THE CHINESE UNIVERSITY OF HONG KONG

Courseware Development Grant Scheme (2018-19)

Final Report

Report due 31 May 2019
Please return by email to CUHK cdgs@cuhk.edu.hk

PART I

Project title: Virtual reality courseware for pediatric nursing
Principal supervisor: Prof. Cho Lee Wong & Ms. Wendy Mei Fung Chan
Co-supervisor(s): Ms Anna Hau Yi Ngan and Ms Irene Chau Ngan Ip
Department / Unit: The Nethersole School of Nursing
Project duration: From October 2018 to May 2019
Date report submitted: 31 May 2019

1. Project objectives

This project aimed to develop an interactive virtual reality courseware that cover an important topic "Pediatric intravenous infusion" in a third-year nursing course, "NURS 3152 Nursing in Clinical Specialties I". The objectives of this project were to (1) maximize students' learning by allowing them to learn in their own pace with the use of the developed courseware; (2) support flipped classroom implementation in the course; and (3) engage students in an active learning environment.

The topic use for developed courseware was "Pediatric intravenous infusion". This topic was chosen because they contained a mixture of knowledge and concepts which were more appropriate to learn by engagement in problem-solving scenarios and interactive activities.

To facilitate students to learn about the topic and guide them on what they should prepare for the lectures, students would be required to view the courseware before class. Course teachers would then make use of the class time to revisit the important concepts in the courseware and clarify students' misunderstanding.

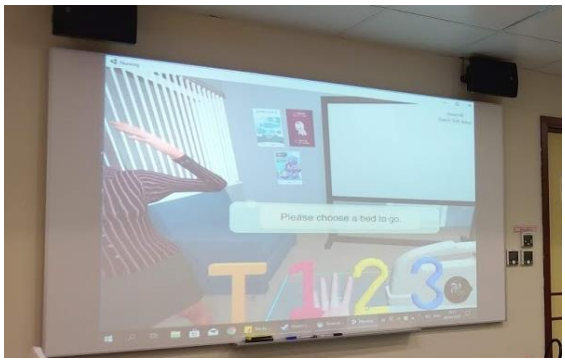
The project has been completed and the project objectives have not been changed.

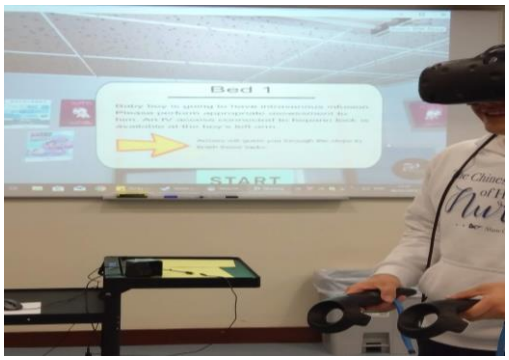
2. Process, outcomes or deliverables

The project has been completed satisfactorily. A courseware consisted of three scenarios that covered the topic "pediatric intravenous infusion" has been produced and used in the course NURS 3152 Nursing in Clinical Specialties I. The courseware and its duration in terms of students contact hours was described as below.

Scenario 1: Pediatric intravenous infusion assessment

Administering intravenous infusion for pediatric patients is a fundamental skill in nursing profession. However, some patients may experience complications either systemic or local at the intravenous site. The aims of this courseware were to enable students to conduct assessment, and identify risk and complications, and implement appropriate interventions for pediatric patients to treat the complications and to ensure a safe and effective therapy. The objective of scenario 1 was to equip students with foundational knowledge in conducting assessment before intravenous infusion.





Scenario 2: Problems solving during intravenous infusion

In Scenario 2, students were required to identify factors that inhibit the intravenous infusion and to consider appropriate intervention for it.

Scenario 3: Manage complications during intravenous infusion

In scenario 3, a pediatric client presented with complications of intravenous infusion was presented. Students were required to identify these factors and to implement appropriate interventions to manage the complications.

Overall, the project completed satisfactorily.

