edit captions and labels, select display options, and write information. "Art.Spaces" is the area to display the artworks from the inventory created in the Art.Depot. There are 15 default gallery room designs, with functions to select wall colors, upload ambient audio files, and combine

gallery rooms. Upon editing the basic exhibition information such as the exhibition title and introduction, the teachers entered the curating mode to place and move the text panels and artworks on the wall. The final virtual exhibitions can be published for online public viewing via sharable links or by embedding them into other websites. Figures 1 to 4 show some exhibitions created by the teachers.



Figures 1-4. Examples of the virtual exhibitions.

Data collection and analysis methods

Focus group student interview

I conducted semi-structured focus group interviews with students after the completion of each teaching unit. A total of twelve interviews were conducted consisting of four students (n=48) in each round from each participating school. In the one-hour interviews, the students were asked about the use and impact of virtual exhibitions on their learning motivation and attitudes, their face-to-face learning in classrooms, and their self-directed learning regarding two areas of visual arts learning in the school context – art criticism and artmaking, and the ways in which the virtual exhibition platform could be refined. The goal of the focus group interviews was to gain in-depth insights into the attitudes and perceptions of the students towards the proposed pedagogy. A random sampling method was used to select the student participants for the interview. The average class size is around 23 students per class. Four students, with two students from each of two classes, were randomly selected to participate in two rounds of interview. Students attending the interviews (n=48) represented 14.5% of the student participant population (n=331). Selecting participants from multiple classes can help ensure that the sample is diverse and representative of the population of interest. Instead of using the sample to make statistical generalizations about the entire population of primary and secondary school students, the sample provided qualitative data that can help inform our understanding of primary and secondary school students' attitudes towards the proposed pedagogy.

Student questionnaire

The data relating to student engagement with the virtual exhibitions was collected via questionnaires distributed to all student participants (n=331) after each teaching unit. The students were allowed time to complete the questionnaires in paper format in class which took approximately 10 minutes. There were seven multiple choice and two open-ended questions inquiring about the duration and frequency of the students' visits to the virtual exhibitions, preferences of online tasks, parts that they liked most about the exhibitions, and the ways in which they learnt from the exhibitions.

Individual teacher interview

I conducted twelve class observations of the teacher participants (n=6). After each class observation, teachers were interviewed individually face-to-face for one to one-and-a-half hours. A total of twelve interviews were conducted. The interviews focused on the experience of assuming the dual role of teacher and curator, the impact of using virtual exhibitions as a pedagogical tool on face-to-face and online teaching, and the effectiveness of the pedagogy in teaching art criticism and artmaking.

Reflective journal and review meeting

Reflective journals, which included the teacher's critical reflections on the difficulties encountered using the proposed pedagogy and actions for improvements, were collected from teachers after each week. I also conducted two review meetings upon the completion of each teaching cycle and a final focus group meeting with all the teachers. These meetings focused on evaluating the teaching implementation, proposing ideas to improve the next exhibition planning, and recommending the future development of the proposed pedagogy.

Collection of artefact and document

Students' artworks and teaching materials were collected to supplement and triangulate data collected from interviews and questionnaires.

All video recordings of classroom observations, interviews, reflective journals and review meetings were transcribed for thematic analysis, a method of qualitative analysis in which meaningful patterns (themes) are systematically identified and described (Riger & Sigurvinsdottir, 2016). The interviews and questionnaire were conducted in Chinese and the results were translated to English for analysis and presentation.

10. Results and discussion

The following results are derived from data collected after the two rounds of field work conducted during the 2021-22 academic year. They were organized according to the methods of data collection.

Results of the student questionnaires

Questionnaires were distributed to the participating students (n=331) at the end of each teaching unit. The total number of returned questionnaires was 575 and the overall response rate was 86.9%. The questionnaires measured students' attitudes towards the virtual exhibitions, frequency and duration of the visits, and their enhanced areas of visual arts learning. There were also open-ended questions inquiring about examples of using the virtual exhibitions and suggestions regarding the exhibition platform.

