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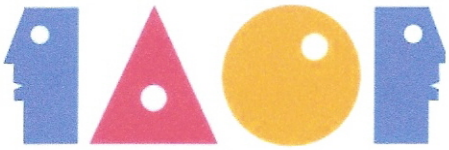

THE IMPACT OF MUSEUM PRACTITIONERS' INFORMATION LITERACY ON THE EFFECTIVENESS OF EXHIBITION DIGITIZATION IN THE POST-PANDEMIC ERA

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Abstract

The rapid development of digital technologies in the 21st century has promoted changes in human life and the pattern of social economy. Museums have also been involved in the digital wave during the past two decades. Museums around the world are actively promoting digital exhibitions, making it easier for the public to search for and browse content over the Internet. In response to the 2020 COVID-19 outbreak, Taiwan upgraded its alert level the following year, adopting measures to minimize potential public exposure to the virus. These epidemic prevention measures have had a great impact on museums offering physical exhibitions and activities. How to turn such a crisis into an opportunity has become a priority for world museums in the post-pandemic era. However, while museums are focusing on adopting the application of digital technologies, the key factor in promoting digitalization in fact amounts to the information literacy of museum staff. This

study conducted in-depth interviews with practitioners of public museums, using grounded theory to summarize and compile data collected from the interviews. The study attempts to determine the key information literacy skills that prevent museum staff from performing digital exhibitions. In addition to summarizing the elements and theoretical propositions related to information literacy in museums, the study proposes relevant discussions.

Key words: Museum, COVID-19, Digital exhibition, Information literacy.

Introduction

Technological development changes daily. Its rapid growth in the second half of the 20th century, along with the application of digital technologies, has drastically changed people's lifestyles and reshaped knowledge acquisition modes. As a typical institution of social education and an "informal educational institution" that complements school education (Wu, 2021), museums are reinventing themselves with digital technologies and new media to bring fresh experiences to visitors and make knowledge sharing easier.

In 2020, the novel coronavirus (COVID-19) started to spread, infecting millions of people worldwide. Countries have adopted corresponding measures to minimize potential public exposure to the virus, temporarily shutting down public places such as schools, libraries and museums. These epidemic prevention measures have had an outsize impact on museums. While physical exhibitions and activities cannot be performed during the pandemic, keeping museums closed is not a long-term countermeasure. When people's movement is restricted, they will seek spiritual and emotional comfort. This is when technology-mediated information services can be applied at the cultural and artistic level.

How to turn such a crisis into an opportunity has become a priority issue for museums around the world? The Trends Watch report, published annually by the Center for the Future of Museums since 2012, predicts the trends of museums as well as the impact of IT on museums. However, can museums rely solely on IT to provide visitors a better learning experience? A museum practitioner or curator must understand what role and function the museum plays in the process of visitor engagement (Su, 2021). In 1974, Paul Zurkowski, president of the Information Industry Association of the United States, coined the term "information literacy." It defines that information literacy needs to understand the value of information, as well as to search, evaluate and organize information effectively when information is needed. This paper is written from the perspective of information-literate museum practitioners, accompanied by interviews conducted with public museum practitioners using the semi-structured, in-depth approach. It uses grounded theory analysis for summarizing and compiling data to ex-

plore key factors in information literacy that may impact museum practitioners in performing digital exhibitions. It is hoped that this study will provide some reference for follow-up research on related topics.

The purpose of this study follows:
1. To find out the level of information literacy possessed by museum practitioners in Taiwan.
2. To pose the question: in the post-pandemic era, what difference can the competence of information literate practitioners make to the implementation of digital exhibition?
3. To propose relevant elements and theoretical propositions based on information literacy's impact on the effectiveness of digital exhibition in the post-pandemic era, and to advance suggestions for future studies.

Literature Review

Information Literary

The term "information literacy" was proposed in 1974 by Paul Zurkowski, President of the American Society of Information Science and Technology. Zurkowski suggested that the whole nation should establish an information literacy program to foster citizens' ability to learn, express information needs, solve problems and assess the quality of information. In 1989, the American Library Association (ALA) began promoting the concept of Information Literacy, which remains frequently cited. The concept of information literacy includes "the ability to identify, search, evaluate, and use information" (Tu, 2008). Many scholars have since interpreted the meaning of information literacy from different perspectives, summarized as follows.

Rader (1990), Director of the Library of Cleveland State University, believed that in an era of information overload, people receive, on a daily basis and from various media, a large amount of information—some of which may be useless. However, being information illiterate means the lack of proper ability to effectively process the information. Information literacy is a set of integrated capabilities, which can also be referred to as the ability to effectively retrieve and evaluate information for problem solving.

