香港教育大學

The Education University of Hong Kong

Project entitled

From the perspective of in-service teachers,

can the technology of Virtual Reality be adopted in the General Studies curriculum?

Submitted by

[redacted]

[redacted]

submitted to The Education University of Hong Kong

for the degree of Bachelor of Education (Honours) (Primary)

April 2019

Declaration

I, [redacted], declare that this research report represents my own work under the supervision of Dr Ho Wing Kei, and that it has not been submitted previously for examination to any tertiary institution.

Signed _____[redacted]___

[redacted]

15th April, 2019

Table of Contents

Abstract

Based on the promotion of STEM education and e-learning, it seems that the application of virtual reality (VR) become a heated topic. Therefore, the purpose of this study is to understand the in-services General Studies (GS) teachers' opinions about the question: "Can the technology of Virtual Reality be adopted in the General Study curriculum?".

A quantitative research method was conducted from February to March 2019 and questionnaires were received from 22 in-services GS teachers. Results of the research proved that the only a few in-services GS teachers applied VR in their GS lesson. Most participants felt difficult to apply VR in teaching. Although the application of VR in daily teaching was not universal and full of challenges, most participants in general agreed that the application of VR are aligned with the GS Curriculum framework, especially for teaching the GS subject knowledge. However, only half of them were willing and confident to utilize the technology of VR in their future teaching.

Keywords: STEM, Virtual Reality, in-service teachers, primary school, General Studies, Curriculum, challenges.

1 Introduction

In recent years, the technology of virtual reality (VR) has been applied to different aspects. Not only can VR be utilized for entertainment, like video games or movies, but it can also be applied to the education sector. As Choi et al. (2016) mentioned, there were increasing demands for the application of VR in education. As a result, the application of VR has become one of the heated topics because of the promotion of STEM education.

As reported in some news, many schools started to consider the application of VR in their school. For example, a Chinese teacher from Cotton Spinners Association Secondary School applied VR to teach Chinese Poetry (HK01, 2018, June 19). Meanwhile, different universities also started and provided various supports of the VR teaching resources for in-service and pre-service teachers. In order to provide teachers with VR teaching materials, Centre for Learning Sciences and Technologies of the Chinese University of Hong Kong developed an online platform in 2016, called EduVenture® VR (On.cc, 2016, October 27). The Education University of Hong Kong also revealed their development of VR teaching kit (EdUHK, 2018). Also, some companies concerned the application of VR in education. For instance, Towngas and Hong Kong Education City organized the inter-school VR game design competition to raise students' awareness of environment protection (am730, 2018, September 9).

According to the GS curriculum guide (Primary 1-6) prepared by The Curriculum Development Council in 2017, virtual reality is stated as one of the example for the utilization of electronic learning tool in outdoor learning enhance learning effectiveness.

Based on this trend, the application of VR will be one of the significant teaching approaches or important resources and can be adopted in future curriculum of GS. As a result, exploring the possibility of the application of VR in GS curriculum is valuable.

2 Literature Review

2.1 Background of Virtual Reality

To have an accurate purpose of the study, understanding the definition of VR is a must. VR is clearly defined as "an artificial environment that is experienced through sensory stimuli (such as sights and sounds) provided by a computer and in which one's actions partially determine what happens in the environment." (Donally, 2018, p.7). In other words, VR can enable a user to intact with an artificial 3D sensory environment. Similar definition of VR also stated in the Choi, Dailey and Estes's book (2016).

Basically, there are 4 different forms and methods of VR (Wong, Chan & Ng, 2018; Lam, 2006):

VR Type	Peripheral devices	Example
Desktop VR	Personal computer, Keyboard…	Street View in Google Maps
Simulation VR	Simulate devices, such as simulator cockpits	Pilot training, Driver simulators
Project VR	Projector screen, Projector, Spatial sound devices…	Museum
Immersion VR	Head-mounted display, Data glove, Position racking devices,Spatial sound devices…	Google cardboard

According to current trend of the application of VR as mentioned in the introduction, medias mainly discussed head-mounted display in primary schools, like Google cardboard. Therefore, this study only focused on the immersion VR.

2.2 Advantages of VR in education

Students' interest:

The most obvious advantages of the application of VR in education is piquing the students' learning motivation. As Donally (2018) said, the new generation students are eager to explore learning through new technology, such as VR or AR. The research conducted by Kavanagh, Luxton-Reilly, Wuensche, Plimmer (2017) provided evidence and showed the characteristics of VR can appeal to educatioors to use VR in teaching for improving student motivation. Parong and Mayer (2018) also conducted an experiment and the result showed that students who learned in immersive VR in science lesson reported a higher levels of learning interest and motivation than traditional PowerPoint slideshow lessons. It is undoubtedly that the application VR in a lesson can be easy to capture their attention. For the long-term, the application of VR in education can be possible to develop students' self-learning habit.