Frequency and duration of using virtual exhibitions

To understand the extent to which students used virtual exhibitions for self-directed learning, students were asked to indicate how often they visited the virtual exhibitions after class, as well as how much time they spent on each visit on average. Table 1 shows a majority (77.9%) of the students visited each virtual exhibition 1 to 6 times with 67.8% of students spending up to 15 minutes and 28% of students spending 16 to 30 minutes on average per visit. The findings showed that student engagement **through self-initiated visits which often took place outside the classroom can be revealed through markers (Vytasek et al., 2020) such as the numbers and duration of the virtual exhibition visits.**

Table 1. Frequency and duration of using the virtual exhibition by students

Question	Response				
	0	1-3	4-6	7-9	10 or more
How many times did you browse the virtual exhibition in your spare time?	85 (14.8%)	327 (56.9%)	121 (21%)	26 (4.5%)	16 (2.7%)
	0 - 15 minutes	16 - 30 minutes	31 - 45 minutes	46 - 60 minutes	1 hour or more
How much time did you spend browsing the virtual exhibition on average per each visit?	387 (67.3%)	161 (28%)	19 (3.3%)	3 (0.5%)	5 (0.9%)

The parts of the virtual exhibitions that students found most useful

Table 2 shows that students particularly liked the 3D virtual environment, multimedia exhibits display, and exhibit introduction. An unanticipated finding is that the hyperlinks and extended learning activities were deemed less useful when compared to others. This may be because the default setting of the hyperlinks restricted the flexibility to adjust the user interface design, thus making it difficult to organise all related resources for navigation in a user-friendly manner. These results reinforce the importance of designing pedagogy aligned with individual preferences to achieve desirable online learning outcomes (Kipp & Rice, 2019).

Table 2. The parts of the virtual exhibition that students found most useful

Question	Response					
	3D virtual environment	Multimedia exhibits display	Gallery design	Exhibits introduction	Hyperlinks	Extended learning activities
Which parts of the virtual exhibition do you found must useful?	434 (77.8%)	245 (43.9%)	199 (35.7%)	316 (56.5%)	133 (23.8%)	121 (21.7%)

Enhanced areas in visual arts learning

Students were asked to indicate the areas they thought the virtual exhibitions helped them learn better than before. Most of the students indicated that the virtual exhibitions helped them learn more about the artworks and understand the background information of artworks in depth.

Table 3. The enhanced areas in visual arts learning

Question	Response					
	Learn more about artworks	Learn more about museum and online	Establish connections between artworks	Understand the in-depth background	Help with learning art criticism	Inspire artmaking

	learning resources		information of artworks			
Compared with the ways of learning visual arts in the past, in what ways do you think the virtual exhibition can help you to learn more effectively?	428 (76.7%)	284 (50.9%)	160 (28.7%)	331 (59.3%)	197 (35.3%)	180 (32.3%)

Ways that virtual exhibitions helped students learn

The last part of the questionnaire was an open-ended question inquiring about the ways in which the virtual exhibitions helped them learn visual arts. Students replied that learning visual arts through the virtual exhibitions offered a variety of benefits. These ranged from stimulating their interest and motivation in learning to helping them look into details of the artworks, and from getting a better sense of the proportion of the artworks to serving as an alternative for museum learning during COVID-19. The students generally agreed that the platform provided them with great convenience, a sense of realism, and a virtual presence that stimulated their curiosity in learning.

Results of student interviews

The following sections present the findings derived from the student interviews. Student participants are given codenames, e.g., “S1a”, meaning secondary school level (P refers to primary school level), school 1, and student a.

