Chapter 17
Case Study 10, Japan: Smartphone Virtual Reality for Tourism Education—A Case Study

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1 Background

There is an increasing amount of research and development happening around the use of virtual and augmented reality in education, known more commonly as immersive learning (Hawkinson et al., 2017). This case study seeks to merge vocational training and language learning and explore its application in tourism education. The case study presented here was conducted with students in the Department of Global Tourism, Faculty of Global Engagement, Kyoto University of Foreign Studies, Kyoto, Japan. The learning goals of the faculty and department are heavy on fieldwork research, project-based learning, and experiential learning. This study follows these values and has a focus on the use of virtual learning environments and VR in constructivist learning contexts, and less on the acquisition and use of language.

Students in the program are seeking not only vocational type training for use in the tourism and hospitality industry, but also policy and social studies to enter public service connected to tourism. The curriculum of the faculty and department has an English language learning component, and English is used as the main language of instruction in many content courses offered. The context of learning in which this study was conducted was mainly geared at using virtual reality (VR) in real world situations that might represent future projects, research, and employment. In that spirit, it was imagined that VR could be a beneficial tool to allow students to gain experience in designing, curating, and conducting tours in English, perhaps as preparation to design and conduct tours with actual tourists later in the program. There are many features and benefits that VR can bring to this context of instruction. Therefore,

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a deeper look was needed into the benefits of using VR over more traditional uses of technology in this kind of learning like PowerPoint presentations or video content.

There has been some research to suggest benefits in both the practical training of tour guides and the teaching of English (Yung & Khoo-Lattimore, 2019); therefore, this was a part of a trial study to test the feasibility of further implementing VR into the program. There might also be benefits for building training for tour guides of local attractions by using VR to run simulations of student-created tours as there are many practical issues with training tour guides in real time. There were also concerns of cost, safety, privacy, and overall practicality with using VR in this context, especially with larger numbers of participants being able to use existing facilities. Previous studies pointed to possible issues with network bandwidth, classroom size and layout, and software compatibility issues (Hawkinson et al., 2015). Confirmation was also sought on whether using VR would be favorable to students and under what circumstances.

With these contexts in mind, the study was designed not only to expose affordances to vocational training in tourism contexts, but also to glean insight into practical benefits and issues of using VR for tourism studies for the department.

2 Case Study

2.1 Participants

In this study, data was collected from 22 participants, 4 males and 18 females. The participants were mostly 2nd-year undergraduate students in the Department of Global Tourism taking an elective course called *New Media Lab*. The aim of the course was to give students experience creating media for tourism purposes, which included fundamentals in graphic design, photography, videography, with a large amount of time dedicated to creating content for virtual and augmented tourism. The students in the program are largely Japanese students who have an interest in the tourism industry. Students who take this elective course register in the knowledge that the course is almost completely taught in English. The entire cohort in the program has about 125 students, with 24 enrolling in the course, and 22 participating in the VR projects. The English ability of the participants varied, the average TOEIC score of the cohort being in the 400s (low intermediate). The average TOEIC score was thought to be higher for these participants as they were electing to take a class entirely in English and were able to participate in the course without many language problems. All of the students were in their 2nd year and in the same cohort, aged from 19 to 20 years old. There were a few students from other departments taking the course from the British and American Studies Department, who were 4th-year students and had been studying English for 3 years in that program prior to taking New Media Lab.

2.2 Project Description

As aligned with the goals and curriculum of the course *New Media Lab*, there were several stages leading up to introducing, implementing, and assessing the use of VR in this course. This was the first time the use of VR was a required assignment for students in the department, and thus the design of the VR use was cautious, and a good amount of scaffolding and training of needed baseline skills was introduced. Scaffolding in this context means the introduction of supporting technology and software in stages before the final most advanced tools were introduced. This was a concern leading into the current study since there was little indication that students had a basic level of technology training. In a prior survey of all students in the department, less than 15% of them self-reported knowing what augmented reality was, and less than 27% self-reported ever having used VR. The first half of the course time and content concentrated on these supporting skills. There were 7 clear stages to the course.

Stage 1: A learning module was given on photography, graphic design, and basic video editing before concepts of AR and VR were introduced. Each module tried to focus on the implementation of that skill for use in VR tours. For example, during a two-week module on photography, there was emphasis given to digital file formats, image resolution, and size ratios. These are important in the context of VR tours since an understanding of how images interacted with the VR tools was important. Also, due to time restraints, images from the web using a Google image search were used. As a result, a primer on Google search techniques and the basics of legal image use was given.

