THE CHINESE UNIVERSITY OF HONG KONG

Micro-Module Courseware Development Grant

Scheme 3: e-learning Pedagogy Research

<u>Final Report (2016-17)</u>

Please return by email to The Ad hoc Committee on Planning of e-learning Infrastructure <u>mmcd@cuhk.edu.hk</u>

<u>PART I</u>

Project title: Medical Teachers: e-learning readiness and utilization of e-learning & impact and effectiveness of e-learning on medical students

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Department / Unit: The JC School of Public Health and Primary Care

Project duration: From May 2017 to August 2018

Date report submitted: 31 October 2018

1. Project objectives

Is the project on track to meet its objectives?

Have the objectives been changed as a result of the experience of working on your MMCDG project?

Has the project created any impact as expected?

The University aims to increase e-learning as one of its strategic aims, among which the current call is for pedagogical research projects to tackle barriers and difficulties in e-learning development. This study aims to investigate both teachers' e-learning readiness and students' use of e-learning and the impact on learning behaviour. There were two parts to this study:

Part 1 Objectives: Teachers Study
- Modify a valid and reliable e-learning instrument for assessing e-learning readiness for teachers
- Evaluate the e-learning readiness of the CUHK medical faculty teachers and associated individual, departmental, faculty and university organizational factors

Part 2 Objectives: Students Study
- Identify issues relating to e-learning learning behaviour, internet use and e-learning modalities
- Quantify general internet use and educational e-learning use and usage patterns
- Evaluate student e-learning readiness, harmful internet use, use of educational e-learning and its associations.

During the implementation of the project, project extension was applied due to modifications to the surveys and the subsequent waiting time for ethical approval. Teachers' and students had also required more time to complete the survey and diary. Meanwhile, the

objectives remain unchanged.

We modified a valid e-learning survey to explore teachers' and students' readiness for e-learning based on literature. We designed a daily diary based on literature to explore the internet usage patterns amongst medical students. We also conducted three focus groups with 18 medical students to explore their opinions and views towards internet use and e-learning; for example, barriers and facilitators to the use of e-learning.

2. Process, outcomes or deliverables

Please specify the number of micromodules produced, and the course(s) (with course codes and titles) that have used the micromodules in Part IV and provide more detailed descriptions in here. Must specify the duration of each micro-modules (in terms of students' online contact hours), the total duration time of all deliverables and style. (With reference to the "Summary of video presentation styles" developed by CLEAR)
Have the research design, methodology and timeline been changed/adjusted?
Overall, was the project completed satisfactorily?

The project was completed and satisfactory, but there was a need to change the project timeline.

In the original proposal, students' online learning activity was to be tracked via the Blackboard platform alongside with a daily diary for the observational study (Part B). However, due to administrative constraints and confidentiality issue, access to the Blackboard data was not granted.

The survey was rescheduled to March 2018 instead of the original schedule of September and October 2017; this was due to the ethical approval needed for the revisions to the questionnaire, the focus group consent form and the semi-structured interview guide. The launch of the questionnaire was from March to May. Both teachers and students had two months to complete the questionnaire, and three reminders were sent out on March 19th, May 8th and May 28th respectively, to encourage for as many responses as possible. The three focus groups were conducted in June and July. This timeframe was more favourable for medical students to participate as the clinical year had just started and medical students tend to have less workload and did not feel as stressed. Thus, the timeline was updated so that the cleaning of data was in June and July and analysis was done in July and August.

Part 1: Teachers Study

An online survey evaluating e-learning readiness was sent to 405 full-time teachers at the medical faculty that represented teachers from all levels, clinical and preclinical tutors, course coordinators, and the rank of professors. Honorary, community and part-time staff were excluded from our study. MyCuform was used for the format of the online survey. An invitation email with a hyperlink was sent to teachers between Mid-March and May 2018. A 2-month period was used so that all teachers had an opportunity to reply. Three email reminders were sent on March 19th, May 8th and May 28th to prompt the completion of the survey.

The e-learning readiness instrument used in our study was based on literature related to exploring the e-learning readiness (Aldhafeeri and Khan, 2016). It had been validated with Cronbach's alpha at 0.88. Modification of the survey was made by the investigator team so that for use in higher education. The instrument was selected based on its validity and reliability and looking into the 8 domains of the e-learning framework including: institutional, ethical, resource, support, pedagogical, management, interface design and technological domains

(Khan 2012). Finally, the teacher survey consists of a total 40 items, with 25 items related to readiness rated on a 5-point Likert scale from strongly disagree to strongly agree with an option for non-applicable and other questions related to the use of e-learning and teaching information (*See Appendix I. for teacher survey*).

Data collection and cleaning was conducted in June and July 2018. Teacher readiness scores were analyzed according to domains. Teacher's information and e-learning usage include OME support and workshop engagement, CLEAR support and workshop engagement, library engagement was reported by descriptive statistics. For each readiness item, responses which contain agree and strongly agree was described in frequency and percentages. One sample t-test was also used to estimate statistical differences.

Part 2: Students Study
The study consists of three parts.

Part A: Online survey
Part B: Observational study
Part C: Focus group study

Part A: Online survey
The e-learning readiness instrument used in our study was also based on the same literature i (Aldhafeeri and Khan, 2016). It had been validated for use with Cronbach's alpha at 0.82. Modification of the survey was also made by principal investigator so that it can be used in university. The instrument was also selected based on its validity and reliability and the inclusion of the 8 domains of the e-learning framework (Khan 2012).

In addition to student readiness for e-learning, there is also competing dynamics with unhealthy internet use and internet addiction, so the Internet Addiction Test (IAT) was also included in the survey. It was developed by Young et al. (Young, 1998). It consists of 20 items with a 5-point Likert rating scale related to the degree of internet use affects daily life, social life, feelings and sleeping patterns (Widyanto & McMurran, 2004). The minimum score is 20, and the maximum score is 100 (Widyanto & McMurran, 2004). The higher the score represents the higher level of internet addiction. According to Young et al., (Young, 1998), respondents who score ≥70 are classified as addictive users that internet use is causing problems for them. Respondents who score 40-69 are classified as a problematic user which causes some life problems due to use of the internet. Respondents who scored 20-39 are classified as average users, and they can control the use of the internet (Young, 1998). IAT had a good validity and reliability result (Widyanto & McMurran, 2004) and had been used in many research related to the investigation of internet addiction in medical students (Zhang, Lim, Lee, & Ho, 2018).

Finally, the student survey consists of a total 55 items, with 17 items related to readiness rated on a 5-point Likert scale from strongly disagree to strongly agree. Meanwhile, other information included demographics and internet use, e.g. on social media as well education sites and library resources over the past one month regarding minutes and frequency days per week were also included in the survey (*See Appendix II. for student survey*).

An invitation email was sent to students in medical faculty between Mid-March and May 2018. A two months period was used so that all students had an opportunity to reply. Three email reminders were sent on March 19th, May 8th and May 28th to prompt the completion of the survey.

Data collection and cleaning was conducted in June and July 2018. The readiness items were also categorized by domain and reported in frequency and percentages. Sub-analysis of student readiness scores was analyzed according to gender, year of study, items related to the use of internet include average hours spent on social media, online education, online leisure, reading and general surfing. Demographic characteristics, programme of study, year of study, the system of admission (i.e. JUPAS, non-JUPAS), items related to the use of the internet were also reported by descriptive statistics. For each readiness item, responses which contain agree and strongly agree was described in frequency and percentages. One sample t-test was used to estimate the statistical differences of the mean score. Chi-square test for categorical variables used to show statistical differences between student e-learning readiness and internet addiction score. Demographics characteristics and items related to the use of the internet were also investigated with the association of internet addiction score by Chi-square test.

Part B: Observational study

An observation study with a daily diary was used to explore the pattern of students' internet and educational use. The diary consists of activities required to be tracked on a 24-hour basis for seven days. Students were to draw a line through a grid to record the durations they spent on each activity. Each cell of the grid that the line is drawn over represented 15 min. The design of the diary was based on a study of internet usage and patterns in Japan (Kenichi Ishii, 2014). We had modified the diary on some of the internet-based activities to be more applicable for students. The diaries were distributed in hard copies to medical students after an interactive workshop on June 2018.

The students were asked to record the time spent on:
(1) sleeping;
(2) at each location (home / work/ school etc.);
(3) activities with the use of the internet (which include using direct social interaction, social media, online browsing, leisure activities such as listening to music, gaming, watching entertainment videos, online education such as using blackboard, reading journal articles);
(4) activities without the use of the internet (attending lectures, exercising, reading papers/magazines physically, watching TV, listening to CDs/radios, chatting with friends/families and talking over mobile phones).

Part C: Focus group study

Three focus groups of a total of 18 medical students were conducted between June and July 2018. Written informed consent was obtained from each participant. The principal investigator conducted the focus groups. A semi-structured discussion guide was used. The interview topics focused on students' learning behaviour, use of internet, facilitators and barriers to the use of e-learning. The focus groups were up to 1.5 hours, and audios were recorded. The focus groups were either conducted in Cantonese or English. A unique identifier number was assigned to each participant to ensure confidentiality. Audio recordings were translated (for Cantonese) and transcribed verbatim by two research assistants. Deductive Thematic analysis was conducted based on the 8 domains from the e-learning framework (Khan, 2012).

References
(1) Aldhafeeri, F.M., & Khan, B.H. (2016). Teachers' and Students' Views on E-learning

readiness in Kuwait's Secondary Public Schools. Journal of Educational Technology Systems, 45(2) 202-235

(2) Kenichi Ishii. (2014). Internet Use in Japan: A Time Diary Method. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.556.2268&rep=rep1&type=pdf

(3) Khan B.H. (2012). User interface design for virtual environments: challenges and advances, Hershey, PA: IGI Global.

(4) Widyanto, L., & McMurran, M. (2004). The psychometric properties of the internet addiction test. Cyberpsychol Behav, 7(4), 443-450. doi:10.1089/cpb.2004.7.443

(5) Young, K. S. (1998). Caught in the Net: How to Recognize the Signs of Internet Addiction-- and a Winning Strategy for Recovery: John Wiley \& Sons, Inc.

