

Quality Enhancement Support Scheme

Final Evaluation Report
Project No. : 05/QESS/2015

Part A

Project Title : The development of an education and research center with automatic virtual reality platform for 3D interactive learning and big data analytics

Name of Grantee : Hang Seng Management College

Project Period : From December 2015 (month/year) to December 2017 (month/year)

Part B

Please use separate A4-size sheets to provide an evaluation of the Project with regard to the following aspects:

1. Project activities contributing to the attainment of Project objectives, extent of attainment of the objectives, evidence or indicators attesting to the attainment of the objectives, and if applicable, reasons for not able to achieve the objectives.
2. Impact or benefits of the Project to the participants, the target institution(s) or the sector.
3. Cost-effectiveness of the Project against clear indicators, e.g. utilization of available resources, unit cost per beneficiaries, sustainability of Project activities/impacts, applicability of Project outcomes/deliverables to other institutions, or alternative approaches for equivalent benefits at less cost, etc.
4. Outcomes and deliverables of the Project.

Signature of
Authorised Person : _____



Name and Position of
Authorised Person : Prof. Simon S.M. Ho, President

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1. Attainment of Objectives

Objective statement	Activities related to the objective	Extent of attainment of the objective	Evidence or indicators of having achieved the objective
<p>Objective 1: To enhance students learning experience in sophisticated supply chain operations with the use of interactive 3D visualization platform.</p>	<p>Teaching modules on supply chain modules</p> <ul style="list-style-type: none"> ▪ <i>Shipping and Transport Logistics</i> module has been adopted with VR to enhance students learning experience starting in September 2016. ▪ An integrated exercise with the use of VR platform was carried out in the teaching module, <i>Operations and Supply Chain Management</i>, starting on November 2016. ▪ Module of <i>Information Technology in Supply Chain</i> has been started to use VR in teaching and learning on November 2016. ▪ Other modules, including <i>Training and Development, Virtual Reality for Society, Romanticism, and Financial Management</i>, have enhanced with the use of VR platform in some of the lectures. <p>A user experience survey has been carried out along the project period for visitors and students who have experienced VR facilities and used the facilities in assisting learning.</p>	<p>Fully achieved</p>	<p>About 560 HSMC students have adopted and experienced VR in classes to learn supply chain-related operations (as of March 2018). For example:</p> <ol style="list-style-type: none"> (1) A total of 27 BBA-SCM students in studying the module of Shipping and Transport Logistics have experienced the use of VR in understanding operations and concepts of container terminal and air cargo terminal on September 2016. (2) A total of 71 BBA students have experienced the VR facilities and content in the module of Operations and Supply Chain Management on November 2016. (3) A total of 35 BBA-SCM students in Information Technology in Supply Chain has used VR facilities in learning on November 2016. <p>A total of 2,297 visitors have experienced the VR facilities and developed content in HSMC (as of November 2018). 210 of these participants have filled survey. Among 210 participants, about 140 students, who have experienced the developed CAVE platform, have filled in the survey. Five of questions about learning experiences are as follows:</p> <ul style="list-style-type: none"> ▪ I find the use of virtual reality in learning stimulating and interesting. (6.0 / 7.0) ▪ I find using virtual reality will increase my interest in business operations in companies. (5.8 / 7) ▪ I find using virtual reality assist me to understand and learning complex business operations in logistics, finance, information technology or other disciplines. (5.8 / 7) ▪ I find the immersive environment of CAVE can arose my interest in learning. (5.7 / 7) ▪ I find the interaction between human and virtual environment in CAVE