3. Evaluation Plan

The evaluation plan comprised quantitative surveys and qualitative interviews. Quantitative survey was designed and delivered to students after completion of the course. Qualitative data related to the perception of the developed courseware were collected by interviews. Students were deliberately asked to reflect on their general perception and satisfaction toward the developed courseware, and to make suggestions for change.

Data analysis has been conducted and indicated that the objectives of this project have been achieved. A brief summary of the results were shown as below.

Results of student surveys:

The "Satisfaction with VR courseware" is a self-developed questionnaire employed to evaluate the students' perception and satisfaction toward developed courseware. It consists of 10 items and the responses are gathered using 5-point Likert scale ranging from (1) 'strongly disagree' to (5) 'strongly agree'. Students were invited to complete an evaluation of this questionnaire at the end of the class. SPSS version 24.0 (SPSS, Chicago, IL, USA) was used for data analysis.

There were 243 students enrolled in this course. Two hundred twenty-three valid responses (79.1%) were received. The below table showed the satisfaction with courseware as rated by the participants. Overall, they were satisfied with the courseware. A majority of participants (90.6%) agreed that the courseware helped them to gain a better understanding of nursing knowledge and skills on the designated topics, and most of them (80.1%) agreed that the courseware helped them to learn at their own pace. Majority of students agreed that more courseware should be produced in the future (Table 1).

Table 1. Satisfaction with VR courseware

	Strongly disagree (%)	Disagree (%)	Neither agree nor disagree (%)	Agree (%)	Strongly agree (%)
1. The VR courseware enhance my learning interest.	0%	4.5%	1.8%	61.0%	32.7%
2. The VR courseware help me gain a better understanding of nursing knowledge and skills on the designated topic.	0%	1.8%	7.6%	59.2%	31.4%
3. The VR courseware help me learn at my own pace.	0.5%	5.4%	14.0%	50.7%	29.4%
4. Knowledge and skills gained through the VR courseware enhance my confidence in handling related situations in the clinical environment	0.8%	3.6%	11.7%	56.5%	27.4%
5. The VR courseware enhance my critical thinking ability.	0.4%	5.4%	14.8%	52.0%	27.4%
6. The VR courseware enhance my problem-solving ability.	0.5%	3.6%	10.3%	56.5%	29.1%
7. Using VR experience is more engaging and interesting in comparison to traditional lectures.	0.9%	2.2%	5.4%	47.1%	44.4%
8. More VR courseware should be developed and adopted in the future.	0.5%	1.3%	8.5%	49.8%	39.9%
9. The VR experiences enhance the overall quality of the course.	0.8%	1.8%	8.1%	50.7%	38.6%
10. Overall, I am satisfied with using VR courseware in the course.	0.9%	1.3%	7.2%	54.7%	35.9%

Results of teachers' reflections:

A total of four teachers' reflection were collected by means of survey. The 22-item Approaches to Teaching Inventory is a 5-point Likert scale (1=only rarely to 5=almost always) used to explore teachers' approaches to teaching as a measure of teaching quality. Overall, teachers adopted various approaches in teaching this course with mean score of the items ranged from 3.50 to 5.00.

Results of interviews:

A convenience sample of 22 students were recruited on a voluntary basis for the interview. Four focus group interviews were conducted between March to April 2019 after the class completed. Interviews were arranged at times convenient for those who agreed to participate. The interview captured the students' experiences and perception of the using the courseware. Interview questions included "What is the most pleasurable aspect of the courseware?", "How the courseware facilitate your understanding of the concept in each topic?". All the interviews were conducted in Cantonese and tape-recorded. After the interview, the tape was transcribed verbatim by student helpers.

Findings revealed that a majority of students responded positively to using VR to teach IV skills. Most of them described that VR promoted their engagement and increased their interest in learning in the laboratory sessions. Compared to simulation, they found that VR provided them with a more interactive learning environment. In addition, it allowed them to make mistakes and learn from error. Students appreciated that the VR scenarios were "real" and "similar to what they encountered during clinical practicum". Therefore, when they were immersed in the scenarios, they felt the need and urgency to help the client manage the complications immediately. The scenarios also helped them to think critically about the interventions needed to implement in the future when they encounter similar situations in a real environment.