Olsen (1992) further emphasized that information literacy is not merely about conventional reading, speaking, and writing skills, but also about the ability to understand the role, power and use of information; the ability to understand the different types of connotation; and the ability to retrieve, evaluate, organize and use information. McClure (1994) believed that information literacy is more than a concept—it is a capability that utilizes information to solve problems. Information literacy should consist of four components: traditional literacy, media literacy, computer literacy, and network literacy.

Many Taiwanese scholars have explained and defined the concept of information literacy. Lucy Te-chu Lee, leader of the NSC Research Project "Information Literacy: Its Meaning, Contexts, and Development" (1994), pointed

out that knowledge and information became a requirement in modern life. It is necessary for everyone to possess the knowledge and skills in information management and application, whether for life or work. Information literacy is about educating the citizen to understand the value of information, and to have the ability to search, evaluate, and use information effectively when needed. Meimei Wu (1996) explained the concept from the perspective of its internal and external abilities. Internal literacy is the ability to think, clarify the problem, analyze the information, interpret this information correctly, and organize the information that is useful to oneself; the external ability is to know how to acquire information, to receive and present the transformed information, and to solve problems with the information.

In his book "The Wealth of Knowledge" (2004), Thomas A. Stewart considers information literacy's importance. As society has entered the knowledge economy era, knowledge-based jobs are gradually replacing labor-intensive jobs. Enterprises must utilize and invest in the intellectual capital of knowledge workers, with employees' information literacy an indicator of intellectual capital. Therefore, information literate employees are one of the most important assets in an enterprise (Tseng, 2009). The majority of enterprise knowledge is based on employees. To become competitive, an enterprise must value the quality and capabilities of its employees; hence, it is extremely important to assess the competence level of employees' information literacy skills.

In summary, information literacy refers to the ability of individuals to use information to solve problems. Keeping up with the trend in today's ever-changing world, the definition of information literacy given by scholars and experts is in flux. As presented chronologically, it can be found that in IT development's early days, the definition of information literacy tended to focus on awareness and skills discussions; however, as science and technology have become universal and the use of information spreads among wider sections of the population, the interpretation of information literacy is no longer limited to awareness and the ability of application but escalates to the moral and ethical level. In recent years, online exhibition has established a new way for the public to participate in art. In 2020, many new online art exhibition platforms were established in response to the disruption caused by COVID-19 (Tseng, 2021). In order to protect the various types of art images from different eras, it is important to strengthen the moral and ethical aspects of information literacy.

Digitization of Museum

Along with the improvement and popularization of technology and the Internet, the rapid innovation and breakthroughs in information technology have drastically changed social patterns and integrated into all aspects of human life. As the speed of social change accelerates, "knowledge" has become the most critical force for individuals as well as countries. The development of IT has entered the "knowledge economy" era, with education as the knowledge economy's

foundation. Accordingly, how to judge information, extract the required information, and possess the ability to use information will become compulsory skills in a modern society of information overload.

"The key that many museums are promoting education actively lies in economic factors and social ideology" (Zeller, 1989; Cherry, 1992). Museums in Taiwan are also faced with the expectation of becoming community museums; they must consider how to utilize their collections and exhibits in order to embed education into play and implement the meaning and function of education (Liu, 2004). When participation in museum activities has been transformed into forms of “leisure” and “entertainment”, extending the educational environment from schools to nearby or community museums or art galleries can stimulate students’ learning motivation and effectiveness. Influenced by Dewey's "empirical" philosophy and Piaget's cognitive development theory, Hein believed that true education comes from the learner's own experience, and especially from the learner's active participation (Hein, 2002). Therefore, museums need to embed educational concepts into the entire visiting process through curation, design of presentation, educational activities, and the like, in order to become a public educational institution (Kao, 2020).

In recent years, museums have been involved in the digital wave. Museums around the world are actively promoting digital exhibits (Mintzer, 1999), making it easier for the public to search and browse content through the Internet; museums are now providing viewers a new visiting experience beyond a static display of artefacts and collections. The digital artefacts can be displayed without the constraints of time and space, so their influence on culture, education, and economy is much greater. With the popularization of information technology in today's society, it is even more imperative that museums introduce technology and apply it to overall functional operations. As the knowledge economy is changing economic structures, social organizations and lifestyles, museums are using new media to make it easier to enter our daily life. Parry (2011) analyzed the changes in new media in the past decade and summarized four directions for media development: new social media, new situated media, new sensory media and new semantic media.