(6) Zhang, M. W. B., Lim, R. B. C., Lee, C., & Ho, R. C. M. (2018). Prevalence of Internet Addiction in Medical Students: a Meta-analysis. Acad Psychiatry, 42(1), 88-93. doi:10.1007/s40596-017-0794-1

3. Evaluation Plan

Have you altered your evaluation plans?

Does your evaluation indicate that you have achieved your objectives?

As mentioned in Part 2 of this report, due to the revisions to the questionnaire and the schedules of the students, the project period was extended. However, we have not altered the evaluation plan.

Part 1: Teachers Study

Demographics and Pre-disposition factors

Of the 405 teachers, 28 of them completed the online survey. Consent was submitted via the myCUform system. The response rate was 6.9% (Table 1).

Table 1. Response Rate of teachers, according to the size of mailing list recipients (n= 405)

Total Participants	28 (6.9%)
Dates of Email Sent	**#of participants / percentages**
19/3	10 (2.5%)
8/5	14 (3.5%)
28/5	4 (1.0%)

Amongst the teacher participants, male and female were evenly distributed (50%). There were five teachers (17.9%) that aged 25-35, nine teachers aged 36-45 (32.1%), ten teachers aged 46-55 (35.7%) and four over the age of 55 (14.3%). There were Professors (32.1%), Assistant Professors (21.4%), Associate Professors (21.4%), Research Assistant Professors (10.7%), Clinical Lecturers (7.1%), a Clinical Professional Consultant (3.6%) and a Senior Lecturer (3.6%). Most participants were from the School of Public Health and Primary Care (SPHPC) (25%), there were others from Department of Medicine (17.9%), School of Biomedical Sciences (SBS) (14.3%), Department of Surgery (10.8%), Department of Psychiatry (7.1%), Department of Paediatrics (3.6%), Department of Anaesthesia and Intensive Care (3.6%), Department of Microbiology (3.6%) and Department of Chemical Pathology (3.6%). Three participants did not disclose the department that they are from (10.7%) (Table 2).

Table 2. Demographic characteristics of Teacher respondents, according to sample size (n=28)

Demographic characteristics	N (%)
Age group*	
25-35	5 (17.9%)
36-45	9 (32.1%)
46-55	10 (35.7%)
>55	4 (14.3%)
Gender	
Male	14 (50.0%)
Female	14 (50.0%)
Teaching Position	
Assistant Professor	6 (21.4%)

Associate Professor	6 (21.4%)
Clinical Lecturer	2 (7.1%)
Clinical Professional Consultant	1 (3.6%)
Research Assistant Professor	3 (10.7%)
Professor	9 (32.1%)
Senior Lecturer	1 (3.6%)
Department	
School of Public Health and Primary Care (SPHPC)	7 (25%)
Department of Surgery	3 (10.8%)
School of Biomedical Sciences (SBS)	4 (14.3%)
Department of Medicine	5 (17.9%)
Department of Psychiatry	2 (7.1%)
Department of Paediatrics	1 (3.6%)
Department of Anaesthesia and Intensive Care	1 (3.6%)
Department of Microbiology	1 (3.6%)
Department of Chemical Pathology	1 (3.6%)
Non-Disclosure	3 (10.7%)

On average, most participants spent 0-10 hours a week dedicated to teaching (82.1%). Only three participants (10.7%) had spent 10-20 hours per week, and two participants (7.1%) had spent 20-30 hours per week dedicated to teaching. The teaching hours are devoted to lectures/classrooms (28.3%), teaching tutorials (78.6%), clinical hours (53.6%), and as a Course Coordinator (71.4%). Fifteen participants taught multiple Student Years (53.6%): Nine participants taught Year 1 students (32.1%), seven taught Year 2 (25%), eight taught Year 3 (28.6%), fourteen taught Year 4 (50%), seven taught Year 5 (25%) and eleven taught Year 6 (39.3%) (Table 3).

Table 3. Time dedicated to teaching and educational roles characteristics, according to sample size (n=28)

Average Teaching hours	N (%)
0-10	23 (82.1%)
10-20	3 (10.7%)
20-30	2 (7.1%)
Teaching Responsibilities	
Lectures/ Classroom	25 (89.3%)
Tutorials	22 (78.6%)
Clinical	15 (53.6%)
Course Coordinator	20 (71.4%)
Taught Student Years	

Year 1	9 (32.1%)
Year 2	7 (25%)
Year 3	8 (28.6%)
Year 4	14 (50%)
Year 5	7 (25%)
Year 6	11 (39.3%)

E-learning engagement amongst the participants is high. 60.7% of participants had incorporated e-learning / social media modalities into their class, including the use of Moodle / Blackboard (39.3%), YouTube / Vimeo (35.7%), U-reply (25%), Facebook (10.7%) and custom online courses (7.1%). Fifteen (53.6%) participants had e-learning training and fourteen (50%) participants had formal training with CUHK CLEAR course within the past 5 years. However, only ten (35.7%) participants had e-learning and teaching grants applications within the past five years. Majority of the participants (96.4%) had never used a Massive Online Course except for one teacher (3.6%) who taught an '*Everyday Chinese Medicine*' online course (Table 4).

Table 4. E-Learning engagement and training characteristics, according to sample size (n=28)

E-learning training activities attendance within past 5 years	N (%)
Yes	15 (53.6%)
No	13 (46.4%)
E-learning and teaching grants application within past 5 years	
Yes	10 (35.7%)
No	18 (64.3%)
Formal training in education	
CUHK CLEAR course (within the past 5 years)	14 (50.0%)
None	13 (46.4%)
CLEAR>5 years ago	1 (3.6%)
Use of E-learning means, technology or social media modalities in class	
Yes	17 (60.7%)
No	11 (39.3%)
U-reply	7 (25%)
Moodle/Blackboard	11 (39.3%)
Facebook	3 (10.7%)
YouTube/ Vimeo	10 (35.7%)
Online course	2 (7.1%)

Massive Online Courses Taught	
No	27 (96.4%)
Everyday Chinese Medicine	1 (3.6%)

Only six (21.4%) participants had published articles or presentations related to e-learning. Four of which (14.3%) was an original article; two was within a Faculty / University educational workshop (7.1%). Four (14.3%) had an oral presentation about the publication, and three (10.7%) had a poster presentation published. Two of the publications (7.1%) were part of an International educational conference (Table 5).

Table 5. Publications and Presentations related to E-Learning, according to sample size (n=28)

Publications of educational articles/ Presentations about e-learning	N (%)
Yes	6 (21.4%)
No	22 (78.6%)
Original Article	4 (14.3%)
Commentary	0 (0.0%)
Editorial	0 (0..0%)
Faculty/university educational workshops/conference	2 (7.1%)
Oral presentation	4 (14.3%)
Poster presentation	3 (10.7%)
International educational conference (AMEE/APMEC/OTTAWA)	2 (7.1%)

E-Learning Readiness Results

The 25 items from the survey were categorized into the 8 domains of the e-learning framework which includes institutional, ethical, resource, support, pedagogical, management, interface design and technological. Responses were based on a 5-point Likert scale ranging from strongly disagree to strongly agree. A numerical value ranging from 1 to 5 was assigned to the Likert scale where '*strongly disagree*' = 1 and '*strongly agree*' = 5 unless the question was specified for reverse scoring. The mean scores of all participants were tabulated according to each question and corresponding domain (Table 6).

Table 6. Teacher's e-learning readiness score (n=28)

	Mean±SD
Overall	3.35±0.55
Domains	
Institutional	3.13±0.48
Management	3.23±0.66

Pedagogical	3.50±0.66
Technological	3.15±0.78
Resource support	3.18±0.70
Ethical	4.01±0.82
Evaluation	3.44±1.01

The overall mean score of teachers was 3.35±0.55, which was nearly ready for e-learning and statistically significant (p<0.001). Only the Ethical domain among teachers had a mean score >4. The majority of the domains had a mean score between 3.1 and 3.5. Institutional and technological domains had the lowest scoring (3.13±0.48 and 3.15±0.78). Thus, signifying that the participants are agreeable to prepare for or ready to engage with e-learning modalities within their teaching. However, the participants' responses also indicated that they generally agree that the Institution and Technological support is not as ready.

However, when looking into more detail at the responses of the individual questions, many teachers disagreed with the following statements:
Q.3 "I am given adequate planning time to create e-learning materials for our courses." (mean score: 2.46 ± 1.14).
Q.22 "We have spent adequate time and effort in studying the needs of our students." (mean score: 2.65 ±1.02).

Many teachers feel that they are not given enough time or not notified early enough for the preparation of e-learning resources. Additionally, teachers indicated that assessments of students need are still required.

With regards to the Technological factors, many teachers disagreed to,
Q.6 "I am comfortable working with video presentation/processing software (I-Spring, Adobe, Articulate etc.)" (mean score: 2.85 ± 1.20).
Q.7 "I have used the latest emerging technology in my classroom" (mean score: 2.77 ± 1.18).
Thus, better technological support and workshops are still needed to equip the teachers with the right skillsets to effectively incorporate the latest technologies in their lessons.

Unanimously, teachers agreed that copyright is an important aspect that needs to be considered when creating e-learning materials.
Q.18 "Copyright issues are important in creating e-learning materials" (mean score: 4.01±0.82).

Although teachers expressed negative attitudes on some of the questions, most of the teachers agree e-learning can increase their teaching flexibility (mean score: 4 ± 0.96) and can provide an opportunity for students to learn (mean score: 4.04 ±0.65). Details of each response are listed in Appendix I.

Part 2: Students Study

Part A: Online Survey

Demographic and Pre-disposition factors

3100 students' emails for recruitment of the survey were sent through a mailing list that consisted of all enrolled MBChB, Nursing, Public Health, Pharmacy, Biomedical Sciences and Gerontology students from CUHK. Consent was submitted via the myCUform system. Over

the course of the study period, a total of 158 students completed the online survey. The response rate was at 5.1% (Table 7).

