

The Model of Virtual Museum of Nonthaburi

รูปแบบพิพิธภัณฑ์เสมือนจริงของจังหวัดนนทบุรี

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Abstract

This research aim to study the model of virtual museum of Nonthaburi. The development was divided into 2 phases. The first phase was to study basic information in designing the virtual museum of Nonthaburi. The researcher collected information from documents regarding principles, concepts, and theories related to virtual museum design. Interviews with 10 curators and experts were conducted using a questionnaire with structured interview. The second phase was to design the virtual museum of Nonthaburi. The museum is presented in a 3D formatted website. Each room contained 3D media of interesting objects. Video clips showed the story of the province. Each exhibit room had descriptions and/or electronic documents in infographic format, audios and/or music, and games to assesses knowledge and interact with visitors. The design was examined by 15 experts using purposive selection method. The data was analyzed using means, standard deviation, and content analysis.

Research results

1. The model of virtual museum of Nonthaburi consists of 6 components: 1) information, 2) media and tools used, 3) interaction, 4) design, 5) decision support system, and 6) supporting factors.

2. The results of overall quality assessment by the expert found that the quality was at the highest level ($\bar{X}=4.51$, S.D. = .57). Considering each item, it was found that information displayed in the virtual museum, Room 3 : The Old City Hall to the Museum of Nonthaburi had the highest level ($\bar{X}= 4.77$, S.D. = 0.64), the exhibits are organized into categories and creating interaction between the audience and museum. ($\bar{X}= 4.73$, S.D. = 0.46) as respectively.

Keywords: virtual museum, Nonthaburi province, local learning resources

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บทคัดย่อ

งานวิจัยนี้มีวัตถุประสงค์เพื่อศึกษารูปแบบพิพิธภัณฑ์เสมือนจริงของจังหวัดนonthaburi โดยดำเนินการพัฒนาแบ่งออกเป็น 2 ระยะ ได้แก่ ระยะที่ 1 ศึกษาข้อมูลพื้นฐานในการออกแบบพิพิธภัณฑ์เสมือนจริงจังหวัดนonthaburi เป็นการเก็บข้อมูลจากเอกสารเกี่ยวกับหลักการ แนวคิดและทฤษฎีที่เกี่ยวกับการออกแบบพิพิธภัณฑ์เสมือนจริง และการสัมภาษณ์ภัณฑารักษ์ ผู้เชี่ยวชาญ จำนวน 10 คน โดยใช้แบบสัมภาษณ์แบบมีโครงสร้าง (Structured Interview) ระยะที่ 2 การออกแบบพิพิธภัณฑ์เสมือนจริงของจังหวัดนonthaburi ด้วยการนำเสนอผ่านเว็บไซต์ในรูปแบบ 3 มิติ โดยแบ่งเป็นห้อง ประกอบด้วยสื่อในรูปแบบของภาพ 3 มิติของวัตถุที่น่าสนใจ คลิปวิดีโอนำเสนอเรื่องราวของแต่ละห้องจัดแสดง ป้ายและ/หรือเอกสารทางอิเล็กทรอนิกส์ในรูปแบบอินโฟกราฟิกส์ให้ศึกษาข้อมูลเพิ่มเติม เสียง และ/หรือดนตรีประกอบ เกมประเมินความรู้และสร้างปฏิสัมพันธ์กับผู้เข้าชม และตรวจสอบคุณภาพโดยผู้เชี่ยวชาญ จำนวน 15 ท่าน ผ่านการคัดเลือกแบบเจาะจง (Purposive Selection) การวิเคราะห์ข้อมูลโดยใช้สถิติค่าเฉลี่ย ส่วนเบี่ยงเบนมาตรฐาน และการวิเคราะห์เนื้อหา