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<p>Objective 2: To improve the quality of teaching facilities, methodology, and practices on complex supply chain operations.</p>	<p>Establishment of Virtual Reality and Big Data Analytics Centre – the VR facilities for teaching has been launched on 6 October 2016.</p> <p>Teaching modules on supply chain operations have been applied VR technologies in enhancing students to learn complex operations. Interactive VR scenes on Air cargo terminals, Container Terminals, and Cargo loading in an aircraft are launched.</p>	<p>Fully achieved</p>	<p>can stimulate my learning. (5.8 / 7).</p> <p>Over 150 guests and students have participated the opening ceremony of the Virtual Reality and Big Data Analytics Centre.</p> <p>3 supply chain modules have enhanced the teaching with the use of VR facilities. 4 other modules on general education, management, English literature and financial management later have been enhanced teaching facilities with VR as well.</p>
<p>Objective 3: To facilitate closer alignment between academic institutions and industry sectors as well as among academic institutions.</p>	<p>Industry practices exchange and meetings with CPSL and CX about air cargo process and content scenario along 2016 and 2017.</p> <p>Opening ceremony cum Virtual Reality Forum on 6 October 2016 has facilitated closer alignment between academics and industry on VR development.</p> <p>Talks and seminars have been organized with industry practitioners being invited to HSMC to share about the latest VR development.</p> <p>Visitors from industry, associations, secondary schools, academic institutions, overseas universities and government officials have visited the VR facilities in the centre.</p> <p>PI of the project has been invited to deliver a talk on ‘How VR and AR Can Bring Innovation and Better Productivity to Enterprise?’ in the 2017 HCMS Annual Seminar on October 2017.</p>	<p>Fully achieved</p>	<ul style="list-style-type: none"> ▪ Total number of visitors: 2,297 (as of November 2018). ▪ Total no. of secondary schools, academic institutions and overseas universities visited the CAVE facilities and VR content: over 70. ▪ Total number of secondary schools visited the VR facilities: Over 60. ▪ Total number of companies and associations visited the centre: Over 60. ▪ Total number of participants in the opening ceremony cum Virtual Reality Forum: Over 150 guests and students. The event has been published in 3 newspapers. ▪ 2 seminars have been organized in October 2017 and March 2018, with industry practitioners as speaker. ▪ Visits to School of Creative Media on VR facilities have been organized on September 2017 and February 2018. A total of 80 students have participated the event. ▪ Over 100 participants attended the seminar of 2017 HCMS Annual Seminar.
<p>Objective 4: To promote interactive 3D learning and teaching platform with the use of the CAVE system.</p>	<p>Interactive and immersive VR scenes have been developed for teaching modules in various disciplines, including supply chain, general education,</p>	<p>Fully achieved</p>	<p>7 modules have been enhanced with VR facilities in teaching.</p> <p>A website about the project and centre has been established:</p>

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	management, English literature, quality management and finance.		<p>https://vrbd.hsmc.edu.hk/</p> <p>500 copies of brochures about the VR centre and facilities have been produced.</p> <p>A set of posters about the VR teaching and learning platform has been developed.</p> <p>A booklet about the teaching and learning excellence with virtual reality technologies has been produced.</p>
Objective 5: To provide a platform for research on 3D interactive virtual reality on supply chain, finance, big data, and healthcare.	Research conference presentations and papers	Fully achieved	<p>Two conference papers and presentations have been carried out.</p> <ul style="list-style-type: none"> ▪ Wong, E.Y.C., Kong, K.H., Hui, R.T.Y. (2017) The influence of learners' openness to IT experience on the attitude and perceived learning effectiveness with virtual reality technologies, IEEE International Conference on Teaching, Assessment, and Learning for Engineering (TALE), 12-14 December 2017. ▪ Wong, E.Y.C., Mo, D.Y.W., Ng, T.Y., Chan, K.Y., Chan, K.Y., Lau, H.Y.K. (2017). Development of Immersive Virtual Reality System for Planning of Cargo Loading Operations. ICVAR 2017: 19th International Conference on Virtual and Augmented Reality. 8-9 January 2017, Singapore. A Best Presentation award has been received. <p>The VR Centre has participated a research workshop, "Augmented Reality Public Art Initiative – How to use Layar to show AR objects on phones" on November 2017.</p> <p>Further research on VR development and learning effectiveness have been carried out.</p>

2. Project Impact

The project enhanced students learning effectiveness, professional development, and institute teaching facilities. It increases the awareness of academics and students on the use of advanced virtual reality technologies in teaching and learning. Over 2,290 visitors from industry, government bodies, secondary schools, self-financed education institutions, local and overseas universities, associations, and HSMC

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academics and students have visited the VR centre and facilities during the project period. The project implementation on establishing a VR facility in teaching and learning has become a reference model and practice for other universities and self-finance institutions.