In response to the outbreak of COVID-19 in 2020, Taiwan upgraded its alert to level 3 in 2021 and quickly adopted measures such as implementing social distancing, shutting down public places like schools, libraries and museums, and cancelling large scale activities to minimize potential public exposure to the virus. In this case, working from home and online teaching have become temporary solutions. These epidemic prevention measures have had a great impact on museums that provide physical exhibitions and activities, as well as on workers in surrounding industries. How to turn the crisis into a turning point will become a priority consideration for museums? Furthermore, during the outbreak of the pandemic, people’s movement is restricted; people need to

find mental and spiritual comfort and shift their focus on something, which is where arts and culture come in. (Shu & Shu, 2020)

The COVID-19 pandemic has caused considerable disruption to the world, and it has become a major turning point in the digital transformation of museums. Museums must re-adjust their business operations to respond to the impact of the pandemic and determine a working model to integrate art and technology. (Agostino, et al., 2020; Lin, 2020). As an executor in the promotion of digital exhibitions, museum practitioners must persist in learning and keeping up to date with the latest technology and equipment to be able to launch new types of digital outcomes (Tseng, 2021).

Information Literacy Skills of Museum Practitioners

Even before the 2019 pandemic outbreak, museums had worked hard to promote all sorts of digital activities, including digital exhibitions and virtual museums, in addition to providing resources via social media. However, participation in museums' digital activities remained relatively low. Many studies pointed out (NEMO, 2020; Shu & Shu, 2020) that, while the closure of museums and social distancing measures implemented after 2020 prevented people from visiting museums in person, the number of online museum visitors increased by more than 40%, indicating that people have been attracted by the digital resources and services provided by museums after the pandemic.

However, when museums make policies aimed at bridging the digital gap, museums seemingly focus on hardware and ignore the software—that is, the staff responsible for the implementation of digital exhibitions. A museum wishing to promote digital exhibits must focus on improving the staff's information literacy skills (Marty, 2006). Museum practitioners must possess information literacy's core capability, which is the ability to handle digital collections and add value to them. In the digital wave, this is an important ability that staff must possess so that they can effectively organize exhibitions and disseminate event information, and so that they are competent in their job (Tu, 2008). After summarizing the definitions of information literacy from scholars, the study proposed that museum practitioners should possess the following information capabilities:

1. The ability to select and retrieve information for digital exhibits.
2. The ability to organize and handle the exhibits' or collections' information.
3. The ability to explore, utilize and disseminate information about exhibitions or events.
4. The ability to evaluate information about art.
5. The ability to comply with the museum's code of information ethics and morality.

Research Design and Implementation

Research Design

The design and implementation of this study can be divided into four parts: research methods, selection of the inter-

viewee, data collection and the process of data coding. In-depth interviews were conducted with six museum curators using semi-structured interviews and data analysis based on grounded theory. Data was coded using the coding procedures of grounded theory.

Research Method

The main purpose of conducting in-depth interviews in the study is to understand the interviewee's subjective experience and obtain more realistic information. It is hoped that the interviewees would be led through conversations to provide information or express their opinions and thoughts on a certain topic, while remaining objective. For Step 1, the interviewer must adjust his/her mindset. For Step 2, preparations must be completed prior to the interview. For Step 3, a preliminary meeting with experts is held to adjust the questions. For Step 4, appointments are made. For Step 5, the interview pace and atmosphere are controlled. The last step is to recreate the scene through excellent writing skills (Fan, 1994; Wan, 2004; Lin & Shu, 2019).

Symbolic interactionism and pragmatism provide the philosophical foundation of grounded theory, which emphasizes human experience and analysis for problem solving. The difference between grounded theory and other qualitative research methods is that grounded theory does not start with a theory; rather, it constructs meaningful connotations from the collected data before the theory is developed from the data (Streubert Speziale & Carpenter, 2003; Wang, 2012). Grounded theory methodology can be used when there is no in-depth research on a certain topic within a specific group (Strauss & Corbin, 1990). Grounded theory divides the process of data analysis into three levels: open coding, axial coding, and selective coding. Despite these three levels being listed in sequence, and although their relationship is non-linear in the process of data analysis, they are mutually related in most qualitative studies (Strauss & Corbin, 1994).

This study is aimed at museums with experience in applying information technology in exhibitions and the ability to carry out in-depth interviews with their practitioners instead of at museums with pure physical exhibitions. After the interview data is gathered, the grounded theory method is applied to assign codes for data analysis, then questions are identified through cases and a reasonable interpretation framework is established. (Zhou & Yan, 2016).

Selection of the Interviewee

In qualitative research, "purposive sampling" from the "non-probability sampling" method is usually adopted instead of statistical random sampling (Coyne, 1997). This sampling method can select a specific scenario, character and event to gather important information that cannot be obtained by other quantitative sampling methods. This is because the validity of the research results does not lie in the number of sampling cases, but in the accuracy of the answers given by the sampled interviewees (Fan, 1994; Lin & Shu, 2019). This

study adopts "purposive sampling" on the selection of interviewees, in hopes that the selected interviewees are "representative" or " paradigmatic—that is, that the sampling results are representative of the general members (Yang, 2019).