For improvements, few students suggested to have less instructions but to allow them to freely explore the environment and manage the situations in the VR scenarios with lesser hints. Others suggested that courseware related to managing emergency situations and complex wounds should be developed in the future.

4. Dissemination, diffusion and impact

The courseware produced in this project have been used in a Year 3 Term 2 course titled NURS 3152 Nursing in Clinical Specialties I. Besides, the courseware can be used in other post-graduate nursing courses. For instance, the developed courseware in this project can be used in a Year 1 course titled NURS 6203 Fundamentals of Nursing III in the coming academic year.

The results of the current project will provide important information and help motivate teachers to produce courseware to facilitate teaching in other nursing courses. Students can make use of the courseware to practice or views the contents of the courseware at the own

time and their own pace. Therefore, it enables students to familiarize themselves with the use of eLearning in their studies.

We will continue to share our experiences in flipped classroom implementation and courseware development in local, regional, and international conferences. Poster and oral presentations will be submitted to the CUHK "Teaching and Learning Innovation Expo".

PART II

Financial data

Funds available:

Funds awarded from MMCDG $ $95,294

Funds secured from other sources $ 0

(please specify_____)

Total: $ $95,294

Expenditure:

Item	Budget as per application	Expenditure	Balance
Courseware development service			
VR application development (support HTC VIVE)	$76,250	$76,250	0
HTC VIVE for demo	$13,876	$13,876	0
Others	$		
Student helpers to collect quantitative data and transcribing qualitative data	$ 5,168	$ 5,082	$ 86
Total:	$ 95,294	$ 95,208	$ 86

PART III

Lessons learnt from the project

This project aimed to develop an interactive virtual reality courseware that covers an important topic in the third-year nursing courses, "Pediatric intravenous infusion". A VR courseware consisting of three scenarios was developed and the project was successfully completed.

The success of this project lies on the effort of our dedicated course teachers. We have spent long time to draft the content and scripts for the storyline and VR scenarios. Besides, we have good planning prior to the project commenced. For instances, several teaching team meetings were held before the course commenced to determine the format and presentation of

the courseware. Another purpose of these meetings was to discuss how the courseware could be implemented. On the other hand, the students were informed that they would attend innovative and interactive laboratory session in addition of the traditional didactic face-to-face demonstration during course introduction. The expected learning activities were also outlined.

However, we have encountered some difficulties in producing the courseware. We underestimated the time required to produce the scenarios as we took months to draft and design the VR storyline. Nevertheless, the courseware has been successfully developed and used in a Term 2 course of this academic year for Year 3 students.

Informal feedback from the students indicated that they found the scenarios interesting and could enhance their understanding on administrating intravenous infusion for pediatric patients. During the process, we found that students were familiar with the VR software and were fast learner. Even some of them said it was their first time to experience the HTC Vive system, they could use it with only minimal instructions. In the qualitative interviews, few students suggested to have less instructions but to allow them to freely explore the environment and manage the situations in the VR scenarios with lesser hints. Based on this experience, we will provide fewer instructions in the scenario when developing other VR courseware later. Others suggested that more courseware related to managing emergency situation and complex wounds should be developed.

With the experiences gained from this project, we will continue to produce courseware in other nursing courses and will consider applying for funding to develop more VR courseware in the future.

PART IV

Information for public access

1. Keywords

(Most relevant)	Keyword 1: Courseware
	Keyword 2: virtual reality
	Keyword 3: pediatrics
	Keyword 4: intravenous infusion
(Least relevant)	Keyword 5: nursing

2. Summary

Table 1: Publicly accessible online resources (if any)
(a) **Project website:** NA
(b) **Webpage(s):** NA

(c) **Tools / Services:**

Tools: Unity gaming engine is implemented to construct high-quality 3D VR environment with following features:

- Unity version 2018.2.4f1 supporting Oculus family of VR devices and Oculus Rift Development Kit 2 (DK2)
- Powerful on handling object physics and animations.
- Compatible to the HTC Vive VR configurations and plugin
- Realistic simulation with its gaming logic scripting capability matching the specific purpose of training nursing skills

Services: Edvant Company Limited

(d) **Pedagogical Uses:**

If any flipped classroom activities have been conducted, please provide information in here. If relevant, please indicate how your project output can be used to support flipped classroom activities.