- Broadening horizons of students and instructors as well as increasing their sense of achievement in teaching and learning
 - Supply chain modules have been introduced with the use of virtual reality technologies to enhance the teaching and learning experience, including Shipping and Transport Logistics, Operations and Supply Chain Management, and Information Technology in Supply Chain. Interactive and immersive VR scenes on air cargo terminal, container terminal and cargo loading on aircraft was used.
 - Other modules on general education, management, English literature and financial management have also been enhanced with the use of VR in teaching and learning, broadening horizons and increasing effectiveness in teaching and learning.
 - Over 560 students attended the above-mentioned modules in the academic year of 2016/17 and 2017/18.
- Training students to better meet social demands
 - A General Education course module, Virtual Reality for Society, has been established and launched with the use of virtual reality facilities since the semester 1 of 2017/18 academic year. Three classes with 98 students have attended the course in the two semesters of 2017/18.
- Fostering students' development in their potential and specific abilities
 - With students applying VR facilities in learning supply chain, general education, English literature and finance, their abilities, skills and knowledge in respective areas have been enhanced. For example, students could understand more on the operations process of air cargo terminals and students studying the module Virtual Reality for Society could practice developing virtual reality platform for arts and culture heritage.
- Increasing training opportunities for instructors and enhancing their professional development
 - The VR facilities and applications have been extended from 2 modules to 7 modules within two academic years. This allows more opportunities for instructors to adopt VR technologies in teaching.
- Improving learning atmosphere
 - Students enjoyed the learning experience through Virtual Reality platform. Students not only make use of VR to facilitate learning but also join as a team in developing project work on VR.
 - A survey has been drafted and distributed to the students who have experienced the VR in learning. In the 140 students who filled in the survey, five questions are on the learning experience and scores are positive in related to the learning experience, for example:
 - Use of virtual reality in learning stimulating and interesting. (6.0 / 7.0);
 - Using virtual reality in increase one's interest in business operations in companies. (5.8 / 7);
 - Using virtual reality in assisting students to understand and learning complex business operations in logistics, finance, information technology or other disciplines. (5.8 / 7);
 - Immersive environment of CAVE can arose students' interest in learning. (5.7 / 7); and
 - Interaction between human and virtual environment in CAVE in stimulating one's learning. (5.8 / 7).
- Fostering team spirit and enhancing the overall image of the institution
 - An opening ceremony of VRBD Centre cum Virtual Reality Forum has been organized on 6

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October 2016. Over 150 guests and students have participated. The event was published in three newspapers (Wen Wei Po, Sing Tao Daily and Tai Kung Po).

- A website illustrating the project update and centre has been launched: vrbd.hsmc.eud.hk.
 - A total of 2,297 visitors (as of November 2018) have visited the established VR facilities in the campus, including representatives from industry, government bodies, secondary schools, self-financed education institutions, local and overseas universities, and associations.
 - The Principal Investigator of the project has been invited in a talk on ‘How VR and AR Can Bring Innovation and Better Productivity to Enterprise?’ in the 2017 HCMS Annual Seminar on October 2017.
 - The VR facilities has been demonstrated for the accreditation on several programmes in HSMC, illustrating the application of VR technologies in teaching and learning.
- Inducing collaboration with other institutions or professional organizations.
 - The VR centre has participated and collaborated with Hong Kong Management Association (HKMA) on a seminar. The Principal Investigator of the project has delivered in a talk on ‘How VR and AR Can Bring Innovation and Better Productivity to Enterprise?’ in the 2017 HCMS Annual Seminar of HKMA on October 2017.
 - A site visit has been organized with Institute of Industrial Systems Engineers (IISE). President, Executive Committees and Members of IISE(HK) have visited Virtual Reality Centre on 24 June, 2017. Views and ideas have been shared during the visit and discussion. Members are interested in the use of virtual reality in product design and training.
 - Representatives of other professional organisations, e.g. Chartered Institute of Logistics and Transport in Hong Kong (CILTHK), Hong Kong Logistics Associations (HKLA), Hong Kong Institute of Engineers (HKIE) Logistics and Transport Division, Hong Kong Young Industrialist Council (HKYIC), Hong Kong Professional and Senior Executives Association, Federation of Insurers, Liaison Office of the Central People’s Government in the HKSAR, United Nations (UN), Transport and Housing Bureau (THB), Hong Kong Institute of Human Resource Management (HKIHRM), Hong Kong Society of Financial Analysts (HKSFA), The Institute of Purchasing & Supply of Hong Kong (IPSHK), etc., have also visited the centre.