Knowledge retention:

Meanwhile, not only can the application of VR have the improvement of students' learning motivation, but also the academic performance. Donally (2018) cited Juan,

Mendez-Lopez, Perez-Hernandez and Albiol-Perez's research in 2014. The research result provided evidence that students had a better performance of memory in post-test than pre-test when using augmented reality in the lesson. More importantly, the characteristics of VR contributes to make information more concrete (Choi et al., 2016). It is conducive for students to learn some abstract information. In other words, when students are provided an authentic learning environment, teachers are conducive to engage students with purposeful and deepened learning.

Overcoming the barriers of learning:

With the advanced technology, teaching and learning can be more effective. As Donally (2018) mentioned, many schools have limit field trips and outings due to different reasons, such as the complicated arrangement for field trips or the pressure of teaching schedules. However, this situation can't respond students learning needs. By using the application of VR, teachers can provide a virtual field trips to Great Barrier Reef, even the solar system or the human digestive system. Thus students can understand more about the knowledge of the ocean, even the space or human body. Furthermore, Wong, Chan and NG (2018) recommend that teachers can make use of virtual field trips to develop students' global perspective, such as experiencing a VR movie about the Syrian Civil War and Syrian Refugee. Also, the application of VR can

help teachers and students to overcome other obstacles in learning, such as language barrier.

2.3 Educational Theory

Although there are many benefits for teachers and students when applying the VR technology to teaching and learning, the more important thing is that considering how connect VR technology with pedagogy or learning theory. As Hung, Rauch and Liaw (2010; cited in Choi et al 2016) argued that, educators need to consider carefully the linkage between a new technology and pedagogy or a learning theory. Therefore, the following part will focus on the relation between the application of VR and learning theory.

As mentioned in the previous part, learning motivation plays a vital role in learning and this is related to motivational theories. Parong and Mayer (2018) cited Dewey (1913) and Schiefele (2009) and pointed out that interest theory and self-efficacy theory are one of the reasons why using immersive VR for teaching of scientific material. Interest theory explains that students are engage in the lesson or task and work harder for understanding the content if they are interested in the learning material. Meanwhile, Parong and Mayer (2018) also mentioned that the application of VR can be a feedback system by providing immediate and adaptive feedback and thus boost students' self-

efficacy. Parong and Mayer provided evidence to show that the application of VR can enhance students' motivation by the explanation of interest theory and self-efficacy theory.

Another important educational theory supporting the application of VR in education is constructivism. The meaning of constructivism emphasizes that an active and constructive process are conducive for humans to generate meaning. In other words, based on the interaction between their ideas and experiences, students can establish their own understanding of reality because education should be experimental and experiential (Dewey 1985; Hung et al., 2010; cited in Kavanagh et al., 2017). More importantly, different scholars believed that the application of VR for teaching and constructivism are inextricably linked (Anopas & Wongsawat, 2014; Hung et al., 2010; Panteldis, 2009; cited in Kavanagh et al., 2017) Sze (2007) had a further explanation about the relation between VR and constructivism. She pointed out that the development of situated instruction theory based on constructivism. VR is a good way for teachers to practice situated instruction theory. This theory emphasizes that knowledge is a product under the interaction between learners and environment. The key point of situational teaching is that individuals must be placed in the context, activities, or communities. By observation, imitation, and a series of actual activities,

learners experiencing continuous exploration and reflection and students can grasp different knowledge and skills.

The review of the literature showed the background of VR, advantages of VR in education and the related educational theories. Based on the review of advantages of VR and different related educational theories, this study predicts that the application of VR can be aligned with the requirements of the GS curriculum guide to a large extent.

2.4 The application of VR in GS curriculum

According to the GS curriculum guide (2017), the GS curriculum framework is composed by 3 major components, including fundamental subject knowledge, generic skills and value and attitudes. It seems that the application of VR can respond to the GS subject knowledge part. As the guide pointed out, there are 6 major strands in the GS curriculum, including Health and Living, People and Environment, Science and Technology in Everyday Life, Community and Citizenship, National Identity and Chinese Culture and Global Understanding and the Information Era. VR can be applied in various topics as the previous part mentioned, such as historical sites, nature environment or even human body. Meanwhile, GS curriculum guide emphasizes 9 different generic skills, including communication skills, critical thinking skills, self-management, skills, mathematical skills, creativity self-learning skills, IT skills,

problem solving skills and collaboration skills. Different scholars argued that VR as a new technology can support the development of critical thinking and problem-solving skills. Therefore, the prediction is that VR can be a tool for teachers to develop students' generic skills. Similar situation can be found in the value education in GS curriculum. Wong, Chan and Ng (2018) believe that teachers can cultivate in students with positive attitude and values through the application of VR, such as respect for others, national identity, commitment, integrity and care for others.

