Development and Testing of a Digital Map Guide of Ilocos Norte National High School Main Campus

Devonne Clyde G. Baniaga[1], Gartly R. Cortez[1], Iordanis Keith D. Jacinto[1], Miella Carmel F. Rabago[1], Neil Bryan V. Real[1], Rein Arwen D. Santos[1], Jazhmaigne Lizney Ea C. Taylan[1], Keziah Faye M. Arellano, MSc[1], Johnny R. Pagaduan[1], Jhansen Rey M. Obispo, PhD[1]

[1]*Ilocos Norte National High School*

[*]*corresponding author: keithto2474@gmail.com*

Abstract: Asking for directions is one of the most interactive daily activities. There are times when miscommunication occurs as most people are keener on visual competence than auditory learning. Various institutions address this issue with a static map, which can be inadequate; hence, according to most studies, the presence of a digital map is essential for better guidance in situating certain places. This study aims to develop a digital map guide, test its technical qualities by IT experts and prospective users, and determine the relationship between their responses. The researchers used smartphones to capture the necessary images, and were stitched using PTGui. After layout arrangement, the stitched photos were processed using Pano2VR. Then, the essential facilities were labeled, and the prototype proceeded to be tested by the respondents. The results showed that the mean of the technical qualities of the digital map guide in terms of positional accuracy, visual representation, and user-friendly interface, as per the IT experts' assessment, had a very satisfactory rating. Likewise, the mean of the responses of prospective users showed that the digital map guidance also had a high level of satisfaction with its technical qualities. Based on the results of this study, there was a moderate positive correlation that had an insignificant relationship between the evaluation of IT experts and the testing of prospective users. It was concluded that the digital map guide had undergone the proper procedures, though there was a lack of potential respondents.

Keywords: development and testing; digital map; INNHS school campus; IT experts; technical qualities

1. INTRODUCTION

A school is an institution for learning where students are immersed extensively in their personal growth. Public schools are often one of the highly densely populated areas in an urban community (Llego, 2020). With overcrowding comes a burden for those involved in the locating process. Parents looking to enroll their children in said school are inclined to visit the school personally to scrutinize if the institution meets their quality learning standards for their children. Likewise, prospective students evaluate their affinity towards the institution through personal interaction to better sense what they can expect from the school. New students and visitors who had never stepped inside Ilocos Norte National High School rely on directions from fixed layout maps and school personnel.

1.1 Alternative for In-person Visitation

Most educational institutions have adapted a digital map to enhance the experience of campus visits and implement modernization features (Slater, 2018). Hence, various educational institutions already offer alternative tour options besides the traditional self-guide, like audio and virtual tours, which are excellent tools for students and families to visit the campus with or without the actual presence in the school area (Okerson, 2016). One of the most effective methods for visiting school premises is through a 360 degrees campus tour online, wherein the students perceive their surroundings in a picturesque manner with just a scroll on their digital device (ICEF, 2020).

1.2 Development and Implementation of Digital Map Guide

For that reason, along with the continued usage of smartphones and the rise of technology, the researchers firmly believed that the Pano2VR, which is a panorama image conversion and application software based on the flash animation technology Kai Cao (2022), can be used to develop a digital map for Ilocos Norte National High School's main campus. Thus, the researchers aimed to

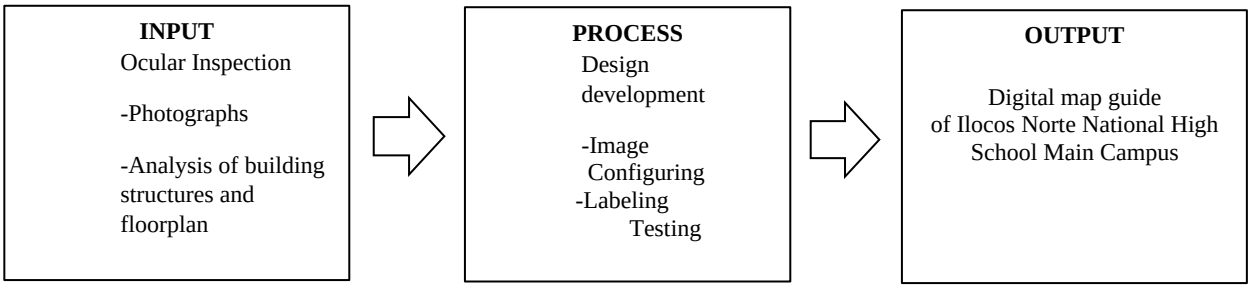
develop and test a digital map guide to allow program users to expand their knowledge of map applications, improve their comprehension skills in real-world scenarios, and acquaint themselves with the school's main campus.