Table 7. The response rate of medical students, according to the size of mailing list recipients (N= 3100)

Total	158 (5.1%)
Dates of Email Sent	**#of participants / percentages**
19/3	68 (2.2%)
8/5	53 (1.7%)
28/5	32 (1.0%)

Amongst all the participants, there were 54 male participants (34.1%) and 104 female participants (65.8%). Primarily MBChB students responded which represented 74.1% (117 students) of the sample. However, there were student participants also from Nursing (17.1%), Pharmacy (4.4%), Public Health (1.9%), Biomedical Sciences (1.9%) and Gerontology (0.6%). 28 students were in Year 1 (17.7%), 40 students in year 2 (25.3%), 16 students in Year 3 (10.13%), 35 students in Year 4 (22.8%), 18 students in Year 5 (11.4%), and 16 students in Year 6 (10.1%). Four students did not disclose the year of their study (2.5%). 92 students were admitted through the JUPAS system (58.2%), 62 students through the non-JUPAS system (39.2%), three from the mainland (1.9%) and one international student (0.6%) (Table 8).

Table 8. Demographic characteristics of student respondents, according to sample size (n=158)

Students'characteristics	N (%)
Gender	
Male	54 (34.1%)
Female	104 (65.8%)
Programme	
MBChB	117 (74.1%)
Nursing	27 (17.1%)
Public Health	3 (1.9%)
Pharmacy	7 (4.4%)
Biomedical Sciences	3 (1.9 %)
Gerontology	1 (0.6 %)
Year of Study	
1	28 (17.7%)
2	40 (25.3%)
3	16 (10.13%)
4	35 (22.8%)
5	18 (11.4%)
6	16 (10.1%)
Non-disclosed	4 (2.5%)

System of Admission to CUHK	
JUPAS	92 (58.2%)
Non-JUPAS	62 (39.2%)
Mainland Student	3 (1.9%)
International Student	1(0.6%)

E-Learning Readiness Score (Students)

The 25 readiness items from the survey were categorized into the 8 domains of the e-learning framework which includes institutional, ethical, resource, support, pedagogical, management, interface design and technological (Khan, 2012). Responses were based on a 5-point Likert scale ranging from strongly disagree to strongly agree. A numerical value ranging from 1 to 5 was assigned to the Likert scale where '*strongly disagree*' = 1 and *'strongly agree'* = 5 unless the question was specified for reverse scoring. The mean scores of all participants were tabulated according to each question and corresponding domain (Table 9).

Table 9. Student's e-learning readiness score (n=158)

	Mean±SD
Overall	3.36±0.42
Domains	
Institutional	3.15±0.60
Management	3.34±0.70
Pedagogical	3.5±0.49
Technological	3.29±0.66
Resource support	3.5±0.58

With regards to students' readiness score, the overall of the mean score was 3.36±0.42, which was 'nearly ready' in e-learning and statistically significant ($p<0.001$). All of the readiness factors were between 3.1 and 3.5. Institutional was the lowest (3.15±0.60). Students tended to disagree that enough time was given to view all the e-learning education materials such as lectures, videos and assignments (2.97 ±1.05). However, many students agree that e-learning can increase their flexibility in learning (4.11 ±0.74) and believe that it can be a supplement to the traditional classroom teaching (4.03 ±0.69) (*See Appendix II. for student survey*).

Internet Addiction Test (IAT) Score

The mean score was 46.3±13.94 of the participants with a minimum of 21 marks to a maximum mark of 83. Although, more than half of them were classified as a problematic user (57.6%), and ten of them were classified as an addicted user (6.3%). Demographics such as age, gender, household income were not associated with the internet addiction score. However, students with more tablets were more likely to have a higher internet addiction score ($p=0.009$) (Table 10). Students spent more hours in using social media (30% vs 13.2% and 14.0%), watching films/gaming (30% vs 8.8% and 7.0%) were also with a higher internet addiction score, but the results were not significant. Meanwhile, a statistically significant result was found in general surfing with the internet, students spent more hours in general surfing were more likely to have higher internet addiction score (40% vs 6.6% and 5.3%, $p=0.033$) (*See Appendix IV*).

There were no significant results found between the gender, year of study and total IAT scores. Although more students from earlier years of study (year 1, 2 and 3) tend to have a higher IAT score when compared to later years of study (year 4, 5 and 6), the *p* value was at 0.073. Thus, there was a lack of statistical evidence to conclude that there is a significant difference between earlier and later years of study (Table 10).

Table 10. Early vs Later study years internet usage distributed by IAT score, according to sample size (n=158)

IAT score	≥70 (addicted)	40-69 (problematic)	≤39 (average)	*P* value
Total (n=158)	10 (6.3%)	91 (57.6%)	57 (36.1%)	
Early vs Late Years				
Early Years (Year 1 / 2 / 3)	8 (80%)	51 (56%)	25 (43.9%)	
Late Years (Year 4 / 5 / 6)	2 (20%)	37 (40.7%)	31 (54.4%)	0.073
Not Specified	0 (0%)	3 (3.3%)	1 (2.5%)	

Comparison of e-learning readiness score with internet addiction score

There was a slight positive correlation between overall readiness mean score (r=0.238, p=0.003), e-learning readiness factors including pedagogical (r=0.244, p=0.002) and technological issue (r=0.210, p=0.008) (Table 11). Students who were ready to use e-learning may spend more time on the internet, thus may increase the score.

Table 11. Correlation between students' e-learning readiness and internet addiction score

Domains	Pearson correlation coefficient I	*P* value
Students' overall readiness mean score	0.238	0.003*
Institutional	0.093	0.243
Management	0.051	0.528
Pedagogical	0.244	0.002*
Technological	0.210	0.008*
Resource support	-0.023	0.771

*Significant results that meet requirement of P <0.05

Comparison of teachers and students e-learning readiness score

The readiness score of the teachers and students all fall within the range of 3.1 to 3.5. Aside from the Resource Support domain, the teachers' e-learning readiness is only slightly lower than that of the students if not the same. Both teachers and students agree that pedagogically, e-learning is a beneficial medium for the teaching/learning experience. However, both teacher and students also view that the institutional support is not as well

prepared as the other domains. Interestingly, students feel that they are more adequately given resource support to learn through e-learning modalities, whereas teachers tend to feel less adequately supported regarding resources for teaching. Overall, albeit the differences are small, students tend to score higher than teachers on the e-learning readiness score (Chart 1).
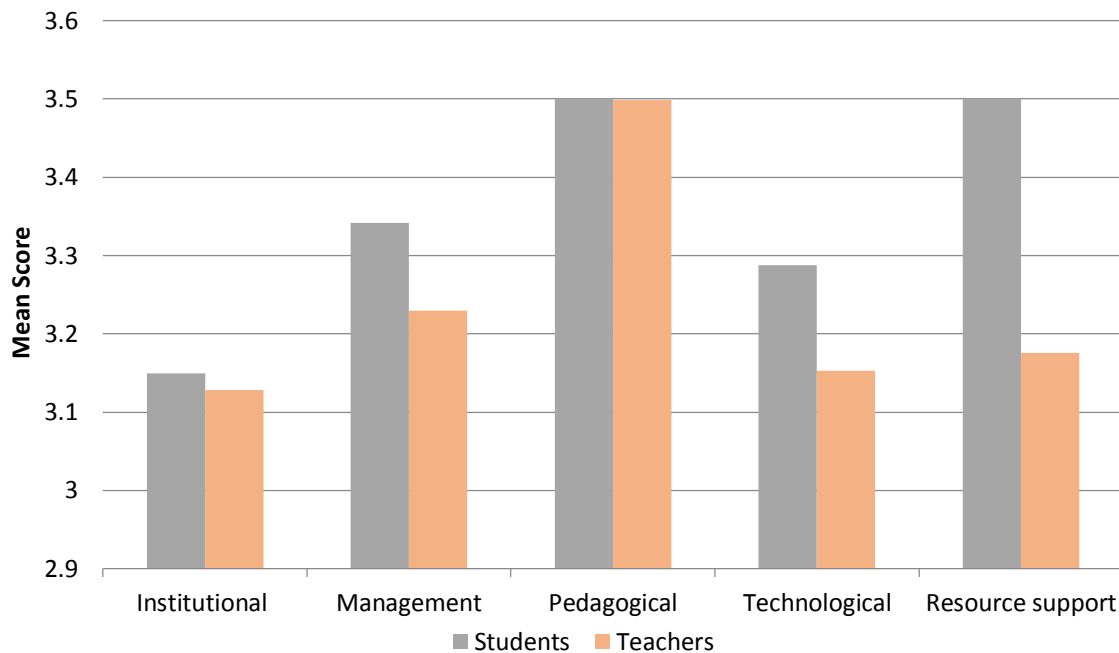
**Chart 1.** Teachers' and students' e-learning readiness score

Part B: Observational Study

Forty-seven diaries were distributed to year 6 medical students on June 2018. Written consent was obtained from each participant. Thirty-three diaries were received, and the response rate was 70.2%. There were 15 (45.5%) males and 18 (54.5%) females. Meanwhile, 22 (66.7%) students were living in a hostel, and 11 (33.3%) students were living at home.

Online activities in the diary included direct social interactions (i.e. Skype, emails, WhatsAppetc.), social media, online browsing, gaming, listening to music, watching videos and online education. For online education, further analysis on the different modalities of e-learning was examined. Online education was also categorized in usage on PC, tablet and mobile devices. Furthermore, usage patterns for the reading of academic papers and library resources, completing assignments online, and usage of e-learning platforms (Moodle / Blackboard) were also evaluated.

Offline activities in the diary included education (i.e. lectures, seminars etc.), reading physical papers (i.e. newspaper, books etc.), offline leisure activities (i.e. TV, Videos, games etc.), exercise and offline social interactions (i.e. meetings, chat over the phone etc.)