Motivating students towards self-directed and active learning

Some student participants acknowledged the usefulness of the virtual exhibitions for self-paced and free-choice learning. Two students commented:

I like the virtual exhibition as I can view paintings and learn the techniques at home. I can review the paintings again and again in the virtual exhibition and it is more effective for learning. Now I have the right to control my navigation and select the learning content according to my own preference. (P1b)

Visiting the virtual exhibition in-depth allowed me to delve into my own feelings and views towards the exhibits. I saw it as a self-study process. It was very good to discover the answer through the exhibition by myself. While the teacher talked about the artworks from her perspective, I could have a different view towards the artworks from my own perspective through the virtual exhibition. (S1a)

Another student (S1c) highlighted the self-directed research process facilitated by the virtual exhibitions:

Whenever I discovered the artworks that interested me in the virtual exhibition, I would undertake research and study on my own. This process of discovery left me with deep impressions and a thorough understanding of the artworks. For instance, I copied the titles of artworks such as “Wooden Mirror” in the virtual exhibition to search for related information over the Internet. I also watched videos about the making process of the exhibited artworks on YouTube.

Some of the students’ active engagement in learning visual arts may be attributed to the embodied affordances (Henriksen et al., 2020) of the virtual exhibition platform. Learning by

using the virtual exhibitions breaks through the time, space, and instructional limitations of traditional classrooms. Students can learn at their own pace and flexibly review and exchange updated learning resources (Hunma, 2018). Studies (Dalgarno & Lee, 2010) have indicated that 3D virtual environments allow students to approach the learning content directly through a first-person perspective thus reinforcing their learning through active engagement.

Stimulating artmaking ideas and skills

The virtual exhibitions created learning situations for students to develop transferrable artmaking skills and foster creativity. One student (S3a) observed that:

This virtual exhibition brought together artworks of different styles. I could come up with my own ideas quickly during the concept development process. Some inspiration emerged that helped me to visualize the desired outcome of my final artwork. For instance, I studied an artwork in the exhibition depicting a blurry scene of the London Bridge with subtle use of colors. It helped me learn how to paint the waves and shadows of water and create the desirable effect in my work.

Artmaking techniques and skills were also learned from the virtual exhibitions. Here, a primary school student (P1c) discusses examining the brushstrokes:

I learned more about the use of colors, lighting contrast, and exaggeration in compositions from the exhibits. ... I could still see the detailed brushstrokes there, for example, the meticulous brushwork depicting the animal hairs.

Another primary student (P1a) mentioned the inspiration that she attained from the juxtaposition of artworks in the virtual exhibitions:

There were many works in the virtual exhibition. Each of them showed different styles, including Chinese, Japanese, cartoons, and the Royal Collection. I looked for my favorite style and different elements as reference ... I think the overall effect of my work was better than before.

This finding corroborates previous research findings showing that learning in the virtual sphere may help students form new ideas and concepts through interactions and encounters with virtual artefacts and space (Lu, 2013). IJdens (2021, p. 4) also reported that digitalisation increases “learner motivation and the learning of ... productive, receptive and reflective skills in arts, creative, collaborative, thinking and communication skills”.

Enhancing students’ confidence through peer learning

The virtual exhibitions provided students with functions to easily share links through email and social media which encouraged them to be more confident and readily share their ideas and interpretations with others, broadening the scope of peer learning. A secondary school participant (S3c) commented:

I could enter the virtual exhibition anytime. Whenever I wanted to share an enjoyable and interesting section of the virtual exhibition, I could jump to that part immediately which made sharing more instant and natural. Also, as the virtual exhibition was in electronic format, I could take screenshots, add comments, and send it to others, which is very convenient.

Another secondary school participant commented:

I discussed the virtual exhibition with classmates in class and recommended this exhibition to other friends after class. I also posted and shared this virtual exhibition on Instagram. (S1a)

Students found that displaying their artmaking process and creative outputs in multimedia format alongside their peers' artworks in the virtual exhibitions helped create a positive and active peer learning environment. A student (P3g) explains:

We created a narrated video to present our artmaking ideas and process which is on display together with our artwork in the virtual exhibition. We were excited to view the videos as we were curious to know one another's ways of artmaking. ... I could better understand the concept behind my classmates' creation ... which provided me with some sort of new insight and inspiration.