To comply with the theory's sampling principle, practitioners from the Kaohsiung Museum of Fine Arts, the National Science and Technology Museum, and the National Museum of Taiwan Literature were chosen as interviewees for the study. National and municipal museums are the most common forms of museums in Taiwan. Therefore, the first step was to select museums from a list of national, municipal museums or art galleries that meet the target and question criteria. Study cases were chosen from the following types of museums: social history, arts and culture, and natural science. Finally, directors with expertise relevant to the study were selected for the semi-structured in-depth interviews.

A brief description of the interviewees and their workplace:
(1) Established in 1994, Kaohsiung Museum of Fine Arts is Taiwan's third public arts museum. Since incorporating in 2017, the museum expects to strengthen the competitive advantages of its professional development through this organizational transformation. At the same time, the museum is making more efforts to enhance its public quality and accessibility, and to respond actively to society's current needs and expectations of the museum. In response to the cross-field, cross-platform exhibition and technological development trends in contemporary art, the museum has, in recent years, been working on the digitization of art collections and exhibitions. This study dedicated 1.5 hours to interviewing three museum practitioners and professional staff, numbered R1, R2, and R3, from the Exhibition Department, Education and Public Services Department, and the Children's Art Museum, respectively. These individuals worked in the museum prior to the pandemic outbreak, and so they fulfill the background setting of interviewees. The overall interview time was about 1.5 hours.
(2) 1997 saw the official public opening of the National Museum of Science and Technology, with the promotion of social science and technology education as the museum's main goal. The exhibitions in the museum are mostly about the development of technology and its influence on social life. After 2000, the museum began holding special exhibitions in cooperation with external organizations. It applies the latest technologies to new exhibitions, attracting more viewers and achieving the goals of entertainment and education. Cooperation with external organizations likewise enhances the professional abilities of the staff. The interviewee selected for this study is the associate researcher of the Exhibition Department, numbered R4, who has served in the museum for more than 20 years and fulfills the background setting of interviewees. The overall interview time took about 1 hour.
(4) Founded in 2003, the National Museum of Taiwan Literature is the first national museum dedicated to literary arts in Taiwan. To provide the public

with easy access to Taiwanese literary materials, the museum has been working hard on building a diverse subject database of Taiwanese literature through digitization and data analysis—practices that add value to public information. In addition to the functions of collection, preservation and research, the museum organizes exhibitions, events and continuing education classes to bring literature closer to the public and promote cultural development. The interviewees selected for the study include the leader of the Research Collection Department (R5) and the technician of the Exhibition and Education Department (R6). Both have many years of experience in digital exhibition and worked in the museum prior to the outbreak, and so they fulfill the background setting of interviewees. The overall interview time was about 2 hours.

Procedure for Data Collection and Analysis

To allow the interviewees to express their opinions fully while keeping the conversation to the point, the interview questions were designed based on the semi-structured interview method. In accordance with the government's epidemic prevention policy, the in-depth interviews were conducted on-site, online or by phone where appropriate.

Interviews conducted in qualitative research can be semi-structured or informal. However, in grounded theory interviews, a large amount of data is needed for inductive analysis. Therefore, it is important to maintain the questions' flexibility. Semi-structured questions are needed to gather rich information (Wang, 2002). A grounded theory interview uses a wide range of open-ended conversations to collect and analyze the interviewee's views on the subject (Wimpenny & Gass, 2000). Grounded theory often uses in-depth interviews to stimulate non-standard ideas from the interviewees. The purpose of in-depth interviews is to understand the interviewee's experience and what it means to them (Seidman, 1998).

The data was collected in the following way: secondary data and reports were first collected from the selected museum, followed by interviews with the museum practitioners (each interview took approximately 1 hour). Here is the outline of the first phase interview questions:
(1) The museum has held online exhibitions before; why would you want to digitize the exhibition?
(2) Digital exhibition is different from conventional exhibition. What technologies or equipment are involved in the process of digitization?
(3) What are the competence requirements for museum practitioners in organizing digital exhibitions?
(4) Has the pandemic influenced any changes in the promotion of digital exhibitions?
(5) Given the pandemic's influence, do the information literacy skills of museum staff have any significant impact on digital exhibitions?
(6) The pandemic does not seem to be ending any time soon; what kind of information literacy skills do you think must be strengthened in museum staff?

Data Coding Process

This research adopted in-depth interviews and analyzed coding with the grounded-theory method. After completing the selection of interviewees, we collected the original data gathered from interviews and observations for data analysis. In the process of comparison and translation, categories were conceptualized and defined and the relationship among these categories were sorted out. After linking the categories and subcategories, the research results were written based on the core categories. Theories were established through the three procedures of open coding, axial coding and selective coding, then compared with relevant documents. Based on the study purpose and the interview structure, the core categories were discovered and integrated into the theory structure to support the results.