3 Research aims

However, it is hard to find the related research in term of the Hong Kong context and verify different views about the application of VR in education. Therefore, the major purpose of this research is to investigate the extent that the application of VR can be aligned with the requirements of the GS curriculum guide from the perspective of in-service GS teachers. Beside, to understand the trend of the application of VR in GS subject. Lastly, to analysis the challenges they face when it comes to the application of VR. There are the three research questions:

1. Did in-service GS teachers apply VR in their GS lesson or other subjects?
2. To what extent the application of VR can be aligned with the requirement of GS curriculum guide?
3. What are the challenges that impeded in-service GS teachers from implementation?

4 Research Methodology

4.1 Research method – quantitative method

In this research project, a quantitative method was adopted. In order to confirm the prediction and hypothesis of the supporting theories about application of VR for teaching, a questionnaire was designed and delivered to collect primary data from the in-service teachers. This primary data directly provided objectively and scientifically evidences about in-service GS teachers' opinion on the application of VR in GS subject. By collecting data from the participants, it is expected that the result can provide the relevance of the generalizations to other Hong Kong in-service GS teacher and answer research question one, two and three and be conducive to have a further discussion.

4.2 Participants

The target of this research project is in-service GS teachers. 22 Hong Kong in-service GS primary teachers was invited for this research project. They are working in different aided primary schools.

Teaching experience	Number of teacher(s)
0-5 year (s)	16
6-10 years	1
11-15 years	2
16-20 years	2
More than 20 years	1

Table 1: Teaching backgrounds of the 22 participants

Gender	Number of teacher(s)
Male	3
Female	19

Table 2: Background information of the 22 participants

5 Findings

To answer the research questions, the findings will be divided into 3 parts to present. The current trend in Hong Kong primary schools of the application of VR in GS subject and other subjects will be reported in the first part of the questionnaire.

5.1 The current trend of the application of VR for teaching

Table 3 shows that over 90% of the participants did not apply or utilize the technology of VR when they teach GS subject. Only 9.1% of the participants had the experience of using VR in their GS teaching.

Table 3: Responses about the current of the application of VR in GS subject:

Question 1: Did you apply VR in General Studies teaching?	
Yes	NO
9.1%	90.9%

Same as the condition of table 3, the table 4 shows that over 90% of the participants did not have the experience in applying VR for teaching other subjects. 9.1% participants applied the VR technology in other subjects, including Mathematics and

ICT. Combining two result of the question 1 and question 2, 4.5% participants had the experience of applying VR in both GS and other subjects. This part of result shows that the trend of applying VR in teaching is not common and universal.

Table 4: Responses about the current of the application of VR in other subjects:

Question 2: Did you apply VR in other subject?	
Yes	NO
9.1%	90.9%

5.2 The application of VR and the requirement of the GS curriculum guide

The second part of the findings will show the result of what extent of the application VR can be aligned with the GS curriculum guide, including subject knowledge, generic skills and value and attitude.

5.2.1 The application of VR and six GS strands

From the survey result, all participants agreed that all least 1 strand of GS curriculum can be applied the technology of VR. More than half of participants believed that the application of VR can be applied to 3 or more strands of GS curriculum.

Table 5: Responses about how many GS strands are suitable for applying VR

Number of strands	Number of participants
0	0
1	1
2	8
3	9
4	0
5	1
6	3

From table 6, there were over 85% of participants thought that the strand of People and Environment in GS curriculum was suitable for applying VR. Over 50% of them believed that the application of VR can be utilize to the strands of Science and Technology in Everyday Life and Global Understanding and the Information Era. However, only 18.2% participants argued that teachers can use VR for students to teach Community and Citizenship. The results of table 5 and 6 imply that although the application of VR can be applied to various strands, it is hard for applying in some topics related to value and attitude education, such as the strand of Community and Citizenship.

Table 6: Responses about the application of VR and six GS strands

Question 3: What is the strand of GS suitable for the application of VR in teaching? (can choose more than one answer)	
Strands	Percentages of participants
Health and Living	45.5%
People and Environment	86.4%
Science and Technology in Everyday Life	68.2%
Community and Citizenship	18.2%
National Identity and Chinese Culture	31.8%
Global Understanding and the Information Era	54.4%
None of above	0%

5.2.2 The application of VR and generic skills

Table 7 shows the opinion of 22 participants about the application of VR in facilitate students' different generic skills. Almost 60% participants agreed that the application of VR can facilitate students' basic skills, including communication skills, mathematical skills and IT skills. Similar situation can be found in the opinion about developing students' thinking skills. 55% of participants agreed that the application of VR can facilitate students'

thinking skills, and 45 percent of them disagreed to the statement. However, 59% participants disagreed that students' can be developed their personal and social skills by using VR in the GS lesson. The result shows that not all generic skills can be developed by using VR in GS lesson. More importantly, there is no significant difference between the agreement and disagreement. It reveals that teachers' opinion has polarized on the application of VR in developing students' generic skills.