The courseware aim at facilitating students to gain preliminary concepts in the topics before class and support flipped classroom. The students were required to use the courseware to obtain a brief overview of the fundamental concepts that would be covered in the lecture. During the practical sessions, the students were then divided into smaller groups to work collaboratively in discussing the content of the courseware. Following the practice, the teachers provided feedback to their students. Finally, the teachers presented a short yet in-depth summary of the discussed topic. With the use of courseware to support flipped classroom implementation, course teachers can then make use of the class-time to further elaborate the contents and engage students to do in-class activities such as discussion and presentation thereby consolidating their knowledge.

(e) **Others (please specify):**

The virtual reality (VR) software “Pediatrics Intravenous Infusion” is developed.

Table 2: Resources accessible to a target group of students (if any)			
If resources (e.g. software) have been developed for a target group of students (e.g. in a course, in a department) to gain access through specific platforms (e.g. Blackboard, facebook), please specify.			
Course Code/ Target Students	**Term & Year of offering**	**Approximate No. of students**	**Platform**
NURS 3152/ Undergraduate nursing students	Year 3 Term 2 (2018-2019)	250	Laboratory session

Table 3: Presentation (if any)	
Please classify each of the (oral/poster) presentations into one and only one of the following categories	**Number**
(a) In workshop/retreat within your unit (e.g. department, faculty)	NA
(b) In workshop/retreat organized for CUHK teachers (e.g. CLEAR workshop, workshop organized by other CUHK units)	NA
(c) In CUHK ExPo jointly organized by CLEAR and ITSC	Will submit an abstract to CUHK ExPo
(d) In any other event held in HK (e.g. UGC symposium, talks delivered to units of other institutions)	NA
(e) In international conference	Will submit an abstract
(f) Others (please specify)	NA

Table 4: Publication (if any)	
Please classify each piece of publication into one and only one of the following categories	**Number**
(a) Project CD/DVD	NA
(b) Project leaflet	NA
(c) Project booklet	NA
A section/chapter in a booklet/ book distributed to a limited group of audience	NA
(e) Conference proceeding	NA
(f) A chapter in a book accessible internationally	NA
(g) A paper in a referred journal	NA
(h) Others (please specify)	NA

3. A one-page brief write up

With support from the Courseware Development Grant, an interactive virtual reality courseware that cover an important topic "Pediatric intravenous infusion" in a third-year nursing course, "NURS 3152 Nursing in Clinical Specialties I". The objectives of this project are (1) maximize students' learning by allowing them to learn in their own pace with the use of the developed courseware; (2) support flipped classroom implementation in the course; and (3) engage students in an active learning environment.

The topic use for developed courseware is "Pediatric intravenous infusion". This topic is chosen because they contained a mixture of knowledge and concepts which are more appropriate to learn by engagement in problem-solving scenarios and interactive activities. On the other hand, the "presence" offered in the VR courseware provided students with the opportunity to be an active participant in the simulated hospital environment. These experiences were difficult to be presented and described in the lectures.

To facilitate students to learn about the topic, students will be required to use the courseware in the practical session. With the developed courseware, the course teachers could make use of the class time to revisit the important concepts described in the micro-modules and clarify any misunderstandings that arouse. At the same time, students were expected to participate in various in-class activities, such as discussions, to consolidate what they learned in the courseware. All these helped the students to apply their knowledge and practice their critical thinking skills.

To date, the project has been evaluated by student surveys and qualitative interviews. The surveys indicated that 90.6% of the students agreed that the courseware helped them to gain a better understanding of nursing knowledge and skills on the designated topics. Most of them (80.1%) agreed that the courseware helped them to learn at their own pace. Majority of students agreed that more courseware should be produced in the future. The qualitative interviews indicated that majority of students liked the developed courseware because the VR scenarios make learning more engaging and interesting. Most importantly, these courseware helped them enhance their understanding the skills in administrating pediatric intravenous infusion.

The evaluation indicated that the project has achieved its objectives effectively and completely.