3. Cost-effectiveness

Table 2: Financial Status

Budget items <i>(Based on Schedule I of Project Agreement)</i>	Approved budget	Actual expense	Balance
Manpower	\$746,000	\$605,583.91	\$140,416.09
Equipment	\$0	\$0	\$0
Services	\$0	\$0	\$0
General Expenses	\$1,238,600	\$1,237,917.75	\$682.25
Others	\$15,400	\$8,000	\$7,400.00
Total	\$2,000,000	\$1,851,501.66	\$148,498.34

- Utilisation of available resources
The academic staff and supporting offices, including Human Resource Office, Campus Development and Management Office, and Information Technology Services Centre have been involved in supporting the development of the virtual reality facilities, recruiting project staff and

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providing help in computers and network support.

- **Unit cost for the direct beneficiaries**
The total number of participants experiencing developed VR facilities as well as teaching and learning through the developed VR platform and content from the launch of system to the reporting period is 2,297. The unit cost for the direct beneficiaries is estimated to be HK\$806.
- **Sustainability of the learning programme and materials developed**
Presentation materials, exercise sheet and booklet on the learning modules have been developed to facilitate sustainable teaching in the coming years. The institution has also supported the sustainability of the virtual reality centre and learning platform with a technician staff to assist future teaching and learning in the institution.
- **Expenditure items which require no injection of resources when the project is replicated by other institutions**
The developed interactive and immersive virtual reality contents for teaching and learning could be shared with other institutions which have similar facilities. Future joint institution virtual reality development for teaching and learning could be explored and achieved as well.

4. Deliverables and Modes of Dissemination

The deliverables include virtual reality facilities, teaching content, forum, seminars, invited talk, lectures, website, brochure, booklets, and conference paper publications. These deliverables are disseminated in various channels, including academic lectures, guest visits, forum, seminars, talk, website, brochure, booklet, international conference, and demonstration for industry and associations.

- *Virtual Reality facilities – Cave Automatic Virtual Environment (CAVE)* – a VR CAVE system has been established and developed.
- *Interactive and Immersive Virtual Reality Teaching Content* – VR teaching scenes and content on air cargo terminal, container terminal, material handling systems, and air cargo loading have been made and developed. Further content on arts appreciation, Cultural preservation, and financial management have been developed for teaching and learning.
- *Forum* – A Virtual Reality Forum has been organized on 6 October 2016. Over 150 guests and students have participated the event.
- *Seminars* – Two seminars about latest trends and applications on virtual reality have been organized in 3 October 2017 and 15 March 2018, with prestigious industrial practitioner invited to the seminars. Industry practitioners have also been invited as speaker, 80 students have attended the two seminars. These forums and seminars are organized in the campus in disseminating the project deliverable.
- *Invited Talk* – The project deliverable has been shared in publicly in an invited talk organized by Hong Kong Management Association (HKMA) on ‘How VR and AR Can Bring Innovation and Better Productivity to Enterprise?’ in the 2017 HCMS Annual Seminar on October 2017.
- *Lectures* – Lectures of 4 course modules in supply chain and information management disciplines have applied the developed VR technology and platform in enhancing teaching and learning. Besides supply chain and information management, other disciplines, for example, general

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education, English literature, management and finance, have started benefit from the developed VR platform. Students and instructors can experience and apply the established virtual reality facilities and virtual reality contents through the academic lectures.