Table 7: Responses about the application of VR and generic skills

Question 4: Can the application of VR facilitate students' different generic skills?				
3 clusters of generic skills	Strongly Disagree	Disagree	Agree	Strongly agree
<u>Basic Skills:</u> Communication Skills Mathematical Skills IT Skills	0%	40.9%	54.5%	4.5%
<u>Thinking Skills:</u> Critical Thinking Skills Creativity Problem Solving Skills	9.1%	36.4%	50%	4.5%
<u>Personal and Social Skills:</u> Self-management Skills Self-learning Skills Collaboration Skills	9.1%	50%	31.8%	9.1%

5.2.3 The application of VR and values and attitudes

The table 8 shows the participants' opinion about the utilizing VR to cultivate students' positive values and attitudes. However, all values and attitudes the GS curriculum guide emphasized cannot be cultivate to students through applying VR in teaching. 72% of participants showed disagreement on that the application of VR can cultivate students' perseverance. Over 60% of them disagree that the application of VR can cultivate students' values and attitudes in integrity and national identity. Result also shows that there is only a slight difference between agreement and disagreement about the application of VR cultivating students' respect for others, responsibility, commitment and care for others. The result of this section shows that in-service GS teachers tend to have negative attitude about cultivating students' values and attitudes through the application of VR.

Table 8: Responses about the application of VR and values and attitudes

Question 5: Can the application of VR cultivate students' values and attitudes?				
Values & attitudes	Strongly Disagree	Disagree	Agree	Strongly agree
Perseverance	13.6%	59.1 %	27.3%	0%
Respect for Others	9.1%	40.9%	40.9%	9.1%
Responsibility	9.1%	45.5%	45.5%	0%
National Identity	18.1%	45.5%	36.4%	0%
Commitment	9.1%	45.5%	45.5%	0%
Integrity	9.1%	54.6%	36.4%	0%
Care for Others	9.1%	45.5%	40.9%	4.6%

5.2.4 The application of VR and e-Learning

Although e-learning is not part of the GS curriculum framework, it plays a significant role in GS subject. As the GS curriculum guide stated, teachers should make good use of the e-Learning because it enables students to extends their learning. The guide also mentioned 4 major characteristics of e-Learning. For table 9, the majority of participants agreed that the application of VR has the characteristics of e-Learning. Over 90% of participants agreed that the application of VR is interconnected and interactive. 80% of them agreed that the application of VR is extendable. 70% of them agreed that the technology of VR is collaborative. The result provides obvious evidence that the application of VR can be a kind of e-Learning methods. In other words, students can extend their learning by using VR. For example, students can learn some abstract concepts or ideas through the use of VR because VR is interactive.

Table 9: Responses about the application of VR and characteristics of e-Learning

Statements	Strongly Disagree	Disagree	Agree	Strongly agree
VR is interconnected and it connects learners with information worldwide.	0%	4.5%	59.1%	36.4%
VR is collaborative and it helps students learn collaboratively within and beyond classroom.	4.5%	22.7%	36.4%	36.4%

VR is interactive. With multimedia, abstract concepts can be explicitly illustrated.	0%	9.1%	63.6%	27.3%
VR is extendable. It enables students to learn beyond classroom according to their ability, progress and interest.	0%	18.3%	50%	31.8%

5.2.5 The application of VR and catering for learner diversity

Catering for learner diversity is a common issue for many in-service teachers. The GS curriculum guide also considers this issues and provides recommendation. From table 10, the result shows that participants agreed that the application can be beneficial for catering learner diversity. Over 80% of them believed that the application of VR can cater for students' difference and special learning needs. In other words, the application of VR can be a diversified teaching and learning resource.

Table 10: Responses about the application of VR and catering for learner diversity

Statements	Strongly Disagree	Disagree	Agree	Strongly agree
The application of VR can cater for students' difference	4.5%	13.6%	54.5%	27.3%
The application of VR can cater for students' special learning needs	4.5%	9.1%	54.5%	31.8%

5.2.6 The overall evaluation of the application of VR for teaching GS subject

The last question of this section, participants needed to evaluate the application of VR in GS teaching. The table 11 shows that 77.3% participants agreed that the application of virtual reality can align with the requirements of General Studies curriculum guide.

Table 11: Responses about the application of VR and the requirement of GS curriculum guide

Statement	Strongly Disagree	Disagree	Agree	Strongly agree
The application of Virtual reality can be aligned with the requirements of General Studies curriculum	0%	22.7%	68.2%	9.1%

5.3 Challenges of applying and implementing VR

According to the survey result in the table 12, participants faced different challenges in applying VR. All the statements about challenges of applying VR in lesson has at least 75% for agreement. All of them agreed that applying VR in lesson will cause teachers spend extra time on preparing the application of VR teaching resource and it is of most concern to participants. Also, over 95% participants agreed that the cost of educational VR technologies is high. 2 participants shared other challenges in the applying VR for teaching in the column “Other potential challenges”. From participant A, “The weight of Cardboard

is heavy. Students feel eyes uncomfortable and neck pain after a prolonged use of VR.". From participant B, "It is hard for teachers to find suitable VR learning resources to students to learn because there is no resources depository for relevant VR teaching."