The above findings show that students developed a stronger desire to share their learnt content and participate in group critiques. Reviewing their peers' artworks in the virtual exhibitions was associated with fun elements, motivating students to inquire, discuss, and understand their artistic choices and the concepts behind each other's creation. This pedagogical approach supports the claims of other studies in this area attesting to the benefits brought by the 3D virtual learning sphere to students' art learning through art critique and discussion (Lu, 2013). Students also felt stronger peer and family support during their learning journey as they were able to showcase their achievements in a well-presented manner. These results dovetail with the findings of earlier studies showing that learning communities on the web build a motivational climate among peers (Freedman et al., 2013).

Ways of improving the virtual exhibition platform

Students were asked about how the virtual exhibitions could be improved based on their first-hand user experience. A recurring suggestion was to improve the design of the virtual exhibitions by adding more colorful, vivid visual decorations, games and animated elements to the gallery. Students also illustrated some ways to enhance interactivity in the virtual exhibitions:

Avatars of other visitors can be added to the virtual exhibition. This would make the virtual exhibition visit more realistic. (P2a)

The virtual exhibition could include some more interactive elements, for example, a pop-up virtual canvas that every student can draw on when clicking the image of an artwork. (S3f)

I hope that a comment area can be added to each pop-up description box of the artworks. This would allow us to create "tags" such as "cold color tone" or "minimalist style" for each artwork to facilitate learning and commenting. (S3h)

Differences between primary and secondary school participants

The results of the focus group interviews indicated that there is not much difference in the attitudes and perceptions of the primary and secondary school participants on learning via virtual exhibitions. Both groups felt that the 3D virtual exhibition experience could provide a valuable supplement to traditional art classroom learning. The primary school students talked more about the ways in which the juxtaposition of a wide range of artworks could expand their learning scope, while the secondary school students focused more on the ways in which virtual exhibitions enhanced their learning process, particularly in the areas of online research, visual journaling, art critique writing, and artmaking.

Results of teacher interviews

The following sections present the findings derived from the teacher interviews. Via

the thematic analysis, several themes emerged, which are discussed below.

Building technological capacity through creating virtual exhibitions

While the integration of digital technologies into traditional art classroom opens up unprecedented media-rich learning experiences, Lemon (2015) notes that there are teachers identifying themselves with their students as “co-learners” in building up their technological capacity (p. 240). Most of the teacher participants capitalized on the use of the virtual exhibition platform and enhanced their capacity in using technology to teach, in particular due to the increasing use of online teaching necessitated by the COVID-19 pandemic. Sonia pointed out that:

I am now quite confident in using the virtual exhibition platform. During the past two years of the pandemic, I have used different e-teaching platforms, such as Google Classroom/Zoom class. ... I develop the skills that I learnt from the introductory workshops to create virtual exhibitions via the platform without much difficulty.

Although the teacher participants were confident in their information technology skills, curating virtual exhibitions for teaching was a new area for exploration to them. Tiffany recalled that:

This is the first time for me to create a virtual exhibition ... I plan over and over again and I need to consider on how the artworks are presented in a virtual space.

Vicky highlighted the value of experimenting the virtual exhibition as an instrument to teach:

It is an opportunity of “learning by doing” for both teachers and students. ... For me, it is also good to attempt something new as I have been teaching for many years ... It’s painful to carry out the preparation work ... I didn’t have a clue on how to make it at the beginning, yet I got familiar with it after the first trial.

Lemon (2015) notes that “digital equipment and devices is a tool that allows accessible technology to enter the classroom and assume a key role in the enactment of curriculum” (p. 240), the virtual exhibition became a catalyst encouraging and supporting teachers to transfer existing information technology skills to meet with new digital forms of art teaching.

Making use of the enhanced presentation of virtual exhibitions

Virtual technology allows displays of artworks in an interactive 3D environment where visitors can navigate and ‘walk through’ in a manner similar to visiting a museum. In contrast to the 2D environment, the learners are able to construct knowledge from a first-person perspective (Hew & Cheung, 2010), and process learning information with a higher degree of vividity and interactivity (Nah et al., 2011). Chloe gave an account of the virtual exhibition as an advanced teaching instrument:

The 3D environmental design of the virtual exhibition was just like real. Also, the interactive functions of the virtual exhibition, for example, the zoom-in viewing, 360 degree viewing of 3D sculpture, click-in to viewing of detailed information or external website browsing have provided students with detailed information and alternative viewing that could not be experienced in real museum exhibitions.