- *Website, brochures and booklets* – A website has been developed to share the project content and deliverable (vrbd.hsmc.edu.hk). A booklet about teaching modules that have been applied virtual reality technologies has been produced. Brochure about the virtual reality facilities in the centre has been produced to disseminate the project deliverable.
- *Publications* – The project deliverables have been presented and published in two international conferences held in Singapore and Hong Kong. Two conference papers have been presented and published:
 - Wong, E.Y.C., Kong, K.H., Hui, R.T.Y. (2017) The influence of learners' openness to IT experience on the attitude and perceived learning effectiveness with virtual reality technologies, IEEE International Conference on Teaching, Assessment, and Learning for Engineering (TALE), 12-14 December 2017.
 - Wong, E.Y.C., Mo, D.Y.W., Ng, T.Y., Chan, K.Y., Chan, K.Y., Lau, H.Y.K. (2017). Development of Immersive Virtual Reality System for Planning of Cargo Loading Operations. ICVAR 2017: 19th International Conference on Virtual and Augmented Reality. 8-9 January 2017, Singapore. A Best Presentation award has been received.Four newspapers articles have also been published.
- *Visits* – guests can visit the virtual reality centre and experience the latest development of virtual reality and augmented reality. Over 2,000 local and overseas visitors have experienced the virtual reality facilities in the campus.
- *Demonstrations for industry and associations* – Demonstrations have been carried out to representatives from various industry associations, including Chartered Institute of Logistics and Transport in Hong Kong (CILTHK), Hong Kong Logistics Associations (HKLA), Hong Kong Institute of Engineers (HKIE) Logistics and Transport Division, Hong Kong Young Industrialist Council (HKYIC), Hong Kong Professional and Senior Executives Association, Federation of Insurers, Hong Kong Institute of Human Resource Management (HKIHRM), Hong Kong Society of Financial Analysts (HKSFA), The Institute of Purchasing & Supply of Hong Kong (IPSHK), and Hong Kong Management Association (HKMA).

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5. Activity List

Table 3: Activity List

Types of activities (e.g. seminar, performance, etc.)	Brief description (e.g. date, theme, venue, etc.)	No. of participants				Feedback from participants
		Institutions	Teachers	Students	Others (Please specify)	
Visit	Over 230 Visits with 2,297 visitors experienced VR facilities and content in the centre from Oct 2016 to Nov 2018.	> 130 institutions	>50 teachers	> 1,200 students	> 200 Overseas academics, government officials and associations.	Positive responses are received from the visitors. There are universities and institutions interested to adopt the project model.
Virtual Reality Forum	6 October 2016 in HSMC. About 150 guests and students attended.	10	10	90	External guests, including industry practitioners, scholars, association representative.	Industry practitioners and guests appreciate HSMC in developing advanced VR technology in teaching and research.
Seminars organized in HSMC	Seminar on Latest development of Mixed Reality and Business Application on Virtual Reality Date: 15 March 2018 Venue: A314, HSMC. Seminar on "How will virtual reality change our lives?" Date: 3 October 2017 Venue: A211, HSMC	-	5	80	-	Students appreciate the sharing from the industry speakers and the VR facilities and demonstration through the seminar.
External Seminar	2017 HCMS Annual Seminar of HKMA on 21 October 2017	30	5	-	About 100 participants from industry.	Industry practitioners appreciate the VR development in training carried out in HSMC.
Research Interest Sharing Session	An inter-disciplinary research interest sharing session is held on 1 June 2017 in N501. Project deliverable is shared in the session	-	40	-	40 academics in HSMC participated in the event.	Academics and scholars appreciate the work carried out in the VR project, facilitating both teaching and research in the institution.

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International Conference in Singapore	ICVAR 2017: 19th International Conference on Virtual and Augmented Reality on 8-9 January 2017	30	100	10	Scholars from worldwide.	A best presentation award has been received in the conference.
International Conference in Hong Kong	IEEE International Conference on Teaching, Assessment, and Learning for Engineering (TALE) on 14 December 2017 in Hong Kong	30	100	10	Academics and scholars from other universities.	Various comments about interactive learning platforms are discussed.
Academic lectures	Various subjects on supply chain, information technology, general education, English Literature, finance and management start using the VR facilities in teaching and learning.	-	10	>560	-	Students appreciate the VR facilities and content developed in the campus. They expect further support and resources could be added to the institution, e.g. head-mounted display, VR computers, etc.

6. Difficulties Encountered and Solutions Adopted

Throughout the project, there are various difficulties encountered, for example space in campus, facilities construction, scenes and configurations of aircraft for content development, staff recruitment, etc. There are limited spaces in the campus, locations of the virtual reality facilities and centre have been changed several times. With the joint effort and support from management, the locations and facilities construction could be carried out smoothly. Scenes and configuration on main deck of aircraft would be difficult to obtain. With support from cargo terminal and airline, permits have been arranged for obtaining scenes and information so that the VR scenes could be developed smoothly. Expertise on multimedia design and programming is not sufficient in the job market, this makes recruitment difficult. After some referrals, more candidates are explored, and finally selected candidates are recruited.