From table 13, 77% participants showed agreement for the statement about "Utilizing VR in GS lesson is full of challenges and difficulties". The result shows that participants feel difficult for applying VR in their daily teaching.

Table 12: Responses about the challenging factors

Statements	Strongly Disagree	Disagree	Agree	Strongly agree
Teachers need to have high level of IT skills to apply the technology of VR.	0%	13.6%	50%	36.4%
Teachers need extra time for preparing the application of VR teaching resource.	0%	0%	40.9%	59.1%
School need to a high cost for educational VR technologies.	0%	4.5%	45.5%	50%
School don't provide relevant facilities for applying VR in teaching, such as screen mirroring projector or wireless network.	0%	22.7%	45.5%	31.8%
School's requirement of teaching schedule is unfavorable for teachers to apply VR in lesson.	0%	13.6%	63.6%	22.7%
It is easy for teachers to encounter technical error when using the VR in teaching.	0%	18.2%	72.7%	9.1%

Table 13: Responses about the overall evaluation of the challenges in applying VR in GS teaching

Statements	Strongly Disagree	Disagree	Agree	Strongly agree
Utilizing VR in GS lesson is full of challenges and difficulties	0%	22.7%	45.5%	31.8%

5.4 Applying VR for GS teaching in future

Although 90% participants did not use VR in their GS lesson for teaching, the table 14 shows that there are almost 60% participants are willing to adopt VR in their future GS lesson. Barely half of participants felt confident in apply VR in their future GS lesson. Meanwhile, the table 14 showed that less teaching experience teachers are more willing and confident to utilize the technology of VR in their teaching than more teaching experience teachers.

Table 14: Responses about the overall evaluation of applying VR in future GS teaching

Statements	Teaching experience	Strongly Disagree	Disagree	Agree	Strongly agree
I will adopt VR for GS teaching in future.	All participants	0%	40.9%	50%	9.1%
	0-10 years	0%	35.3%	52.9%	11.8%
	11 years or above	0%	60%	40%	0%
I am confident in apply VR for GS teaching in future.	All participants	0%	45.5%	45.5%	9.1%
	0-10 years	0%	41%	47.1%	11.8%
	11 years or above	0%	60%	40%	0%

6 Discussion

The findings showed participants rarely using VR for their teaching. However, they though that the application of VR was aligned with the requirements of the GS curriculum guide to a certain extent. Also, the result provided that participants had a wide variety of challenges to apply VR in their teaching. The survey also showed the optimistic attitude from participants towards using VR for teaching GS.

6.1 Rarely using VR for teaching

According to the survey result, in-service GS teachers rarely apply VR for their teaching. In other words, the trend of the application of GS for teaching is not universal. In fact, similar situation can be found in other countries. A New Zealand report analyzed 99 papers about the implementation of VR in education (Kavanageh et al, 2017). The result pointed out that 51% of these papers of the application of VR created for use in higher education. However, there were only 9% papers of the application of VR for use in secondary education, 6% for primary education and 4% early childhood education. The result implied that the application of VR in education may be related to the different educational stage. It is expected that the knowledge learn from higher education are more abstract, complex and in-depth, such as medicine and engineering. Therefore, it is not surprising about the increasing and significant demands for the technology of VR

in higher education. Meanwhile, the needs of primary education for the technology of VR is not prime because existing teaching resources can help teachers to cope with their teaching problem.

6.2 Aligning with the requirements of GS curriculum guide to a certain extent

The result provided evidence that 77.3% in-service GS teachers agreed the statement: "The application of Virtual reality can be aligned with the requirements of General Studies curriculum". According to the table 6, 7 and 8, the in-service GS teachers argued that the application of VR is suitable to use for teaching subject knowledge and especially in STEM-related areas rather than facilitate students' generic skills and cultivate positive values and attitudes.

6.2.1 The application of VR in a wide variety of subject knowledge

The in-service GS teachers believed VR can be applied to a wide variety of strands of GS, especially in STEM-related areas. The New Zealand report (Kavanageh et al, 2017) showed that 35 of the 99 papers about the application of VR in education were mainly applied to Health-related domains, including general medical topics, surgical education, physical education. The application of VR in Engineering domains and science domains were also common, such as aviation, architecture or general physics.

Same point of view also mentioned in Wong, Chan and NG's book (2018). Same as this New Zealand report, the result of this project indicated that in-service GS teachers tend to use VR in the STEM-related strands, like "People and Environment", "Science and Technology in Everyday Life" and "Global Understanding and the Information Era". It is not hard to understand the reason. The technology of VR can be conducive for teachers to explicitly illustrate abstract concepts and idea and it is beneficial for teachers and students to teach and learn science, engineering and medical subject. However, the use of VR in values education and moral, civic and national education are uncommon.