Stage 2: The students were taught the basics of graphic design and digital color. This was considered to be essential as the VR tours were to be submitted in an online student portfolio in the form of a Google Site, and thus some basic understanding of presenting a VR tour on a webpage was necessary.

Stage 3: Students were told the basics of camera angles and video editing techniques. There was not ample time to create videos; most of the time was spent introducing ideas like perspective, framing, and types of video cuts. This was thought to be important to better place images, audio, and video into 360° scenes in VR that made sense from the perspective of the 360° camera. There have been studies suggesting that using and creating VR environments require a spatial awareness (e.g. Rasheed et al., 2015), and discussions on camera angles were done in the hopes of having students think about how the perspectives and angles represented in the images added to the VR tours did not seem jarring to users.

Stage 4: After the basic supporting fundamentals in stages 1–3 were presented, an introduction about the use of technology in tourism contexts was given. This began by distributing a version of Google Cardboard and taking the students on a guided tour using Google Expeditions (see Fig. 1). Google Expeditions is a VR tour smartphone application that is available on iOS and Android smartphones and tablets. Students were asked to download and install the application on their phones, and they then joined a guided tour hosted by the instructor on a tablet. This setup requires a

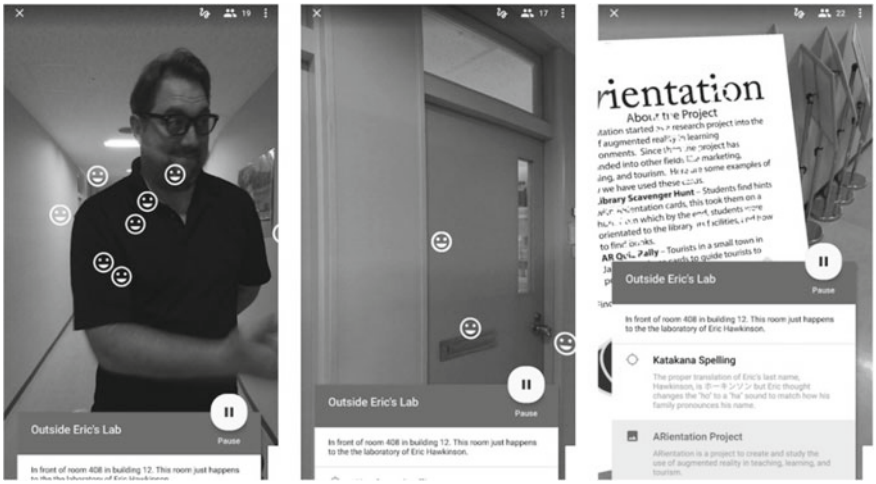

Fig. 1 Guiding a VR tour in Google expeditions

shared local network connection so that the device of the guide can communicate with those participating in the VR tour. For this purpose, an extra WiFi router was configured and connected to the institution's network to gain access to the Internet while also sharing the same access point for which the Expeditions application could allow all to participate in the same tour at the same time. This was important because there is a concern of using bandwidth to download tours, which can be heavy due to large media files. The tour was given as an example of what was later going to be assigned to students to emulate in their own hometown tours. The instructor gave an account of the location and its points of interest while pointing them out on the controlling device, all while monitoring where students were looking inside of the VR environment.

Stage 5: After the sample tour, students were given a primer in creating tours in Google Tour Creator, giving a short demo in class making a sample tour using content from Google Street View. Google Street View is an integrated service within the Google tools of Google Maps, Google Earth, and Google Earth VR. Google Tour Creator is a VR tour creation tool that can allow you to use 360° images from Google Street View and annotate them with text, pictures, and audio. All of these tools work well together as they are all from the same group of services and are free to use. After the demonstration, students were given a link to a tutorial website that had step-by-step instructional videos and links to official tutorials and troubleshooting guides.

Stage 6: Students were then asked to create a tour of their hometown. A set of minimum requirements were stated of at least 3 locations, 10 text annotations, 3 photos, and 1 audio narration. They were asked to try to design guided tours to be completed in 5–10 min. About 3 h of in-class time was given to create tours and get help from the instructor and peers.

Stage 7: After the tours were created, students were put into groups of 5 or 6 and asked to take turns guiding tours. After each tour, they completed either a peer or self-evaluation and moved on to the next student. This process took approximately 90 min. Links to the tours were collected and added to a database of 360° tours that can be viewed by all and future students in the course.