In conjunction with the results received from the Students' Online Survey, the daily diary indicated that students spend the majority of their waking hours using the internet; whether for educational purposes, leisure, communication or social media (Chart 2).
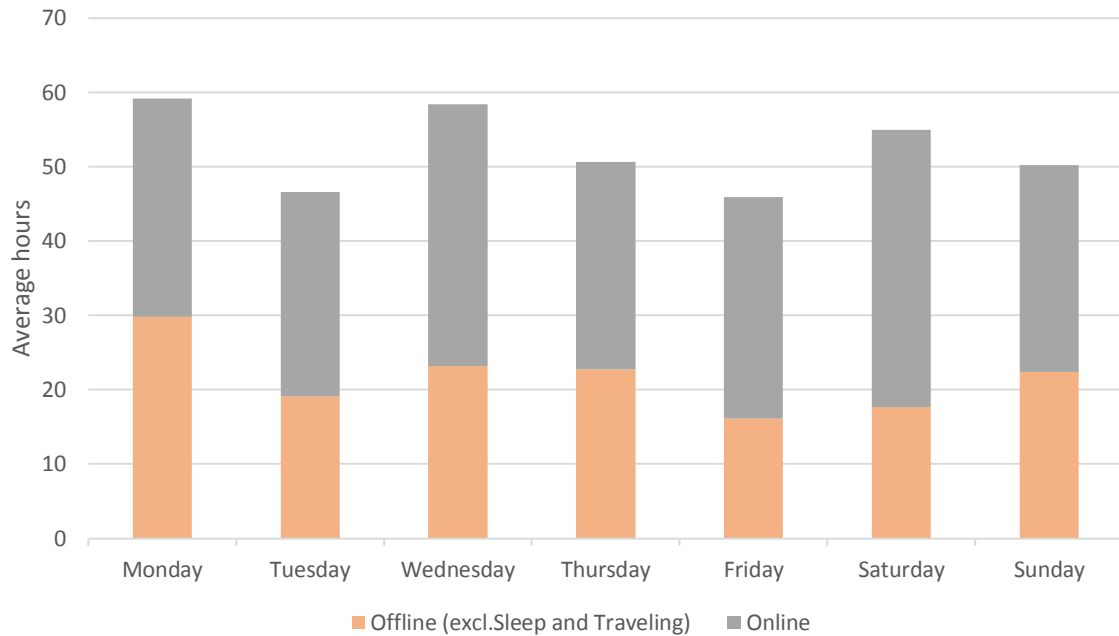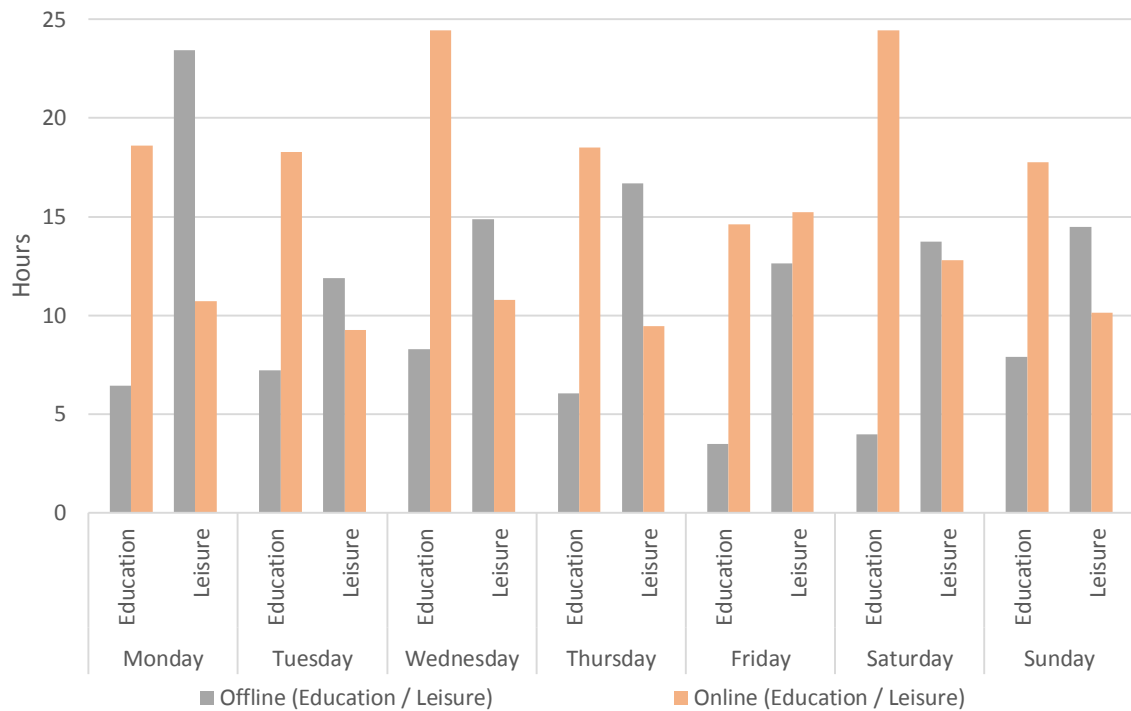
Chart 2. Students' Average Hours spent Offline (waking hours) vs. Online over the week

However, despite the long hours that the students spent online, further analysis reveals that the majority of the times used online were for educational purposes; which include activity on reading paper or coursework online, completing assignments and the use of e-learning platforms (Chart 3). Thus, supports the results received from the online survey that the students are generally ready to engage in e-learning.
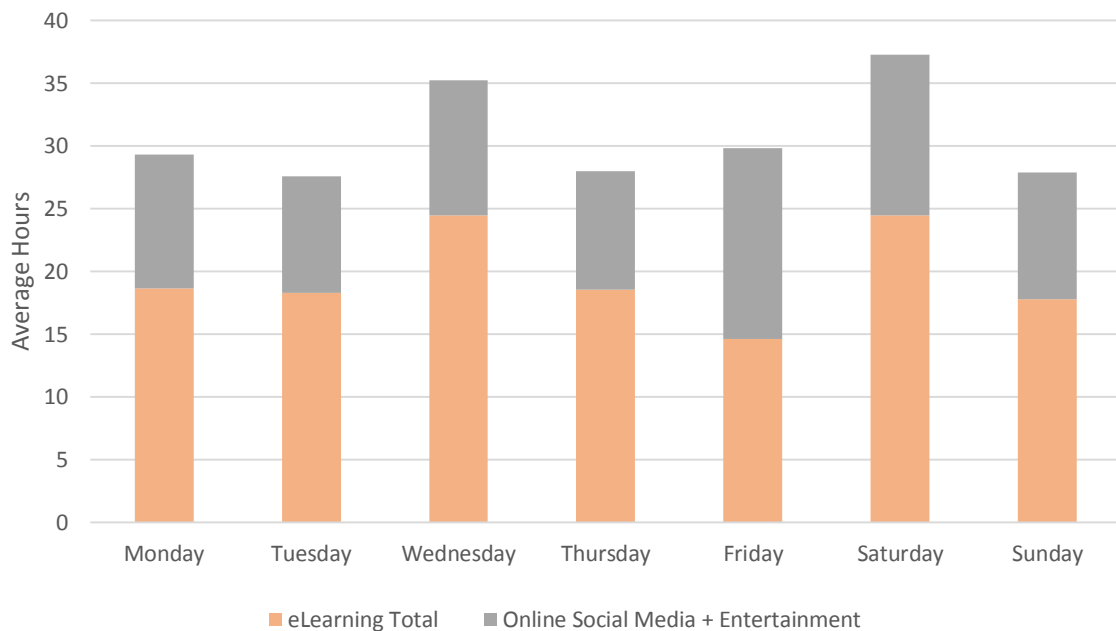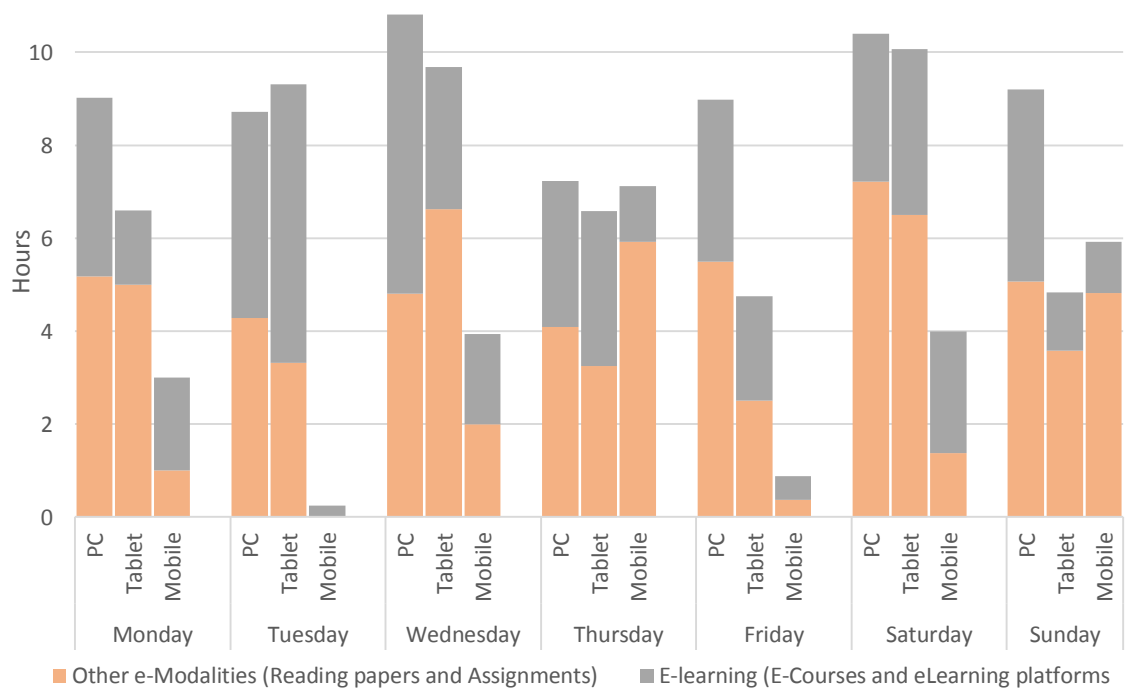

Chart 3. Students' Average hours spent online for e-learning vs. Social Media / Leisure over the week

When comparing the hours between online and offline activities, students tend to spend proportionally more time on e-learning in all its modalities then their time offline dedicated to education. However, when it comes to leisure, students tend to prefer offline activities such as offline social interactions, exercise and media consumption (i.e. TV, games) (Chart 4).

Chart 4. Multiple Comparison between average hours spent on Education (classes vs. e-learning) and Leisure activities (offline vs. online)

Examining the devices that students used for e-learning, PCs are still the primary device of preference. Surprisingly, tablet usage for e-learning is comparable to PC, albeit primarily for reading papers and completing assignments rather than for accessing e-learning platforms (Moodle / Blackboard). Mobile phones usage is still relatively limited in regard to e-learning (Chart 5).