ผลการวิจัย พบว่า

1. รูปแบบพิพิธภัณฑ์เสมือนจริงของจังหวัดนonthaburi ประกอบด้วย 6 องค์ประกอบ ได้แก่ 1) ข้อมูลสารสนเทศ 2) สื่อและเครื่องมือที่ใช้ 3) ปฏิสัมพันธ์ 4) การออกแบบ 5) ระบบสนับสนุนการตัดสินใจ และ 6) ปัจจัยสนับสนุน
2. ผลการประเมินคุณภาพในภาพรวมโดยผู้เชี่ยวชาญ พบว่า มีภาพรวม พบว่า มีคุณภาพอยู่ในระดับมากที่สุด ($\bar{X} = 4.51$, S.D. = .57) เมื่อพิจารณาเป็นรายข้อพบว่า ด้านสารสนเทศที่จัดแสดงในพิพิธภัณฑ์เสมือนจริง ห้องที่ 3 ภูมิประวัตินonthaburi มีค่าเฉลี่ยสูงสุด ($\bar{X} = 4.77$, S.D. = 0.64) รองลงมา คือ มีการจัดหมวดหมู่ของการจัดแสดง (category) และ การให้ผู้ชมมีปฏิสัมพันธ์กับพิพิธภัณฑ์ ($\bar{X} = 4.73$, S.D. = 0.46)

คำสำคัญ : พิพิธภัณฑ์เสมือนจริง จังหวัดนonthaburi แหล่งเรียนรู้ท้องถิ่น

Introduction

Nonthaburi is one of the provinces in central region of Thailand. It is an ancient and important city with history, local wisdoms, art and culture, and lifestyle. Realizing the importance of these treasures, Nonthaburi Municipality established the Museum of Nonthaburi. The purpose is to create a learning center and maintain the spirit of the city. Nonthaburi people would learn and be proud of their roots. They will see the importance of wisdoms, art and culture, and lifestyle of their ancestors and themselves. Also, it allows the public to learn and understand the identity of the city. The museum is located at the Old City Hall. It displayed the history of Nonthaburi, from the city in Ayutthaya period to the port city in Thonburi and Rattanakosin period. The city of Nonthaburi is a melting pot of people from different races who lived harmoniously, creating a way of life of Nonthaburi people. It is a land

of pottery and local wisdom. The museum also provides an opportunity to learn about the architecture of the Old City Hall building which is a cultural heritage of Thailand (Princess Maha Chakri Sirindhorn Anthropology Centre, 2012). However, there are few disadvantages of the museum. Visitors need to travel to the museum for self-study, leading to traveling cost and time. Visitors need to walk around the museum to view the exhibitions. The exhibitions are not as attractive as they should be. This may create gaps in accessing education and information. Therefore, the museum needs to improve the information presentation method to keep pace with changes in information technology in order to better respond to wider needs of visitors.

Virtual museum is a model of creating exhibitions in the traditional museum to attract visitors and encourage learning. The advancement of computer technology, communication system, and internet was used to create multimedia 3D format, both still images and animations which can be viewed from every direction. The media may contain narrative audios and short video clips, making the audience feel like they are in a real place. It can save energy and cost from traveling to visit the actual place. It allows the audience to view objects by rotating and zooming for a close view. The virtual museum can be used as learning support media. It encourages people to be enthusiastic to learn by themselves, as well as helps preserve and disseminate local resources. It contains multimedia that can stimulate senses with movement, making visitors to use senses to learn. This creates many forms of recognition and supports fresh and vibrant learning (Srisuwan et al., 2014). Ardrugsa (2013) mentioned that virtual museums can be used as a tool to transfer technology and support learning for students, general publics, and involved and interested people. Students and people would receive knowledge and understand and apply in real life. This is in line with Suwanrassamee (2008) who analyzed and synthesized the comparison of virtual museum websites in countries such as the United States, France, England, Canada, Australia, and New Zealand. It was found that there was a novelty in the presentation of information to the target audience. Apart from text descriptions and images of the displayed objects, there are educational menus for a specific target group, which is the youth in school age. It also contains a variety of interactive activities in different menu names. This reflects the efforts to reach the youth group to serve as valuable learning resource and provide both non-formal and informal education to the youth of the country.

The researchers are interested in developing a virtual museum which focuses on displaying exhibitions of art and culture in the form of a digital museum that can be accessed online through a website. This is consistent with today's people lifestyle. It can also provide relevant information and further enhance experience. This will help to expand knowledge and experience for those who are interested in researching. Moreover, it raises the cultural value of the country to create educational value. It is the base of ideas in development and creativity. It will also help preserve and inherit the culture of the country. The museum can serve as a lifelong learning center for the public as it is widely available without the limit of time and place.

Research objective

To study the model of virtual museum of Nonthaburi.

Research methods

The development of the model of virtual museum of Nonthaburi province is divided into 2 phase.