This study used Qualitative Data Analysis Software (QDA) NVivo Education Edition v1.5.1 as the analysis tool for interview transcripts. Unlike manual analysis, QDA software can store a large amount of qualitative data and effectively reduce the time required for cumbersome manual data handling. This can help researchers perform deeper inductive analysis and construct theories from them (Richards, 2002; Luo & Chen, 2021).

Textual Recording and Coding

Textual Recording Method

The six interviewees selected for the study include public art museum staff, researchers from NSTM, and researchers from NLM. After in-depth interviews were conducted, the audio recordings were transcribed into text. The interviewees were sequentially coded as "R1", "R2", and so on, to "R6". After carefully reading the transcribed text of the interview, we highlighted for data analysis any topic-related sentences expressed by the interviewee. The transcribed and analyzed texts of dialogues underwent a coding process. The coding was extracted from the vocabulary in the transcribed text; some codes were named after nouns with broader meaning. After completion of the coding process, we placed the codes of different interviewees under the same concept for clarity.

Coding Procedures

Open coding: This study collected data from the museum practitioners on their information literacy, a concept which includes the ability to acquire information, use information for development and dissemination, and comply with a code of ethics. The data were preliminarily categorized and coded, then refined gradually to develop open codes (Lin & Shu, 2019). For example, the transcript of the interviewees mentioned that technologies such as AR, VR, and 3D are introduced into physical exhibitions to raise public interest and participation. After the process of assembling, refining and coding, the text was gradually refined into an open code: somatosensory technology. A total of 30 open codes were summarized in this study.

Axial coding: After open coding was completed, further summarization of the

30 open codes was carried out to find and establish the relations between conceptual categories and subcategories. These codes were then categorized into a tree structure for the axial coding procedure. For example, the tree category of open codes is mobile navigation and somatosensory technology. Open codes with similar properties will be grouped into a higher-level axial conceptual code: technology-infused exhibition. Based on the textual concept of the axial coding, a further 11 axial codes were converged.

Selective coding: Carry out causality conditions analysis of the categorizing process and ascertain a set of specific properties (context) within the range related to the phenomenon, that is, within a broader structural context—the intermediary condition. These contexts and intermediary conditions may influence the actions or strategies taken in response to a phenomenon. Therefore, contexts, intermediary conditions, behaviors and results are all related to a certain core category, and their correlations form a set of paradigms. After analyzing and summarizing the textual content, we developed a total of 4 selective coding categories and meaningful contexts.

Grounded theory analysis is a type of bottom-up inductive approach; based on the data compiled in Table 2, it can be found that the theory is grounded and built upon from the lowest level of data. The four selective codes were further contextualized and refined to be integrated into four core categories. These four core categories are generated with the four selective codes; the selective codes are generated through analysis of the 11 axial codes; the axial codes are generalized from the 30 open codes; and the open codes came from transcripts and textual coding extracted from the semi-structured in-depth interviews at the bottom level. Each analysis and each section are closely linked.

Table 1. Summary of the selective, axial and open coding

Selective Coding	Description	Axial Coding	Open Coding
1. Information literacy of practitioners	The information literacy possessed by museum practitioners is an important competence for effective exhibition planning and information advocacy in the digital wave.	A. Basic information literacy	(1) Ability to operate IT facilities
			(2) Ability to grasp information trends
		B. Digital literacy	(3) Good use of Internet tools
			(4) Positive attitude towards technology
		C. Ethics and morality	(5) Authorization for image and sound use
			(6) Intellectual property rights
2. Technol-	How museums ex-	D. Digital	(7) Online learning

ogy behaviors in museums	pand the scope of visitor's experience and look for a model allowing art and technology to work closely together.	presentation	(8) Online exhibition
			(9) Presentation of digitization results
		E. Technology-infused exhibition	(10) Sensory media
			(11) Situated media
			(12) Encouraging visitor engagement with a digital approach
3. Environmental support	This constitutes the support provided by the museum, enterprises and the government.	F. Internal resources	(13) Digitization of collection
			(14) Financial stability
			(15) Hardware support
			(16) Support from the Technical Department
			(17) Support from the Marketing Department
			(18) information of Science and Technology is expensive
		G. External resources	(19) Enterprise support
			(20) Government support
		H. Cross-domain collaboration capability	(21) Outsourcing technology
			(22) Planning and communication of exhibition information
			(23) Crossover collaboration
		I. Dilemma of space constraints	(24) Difficulty in enabling interactive exhibitions
			(25) Technology as bridging the gap
4. Demand for information literacy in the post-pandemic era	This constitutes the information literacy skills practitioners in post-pandemic museums should possess.	J. Resilience to pandemic	(26) Changes to the promotion approach
			(27) Changes to the presentation method
			(28) Using Social media for promotion
		K. Enhancement of interdisciplinary capabilities	(29) Exhibition revitalization capabilities
			(30) Cloud collaboration capabilities