Chart 5. Students' Average hours spent on e-learning on PC vs. Tablet vs. Mobile over the week

16

Student sleeping patterns were also examined. The time that students went to bed were categorized into three groups: average (before 12 am), late (between 12:−1 - 2:00 am), and extremely late (after 2:01 am). The majority of the students slept before 12 am, but over the weekends more students tend to sleep extremely late (Chart 6). Although there are not many extremely late sleepers, those who do can vary widely in the times they sleep. The most severe late sleepers had recorded that they slept at $4 - 5$ am during the observational period.
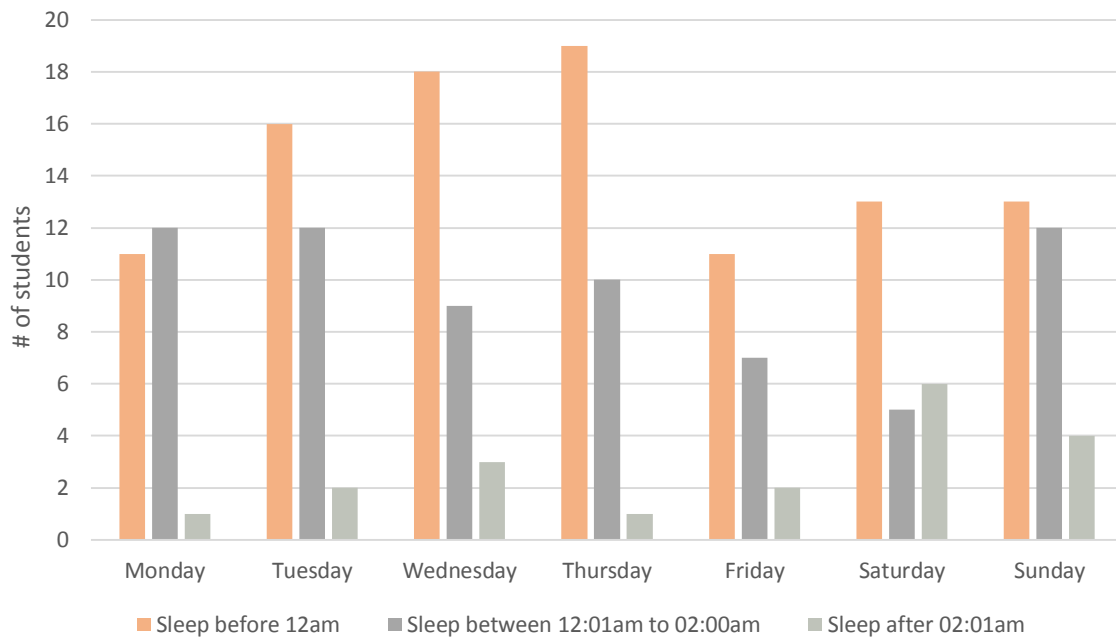
Chart 6. Students' Sleeping Patterns distributed by the start time of sleep

The relationship between internet usage and students' sleeping patterns were compared. The three categories of students' sleeping time were assigned a numerical value from−1 - 3 for scoring, where the average group = 1 and extremely late group = 3. Overall, there were not any significant correlation between the sleeping patterns and internet usage. However, when analyzing the individual days of the week, there appear to be significant positive correlations on Tuesday (r=0.475; p=0.008), Saturday (r=0.477; p=0.018) and Sunday (r=0.375; p=0.041) (Table 12) in which internet use was related to later sleep. Further studies may be needed to evaluate whether there are any relationships between the two factors.

Table 12. Correlation between students' sleeping pattern and duration of internet usage.

	Correlation (Spearman's rho)	*P* **value**
Overall	**0.142**	**0.430**
Monday	-0.153	0.476
Tuesday	0.475	0.008*
Wednesday	0.150	0.427
Thursday	-0.217	0.249
Friday	0.109	0.639
Saturday	0.477	0.018*
Sunday	0.375	0.041*

*Significant results that meet requirement of P <0.05

Part C: Focus Groups

Three focus groups with 18 medical students were conducted. There were 8 (44.4%) year 4 students and 7 (38.9%) were year 5 students. The others were year 1 to 3 students (16.8%). Half of them (50%) were admitted via non-JUPAS, and 8 (44.4%) were admitted via JUPAS into CUHK. Majority of the students (n=13, 72.2%) had taken 1 to 3 e-learning courses in the past year and 4 (22.2%) students had taken more than five e-learning courses in the past year (Table 13). A deductive approach was used for thematic analysis.

Table 13. Focus groups demographic characteristics.

Demographics characteristics	Mean/ N (%)
Age	
19-20	3 (16.7%)
21-23	12 (66.7%)
24-27	3 (16.7%)
Mean age	21.7±1.90
Gender	
Male	7 (38.9%)
Female	11 (61.1%)
Study year	
1	1 (5.6%)
2	1 (5.6%)
3	1 (5.6%)
4	8 (44.4%)
5	7 (38.9%)
Admission system to CUHK	
Jupas	8 (44.4%)
Non Jupas	9 (50%)
International students	1 (5.6%)
Living in CUHK's Hall	
Yes	3 (16.7%)
No	15 (83.3%)
Average time (hours) internet use per day	
1-5	7 (38.9%)
>5-11	6 (33.3%)
>11-15	5 (27.8%)
Number of elearning course had been taken in the past year	
None	1 (5.6%)
1 to 3	13 (72.2%)
>5	4 (22.2%)

Self-Management (Manageability)

Although students indicated that they are accepting towards e-learning modalities in the online survey, in the focus groups various barriers to online and blended learning were mentioned. For instance, a student had found that e-learning often requires self-discipline to keep up and manage with coursework. Students also mentioned that at times they feel detached from the importance or significance of the course material when using e-learning platforms.

"...we have to do the homework to show that we've read through it, but the problem is that students don't actually read through it because they don't see the importance or just don't think it's necessary, so e-learning and self-directed learning really requires the student to know the importance of knowing the knowledge and wanting to dig deep and research for themselves in order to work"
Group2-Student 7

Pedagogical Limitations (Pedagogical)

Students found that e-learning platforms can be very limited, especially regarding content that requires peer interaction. The technological utility of an e-learning platform is not sufficient in providing the soft skills that are obtained during medical students' clinical years. E-learning is seen more as a facilitator or tool to assist with learning but cannot entirely replace traditional modes of learning.

"我覺得面對面好啲。 即係 study group 好啲 ，因為我覺得係 clinical years，好多真係喺 e-learning 做唔到 。譬如我要練個 P, 我要練 history taking 一定要有個人喺度畀我 先可以 practice 到 。" Group 1-Student 3
Translation: I think that face to face is better, as in the study group. As I think e-learning cannot replace some of the contents, especially in clinical years. For examples I need to practice physical examination and history taking, I can only practice when a human is here.

"I don't think e-learning can replace [traditional learning]... it [e-learning] can facilitate and be a tool to help students to learn. To get what the main points of the topics are and know what the teacher wants them to learn. But I don't think it can replace all the interaction during the classroom time and peer support environment during the real lecture." Group 3 – Student 2

Low Prioritization (Pedagogical / Institutional)

Students' motivations for using e-learning platforms are further discouraged by the secondary priority of e-learning perceived by students. Such prioritizations are reinforced by the institution's lack of allocation of resources to expand e-learning modalities and functionality. Some students perceived the limited scope of e-learning modes and functionality in their existing courses not as limitations of e-learning but instead as the institution's lack of commitment and belief towards e-learning. Thus, sentiments of low prioritizations towards e-learning are shared amongst students.

"...when you have a series of lectures being taught in person in the lecture halls, and other lectures taught online that are e-lectures, as a student you'd be like, oh they don't have time to put this in an official lecture or they are not as important, so they just put it on the internet. So then, even myself when I go over online

lectures I don't pay as much attention to it, and that's the perception I have as a student too." Group 2 – Student 5

"But I think e-learning is often half-hearted attempts because at school they sometimes want to try e-learning...they don't seem to believe in the power of e-learning, or they don't seem to rely on e-learning that fully... I think the web is much more than prepared stuff because if it's just prepared stuff like notes than it's not much better than a book or a VCD. The Internet is more about interaction and more about instant feedback, and there's much more to be harnessed from technology, but most of what we have now [e-learning] is just touching on the surface." Group 2 – Student 3

Poor Interface Designs (Interface design)

The interface design of the e-learning platform was often brought up as a determining factor in how to engage the students with the course contents. However, often due to limited resource support, student experiences outdated course materials and design.

"Interface is very important to me. The quality, if it's made well, looks well, and I enjoy clicking through it then I'll be more inclined to finish it and not go randomly clicking through to get it done with." Group 2- Student 1

"We are already in 2018, and everything seems outdated because, with e-resources, it takes a lot to maintain. However, then this is what [supposed to] make e-resources stand out - it's they're easily updated. This is a must with e-resources or e-learning, to sustain say, updating interfaces and making it quicker, clearer every year, instead of staying the same." Group 2- Student 6

Low-Quality e-Resources (Resource Support)

Aside from the quality of the interface design, students find the quality of the e-resources is also essential. For instance, the audio quality or delivery of the information in a video affects students' willingness to use the resource.   The format of the e-resource matters too. Students indicated they prefer pre-recorded videos over live e-lectures due to the ability to fast forward or skip certain parts. Students also enjoy a variability in the modality and sources of the e-resource. Teachers who provide a mix of animations, YouTube videos and outside resources are better perceived.

"I think the quality of e-learning (resources) is also very important. Just like the e-lectures from last year, the voice is very discouraging. The tone is very flat and makes me want to sleep. But actually, in year 3 there are many lectures recorded, and I always use them because I think they were more useful compared to the e-lectures last year, I can fast forward to a point (using recorded lectures)." Group 2-Student 2

"... I think back in year 3; we did have lecturers who in the middle would be like 'I'm going to play this YouTube video to show how it works,' especially like DNA translation and application. It's much easier to see a video of enzymes attaching on this strand and (the teacher) kind of explaining. I think the teachers' role is just to help the students learn. And it's not limited to using the original materials; I think it's fine to borrow from other things [sources] to explain, to get the message you want across." Group 2 – Student 5

Poor Institutional implementations (Institutional)

Some students had indicated frustration with the institutional implementation of e-learning courses. In particular, one student had found that the hours spent on e-learning is often not taken into consideration by course administrators and can be overwhelmed by coursework from both in-class lectures and online courses. This sentiment was also reflected from the results we received through the daily diary where students often spent many more hours on e-learning than offline classes (Chart 4).