6.2.2 The gap between the application of VR and values and civic education

The strategy of values and civic education differs from science education. There are 3 aspects in values and attitudes education, including cognitive, affective and behavioral. To have a comprehensive and successful values or civic education, Krathwohl, Bloom and Masia (1976, cited in So, Cheung & Wong-Yu, 2009) believed that the development of values should be required 5 stages, including receiving, responding, valuing, organizing and characterizing. First of all, students should receive related issues about values conflict and then respond their feelings, ideas or views. After that, students are required to value, organize and characterize values complex. However, the application of VR merely satisfies the first stage of values education. In other words,

in-service GS teachers can only utilize VR for students to watch some 3D movie about values conflict issues but it cannot able for teachers to help their students to respond, value, organize and characterize values. Due to the incomplete value education, the application of VR can only be a tool for teachers to motivate their students in value or civic education.

6.2.3 As a diversified teaching strategies

From the table 9 and 10, most of the in-service teachers agreed that the application of VR can be a teaching strategies to promote e-Learning and cater for learner diversity. According to the GS curriculum guide (2017), the use of diversified learning and teaching strategies is encouraged because it can provide students with different learning experiences. In fact, the technology of VR can stimulate students' multisensory to cater for learners' diversity.

Also, the application of VR to education can be favorable a personalized learning. Some foreign scholars believed that educational VR software can enable students to explore knowledge at their own pace (Kavanageh et al, 2017). Afonseca et al. (2013; cited in Kavanageh et al, 2017) mentioned that the application of VR can be possible to provide a special learning experience for children with Down syndrome. In other words, it is possible for teachers to use VR for students with special education need, such as ADHD or dyslexia.

6.3 Encountering different challenges in applying VR for GS teaching

As the result showed, in-service GS teachers faced various challenges in considering to adopt VR technologies to the GS lesson and most in-service GS teachers felt difficult to apply VR to the lesson.

Kavanageh et al (2017) analyzed 35 paper about the problem with the application of VR in education and categorized into 4 main areas of problems, including Overheard, Input problems, Output problems and Usefulness. In fact, Hong Kong in-service teachers also face these challenges in applying VR in education, such as cost. Kavanageh et al (2017) pointed out that the cost of the initial purchase of the VR technology can be high and many schools may be unable to afford the expense. This is one of the common reasons for the lack of application of VR in education.

However, the most tremendous challenge for Hong Kong in-service teachers is the extra preparation time for the application of VR in lesson. According to the survey conducted by Hong Kong Professional Teachers' Union in 2018, only 1.5% in-service teachers had reasonable working time. In-service teachers are required to be responsible for many duties, such as teaching, consulting students, meeting, managing students' extra-curricular activities… Due to the long working hours of teachers, if there is no any VR teaching resources database for teachers, teachers have to spend more time to prepare, such as shooting VR video. Therefore, it is not difficult to understand that the

all in-service teachers agreed that the preparation time for applying VR is a challenge and it can be the biggest challenge for them.

Furthermore, students' health is also the in-service teachers concern. Using the technology of VR for long time can cause students to felt uncomfortable. In other words, teachers will be restricted their activities of using VR during a lesson because of the time limitation about the students' use of VR.

These various challenges may cause the result that only 50% in-service teachers were willing and confident to use VR in GS teaching.

7 Implications

This research project implies the development of applying VR in GS subject of primary education. Although most in-service GS teachers agreed that the application of VR can be aligned with the requirement of GS curriculum subject knowledge, it is not optimistic for the trend of the VR application in GS education because of various challenges. In fact, there are a paucity of literature, research or study documenting the application of VR in GS subject. As a result, teachers are hard to relate relative pedagogies with VR. It is not surprising that teachers held a doubt about the application of VR in education. If there is anything that help the development of the application of VR in education, it would be the support of the universities or the publishers. The universities or the publishers can provide extra teaching resources to in-service teachers

to utilize VR in their teaching. As Dr Cheung Ting-on, Associate Professor of the Department of Social Sciences in EdUHK, planed that EdUHK will establish VR laboratory, provide training workshops and the VR teaching kit for academics and educators of for helping pre- and in- service teachers to utilize VR in teaching.

Meanwhile, this research project provided a telling evidence that teachers tend to use VR for e-learning and catering for learner' diversities. It is valuable to consider the potential about the application of VR in special education.

8 Limitation

There are several limitations of this research. One of the limitations is the small research size. 40 responses were expected to receive. However, only 22 in-service teachers were willing to answer the questionnaire. In other words, the findings just presented the perspective from a small group of in-service GS teachers. As a result, the relevance of generalizations to other Hong Kong in-service teachers is not enough and limited. To have a more representative result, the further study is expected to enlarge the actual research size.

Another challenges for this research is limited time. A mixed research method was expected to be adopted. However, in this research, only the quantitative method was used due to the limited time. The limited time did not allow to start a further investigation about the opinion from in-service teachers, such as interview.