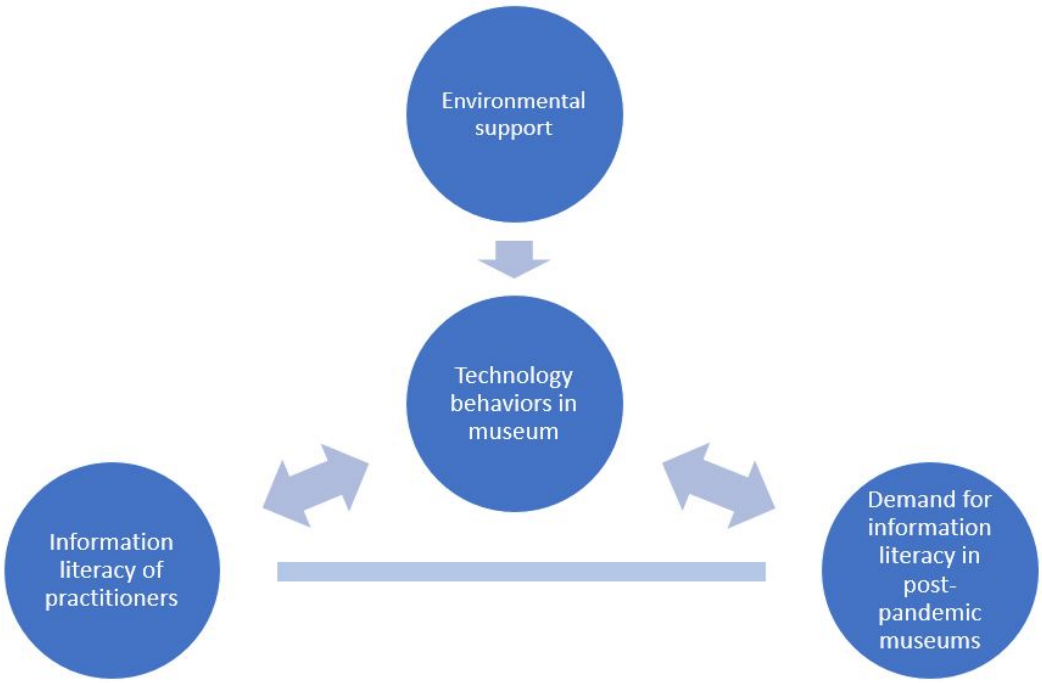

Figure 1. Relations of the impact of information literate museum practitioners in the post-pandemic era

Research Findings

Relations of the Impact of Information Literate Museum Practitioners in the Post-pandemic Era

After the development of the four core categories, this study used the path of tracking condition (Charmaz, 2006; Strauss & Corbin, 1998) to track the conditions of interaction between the four core categories. After the theory emerged gradually, the structure of influence relations was developed, as shown in Figure 1.

Coding of Processes: Developing Theoretical Propositions

The so-called 'process' refers to a series of actions or interactions; process coding focuses on the potential actions, interactions or contextual relationships of codes. Tracking the process entails capturing the context of the entire action and analyzing the changes (or lack thereof) between actions or interactions. Grounded theory is suitable for capturing the experience of museum practitioners in interpreting phenomena and developing theoretical propositions (Strauss & Corbin, 1998; Charmaz, 2006). Based on the relations diagram of the influence of information literacy (Figure 1), the inductive proposition of coding process is constructed as follows.

(1) The relations between a museum's technology behaviors and its employees' information literacy

From interviews to the integrated concept, it is found that the museum's IT behaviors include digital presentation and technology-infused exhibition, such as online learning, online exhibition, presentation of digitization results, somatosensory technology, mobile navigation, and digital approaches to encourage visitor engagement. These behaviors are all derived from the information literacy competence of museum practitioners, including basic information literacy, digital literacy, and ethics and morality—that is, the ability to operate facilities, grasp information trends, make good use of Internet tools, hold a positive attitude towards technology and obtain authorization for use of image and sound or other intellectual property rights, the practitioner's information literacy competence and the museum's technology behaviors will interplay with each other.

Recently, museum practitioners play an important role in the following areas: assessing the appropriateness of introducing technology at the initial stage of planning; considering the integrity of new technology and exhibition design in the development stage; and finally, when the exhibition is finished, observing the usage and subsequent maintenance work (Ken, 2006).