Phase 1 Study basic information in designing the virtual museum of Nonthaburi.
The researcher collected information from documents regarding principles, concepts, and theories related to virtual museum design in both paper-based and electronic media. Interviews with 10 curators and experts in virtual reality design, virtual classroom design, and virtual learning resources were conducted using a questionnaire with structured interview. This was used as a guideline to determine the model of virtual museum of Nonthaburi. The information was analyzed to create the content.

Phase 2 Development and quality examination the virtual museum of Nonthaburi. The researcher developed the structure of the virtual museum by presenting as a website in 3D format. Each displaying room contains 3D media of interesting objects. Video clips show the story of the province. Each exhibit room has descriptions and/or electronic documents in infographic format, audios and/or music, and games to assesses knowledge and interact with visitors. The design was examined by 15 experts in designing virtual reality and virtual resource and curators using purposive selection method by considering the structure, content, presentation, tools, and usage. The questionnaire was a five-level evaluation scale based on the Likert concept. The data analysis was based on the collected data to find means and standard deviation.

Research results

1. From basic information for designing the virtual museum of Nonthaburi based on document analysis and interview data, the researcher gained the key components in developing the virtual museum of Nonthaburi. It can be summarized as follows.

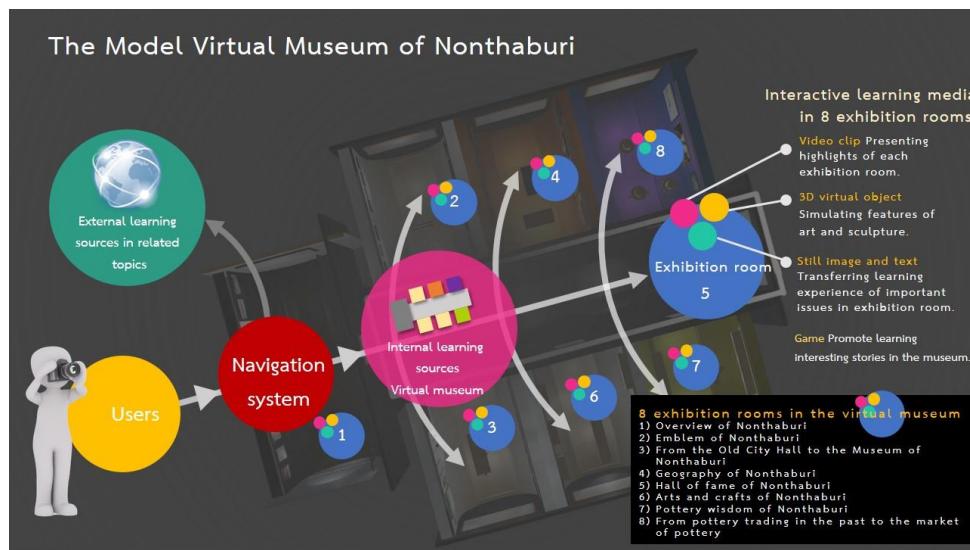


Figure 1 The model of virtual museum of Nonthaburi

1.1 Information. The content presented should be easy to understand and should be organized into interconnected categories. The content should be provided through illustrations accompanied with concise descriptions. If the information is too long, external link should be provided for further study. The audience can choose their own access. Graphic presentations include graphs, charts, and diagrams which can help make the difficult content easy to understand. There should be still images, animations, and audios, depending on the nature of the information presented. The identity of the museum is highlighted to attract the audience's interest. The content should present the history, lifestyle, history of the people of Nonthaburi, material culture, invented objects, appliances, and living tools that are unique in the area. Exhibitions are organized into categories. The audience can choose the access from a variety of formats. In addition to the content and information that are presented indoor, some contents may be displayed outside the building.



Figure 2 Example of information



Figure 3 Video clips

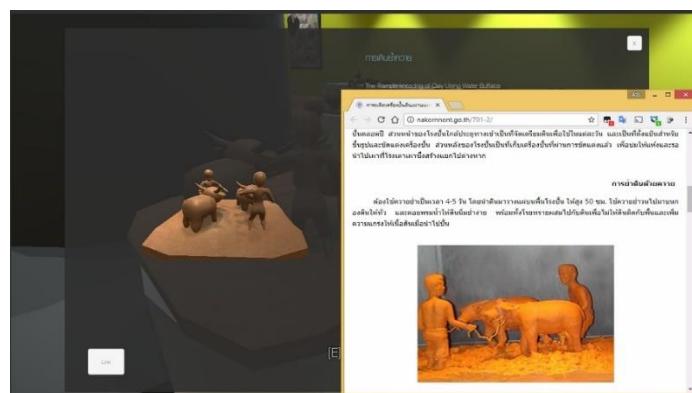


Figure 4 External information

1.2 Media and tools used. The presentation of the content displayed in each room is a full screen format to provide a clearer view. The museum provides 360-degree panoramic view of the surroundings and can interact with the audience. The audience can change the view manually by clicking on the desired location. It can zoom in and zoom out to the displayed objects. There are navigation system, maps, connected information of each room, help or instruction buttons, and external information.