> *"I think they should count the hours (of e-learning in) too because medicine is such an intense course. There are so many lectures that we have to go to. Sometimes I feel like, for example, the bridging course that we just had. There were quite a few e-learning lectures that were just placed online, and a part of me felt like, they did that because if they actually put those lectures in the actual timetable, you will see the whole day, maybe from 9-5, is filled with class. It might be inhumane maybe. (laughs) I think they should count as actual hours." Group 3- Student 4*

Technologically Behind (Technological)

Students had also reflected that they felt teaching staff and professors may not be technologically skilled enough to cope with e-learning teaching; which is opposite to the results that we had received from the online survey where the readiness score between the teachers and students was similar. According to the survey, the teachers were nearly as ready as the students to engage with e-learning modalities in their teaching. It is also interesting that the students had mentioned that they see the mobile phone is now necessary for learning. However, the results from the daily diary indicated that most students still prefer using the PC or tablet for e-learning. Also, more students indicated in the survey were less likely to use a mobile phone when compared to the desktop for learning.

> *"I think if the professors can't even adjust the lectures' microphones or have no idea about the projections I have no idea how they could cope with e-learning. Because the technological gap is quite huge sometimes. And then people age, and they have never seen some things before. Obviously, the iPhone has now been out for ten years, and now we have to use it for learning. If people don't catch up, it's really hard to push this e-learning thing, even if it is there." Group 2-Student 6*

Discussion

This project helps in identifying students and teachers needs and patterns of e-learning use. Our mixed method research approach has shown the following:

Part 1: Teachers Study

The overall e-learning readiness mean score of teachers was 3.35 ± 0.55 ($p<0.001$). Thus, teachers mostly agree that they are ready to engage in using e-learning as part of their teaching repertoire. However, the teachers also indicated that they felt more time is needed for planning and making e-module materials. Improvements in curriculum planning and foresightedness may help alleviate time constraints.

Comparing to the student results, the teachers' attitudes toward resource support were much less favourable. Limited funding gives little support or incentive to keep e-learning platforms up to date beyond the grant provided. One significant barrier cited by students in using e-learning resources are outdated design interfaces for e-learning platforms. The visual

appeal and relevance of e-learning resources may further be limited by the database of copyrighted materials available for teachers. Without graphic design skills, most medical teachers would have difficulty in creating visually appealing and engaging. As a result, many e-learning materials and courses, though content-rich, remains unappealing and underused by students.

Majority of teachers also felt not enough effort and time has been spent in studying the needs of our students and further studies are needed to optimize e-learning platforms to student learning patterns.

Aside from institutional support, teachers had also expressed their lack of confidence in using the latest technologies for their classrooms as a barrier to utilizing e-learning platforms. Teachers indicated that they are still uncomfortable in working with video presentation/ processing software for e-learning. Although ample availability of such software and recording equipment is provided through the Office of Medical Education (OME), training is not always available, and thus the resources are not fully utilized.

It is important to note that due to the small sample size of the teacher participants (n=28), the results were more likely subjected to selection bias and confounding factors. Those who are keener to utilize e-learning or have already output would be more likely to respond and complete to the questionnaire. Therefore, the actual rate of the teacher's e-learning readiness may be lower. Also, the items regarding time, resource support and technological support is likely an overestimation of the positive outlook as likely those who were interested were likely to complete the survey.

Part 2: Students Study
The overall e-learning readiness score of students was 3.36±0.42 (p<0.001) (n=158), indicating that the students mostly agree they are ready in using e-learning as a mode of learning. When compared to the teacher's e-learning readiness, students scored either even or higher in the e-learning domains: *institutional, resource, support, pedagogical, management, and technological.* Students expressed that not enough time is generally given to view all the e-learning education materials such as lectures, videos and assignments (2.97 ±1.05). However, students agree that e-learning can increase their flexibility in learning (4.11 ±0.74) and believe that it can be a supplement to the traditional classroom teaching (4.03 ±0.69).

There is a significant positive correlation between students' e-learning readiness score and internet addiction score (r=0.238, p=0.003). Students who are more technologically capable (r=0.244, p=0.002) and also find e-learning as a useful tool for learning (r=0.210, p=0.008) tend to also score higher on the internet addiction score. However, despite the long hours that student spends on the internet, surprisingly most of the online time was for educational purposes (accessing e-learning platforms, reading papers and completing assignments). For accessing e-learning materials (reading papers, completing assignments and assessing e-learning platforms), PC is still the primary device used. However, the tablet is also used by students to read papers and complete the assignments. Meanwhile, mobile usage for e-learning remains a low priority for students.

The focus groups identified various barriers for students to engage with e-learning. Some themes identified through thematic analysis were '*self-management,' 'pedagogical limitations,' 'low prioritization,' 'poor interface designs,' 'low-quality e-resources,' 'poor institutional implementations,' and 'technologically behind.'*

Students expressed that one key barrier is that the importance of the e-resources are not communicated. A lack of continuity between the different e-learning courses, the assessment contents and practical tutorials often led students confused on the applicability of the lesson to their future medical practice. Students are further demotivated when they encounter poor interface designs and low-quality e-resources.

Other barriers also include a lack of face to face interactions in e-learning platforms. Although most students find e-learning resources essential to the flexibility of their schedule and dedication to their learning; the pedagogical limitations keeps students from fully engaging with e-learning platforms as their primary source of education. The lack of practical and social aspects to e-learning platforms meant a narrow educational scope instead of a well-rounded experience.

The implementation of e-learning courses further exasperates students. Learning hours for e-learning are often unaccounted for, but the data from the daily diary indicates students spend much more time on e-learning than off-line classes. Some students expressed that they would like the hours spent on e-learning platforms to be included as "learning hours" as there are tendencies for teachers to offload the majority of the coursework onto e-learning platform and thus able to cover more content. However, students find that some courses with a lot of e-learning content can be overbearing due to the long hours required to cover all the content. Further discussion with faculty and at the university level is needed to explore the possibility to count the e-learning "learning hours."

Difficulties:
The response rate amongst teachers and students for the online survey was low (teachers: n=28, 6.9%; students: n=158, 5.1%). Another project had shown online response is better than hardcopy, using class reps helped with the recruitment of students, but in this study the response rate remained low.

Lack of teacher educational meetings in faculty of medicine to disseminate the survey. Teachers were in different faculties, thus has different involvement in curriculum, courses and curriculum design

Systematic problems were not easily changed particularly for clinical teachers. No separate teaching track for clinician teachers and researchers so the response rate may not be reflective of the involvement in education and educational management. Meanwhile, e-learning has progressed rapidly.   Tools used had to be adapted and the way e-learning is different than the plan – hence had to be adapted.

4. Dissemination, diffusion and impact

The results of this study is yet to be disseminated.   However abstracts from this study has been submitted to Bau Institute of Medical and Health Sciences education (BIMHSE)   conference in December 2018 and also to the CUHK Teaching and Learning expo. The report will be disseminated to the Office of Medical Education, Faculty of Medicine and impact may include various parts being disseminated to teachers or teaching policy or use of e-learning. Some of the methodology e.g. teacher engagement with e-learning and also looking at outputs may also direct some disciplines to support teachers who are working in this area.

The focus group findings were useful to identify barriers and challenges in e-learning which may be tackled by the university strategies: e.g. technological support and training, design and interface and management of face to face and online hours etc.

PART II

Financial data

Funds available:

Funds awarded from MMCDG	$	150,000
Funds secured from other sources (please specify_____)	$	
Total:	$	150,000

Expenditure:

Item	Budget as per application	Expenditure	Balance
Staff costs and medical	138,000	$136,610.01	
Conference grant	12,000	$0	
Total:		$136,610.01	$13,389.99

PART III

Lessons learnt from the project

Difficulties encountered.   Response rate – re: online was poor.   However, another project shows online response is better than hardcopy.   The use of class reps increased the response rates.

Lack of teacher educational meetings in faculty of medicine/ meetings etc to disseminate the survey. Teachers are in different faculties with different involvement in curriculum, courses and curriculum design. No separate teaching track for clinician teachers researchers so the response rate may not be reflective of the involvement in education and educational management There is a heterogeneity of teachers and courses etc, of which in the plan, curriculum, there is only limited visibility as a teacher and time was needed to find out about the nature of the heterogeneity and how best the questionnaire can be adapted and distributed. Also e-learning has progressed rapidly. Tools used had be to adapted/ modernized for use. There are few validated tools in e-learning and there is a proliferation of literature from year 2000.

The timing of the project can be lengthened. Due to educational research, there is time needed for planning, as well coinciding with lecture time/ recruitment etc for optimal recruitment etc. Project assistants were helpful but also needed to families themselves with the educational arena

There was no time to apply for conference to disseminate findings as the grant funding reimbursement was by August 2018, and the project was still ongoing.

PART IV

Information for public access

Summary information and brief write-ups of individual projects will be uploaded to a publicly accessible CUHK MMCDG website. Please extract from Part I the relevant information to facilitate the compilation of the publicly accessible website and reports.

Part 1: Teachers e-learning readiness.

To study teacher's utilization of e-learning a cross-sectional online survey of all teachers is used. The primary survey instrument was modified for use in tertiary settings from a validated survey already available to assess teaching e-learning readiness.

The survey was sent out to 405 teachers, and 28 responded (6.9%). 7 different teaching titles and 9 medical departments were represented. Use of e-learning in teaching amongst participants was high at 60.7%. The overall mean score of teachers was 3.35 ± 0.55 ($p<0.001$). Teachers indicated dissatisfaction toward institutional and technological support.

Part 2: Students use of e-learning.

The study aims to explore students' effective use of technology for e-learning purposes. The study design is a mixed method study using a survey, focus groups, and an observational study. The survey consists of student demographics, e-learning readiness, and internet addiction tool (IAT). Focus groups were conducted to explore the internet use, learning behaviour and the barriers to e-learning. Also, a self-reported daily diary for one week of internet usage was used for the observational study.