1.3. Conceptual Framework

This part presents the conceptual framework. Figure 1 shows the research paradigm of the study.

Figure 1

Research Paradigm of the Study



2. METHODOLOGY

2.1. Research Design

The study employed the waterfall model of software design to serve as the framework for implementing the research. The chosen research is a linear and chronological approach to the software development life cycle, commonly through the following phases: conception, initiation, analysis, design, construction, testing, production/implementation, and maintenance (Sharma & Singh, 2021).

2.2. Population and Sampling

The study's respondents rating the level of satisfaction in using the digital map guide are composed of people who are new and familiar with the main campus of Ilocos Norte National High School. The respondents included 60 random prospective users and three IT expert evaluators. The researchers used convenience and purposive sampling as the sampling procedures, respectively, as the respondents were composed of two distinct groups.

2.3. Locale of the Study

The school's main campus was the chosen site for this study as it is the central area where the digital map would significantly benefit new teachers and personnel, students, or visitors. Specifically, the study was conducted at the Ilocos Norte National High School main campus – Laoag City.

2.4. Research Instruments

The researchers used two sets of standard questionnaires with a four-point Likert scale with different contents: one as an assessment tool for IT experts and the other as a survey for prospective users. The former has three sets of checklist boxes to evaluate each technical quality of the digital map guide. The latter contains ten questions regarding the digital map guide.

2.5. Materials Used

The materials used in this study were smartphones, specifically iPhone 11 and Samsung A73, stabilized by a tripod and a DJI Phantom 2 drone. The researchers used PTGui and Pano2VR to stitch the individual photos to create the digital map guide.

2.6. Experimental Procedure

Image Gathering. The researchers captured images of the selected vicinity using a smartphone with a built-in quality camera stabilized by a conventional tripod to maximize the accuracy of the dimensions of the captured photos.

Picture Stitching. The researchers combined the photos using the PTGui software with their matching outlines to produce a 360-degree view of the area.

Layout Analysis. Before the actual construction of the digital map guide, the stitched pictures were arranged according to the composition of the visual features of the area.

Map Configuration. The researchers integrated the stitched photos using the program Pano2Vr, forming a complete digital map of the main campus of Ilocos Norte National High School.

Location Labeling. The researchers provided the general name of each significant facility located on the main campus of Ilocos Norte National High School.

Prototype Testing. The researchers tested the developed digital map guide according to the satisfaction rate of prospective users and its technical qualities as evaluated by IT experts.

2.7. Data Analysis

After the researchers had gathered the needed data, the information collected was compiled, sorted, organized, and tabulated. The data are then subjected to their corresponding statistical treatment to answer the research questions. The statistical tools applied are: 1) mean for the first and second research questions, and 2) Pearson-r correlation coefficient for the third research question.

3. RESULTS AND DISCUSSION

3.1. Evaluation of IT Experts

Table 1
Mean results of the response of the IT experts for the visual representation of the Digital Map Guide

CHARACTERISTICS	MEAN	DESCRIPTIVE RATING
1. The images/panoramas of the digital map guide are clear and of high quality.	3.33	Strongly Agree
2. The digital map guide provides a realistic experience of an actual campus visit.	3.67	Strongly Agree
3. The digital map guide is interactive and informative.	4.00	Strongly Agree
Overall Mean	**3.67**	**Strongly Agree**

Legend: 3.26-4.00 Strongly Agree
2.51-3.25 Agree
1.76-2.50 Disagree
1.00-1.75 Strongly Disagree

Table 1 above presents the mean results of IT experts for the visual representation of the Digital Map Guide. The mean response for all aspects related to the visual representation of the Digital Map Guide is 3.67. This indicates that the IT experts strongly agreed with its visual design and legibility.

Table 2
Mean results of the response of the IT experts for the positional accuracy of the Digital Map Guide

CHARACTERISTICS	MEAN	DESCRIPTIVE RATING
4. The digital map guide displays the proper setting of the school area.	3.67	Strongly Agree
5. All hotspots are organized according to the school's layout	4.00	Strongly Agree
6. The digital map guide follows the same orientation upon clicking the indicated path.	4.00	Strongly Agree
Overall Mean	**3.89**	**Strongly Agree**

Legend: 3.26-4.00 Strongly Agree
2.51-3.25 Agree
1.76-2.50 Disagree
1.00-1.75 Strongly Disagree

Table 2 above presents the mean results of IT experts' responses to the positional accuracy of the Digital Map Guide, which has an average mean of 3.89. This shows that the positional information provided by the digital map guide was accurate.