2.3 Data Collection and Analysis

Data was collected from the students using a questionnaire with 21 Likert-type, 1 multiple-answer checkbox, and 7 open-ended items. The questionnaire (see Appendix) was adapted from existing instruments, and changes were made to item wording in order to make the questions more suitable to the context of this study. The first part of the questionnaire included items on virtual presence adapted from Schubert et al. (2001), known as the Igroup Presence Questionnaire (IPQ), a scale to measure the sense of presence in virtual environments. The second and third parts of the questionnaire were adapted from Cheng's (2017) motivation and attitude questionnaires. The second part asked the participants about their attention, confidence, and satisfaction, while the third part included questions that tapped into the perceived usefulness of the virtual tours and their willingness to use them in the future. In addition, the participants also reported any physical discomfort they had experienced during virtual tours, such as nausea or eye strain. In the last part of the questionnaire, they responded to several open-ended questions designed by the authors to provide more details on the enjoyment and challenges of joining classmates' virtual tours and creating and delivering their own. The students filled out the questionnaire after guiding their own tours and joining those of their group members.

2.4 Results

The students' mean responses to items 1–6 alongside standard deviation (SD) values are displayed in Table 1. These items asked them about their sense of spatial presence in the virtual space. Out of 6 statements on virtual presence, numbers 4 and 6 were negatively worded and are marked with asterisks in Table 1. The participants' responses reveal a rather high sense of spatial presence experienced when joining virtual tours in which they were introduced to their classmates' hometowns. However, given their high ratings of positively worded statements (items 1, 2, 3, 5), mean responses to items 4 and 6 were expected to be lower than they are. This can perhaps be attributed to incomprehension or careless reading of questionnaire items. It is thus necessary to conduct further checks about these items by interviewing those participants who rated all items highly to clarify the cause of inconsistent self-reports.

Table 1 Students' self-reports of spatial presence in virtual tours

Part 1: Virtual presence	Mean	SD
1. During the virtual tours, I had a sense of 'being there'	4.41	0.59
2. I felt present in the virtual towns	4.18	0.85
3. I felt that the virtual towns surrounded me	4.32	0.84
*4. I felt like I was just looking at pictures of those towns	3.73	1.08
5. I had a sense of being in the virtual towns, rather than watching them from outside	3.68	1.04
*6. I did not feel present in the virtual towns	3.05	1.25

The following section of the questionnaire asked the participants about their attention to the VR tour content and the guides, confidence in the benefits of VR-enabled tours, and degree of satisfaction with the virtual tour experience. Responses to items 7–16 on attention, confidence, and satisfaction are presented in Table 2, with item 15 as the only negatively worded statement. As the numbers indicate, students highly rated their level of attention to VR content and tour guides as well as their degree of confidence in and satisfaction with VR tours. The majority of the participants expressed their confidence in the effectiveness of virtual tours for learning about places, and they equally voiced their contentment toward the activity, which underlines the potentials of VR tasks and activities in tourism education.

As shown in Table 3, the last set of items focused on students' perceptions of the usefulness of VR tours and their willingness to learn with the aid of VR in the future. Similar to the previous sections, the responses to these items also bear evidence as to the students' high opinion of VR tours in improving their learning of tourism and tour guiding alongside communication in English, undoubtedly an indispensable skill for successful tour guides in the globalizing context of Japan. They also expressed their interest in having more learning opportunities enhanced with VR.

Table 2 Students' responses related to attention, confidence, and satisfaction

Part 2: Attention, confidence and satisfaction	Mean	SD
7. The virtual tours drew my attention	4.18	0.66
8. I was curious about the information provided by the tour guides	4.32	0.89
9. Virtually visiting towns with the aid of VR technology was novel to me.	4.14	0.83
10. I paid attention to the tour guides continuously	4.18	0.85
11. I believe that virtual tours can help us learn about different towns	4.68	0.48
12. I believe that going on tours with the aid of VR technology can be helpful for understanding the content of the class	4.55	0.60
13. I am confident in the benefits of VR technology for learning	4.41	0.67
14. I enjoyed joining the virtual tours	4.68	0.65
*15. I was dissatisfied with the experiences of going on virtual tours	2.55	1.60
16. I felt happy when I was on a virtual tour	4.73	0.46

Table 3 Students' responses to VR-enhanced learning usefulness and future use

Part 3: Perceived usefulness and future use	Mean	SD
17. I think the virtual tours were helpful for my learning	4.55	0.51
18. Using VR to conduct my tour helped me communicate in English	3.95	0.95
19. The virtual tours can help me learn about different towns more clearly than through PowerPoint presentations	4.45	0.67
20. After going on virtual tours, I want to visit those towns	4.50	0.67
21. I hope to have more opportunities to learn with the aid of VR	4.41	0.73

Despite all the positive opinions on the benefits of VR-enabled learning, it is not without shortcomings. As it can be observed in Fig. 2, most of the participants reported eye strain after the virtual tours. Other symptoms included dizziness, neck/back strain, and nausea experienced by a few students. As a matter of fact, low-cost VR viewers such as Google Cardboard or mini clip-on VR glasses currently available in the market fail to provide high-resolution VR content that can be viewed for relatively long stretches of time without suffering from eye strain. This finding highlights the importance of timing in VR-enabled tasks to leverage learning without causing too much physical discomfort to learners. It was observed that some students were not using the viewers in 'cardboard mode' and opting to simply use 'browser mode,' in which you use your device like a website and use your finger to change the viewing angle instead of moving your head.