3100 online surveys were sent out to 6 different programmes via a pre-existing mailing list. The response rate was 5.1% and all six programme and six years of study were represented. With regards to students' attitudes, the overall of the mean score was 3.36 ± 0.42 ($p<0.001$). Students agree that e-learning can increase their flexibility in learning (4.11 ±0.74) and believe that it can be a supplement to the traditional classroom teaching (4.03 ±0.69).

47 diaries were distributed to year 6 medical students on June 2018. 33 diaries were received (70.2%). The preferred device for e-learning is still a PC; however, the tablet is also widely used. Mobile usage for e-learning remains low.

The focus groups identified various barriers for students to engage with e-learning. Some themes identified through thematic analysis were '*self-management,' 'pedagogical limitations,' 'low prioritization,' 'poor interface designs,' 'low-quality e-resources,' 'poor institutional implementations,' and 'technologically behind.'*

1. Keywords

Please provide five keywords (in the order of most relevant to your project to least relevant) to describe your micro-modules/pedagogies adopted.

(Most relevant)   Keyword 1: e-learning readiness

Keyword 2: e-learning

Keyword 3: students

Keyword 4: medical teachers

(Least relevant)   Keyword 5: internet addiction

2. Summary

Please provide information, if any, in the following tables, <u>and provide the details in Part I</u>.

Table 1: Publicly accessible online resources (if any)
(a) **Project website:**   *N/A*
(b) **Webpage(s):**   *N/A*
(c) **Tools / Services:**   *N/A*
(d) **Pedagogical Uses:**   *N/A*

Table 2: Resource 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	Approximate No.	Platform

	offering	**of students**	
Eg1. DEPTXXXX	*1st term 2015*	*50*	*Blackboard*
Eg2: Dept of xxxx	*All 1st-year students*	*40*	*facebook*

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)	*TBA*
(b) In workshop/retreat organized for CUHK teachers (e.g. CLEAR workshop, workshop organized by other CUHK units)	*Please insert no*
(c) In CUHK ExPo jointly organized by CLEAR and ITSC	*TBA*
(d) In any other event held in HK (e.g. UGC symposium, talks delivered to units of other institutions)	*Please insert no*
(e) In international conference	*Abstract submitted*
(f) Others (please specify)	*Please insert no*

Table 4: Publication (if any)	
Please classify each piece of publications into one and only one of the following categories.	**Number**
(a) Project CD/DVD	*Please insert no*
(b) Project leaflet	*Please insert no*
(c) Project booklet	*Please insert no*
(d) A section/chapter in a booklet/ book distributed to a limited group of audience	*Please insert no*
(e) Conference proceeding	*Please insert no*
(f) A chapter in a book accessible internationally	*Please insert no*
(g) A paper in an referred journal	*Please insert no*
(h) Others (please specify)	*Please insert no*

3. A one-page brief write up

Please provide a one-page brief write-up of no more than 500 words and a short video.

Project title: Medical Teachers: e-learning readiness and utilization of e-learning & impact and effectiveness of e-learning on medical students

The University aims to increase e-learning as one of its strategic aims, among which the current call is for pedagogical research projects to tackle barriers and difficulties in e-learning development. This study aims to investigate both teacher e-learning readiness and students' use of e-learning and impact on learning behaviour. There are two parts to this study:

Part 1: Teachers Study (Faculty of Medicine)

To study teacher's utilization of e-learning by an online survey of all teachers in the Faculty of Medicine. The primary survey instrument was modified for use in tertiary settings from a validated survey already available to assess teaching e-learning readiness.

The survey was sent out to 405 teachers, and 28 responded (6.9%). 7 different teaching roles/titles and 9 medical departments were represented. Use of e-learning in teaching amongst participants was high at 60.7%. The overall mean score of teachers was 3.35 ± 0.55 ($p<0.001$). Teachers indicated dissatisfaction toward institutional and technological support.

Part 2: Students Study (Faculty of Medicine)

The study aims to explore students' effective use of technology for e-learning purposes. The study design is a mixed method study by using a survey, focus groups, and an observational study. The survey consists of student demographics, e-learning readiness, and internet addiction tool (IAT). Focus groups were conducted to explore the internet use, learning behaviour and the barriers to e-learning. Also, a self-reported daily diary for one week of internet usage was used for the observational study.

3100 online surveys were sent out to 6 different programmes via a pre-existing mailing list. The response rate was 5.1% and all six programme and six years of study were represented. With regards to students' attitudes, the overall of the mean score was 3.36 ± 0.42 ($p<0.001$). Students agree that e-learning can increase their flexibility in learning (4.11 ± 0.74) and believe that it can be a supplement to the traditional classroom teaching (4.03 ± 0.69).

47 diaries were distributed to year 6 medical students on June 2018. 33 diaries were received (70.2%). The preferred device for e-learning is still a PC; however, the tablet is also widely used. Mobile usage for e-learning remains low.

The focus groups identified various barriers for students to engage with e-learning. Some themes identified through thematic analysis were '*self-management,' 'pedagogical limitations,' 'low prioritization,' 'poor interface designs,' 'low-quality e-resources,' 'poor institutional implementations,' and 'technologically behind.'*

Conclusion

Our results revealed that the readiness score between teachers and students are relatively similar, albeit teachers scored slightly lower in a few domains – *'Institutional', 'Management', 'Technological', and 'Resource Support'*. Both teachers and students agree institutional factors and manageability of e-learning materials are still not optimal. Such sentiments are supported by the focus groups where *'poor institutional implementations,' 'pedagogical limitations,' 'poor interface designs'* were mentioned as examples of barriers to e-learning. Students may further be exasperated by the long hours required for e-learning on top of their general offline education.

Appendix:

Appendix I. Teacher e-learning readiness items with domains, frequency and mean score:

Domains	Statement	Strongly disagree and disagree	Neutral	Strongly agree and agree	Mean
Evaluation	1. E-learning provides a great return on investment (e.g. in resources, time, expertise etc.)	5 (18.5%)	10 (37.0 %)	12 (44.4%)	3.44 ± 1.01
Pedagogical	2. E-learning is a very efficient way to learn	5 (18.5%)	7 (25.9.0%)	15 (55.5%)	3.52 ± .098
Institutional, Management	3. I am given adequate planning time to create e-learning materials for our courses.	12 (46.2%)	10 (38.5%)	4 (15.4 %)	2.46 ± 1.14
Institutional, Resource Support	4. If I need additional resources (e.g., simulations or virtual labs) for my classes, the university/CLEAR will provide them	8 (32%)	10 (40%)	7 (28%)	3 ± 1

Domains	Statement	Strongly disagree and disagree	Neutral	Strongly agree and agree	Mean
Technological, Management	5. I can easily upload video and audio files for students	2 (7.7%)	6 (23.1%)	18 (69.2%)	3.85 ± 1.01
Technological	6. I am comfortable working with video presentation/processing software (Ispring, Adobe, Articulate etc.)	12 (44.4%)	7 (25.9%)	8 (29.6%)	2.85 ± 1.20
Technological	7. I have used the latest emerging technology in my classroom	13 (50%)	5 (19.2%)	8 (30.8%)	2.77 ± 1.18
Technological	8. I enjoy learning to use new technologies, such as smartphones and tablets, for teaching	5 (18.5%)	11 (40.7%)	11 (40.7%)	3.30 ± 0.87
Pedagogical	9. E-learning provides increased flexibility for my teaching	2 (7.4%)	6 (22.2%)	19 (70.4%)	4 ± 0.96
Technological, Management	10. I can master the skills necessary to lead and manage students in an e-learning course	6 (22.2%)	11 (40.7%)	10 (37.0%)	3.26 ± 0.94

Domains	Statement	Strongly disagree and disagree	Neutral	Strongly agree and agree	Mean
Pedagogical	11. Online learning opens up a world of opportunities for students to learn	0 (0%)	5 (18.5%)	22 (81.5%)	4.04 ±0.65
Pedagogical	12. E-learning offers many opportunities for me to teach more effectively	3 (11.1%)	10 (37.0%)	14 (51.9%)	3.52 ± 1.09
Pedagogical, Technological	13. I am not prepared for online teaching	10 (37.0)%	11 (40.7%)	6 (22.2%)	2.78 ± 1.22
Management, Technological	14. I am very capable of selecting teaching strategies for e-learning	11 (40.7%)	7 (25.9%)	9 (33.3%)	2.89 ± 0.93
Pedagogical	15. Using e-learning in my courses will give my students more incentive to study than traditional lecturing	6 (22.2%)	13 (48.1%)	8 (29.6%)	3.07 ± 0.87
Pedagogical	16. Using e-learning along with my face-to-face class will improve student learning	4 (14.8%)	3 (11.1%)	20 (74.1%)	3.74 ± 0.90

Domains	Statement	Strongly disagree and disagree	Neutral	Strongly agree and agree	Mean
Institutional	**17.** My faculty is ready to venture into e-learning	8 (29.6%)	9 (33.3%)	10 (37.0%)	3.15 ± 1.06
Ethical	**18.** Copyright issues are important in creating e-learning materials	2 (7.69%)	2 (7.69%)	22 (84.6%)	4.04 ± 0.82
Management	**19.** Online announcement/advising for students is very important to student motivation	3 (11.1%)	4 (14.8%)	20 (74.1%)	3.74 ± 0.81
Institutional, Resource Support	**20.** A trained library staff is essential for the success of our e-learning program	7 (26.9%)	4 (15.4%)	15 (57.7%)	3.35 ± 1.16
Resource Support	**21.** Technical support personnel (ITSC) do a great job of supporting students	3 (11.5%)	9 (34.6%)	14 (53.8%)	3.65 ± 0.98
Pedagogical	**22.** We have spent adequate time and	13 (50%)	6 (23.1%)	7 (26.9%)	2.65 ± 1.02

Domains	Statement	Strongly disagree and disagree	Neutral	Strongly agree and agree	Mean
	effort in studying the needs of our students				
Institutional	**23.** The e-learning initiative has direct support from the university/ CLEAR (Centre for Learning Enhancement and Research)	8 (30.8%)	5 (19.2%)	13 (50%)	3.27 ± 1.12
Resource Support, Institutional	**24.** My university has adequate funding for e-learning	8 (32%)	9 (36%)	8 (32%)	2.92 ± 0.95
Institutional, Pedagogical	**25.** There should be more online courses in the curriculum	3 (11.1%)	7 (25.9%)	17 (22.2%)	3.74 ± 0.94