Figure 5 Top view presentation

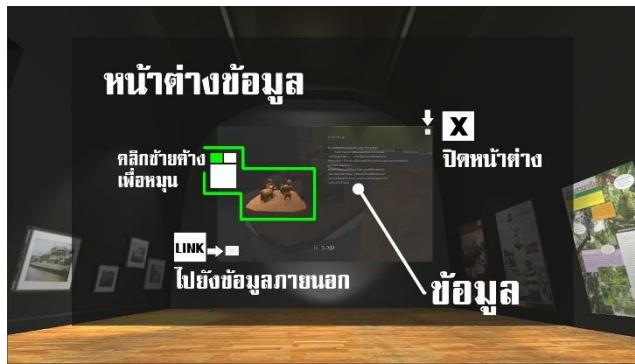


Figure 6 Instruction

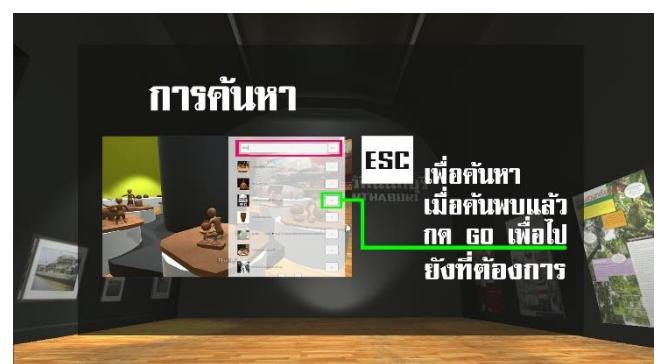


Figure 7 Searching tool

1.3 Interaction. The participation of the audience is available through internal interaction. The audience can manually select information in each room, zoom in and zoom out and change the view. They can also interact with the displayed objects, including viewing the internal structure, selecting the desired location, and creating an identity in the virtual museum. The design can make the audience feel like an adventure to create different emotions and perceptions. This will create fun, excitement, and interaction with the outside or related organizations to create knowledge through social media. It also connects with various community sites to promote the integration of the audience into a sub-society.

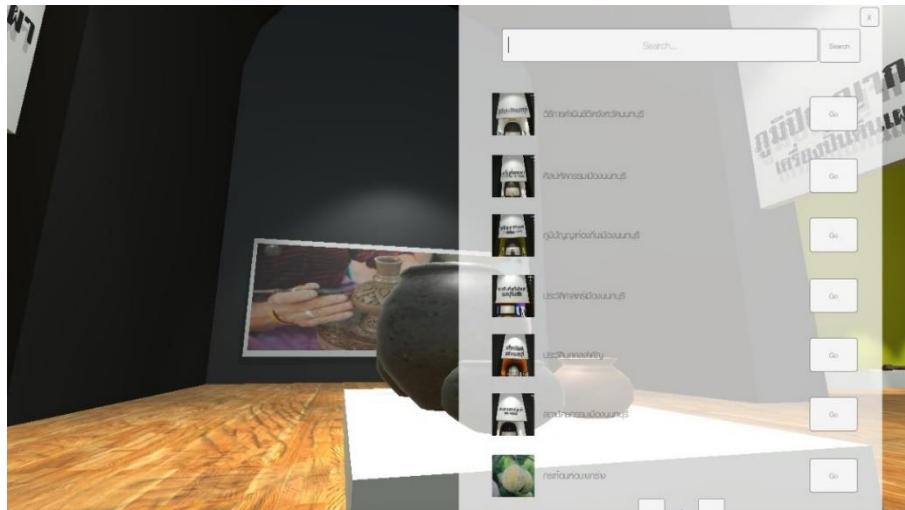


Figure 8 Selecting the content of each room manually.