The study found that museums, regardless of online exhibitions, presentation of digitization results, or encouraging visitor engagement in any digital form, must coordinate these technology behaviors with museum employees' digital competence in basic information literacy, digital literacy, ethics and morality to provide visitors a better viewing experience. Hence, the paper offers the following proposition:

Proposition 1: The technology behaviors in a museum, such as online exhibition, somatosensory technology and mobile navigation, may be affected by its practitioners' competence in information literacy. Moreover, the competence level of the practitioners' information literacy is correlated with the museum's decision in the adoption of technology behaviors.

(2) The relations between the demand for practitioners' competence in information literacy and the museum's technology behaviors in the post-pandemic era.

In the post-pandemic era, the demand for museum practitioners' competence in information literacy, which includes resilience to pandemic and interdisciplinary capabilities (for instance, changing methods of promotion and presentation in response to current status; strengthening social media marketing, gaining the ability to revitalize exhibitions and collaborating in the cloud), will interact with the museum's technology behaviors, including digital exhibition and the introduction of technology into exhibitions.

According to the grounded data, museums in Taiwan had to shut their doors to the public in compliance with government policies after the pandemic out-

break. The lack of visitors meant museums would lose business income from tickets, shops, and catering services, while donations and subsidies were greatly reduced. As a result, museums began to re-evaluate the content of exhibitions, offering free online exhibitions and crossover collaboration (Tsai Ueng, 2020). COVID-19 has accelerated technology behaviors of museums and directly affected the practitioners who need to perform the important aspects of these behaviors. Hence, based on the grounded data mentioned above, the paper offers the following proposition:

Proposition 2: In the post-pandemic era, the demand for museum practitioners' competence in information literacy, which includes resilience to pandemic and interdisciplinary capabilities, derives from museum's technology behaviors. At the same time, the technology behaviors in museums and the demand for information literacy in the post-pandemic era interact with each other.

(3) Museum's technology behaviors depend upon environmental support
Most museums in Taiwan rely heavily on social resources such as the National Science Council, the Ministry of Culture, the Ministry of Education, and public and private universities. These resources are one of the most critical factors to the success of promoting environmental education. Through the formation of partnerships, museums can obtain financial or labor support for the activities (Chen, 2011). It is discovered in the interview data that the so-called environmental support includes internal resources, like digitization of collections, financial stability, hardware support, and support from both technical and marketing departments; external resources, like corporate and government support; the ability for cross domain collaboration, like the utilization of outsourcing services, communication and planning of exhibition information, and crossover collaboration; and the dilemma of space constraints, like difficulties in implementing interactive exhibition and shortening distances with technology. These factors may affect the museum's technology behaviors.

According to the grounded data, the technology behaviors of a museum with full internal support are enhanced with more diversified presentations, combinations of evolving technology innovation with traditional research foundations, revitalized exhibition designs and appropriate environmental support. Such a museum is more likely to generate new ideas (Ken, 2006). However, most museums do not have sufficient manpower in their IT or marketing departments, so responsibilities for the application of technology and marketing usually fall on the exhibition curators or outsourced contractors. This manpower shortage increases the invisible workloads of museum practitioners and distracts practitioners from focusing on their main duties.

The Network of European Museum Organizations stated in its report that although the government supports the operation of public museums, 40% of museum revenue comes from ticket sales or other commercial activities. The pandemic forced museums to close their

doors to the public, so these museums lost revenue. Suay Aksoym, former president of the International Council of Museums, said, "Without the support of the public and private sectors, museums will not be able to survive on their own (ICOM, 2020).

Moreover, the study found that the interviewees generally believed that external resources and cross domain collaboration capabilities do have a significant impact on the museum's technology behaviors. With the high cost of technology and limited museum budgets, integrating all resources to overcome the shortage of manpower, expertise and funds is the most important issue to resolve. Hence, based on the grounded data mentioned above, the paper offers the following proposition:
Proposition 3: Museums' technology behaviors are derived from the support of internal and external environments.

(4) Practitioners' information literacy cannot satisfy the post-pandemic information literacy demand.

With the digital age's arrival, the introduction and application of technological tools in museum exhibitions has become a trend. However, is the information literacy (basic information literacy, digital literacy, ethics and morality) possessed by current practitioners sufficient to meet the information literacy demand in the post-pandemic era? Under the impact of COVID-19, in the short term, museums were forced to close their doors to the public, resulting in the loss of revenue, as well as in salary cuts and layoffs. In the medium and long term, museums are likely to lose external resources, resulting in project cancellations and brain drain. Museum practitioners must update their methods of exhibition design and advocacy, make good use of social media and improve their capabilities in cloud collaboration and exhibition revitalization to turn the crisis into an opportunity (Tsai Ueng, 2020).