The participants' responses to the open-ended questions were also subjected to qualitative content analysis. Several common themes emerged in response to the questions, which have been categorized and tallied in Table 4. As shown in Table 4, the participants enjoyed visiting and learning about their classmates' hometowns and their life stories. They did not experience too many major challenges, although

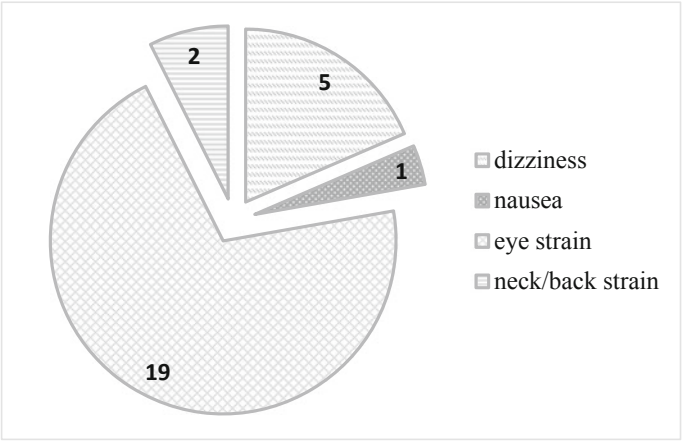

Fig. 2 Students' self-reports of physical discomfort caused by VR

Table 4 Students' responses to open-ended questions

Questions	Responses	Tallies
What was fun or interesting about joining classmates' virtual tours?	Visiting and learning about a new place	16
	Learning about classmates' personal life stories	7
	Feeling present in the virtual environment	2
What was challenging about joining classmates' virtual tours?	Listening to and understanding classmates	6
	Dealing with connection issues	3
	Suffering from eye strain	2
What was fun or interesting about creating your own tour?	Remembering childhood memories	10
	Teaching classmates about one's hometown	5
	Rediscovering one's hometown through VR	3
What was fun or interesting about being a guide?	Being able to introduce one's hometown	13
	Receiving positive responses from classmates	6
	Appreciating the power of VR in virtual tour-guiding	2
What was challenging about creating your own tour?	Selecting spots to introduce in the tour	9
	Preparing the content	6
	Learning how to create VR tours	4
What was challenging about being a guide?	Introducing one's hometown in English	8
	Guiding classmates and responding to questions	4
If you were to make another VR tour to show people a place, where would it be and why?	Hometown/City of residence	5
	Country or city of study-abroad program	5
	Country or city visited or to visit	5

some found it difficult to listen to and comprehend tour guides' explanations, and a few experienced technical issues. Regarding virtual tour creation, around half of the students mentioned the pleasure they took in introducing their hometowns while looking back upon their memories. Many were content in introducing their hometowns to classmates and receiving positive feedback from the audience. However, some students found it challenging to guide participants and answer questions in English and to respond to questions. Overall, the participants were positive about the power of virtual tours in learning about tour-guiding as well as practicing their oral/aural skills.

In line with the findings of this study, previous research also bears evidence as to the effectiveness of virtual reality in learning contexts. Reviewing two decades of research on virtual 3D environments, Dalgarno and Lee (2010) identify five key affordances of such environments, namely 'facilitation of tasks that lead to

enhanced spatial knowledge representation, greater opportunities for experiential learning, increased motivation/engagement, improved contextualization of learning and richer/more effective collaborative learning' (p. 10). In other words, virtual reality allows teachers to bring the real world into the classroom and provide opportunities for immersive learning.

These findings support the idea of the use of VR for vocational training in tourism contexts, even in a second language. They also corroborate the findings of studies that lend proof to the benefits of this technology for improving learning outcomes. For instance, virtual reality and immersive learning have assisted learners in familiarizing themselves with the target culture (Shih, 2015). Moreover, Chen et al. (2019) have reported on the benefits of deploying Google Earth virtual reality in improving young learners' expository writing. Similarly, in a Chinese L2 learning context, Xie et al. (2019) have examined the use of Google Expeditions on learners' oral proficiency and have shown the positive impact of virtual reality on learners' oral proficiency. In short, similar to our findings, all these studies report proven benefits of integrating VR into learning contexts.