9 Conclusion

This research has investigated the trend of applying VR in teaching, the extent of the alignment bewtween VR and the requirement of the GS curriculum guide from the perspectives of in-service GS teachers and the challenges in-service GS teachers faced when considering the application of VR. The result of questionnaire showed that the application of VR in primary school teaching is not common. Although most participants agreed that the application of VR is aligned with the requirement of the GS curriculum guide in general, there are polarized opinions about the application of VR in values education. However, there are positive attitude about the application of VR in e-Learning and catering for learners' diversities. Furthermore, participants agreed that the application of VR in teaching is difficult. Most of them were not willing and confident about the application of VR in their future teaching. Only by considering carefully the meaningful use of VR, the possibility of adopting VR in GS subject cannot be ruled out.

In the future, more and more new technologies will be applied in education. It is expected that this research can provide some insight and concern for someone when it comes to the application of new technologies in education.

(Words: 6071)

References

Choi, D., Dailey-Hebert, A. & Estes, J. (2016). Integrating Technological Innovations to Enhance the Teaching-Learning Process. *Emerging tools and applications of virtual reality in education*. (pp. 277-304)

Donally, J. (2018). *Learning transported: Augmented, virtual and mixed reality for all classrooms*. Portland, Oregon. International Society for Technology in Education.

Kavanagh, S., Luxton-Reilly, A., Wuensche, B., & Plimmer, B. (2017). A Systematic Review of Virtual Reality in Education. *Themes in Science and Technology Education*, 10(2), 85-119.

Parong, J. & Mayer, R. (2018) Learning Science in Immersive Virtual Reality. *Journal of Educational Psychology*, 110(6), 785-797.

The Curriculum Development Council (2017), *General Studies Curriculum Guide for Primary Schools (Primary 1 – Primary 6),* Retrieved from http://www.edb.gov.hk/attachment/en/curriculum-development/cross-kla-studies/gs-primary/GSCG_2017_Eng.pdf

The Education University of Hong Kong (2018), Making virtual reality a reality in local schools, *Education-plus* (pp.16-17). Retrieved April 15, 2019 from https://www.educationplus.hk/eduhk/upload/20190122030230706/EdUHK%20Education-Plus%20201812.FB/16/index.html

煤氣公司與教育城辦 VR 遊戲設計比賽(2018.09.09)：《am730》，檢自 https://hk.on.cc/hk/bkn/cnt/news/20161027/bkn-20161027132605484-1027_00822_001.html

林志勇（2006）：《認識虛擬實境》，臺北市，全華科技圖書。

梁蔚澄（2018.6.19）：中文老師設計 VR 遊戲　學生「遊歷」南宋學古文，《香港 01》，檢自 https://www.hk01.com/%E8%A6%AA%E5%AD%90/199861/%E6%95%99%E8%82%B2%E6%96%B0%E4%B8%BB%E6%84%8F-%E4%B8%AD%E6%96%87%E8%80%81%E5%B8%AB%E8%A8%AD%E8%A8%88vr%E9%81%8A%E6%88%B2-%E5%AD%B8%E7%94%9F-%E9%81%8A%E6%AD%B7-%E5%8D%97%E5%AE%8B%E5%AD%B8%E5%8F%A4%E6%96%87

黃幹知、陳國邦和吳思朗（2018）：《活用 VR 探全球－虛擬實境 X 社區考察》，香港，策馬文創有限公司。

香港教育專業人員協會（2018）：《2018 香港教師工作壓力調查》，檢自 https://www2.hkptu.org/press/2018/180902/180902-appendix.pdf

中大推 VR 考察教材　助教師製虛擬學習場景(2016.10.27)：《東網》，檢自 https://hk.on.cc/hk/bkn/cnt/news/20161027/bkn-20161027132605484-1027_00822_001.html

施文玲（2007）：以學習理論為基礎的數位化教學策略，生活科技教育月刊，40（2），頁 32－41。

蘇詠梅、鄭雅儀、黃余麗華（2009）：《常識科的學與教》，香港教育學院跨學科及通識教育研究中心，香港：新亞洲麥美倫出版有限公司。

Appendices

Appendix 1 – Questionnaire

虛擬實境（Virtual Reality，簡稱 VR）能夠讓用戶沉浸於電腦產生的 3D 感官環境中，在特定環境中與設計者所提供的多媒體互動，從而探索、創造及操縱物件。用戶可向不同角度移動頭部，便可動態地控制視角，允許建構具代表性和詳細的現實環境、造型和模擬環境。