Mei-Tsen Chen (2016) mentioned that museum curators should satisfy the four competence requirements: the ability to connect organizations, interpersonal communication skills, enthusiasm for exhibitions and prior knowledge. Prior knowledge includes exhibition design and related scientific knowledge. A curator may not have the professional background of the exhibition topic, but self-learning is indispensable in the curating process.

The global outbreak of COVID-19 overwhelmed museums. In March 2020, following the advice of governments and health organizations, most museums and art events around the world were closed, including Tate Modern in the U.K., the Louvre in France, and the Museum of Modern Art in New York. Compared to museums in Europe and America, the impact on museums in Asia was less severe, although these museums were also hit hard during the pandemic's second wave in May 2021. While museums were re-adjusting their pace, the pandemic accelerated the application of digital technology, shared resources, and crossover marketing in museums. This would be a major turning point in changing museums' inherent patterns and ac-

celerating digital transformation (Tseng, 2021).

The pandemic is changing people's lifestyles and thinking because of factors including social distancing and an inability to travel abroad. Museums' artwork displays also become a challenge for practitioners. How are online exhibitions planned? Does the spatial distance between artworks need to be widened to avoid visitors' close contact? Can the navigation system be digitized? Museum practitioners are trying their best to learn, adjust and adapt to post-pandemic changes and challenges (Marty, 2006; Lin, 2020).

Proposition 4: Museums need to strengthen employees' information literacy to keep up with the demand of information literacy required for technology behaviors in the post-pandemic era.

Conclusion

The study aims to discuss whether the demand for information literacy in museums has changed following the pandemic. The study considers the perspectives of practitioners' information literacy, environmental support, and museums' technology behaviors and tries to understand the connections between them. The museums' technology behaviors analyzed in this study and the influence or mutual influence factors of these behaviors are discussed below.

The core content of information literacy lies in basic information skills, digital literacy and professional ethics, as well as in whether the concept will affect the operation of technology-infused museums in the 21st century. Technology behaviors include various technology applications, including online exhibitions, somatosensory technology and mobile navigation. If the practitioners possess information literacy skills—the ability to operate IT facilities, grasp trends and apply their knowledge at any time, maintain a positive attitude towards technology and embrace the concept of intellectual property rights in work—then the promotion of technology behaviors will be more smooth. On the contrary, if the museum does not promote enough technology behaviors in its operation, the museum may prevent practitioners from strengthening their information literacy skills, discouraging these practitioners from acquiring more knowledge and information to face the challenges in a digital environment.

Through observation of the demand for information literate practitioners in the post-pandemic era, it is found that some practitioners lacked sufficient competency in information literacy, or else they lacked the ability to operate basic facilities, which affected the overall efficiency in museum and exhibition planning administration. This can be improved through education and training in museums that actively promote technology behaviors following the COVID-19 pandemic.

The perspective of how environmental support affects museum's technology behavior reveals that even government-supported public museums must rely on revenue from ticket sales and other commercial activities in the

museum, such as shops and catering services. Closing their doors to the public due to the pandemic has caused a sharp decline in museum revenue; meanwhile, private museums are facing even greater pressures in business operation. At this time, environmental support appears particularly important. Can the museum's hardware and software support VR or AR technology? Does the museum have enough hardware to facilitate virtual exhibition that supplements the original physical exhibition? Do museum employees have sufficient skills to deal with technical issues and marketing when planning a more complicated online exhibition? These are the broader challenges museum practitioners face. External resources include corporate sponsorship and crossover collaboration. As Museum staff are unable to perform all tasks, from exhibition planning, execution, technical development to marketing and promotion, by themselves, collaboration with external bodies can help them to learn and grow throughout the process, strengthening overall benefits.

Research Limits and Suggestions

There has been much literature exploring the impact of information literacy on museums' digital exhibitions. This study aims to find out through surveys and interviews whether the information literacy required in the post-pandemic era is sufficient for the organization of digital exhibitions. It is suggested that researchers conduct further studies on museums, art galleries or art education institutions with different fields. For example, future research should select museums with a science background, social science and humanities background, or natural science background to find out whether these museums have different resources and expertise, and to determine how their digital exhibitions may be affected by these resources and expertise.

This study may also be extended to conduct research confirming the concept established in the paper. Future research can explore technology behaviors from a macro perspective including digital collection, digital exhibition, and digital promotion in a larger context. Otherwise, research may observe museums in different fields from a micro perspective to determine how other information literacy capabilities can affect exhibition digitization. It is suggested that in addition to quantitative analysis, researchers can use hermeneutics or action research methods to conduct the analysis. As for research perspectives, it is suggested that future studies can explore the topic from a different angle or theory, such as dynamic capability theory, organizational learning, or qualification-based theory, to make the research more diverse.

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