Through free exploration in the virtual space, users can initiate interactions in a creative and insightful manner and thus trigger a true to life enjoyable experience (Kim & Hong, 2020). Kelvin illustrated the importance of the 3D virtual exhibition as a transformative teaching instrument that stimulated a proactive viewing experience:

The artworks displayed in the virtual exhibition reflect the actual size of real artworks in proportion to the gallery space. ... When the artworks were placed next to each other ... students could easily make comparisons between them. Students could grasp the theme of the exhibition without difficulty although it was the first time to present a series of artworks consisting of different styles, periods and artists.

Dumitrescu et al. (2014) identify maintainability as one of the key characteristics of virtual exhibitions. Teacher participants revised and edited the content of the virtual exhibition in response to the progress of the teaching and the learning needs of the students. Tiffany recalled that:

During the teaching phase, I found that some teaching materials from the initial teaching design were not effective for face-to-face teaching. Also, as there were learning differences among classes, I could not use the same teaching materials for all classes. Thus, I revised the teaching materials all the time. Yet, the virtual exhibition enabled me to make constant adjustments accordingly.

Engaging learners with deep interaction through blended learning

The virtual exhibition in this study resembles an online learning platform (OLP) that scaffold students' online learning and has been actively engaged in digital content interaction, in-person interaction and non-digital interaction (Graham et al., 2019). Teacher participant Sonia devised self-directed activities to enhancing non-digital interaction that:

I embedded a section called "Share your Favourite Artworks" in the virtual exhibition. I asked the students to visit the virtual exhibition and share their favourite artworks. They need to insert screenshots of the artwork into the worksheet and write explanations. Although their written explanation is short, it was a good start for them.

Similarly, Chloe enriched the virtual exhibition teaching by introducing class activities and self-directed activities that:

Students were divided into groups and asked to choose some scenarios from the artworks displayed in the virtual exhibition for role-plays. They were asked to pay attention to the actions of the characters and make comparisons to the artworks. I had inserted different self-directed activities, short videos and external references to the virtual exhibition. About 2/3 of the students have completed the self-directed learning part.

Tiffany pointed out the difference between general OLP and the virtual exhibition in engaging student participation:

The virtual exhibition has provided students with a practical tool that guided them to explore the artworks in class along with my teaching instructions. I would use questioning strategies to guide students to explore the artworks in the virtual exhibition, which could stimulate students' learning interest.

Facilitating teaching in themes and context through content curation

Several scholars (e.g., Burton 2017; Vella 2018) addressed the pedagogical value of theme-based curating. As Burton (2017, p. 26) puts it, '...the theme is the art teacher's *raison d'être*', it bines multiple components of the teaching units together along a central axis. Chloe transformed previous teaching ideas and materials into solid and well-researched virtual exhibition plans:

The theme "The World of Mechanical Animals" was developed from a teaching unit "Animal" of last year. The theme "Animal" appeals to students since it has always been

a familiar topic to them. The topic was further deepened through the research process to focus on mechanical animals to introduce more dynamic ideas to students for enhancing their creativity of artmaking. (Chloe)

Vella (2018) holds the view that curating thematic exhibition encourages teachers to maximise the pedagogical advantages. Chloe undertook a thorough research using digital means during the two trials of virtual exhibition curating with progressive improvement on her research skills each time. As a result, she became more resourceful and nurtured a habit of undertaking research to line up themes in relation to context so as to enhance her pedagogical knowledge and quality of teaching:

The role of teacher-curator allowed me to tap into the research process which made me explore ways to closely connect the thematic virtual exhibition with teaching. At the beginning, I would look for theme-related artworks and information as much as possible. Next, I sat ruminating about various ways to organise the materials to fit in the different stages of teaching and learning. Hence, research is a fundamental process to improve and consummate my teaching plan.