（引自黃幹知、陳國邦和吳思朗（2018）:《活用 VR 探全球：虛擬實境 x 社區考察》，香港，策馬文創有限公司。）

以下問卷題目以「融入式虛擬實境」為基礎，主要針對「頭戴式視覺顯示器」在課堂或教學上的使用，例如：Google Cardboard、VR Box 等。

1. 你有沒有曾經在常識科課堂中運用虛擬實境（VR）輔助教學？（包括教學活動、示範等）

   ☐ 有
   ☐ 沒有

2. 除了常識科外，你有沒有曾經在其他科目的課堂中運用 VR 輔助教學？（可多選一個答案）
   ☐ 中文科
   ☐ 英文科
   ☐ 數學科
   ☐ 資訊科技科
   ☐ 體育科
   ☐ 宗教科
   ☐ 普通話
   ☐ 美術科
   ☐ 沒有
   ☐ 其他:_____

對於在常識科上運用 VR 技術輔助教學的看法
此部分旨在了解教師如何看待在常識科課堂上運用 VR 技術的看法。

3. 你認為在哪個常識科學習範疇上能夠運用 VR 輔助教學？（可多選一個答案）

☐ 健康與生活
☐ 人與環境
☐ 日常生活中的科學與科技
☐ 社會與公民
☐ 國民身份認同與中華文化
☐ 了解世界與認識資訊年代
☐ 全部不適合

4. 運用 VR 輔助教學能夠提升學生的基礎能力，包括溝通能力、數學能力、運用資訊科技能力。

☐ 非常不同意
☐ 不同意
☐ 同意
☐ 非常同意

5. 運用 VR 輔助教學能夠提升學生的思考能力，包括明辨性思考能力、創造力、解決問題能力。

☐ 非常不同意
☐ 不同意
☐ 同意
☐ 非常同意

6. 運用 VR 輔助教學能夠提升學生個人及社交能力，包括自我管理能力、自學能力、協作能力。

☐ 非常不同意
☐ 不同意
☐ 同意
☐ 非常同意

7. 運用 VR 輔助教學能夠培養下列的價值觀和態度。

	非常不同意	不同意	同意	非常同意
堅毅				
尊重他人				
責任感				
國民/世界公民身份認同				
承擔精神				
誠信				
關愛				

8. 運用 VR 輔助教學能夠照顧學生的學習差異。

☐ 非常不同意
☐ 不同意
☐ 同意
☐ 非常同意

9. 運用 VR 輔助教學能夠照顧有特殊學習需要的學生。

☐ 非常不同意
☐ 不同意
☐ 同意
☐ 非常同意

10. VR 技術具互聯性，能夠讓學生打破空間限制，獲得全球不同地方的資訊。

☐ 非常不同意
☐ 不同意
☐ 同意
☐ 非常同意

11. VR 技術具有協作性，能夠讓學生在課堂內外進行協作學習。

☐ 非常不同意
☐ 不同意
☐ 同意
☐ 非常同意

12. VR 技術具互動性，能夠讓老師及學生把抽象的概念具體化。

☐ 非常不同意
☐ 不同意
☐ 同意
☐ 非常同意

13. VR 技術具有延展性，能夠讓學生在課堂以外，按自己的能力、進度及興趣學習。

☐ 非常不同意
☐ 不同意
☐ 同意
☐ 非常同意

14. 在常識科課堂上運用 VR 輔作教學能夠配合常識科課程需要。

☐ 非常不同意
☐ 不同意
☐ 同意
☐ 非常同意

在課堂上運用 VR 技術面對的預期困難及挑戰
此部分旨在了解教師對常識科課堂上運用 VR 技術的困難。

15. 老師需要具備較高資訊科技能力才能運用相關技術。

☐ 非常不同意
☐ 不同意
☐ 同意
☐ 非常同意

16. 老師需要更多備課時間準備相關的教學材料。學校添置相關裝置費用高昂。

☐ 非常不同意
☐ 不同意
☐ 同意
☐ 非常同意

17. 學校配套未能配合相關技術，如手機畫面鏡像投影，WIFI 網絡等。

☐ 非常不同意
☐ 不同意
☐ 同意
☐ 非常同意

18. 學校對課程進度的要求不利教師在課堂運用 VR 教學。

☐ 非常不同意
☐ 不同意
☐ 同意
☐ 非常同意

19. 操作時，與 VR 相關的裝置容易產生出錯。

☐ 非常不同意
☐ 不同意
☐ 同意
☐ 非常同意

20. 在常識科課堂上運用 VR 輔助教學充滿困難及挑戰。

☐ 非常不同意
☐ 不同意
☐ 同意
☐ 非常同意

21. 我將來會在常識科課堂上運用 VR 輔作教學。

☐ 非常不同意
☐ 不同意
☐ 同意
☐ 非常同意

22. 我有信心在常識科課堂上運用 VR 輔作教學。

☐ 非常不同意
☐ 不同意
☐ 同意
☐ 非常同意

受訪者背景
此部分旨在了解受訪者基本資料以作分析。

性別是：

☐ 男
☐ 女

教學年資：

☐ 0-5 年
☐ 6-10 年
☐ 11-15 年
☐ 16-20 年
☐ 20 年或以上

問卷完結，謝謝你接受訪問!