Table 3
Mean results of the response of the IT experts for the user-friendly interface of the Digital Map Guide

CHARACTERISTICS	MEAN	DESCRIPTIVE RATING
7. The digital map guide is simple and easy to use for navigation.	4.00	Strongly Agree
8. There is adequate information provided for each hotspot for effective recognition.	4.00	Strongly Agree
9. All areas in the digital map guide load efficiently.	3.67	Strongly Agree
10. The navigation pane is understandable due to the guide provided.	3.67	Strongly Agree
Overall Mean	**3.83**	**Strongly Agree**

Legend: 3.26-4.00 Strongly Agree
2.51-3.25 Agree
1.76-2.50 Disagree
1.00-1.75 Strongly Disagree

Table 3 shows the mean response for the Digital Map Guide's user-friendly interface. The overall user-friendliness of the Digital Map Guide obtained a mean score of 3.83, which suggests that the interface was found to be user-friendly by IT experts. This suggests that the map guide's ease of navigation, effective recognition, efficiency, and information accessibility, contributed to a positive user engagement.

Table 4
Overall mean results of the response of IT experts for the technical qualities of the Digital Map Guide

CHARACTERISTICS	MEAN	DESCRIPTIVE RATING
1. Positional Accuracy	3.89	Strongly Agree
2. Visual Representation	3.67	Strongly Agree
3. User-Friendly Interface	3.83	Strongly Agree
Overall Mean	**3.80**	**Strongly Agree**

Legend: 3.26-4.00 Strongly Agree
2.51-3.25 Agree
1.76-2.50 Disagree
1.00-1.75 Strongly Disagree

Table 4 shows the overall mean findings of IT experts' responses to the technical qualities of the Digital Map Guide. The positional accuracy, visual representation, and user-friendliness were rated on a scale of 1 (strongly disagree) to 4 (strongly agree). The average result for positional accuracy was 3.89, the visual representation was 3.67, and the user-friendly interface had a mean response of 3.83. The digital map guide was generally assessed as usable and accessible by prospective users by IT experts; however, the application may still need modification for better use.

The findings are supported by the study of Qui and Hubble (2002), wherein there are 95% positive reviews on a map software's ability for students to learn and tour independently through many navigation options. The study also states that 90% of learners responded that interaction with the program was natural because learners can access, magnify, and rotate 3D features while navigating freely with detailed guidance.

3.2. Level of Satisfaction of Participants

Table 5
Mean results of the response of prospective users for the technical qualities of the Digital Map Guide

CHARACTERISTICS	MEAN	DESCRIPTIVE RATING
1. The digital map guide helps me in locating and familiarizing the directions of the different facilities inside the campus.	3.92	Strongly Agree
2. The digital map guide follows the same orientation upon clicking the indicated path.	3.75	Strongly Agree
3. The digital map guide operates with the correct layout of the campus	3.88	Strongly Agree
4. The digital map guide exhibits a real-life view of the campus.	3.88	Strongly Agree
5. The digital map guide is a good substitute for in-person visitation	3.65	Strongly Agree
6. The digital map guide is interactive and informative.	3.78	Strongly Agree
7. The digital map guide shows a smooth transition from one	3.57	Strongly Agree

place to another.		
8. The digital map guide is easy to use.	3.80	Strongly Agree
9. The digital map guide is responsive to click.	3.75	Strongly Agree
10. The navigation pane is understandable due to the guide provided.	3.88	Strongly Agree
Overall Mean	**3.79**	**Very Satisfied**

Legend: 3.26-4.00 Very Satisfied
2.51-3.25 Satisfied
1.76-2.50 Dissatisfied
1.00-1.75 Very Dissatisfied

The mean response for the following indicators is 3.92, 3.75, 3.88, 3.88, 3.65, 3.78, 3.57, 3.80, 3.75, and 3.88. The average mean is 3.79. This suggests that the prospective users were very satisfied with the digital map guide. It is implied that the digital map guide is satisfactory with its technical qualities. It is supported by the study of Suwarno (2020), where the researcher concluded that the usage of virtual reality as a campus promotion media provides another option by offering users an in-depth experience, and the program allows users to quickly explore around without having to visit the campus's physical building. Moreover, a study conducted by Rohizan et al. (2019) found that a virtual tour using a digital map seizes an opportunity to strengthen user engagement and technological promotion. Lastly, a study conducted by Suryanto & Wibowo (2020), which developed a prototype of a Virtual Campus Exploration application, concluded that the presence of such a prototype received good feedback based on user evaluation.