Figure 9 Zoom in and zoom out, changing the view.

1.4 Design. A virtual reality system through a screen is applied for the design. It is easy to access. The audience uses only a computer and other devices, such as a mouse, keyboard, and headset. It can create a sense of being in the environment. There should be a title to attract audiences before or during visits. In addition, making the audience feel like walking in a real place, being able to choose what to view, and being able to view all directions will stimulate their attention. The design should combine text, 2D graphics, 3D graphics, and audios. There should be a selection of information to view according to the interests of the audience. The audience can choose to display images in full screen for clearer view. There should be displaying information with a 3D environment, an avatar of the user, and online games with the content related to the museum to educate and entertain the audience.



Figure 10 Combination between 3D graphic and animation

1.5 Decision support system. Navigation system helps to support the decision in the museum. It allows the audience to study the information sequentially and connect knowledge and experience gained in each part of the museum. The audience will receive important information and supporting media to create better understanding or expand knowledge and experience associated with it. The navigation system should have a map showing the location of the audience. It should contain easy-to-use navigation arrows and help buttons.



Figure 11 Naviation system



Figure 12 Map

1.6 Support factors. To attract the attention of the audience, the design should be interesting from the first page. This includes an eye-catching design. The identity of the museum should be presented in the first page. There should also be the switching between the content and activities.



Figure 13 Presenting the identity of the museum in the first page

2. Results of the development and quality examination of the virtual museum of Nonthaburi

After the development of the virtual museum of Nonthaburi, it was examined by 15 curators and experts in virtual reality design, virtual classroom design, and virtual learning resources. The questionnaire was a five-level evaluation scale based on the Likert concept. The results of overall quality assessment by the expert found that the quality was at the highest level ($\bar{X}=4.51$, S.D. = .57). Considering each item, it was found that information displayed in the virtual museum, Room 3: The Old City Hall to the Museum of Nonthaburi had the highest level ($\bar{X}= 4.77$, S.D. = 0.64), the exhibits are organized into categories and creating interaction between the audience and museum. ($\bar{X}= 4.73$, S.D. = 0.46) as respectively.

Table 1 Results of quality examination of the virtual museum of Nonthaburi by the experts (n = 15)

Evaluation items	\bar{X}	S.D.	Meaning
1. Information displayed in the virtual museum			
1.1 Room 1 Overview of Nonthaburi	4.53	0.74	Highest
1.2 Room 2 Emblem of Nonthaburi	4.33	0.72	High
1.3 Room 3 From the Old City Hall to the Museum of Nonthaburi	4.77	0.64	Highest
1.4 Room 4 Geography of Nonthaburi	4.40	0.63	High
1.5 Room 5 Hall of fame of Nonthaburi	4.53	0.64	Highest
1.6 Room 6 Arts and crafts of Nonthaburi	4.67	0.49	Highest
1.7 Room 7 Pottery wisdom of Nonthaburi	4.60	0.63	Highest
1.8 Room 8 From pottery trading in the past to the market of pottery	4.60	0.51	Highest
2. Media and tools used in the virtual museum			
2.1 The exhibits are organized into categories. (category)	4.73	0.46	Highest
2.2 There is a map for the audience to access the content. (map)	4.53	0.64	Highest
2.3 There are graphics to navigate the audience. (navigation)	4.60	0.63	Highest
2.4 There are help or instruction buttons to use the virtual museum. (help)	4.53	0.52	Highest
2.5 Objects can be zoomed in for clearer view. (zoom)	4.53	0.52	Highest
2.6 There are communication tools to contact administrators. (communication tool)	4.60	0.51	Highest
2.7 There are connections with external resource. (external resource)	4.60	0.51	Highest
3. Design			
3.1 Presenting with 3D virtual objects.	4.20	0.41	High
3.2 Presenting information by video clips.	4.60	0.51	Highest
3.3 Presentation by still images and text.	4.40	0.63	High
3.4 Connecting knowledge of each room.	4.67	0.49	Highest
3.5 Convenient and fast access to information.	4.33	0.62	High

Table 1

4. Supporting factors			
4.1 Designing the first page to attract the audience.	4.40	0.63	High
4.2 Presenting the identity of the museum.	4.40	0.63	High
4.3 Switching the content and activities regularly.	4.33	0.49	High
4.4 Creating interaction between the audience and museum.	4.73	0.46	Highest
Average	4.51	0.57	Highest

Discussion

The model of virtual museum of Nonthaburi consists of 6 components. The details of each component are as follows.