It is suggested that using thematic exhibition as pedagogical tool facilitates teachers to present the contextual connections between the learning content to 'motivate learners to study contextual relations between things, rather than the things themselves' (Vella, 2018, p. 298). Vicky exemplified that:

The juxtaposition of different artworks in the virtual exhibition made students wonder the many different styles of artworks that can be related to a particular theme. They were curious to figure out the association between the presented pieces.

Differences on perceptions between teacher and student participants

Based on the findings, it is evident that both the teachers and students involved in the study expressed some positive feedback towards the integration of virtual exhibitions in the teaching and learning of visual arts. The study highlights a shared perspective between the two groups, where the 3D virtual gallery setting offered a refreshing multimedia experience for teaching and learning. However, there were also some notable differences in the perceptions of the two groups. While teachers primarily focused on the pedagogical affordances of the virtual exhibition, such as its ability to facilitate content creation and presentation, students were more interested in the "user experience" aspect of the virtual exhibition. In comparison to other online learning platforms, social media, and online tools, the students observed that the virtual exhibition offered a unique and engaging learning experience.

The observed discrepancy in the perceptions of teachers and students towards virtual exhibitions can likely be attributed to their differing roles in the digital learning landscape. Teachers, as digital curators, are more inclined to view virtual exhibitions as a medium for technology-mediated learning and are more open to experimenting with the pedagogical possibilities of this platform. On the other hand, students, who are often considered "digital natives," are advanced users of digital media tools and tend to approach virtual exhibitions from the perspective of digital users. Nonetheless, studies have challenged the common assumption that all students are digital natives or tech-savvy (Bennett & Maton, 2010). Therefore, the present study suggests the potential of virtual exhibitions as a resource for teaching and learning visual arts, yet future research could focus on investigating the digital competencies that students needed to fully utilize online resources for content creation and collaborative learning.

Limitations and challenges

Demand of training and preparation work

In general, most teachers possessed limited curatorial experience and the knowledge of curating, they found themselves in a challenging position tapping into an unfamiliar field of practice. Hence, preparing teachers for the role of teacher-curator required sufficient training and plenty of preparation work. Some teachers mentioned that the more consultation sessions the better as they noticed remarkable refinement made on their virtual exhibition teaching design after each consultation. Vicky and Kelvin commented that:

Since working on our own after the workshops is somewhat challenging, it would be better if there is more time allowed and more consultation sessions throughout the planning stage. It would be better for the principal invigilator to give us more comments on the draft exhibition texts, hyperlinks and related learning activities, etc. (Vicky)

It was quite demanding as I had to work overtime for the project. Teachers need to be really passionate about arts in order to spend extra time visiting the museums and studying about the artworks. Otherwise, it would also be a challenge and burden for those “non-specialist” teachers. (Kelvin)

Nonetheless, the training and preparation work placed a high demand of extra time on the teachers. In addition, a great deal of time was needed to spend on online research to select suitable artworks before they became efficient digital content curator. Chloe suggested that:

It added extra workload on our normal work duties in particularly it is a project I participated on my own, yet it very meaningful...Perhaps it would be better if I could partner with other teachers to work on the project. Working in collaboration would be a possible way to reduce stress and enhance the quality of work. (Chloe)

Demand of hardware and software support

In observing the accessibility to the virtual exhibition in art classrooms and beyond, it was found that there was an unequal distribution of mobile devices available among different schools owing to the differences in school and student socio-economic status. In addition, the smoothness of the virtual exhibition viewing was controlled by the internet speed. Unpleasant viewing experience occurred in some schools where the Wi-Fi connection was not stable. Sonia recounted how the insufficiency of mobile devices adversely affected their teachings:

Because some students don't have iPads and MacBooks. They only have mobile phones. It's difficult to navigate within the virtual gallery with a phone as the screen is much smaller. Some students have no internet at home and need to stay at school to complete their work. These matters are very minor but they all take up a lot of time to handle.