Table 6
Correlation Result on the responses of IT Experts and Prospective Users

		IT Experts	Prospective Users
IT Experts	Pearson's r	—	
	p-value	—	
Prospective Users	Pearson's r	0.565	—
	p-value	0.618	—

Legend: $0 < r \leq .19$ Very Low Correlation
$.20 \leq r \leq .39$ Low Correlation
$.40 \leq r \leq .59$ Moderate Correlation
$.60 \leq r \leq .79$ High Correlation
$.80 \leq r \leq 1.0$ Very High Correlation

Legend: $p > 0.05$ Not Significant
$p \leq 0.05$ (5%) Significant
$p \leq 0.01$ (1%) Very Significant
$p \leq 0.001$ (0.1%) Highly Significant

Table 6 shows the Pearson Correlation Matrix of the response of IT Experts and Prospective Users. The correlation matrix provides information about the relationship between the responses of IT experts and prospective users, suggesting a moderate positive correlation that is not statistically significant. These values indicate that as the IT experts agree to the technical qualities of the map, the satisfaction level of the prospective users also follows.

4. CONCLUSIONS

In conclusion, the IT expert's evaluation of the Digital Map Guide showed an overall positive rating for positional accuracy, visual representation, and user-friendly interface. The digital map guide's intricate features were amenable to the standards of IT experts.

The testing assessed the level of satisfaction among prospective users, who expressed high satisfaction with the digital map guide's technical qualities. They found the digital map guide as an effective shift to static maps and an alternative to physical visitation.

The correlation analysis between the responses of IT experts and prospective users showed a moderate positive correlation, meaning as the IT experts' agreement increased, so did the users' satisfaction. However, the correlation was statistically insignificant as there was insufficient evidence to conclude a significant relationship between the two groups.

5. ACKNOWLEDGEMENTS

The researchers are very grateful to Dr. Jhansen Rey M. Obispo, Mr. Johnny R. Pagaduan, and Ms. Keziah Faye M. Arellano for their overwhelming guidance and support in making this research possible. Their contributions are valuable and are sincerely recognized. In addition, they would like to thank Engr. John Karlo M. Arellano, Engr. Kizzarne Lois O. Julian, Engr. Mark Julius M. Galapon, the students, staff, and visitors of Ilocos Norte National High School main campus; for their participation and encouragement in this study. Most importantly, the researcher would like to the Almighty Father for giving them what they need to overcome any challenges faced in this study.

6. REFERENCES

Adobe Communications Team. (2022, March 18). *Waterfall methodology: Project management | Adobe Workfront*.https://business.adobe.com/blog/basics/waterfall

Cao, K. (2022, July 5). Development and Design Case Function Comparison of Panoramic Roaming System of Virtual Museum Based on Pano2VR. Hindawi. https://doi.org/10.1155/2022/7363221

Llego, M. A. (2021, August 5). *DepEd Basic Education Statistics for School Year 2020-2021*. TeacherPH. https://www.teacherph.com/deped-basic-education-statistics-school-year-2020-2021/

Okerson, J. R., Hossler, D., Palmer, M., & Hunt, K. (n.d.). *Beyond The Campus Tour: College Choice and the Campus Visit*. W&M ScholarWorks. https://scholarworks.wm.edu/cgi/viewcontent.cgi?article=1004&context=etd

Qiu, Weili & Hubble, Thomas. (2002). The Advantages and Disadvantages of Virtual Field Trips in Geoscience Education. https://www.researchgate.net/publication/253691199_The_Advantages_and_Disadvantages_of_Virtual_Field_Trips_in_Geoscience_Education

Rohizan, R. B., Vistro, D. M., & Puasa, M. R. (2019). Enhanced visitor experience through campus virtual tour. *Journal of Physics: Conference Series*, *1228*(1), 012067. https://doi.org/10.1088/1742-6596/1228/1/012067

Sharma, L., & Singh, V. (2021, October 18). *What is waterfall model in software developement life cycle: SDLC*. TOOLSQA. https://www.toolsqa.com/software-testing/waterfall-model/

Slater, S. (2021, August 16). *5 Ways for Schools and Universities to Use Maps and Virtual Tours*. Concept3D. https://concept3d.com/blog/campus-map/5-ways-for-schools-and-universities-to-use-maps-and-virtual-tours/

Suryanto, Tri & Wibowo, Nur. (2020). Developing and Evaluating a Jejakatua Virtual Campus Tour Prototype Using Auto-stitching Technique. Journal of Physics: Conference Series. 1569. 022055. https://doi.10.1088/1742-6596/1569/2/022055.

Suwarno & Murnaka, Nerru. (2020). Virtual Campus Tour (Student Perception of University virtual Environment). Critical Reviews in Biotechnology. 7. 4694 https://doi.10.31838/jcr.07.19.584.

Virtual campus tours take on new importance during travel restrictions. (2020, April 8). ICEF Monitor. https://monitor.icef.com/2020/04/virtual-campus-tours-take-on-new-importance-during-travel-restrictions/