1. Information. The content should be easy to understand and should be organized into interconnected categories. The researcher had a good source of information, from both expert interview and field-based study of data in the real location. This has resulted in reliable information that reflects well-organized and consistent content design. The identity of the museum is highlighted to attract the audience's interest. Jatuporn (2014) stated that the keys in designing learning consisted of creating galleries and virtual exhibits, descriptions of object's details, and correct and clear brief summarization of the comments. The descriptions must use a simple language. The design of the letter graphic should be clear and attractive, suitable to the displayed antique objects. In addition, the virtual exhibits should present the 2D image of object with four perspectives, including the front, back, sides, and image that depicts the shape of the object. This is in line with the research of Klaynak (2008) which developed the content of the Museum of Tai Lu people's house and had an interest at the highest level. This is because the content is about the arts and cultures that are almost disappear over time. It is regarded as a national heritage, making the content far from ordinary people. The completeness and accuracy is appropriate to the level of education of the target audience and consistent with the presented images.

2. Media and tools used. Media and technology of the virtual museum should be designed to enable the audience to access easily and to use conveniently. The exhibitions can show 360-degree panoramic images which can be viewed in all directions. The audience can adjust and zoom in the view manually. There should be navigation system, maps, links between each room, and external links. This is in accordance with Jatuporn (2014) which stated that the design of the museum should have technology and media that can be used

easily and conveniently with the accurate content. These factors will allow museum visitors to create knowledge and expand their experience. As for the design of object's descriptions, when users click on the object image, the description of the object appears. The description is the information given by the experts. The description is organized into a sequence by using linking technique to the various positions of social media applications. This will allow users to select information that is most suited to their own interest effectively.

3. Interaction. The virtual museum should include both internal and external links which interacts with objects displayed. The audience can adjust the angle of the view, select to learn information in each room, and interact with the links outside the museum to broaden learning experience. Kanokmongkol (2010) mentioned that in expanding the experience of visitors, interactive media in the museum was considered as the most important factor. The media, such as multimedia, will create visitor's interest in antique objects that the museum presents their information to visitors. Multimedia will enable people, tourists, and visitors to understand the content of the exhibition more clearly. There should be animations to create a sense of enjoyment and impression to the museum visitors. Social media is an important communication tool to expand and disseminate knowledge as well as share information.

4. Design. The virtual museum should allow the audience to easily access information without the need for complicated devices. It should make the audience feel like walking in a real place. The design should consist of clear and attractive details such as still images, animations, clips, graphics, and narration audios. Also, the design should allow the audience to interact with the virtual museums to stimulate interest by using tools and technology. Suwanrassamee (2008) stated that the presentation of the virtual museum should focus on the design. Each page should be designed to be attractive, interesting, clear, and well-organized. It should consist of images or audios to create interest. There should be description text accompanied with images, links to other sources, interactive games, and online communication tools. Jatuporn (2014) mentioned that the principle of the design is the presentation of virtual exhibits or displaying of antique object images. The details of the image should be clear and beautiful. The use of light will make the image more prominent.

5. Navigation system. It is a tool that allows the audience to study the story sequentially while receiving knowledge and experience in each section of the museum. This is in accordance with Chiengkham et al. (2014) which stated that navigation design is the design of a navigation system structure for users. The site map is the structure that shows the link of

information to create an understanding between the audience and the content. It is the design of a layout in each page. It consists of a main page, which displays the exhibition's information, and an output page. Suwanrassamee (2008) stated that the virtual museum should have a good navigational bar or navigation system. All directions that can be visited should have a sign to follow which allow the audience to choose to use the service conveniently and can return to the pages within the site.

6. Supporting factors. Publication of news or interesting information is an important factor that enables the audience to engage in the content. The presentation should be interesting, modern, and innovative. This is in line with Sumettikoon et al. (2015) which stated that virtual media was still the highest need in information providing service and knowledge presentation. The museum considers that information providing service and knowledge presentation is an appropriate channel to use virtual media for knowledge exhibition. This is a worthwhile investment and also attracts visitors of the museum. In addition, the design that attracts the audience from the first page by using interesting, modern, and eye-catching presentation is an important factor that encourages the audience to visit. Also, interesting activities and easy-to-accessed interaction are important to motivate visitors.

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