In terms of setting up the virtual exhibitions, there were technical constraints imposed by the virtual exhibition design. For instance, the default settings limited the number of external hyperlinks inserted to the information panel of the artworks and the numbers of placeholders of the artworks placed on the walls. There were also constraints on the quality of the uploaded images that either too high or too low in resolution could not be displayed in the virtual exhibition. Teachers elaborated that:

The virtual platform is quite easy to use. However, the arrangement of artwork is not quite flexible as there are quite a lot of defaults such as the number of “placeholders” on each wall. (Vicky)

It is not easy to display 3D artworks in the virtual gallery as there are not many 3D artwork files available online. Also, the display of “interactive” new media artwork is not possible. For example, only the video that documented the onsite display of Daniel Rozin’s artworks can be shown. The interactivity level is somehow limited. (Tiffany)

Difficulties to assess learning motivation

Most teachers recognised that the free navigation in the 3D virtual environment of the virtual exhibition reinforced students’ learning interest and attention in classroom. However, it was difficult to monitor and assess the degree of participation of each student in and beyond classroom. Some teachers noticed that students might get distracted by switching to other applications or internet browsing while using the mobile device to visit the virtual gallery in classroom. While most teachers did not want to make the self-directed activities compulsory tasks for students, it was difficult to monitor the learning progress and motivation of student online learning after class. Vicky and Sonia articulated that:

It’s difficult to monitor the level of student’s self-learning. I might ask them to visit the virtual exhibition at home. I believe some of the students would be willing to follow the instruction yet I assume they might not spend a long time viewing it. (Vicky)

[The assessment of learning] is rather difficult ... I could only rely on the completed take-home exercise to get a rough impression of their leaning motivation. Nonetheless, the number and duration of visitation cannot be accurately reflected. (Chloe)

Some teachers received feedback from the students that they encountered difficulties navigating the virtual exhibition and got lost in the virtual environment sometimes. Since teachers would not assign any designated navigation routes to the students, the frequency and duration of visiting the virtual exhibition outside classroom all depended on students’ personal experience and motivation.

11. Conclusion

The present study, in recognition of the current shift to online learning, investigated the effectiveness of using thematic virtual exhibitions to enhance student learning in visual arts. The findings indicate that thematic virtual exhibitions would be an effective pedagogical tool connecting and facilitating classroom and self-directed learning in visual arts. Questionnaire and interview responses revealed the virtual exhibition pedagogy **may**: (1) **motivate** students towards self-directed and active learning, (2) **stimulate** artmaking ideas and skills, (3) **enhance** students’ confidence through peer learning, and (4) **increase** teachers’ capability in planning curriculum and delivering classroom teaching using online resources. Overall, this study demonstrated **some** pedagogical value of using teacher-curated thematic virtual exhibitions in art classrooms. Taken together, these findings indicate the probable effectiveness of teacher-curator pedagogy in art classes. The provision of an advanced virtual exhibition platform, high-quality digital images, sufficient trials, and user-experience tests across different mobile devices may reinforce the effective and comprehensive use of virtual exhibitions for art learning. In the face of the opportunities and challenges posed by the demands of using technology in art classrooms, especially during the COVID-19 pandemic, the proposed pedagogy appears particularly **helpful** as it empowers visual arts teachers to take a proactive role as “digital museum curators” while embracing a technology-enabled pedagogical practice.

The implementation of the proposed pedagogy, however, is limited by the technological infrastructure of the virtual exhibition platform, the extra time and work demands imposed on the teachers, and the lack of learning analytics within the virtual space. These limitations notwithstanding, the findings of the study suggest further investigation and experimentation are needed to devise more complex uses of virtual exhibitions that may deliver feedback on student usage, engage more in peer and social learning, be more attractive in the gallery design, and provide more interactive learning opportunities. Students' visitation of the virtual exhibitions on their own still needs improvement in terms of number and duration. There is also a need to investigate the reasons why some students were not willing to visit the exhibitions during their free time. Students' engagement in online learning tasks provided by the virtual exhibitions may require some ways of evaluations so as to provide feedback to teachers for gauging the impact of learning. While keeping relevant and flexible to the always changing educational landscape, the use of virtual exhibitions may be an innovative way to teach and learn visual arts using technology and museum resources.

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Characters (spaces included): 67,838