Although more immersive forms of virtual reality are still in their infancy within the area of language for specific purposes, an increasing number of researchers are showing a growing interest in its applications, and more studies should appear in the years to come. However, as argued by Alizadeh (2019), successful integration of VR in education is bound to (a) careful task design so as to ensure that technology supports learning and is not merely an end in itself; (b) ease of administration and implementation, given that most institutions lack financial and spatial resources for complicated hardware and software provision; and (c) user-friendliness of the technology or device for both teachers and learners. The current study suggests that VR could be a useful tool to build context for language learning, and perhaps an iteration of this study to focus more on the language use is warranted.

In summary, this particular case study shows a clear and practical use of VR in vocational training in a second language. This is not only because learners get practice designing and guiding tours in English, but they also gain understanding of the concepts and tools used to create VR tours which may be more useful and needed in the tourism and hospitality industry moving into the future.

3 Pedagogical Principles

VR tours as a teaching and learning tool in creating and curating tours is an ideal case use of immersive technology, as it can be a better representation of designing and guiding a tour over more traditional presentation tools like presentation slides, but there are some issues of infrastructure and technology training that must be met to use these tools successfully.

Some important principles of this case use include but are not limited to:

- *Power of VR in giving learners first -hand experiences of the learning domain*: VR-enhanced contents for contextual learning can help learners experience real-life-like situations and encounters in an immersive manner, giving agency to users of the experience. This is significant particularly when time/place restrictions as well as safety issues make it impossible to conduct field learning.
- *Opportunities for learner-centered design including content generation and peer teaching*: User-friendly VR creation platforms like Google Tour Creator allow learners to create their own contents and use them in teaching their peers.
- *Importance of task design and timing to avoid physical strain*: It is incredibly important to design VR tasks meticulously and make sure too much exposure to VR content does not exhaust students by straining their eyes or making them experience VR sickness. VR equipment may need special calibration to a user's physical attributes like their inner pupillary distance to help comfort levels, but it is near impossible using budget equipment that changes hands many times.

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Appendix 1

Virtual Tour Experience Self- and Peer-Evaluation Questionnaire
This questionnaire has been created to get feedback on your experience leading/joining virtual tours and learning about your classmates' hometowns.

First name: _____	Last name: _____
Student number: _____	Age: _____

Part 1: Virtual Presence
Rate each statement on a scale of 1 (Strongly disagree) to 5 (Strongly agree).

1. During the virtual tours, I had a sense of 'being there.'
2. I felt present in the virtual towns.
3. I felt that the virtual towns surrounded me.
4. I felt like I was just looking at pictures of those towns.
5. I had a sense of being in the virtual towns, rather than watching them from outside.
6. I did not feel present in the virtual towns.

Part 2: Attention, Confidence, & Satisfaction
Rate each statement on a scale of 1 (Strongly disagree) to 5 (Strongly agree).

7. The virtual tours drew my attention.
8. I was curious about the information provided by the tour guides.
9. Virtually visiting towns with the aid of VR technology was novel to me.

10. I paid attention to the tour guides continuously.
11. I believe that virtual tours can help us learn about different towns.
12. I believe that going on tours with the aid of VR technology can be helpful for understanding the content of the class.
13. I am confident in the benefits of VR technology for learning.
14. I enjoyed joining the virtual tours.
15. I was dissatisfied with the experiences of going on virtual tours.
16. I felt happy when I was on a virtual tour.

Part 3: Perceived Usefulness and Future Use

Rate each statement on a scale of 1 (Strongly disagree) to 5 (Strongly agree).

17. I think the virtual tours were helpful for my learning.
18. Using VR to conduct my tour helped me communicate in English.
19. The virtual tours can help me learn about different towns more clearly than through PowerPoint presentations.
20. After going on virtual tours, I want to visit those towns.
21. I hope to have more opportunities to learn with the aid of VR.

Part 4: VR Sickness

22. Did you experience any of these during the tours? Select as many that apply.

dizziness	☐	nausea	☐	eye strain	☐	neck/back strain	☐

Part 5: Answer the following questions about the process of joining classmates' tours and preparing and delivering your own tour.

23. What was fun or interesting about joining classmates' virtual tours?
24. What was challenging about joining classmates' virtual tours?
25. What was fun or interesting about creating your own tour?
26. What was fun or interesting about being a guide?
27. What was challenging about creating your own tour?
28. What was challenging about being a guide?
29. If you were to make another VR tour to show people a place, where would it be and why?

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