Appendix II. Student e-learning readiness items with domains, frequency and mean score:

Domains	Statement	Strongly disagree and disagree	Neutral	Strongly agree and agree	Mean
Institutional, Management	1. I have enough time to fully engage with online learning sources (viewing lectures and materials, videos, assessments) before class	61 (38.6%)	37 (23.4 %)	60 (38.0%)	2.97 ± 1.05
Pedagogical	2. Online learning increases flexibility in my learning	5 (3.2%)	17 (10.8%)	136 (86.1%)	4.11 ± 0.74
Technological	3. I prefer to use mobile technology such as smartphones and tablets for learning than desktop	65 (41.4%)	49 (31.1%)	44 (27.9 %)	2.87 ± 1.05
Pedagogical	4. My course online experiences helped me engage actively in my learning	21 (13.3%)	45 (28.5%)	92 (58.2%)	3.49 ± 0.87

Domains	Statement	Strongly disagree and disagree	Neutral	Strongly agree and agree	Mean
Institutional	5. A trained library staff is essential for online learning support	55 (34.8%)	57 (36.1%)	46 (29.1%)	2.87 ± 0.98
Institutional, Resource Support	6. ITSC, OME and course coordinators provides great support software	36 (22.8%)	73 (46.2%)	49 (31.0%)	3.08 ± 0.93
Pedagogical	7. I believe online learning to be a valuable supplement to traditional classroom instruction	4 (2.5%)	23 (14.6%)	131 (82.9%)	4.03 ± 0.69
Pedagogical	8. Social media platforms (e.g. WhatsApp, Facebook) should not be used for teaching purposes	58 (36.7%)	39 (24.7%)	61 (38.6%)	3.03 ± 1.19
Resource Support	9. Other online resources outside of required online teaching and resources helped me	2 (1.3%)	26 (16.5 %)	130 (82.3%)	4.01 ± 0.65

Domains	Statement	Strongly disagree and disagree	Neutral	Strongly agree and agree	Mean
	engage actively in learning				
Institutional, Resource Support	10. Technical support is readily available from Faculty/University when required	17 (10.8%)	66 (41.8%)	75 (47.5%)	3.41 ± 0.79
Pedagogical	11. Use of social media (WhatsApp/Facebook) helps me engage actively in my learning	41 (26.0%)	45 (28.5%)	72 (45.6%)	3.20 ± 1.13
Pedagogical	12. Communicating online with students and staff helped my learning	16 (10.1%)	37 (23.4%)	105 (66.5%)	3.68 ± 0.88
Pedagogical	13. Online learning motivates me to study more than traditional lecturing does	46 (29.1)%	41 (26.0)	71 (45.0%)	3.18 ± 1.03
Institutional, Pedagogical	14. The online learning experiences of my medical degree course	28 (17.7%)	43 (27.2%)	87 (55.1%)	3.42 ± 0.92

Domains	Statement	Strongly disagree and disagree	Neutral	Strongly agree and agree	Mean
	are well integrated with my face to face learning				
Technological, Management	15. E-learning management systems (e.g. Blackboard, Moodle) are easy to use	15 (9.5%)	32 (20.3%)	111 (70.3%)	3.71 ± 0.82
Pedagogical	16. There should be more online learning courses in the curriculum	30 (19.0%)	59 (37.3%)	69 (43.7%)	3.30 ± 0.92
Pedagogical	17. Online learning is more effective than traditional lectures for my learning	51 (32.3%)	54 (34.2%)	53 (33.6%)	3.00 ± 0.98

Appendix III. Student participants distributed by Internet Addiction score, according to sample size (n=158)

	≥70 (addicted user)	40-69 (problematic user)	≤39 (average users)	*P* value
Total (n=158)	10 (6.3%)	91 (57.6%)	57 (36.1%)	
Gender				0.835
Male	4 (40%)	32 (35.2%)	18 (31.6%)	
Female	6 (60%)	59 (64.8%)	39 (68.4%)	
Household income				0.681
Less than $10,000	4 (40%)	20 (22.0%)	10 (17.5%)	
$10,000 - $20,000	0 (0%)	6 (6.6%)	4 (7.0%)	
$20,000 - $40,000	0 (0%)	21 (23.1%)	11 (19.3%)	
$40,000-$60,000	2 (20%)	12 (13.2%)	11 (19.3%)	
$60,000 - $100,000	2 (20%)	14 (15.4%)	6 (10.5%)	
>$100,000	2 (20%)	17 (18.7%)	14 (24.5%)	
No of mobile(s) with internet access				0.181
1	7 (70%)	80 (87.9%)	52 (91.2%)	
2-3	1 (10%)	6 (6.6%)	4 (7.0%)	
4 or more	2 (20%)	5 (5.5%)	1 (1.8%)	
No of tablet(s) with internet access				0.009*
1	3 (30%)	52 (57.1%)	34 (59.6%)	
2-3	1 (10%)	7 (7.7%)	3 (5.3%)	
4 or more	1 (10%)	0 (0%)	0 (0%)	
none	5 (50%)	32 (35.2%)	20 (35.1%)	
No of laptop(s) with internet access				0.154
1	8 (80%)	78 (85.7%)	52 (91.2%)	
2-3	0 (0%)	7 (7.7%)	1 (1.8%)	
4 or more	2 (20%)	3 (3.3%)	2 (3.5%)	
none	0 (0%)	3 (3.3%)	2 (3.5%)	

*Significant results that meet requirement of P <0.05

Appendix IV. Student Internet usage distributed by Internet Addiction score, according to sample size (n=158)

Average hours spent daily in the past week of the below internet use	≥70 (addicted user)	40-69 (problematic user)	≤39 (average users)	*P* value
Social Media (Facebook, WhatsApp, Instagram etc.)				0.063
<1	1 (10%)	11 (12.1%)	11 (19.3%)	
1-3	3 (30%)	45 (49.5%)	22 (38.6%)	
3-5	0 (0%)	10 (11.0%)	12 (21.1%)	
5-7	1 (10%)	3 (3.3%)	4 (7.0%)	
7-9	2 (20%)	9 (9.9%)	0 (0%)	
>9	3 (30%)	12 (13.2%)	8 (14.0%)	
Education sites, library and e-learning resources (i.e. Blackboard, Moodle)				0.077
<1	0 (0%)	30 (33.0%)	26 (45.6%)	
1-3	3 (30%)	36 (39.6%)	15 (26.3%)	
3-5	3 (30%)	7 (7.7%)	8 (14.0%)	
5-7	1 (10%)	8 (8.8%)	2 (3.5%)	
7-9	1 (10%)	4 (4.4%)	3 (5.3%)	
>9	2 (20%)	5 (5.5%)	3 (5.3%)	
Leisure activities (gaming, watching films)				0.123
<1	0 (0%)	17 (18.7%)	15 (26.3%)	15
1-3	3 (30%)	37 (40.7%)	25 (43.9%)	25
3-5	1 (10%)	19 (20.9%)	8 (14.0%)	8
5-7	3 (30%)	7 (7.7%)	4 (7.0%)	4
7-9	0 (0%)	2 (2.2%)	1 (1.8%)	1
>9	3 (30%)	8 (8.8%)	4 (7.0%)	4

Reading news/work (including academic work, writing/reading emails)				0.443
<1	1 (10%)	29 (31.9%)	14 (24.6%)	
1-3	5 (50%)	38 (41.8%)	23 (40.4%)	
3-5	1 (10%)	11 (12.1%)	8 (14.0%)	
5-7	0 (0%)	6 (6.6%)	4 (7.0%)	
7-9	1 (10%)	4 (4.4%)	4 (7.0%)	
>9	2 (20%)	2 (2.2%)	4 (7.0%)	
General surfing				0.033*
<1	0 (0%)	38 (41.8%)	23 (40.4%)	
1-3	6 (60%)	36 (39.6%)	22 (38.6%)	
3-5	0 (0%)	4 (4.4%)	3 (5.3%)	
5-7	0 (0%)	5 (5.5%)	4 (7.0%)	
7-9	0 (0%)	1 (1.1%)	1 (1.8%)	
>9	4 (40%)	6 (6.6%)	3 (5.3%)	

*Significant results that meet requirement of $P < 0.05$

Appendix V. Deductive Thematic analysis of Student focus group interviews based on the e-learning domains model.

E-Learning Domains	Student Quotes
Management	*"...we have to do the homework to show that we've read through it, but the problem is that students don't actually read through it because they don't see the importance or just don't think it's necessary, so e-learning and self-directed learning really requires the student to know the importance of knowing the knowledge and wanting to dig deep and research for themselves in order to work" Group2-Student 7*
Institutional	*"I think they should count the hours (of e-learning in) too because medicine is such an intense course. There are so many lectures that we have to go to. Sometimes I feel like, for example, the bridging course that we just had. There were quite a few e-learning lectures that were just placed online, and a part of me felt like, they did that because if they actually put those lectures in the actual timetable, you will see the whole day, maybe from 9-5, is filled with class. It might be inhumane maybe. (laughs) I think they should count as actual hours." Group 3- Student 4* *"But I think e-learning are often half-hearted attempts because at school they sometimes want to try e-learning...they don't seem to believe in the power of e-learning, or they don't seem to rely on e-learning that fully... I think the web is much more than prepared stuff because if it's just prepared stuff like notes than it's not much better than a book or a VCD. The Internet is more about interaction and more about instant feedback, and there's much more to be harnessed from technology, but most of what we have now [e-learning] is just touching on the surface." Group 2 – Student 3*
Pedagogical	*"我覺得面對面好啲。 即係 study group 好啲 ，因為我覺得係 clinical years，好多真係喺 e-learning 做唔到 。譬如我要練個 P, 我要練 history taking 一定要有個人喺度畀我 先可以 practice 到 。" Group 1-Student 3* ***Translation:*** *I think that face to face is better, which means the study group. As I think e-learning cannot replace some of the contents, especially in clinical years. For examples I need to practice physical examination and history taking, I can only practice when a human is here.* *"...when you have a series of lectures being taught in person in the lecture halls, and other lectures taught online that are e-lectures, as a student you'd be like, oh they don't have time to put this in an official lecture or they are not as important, so they just put it on the internet. So then, even myself when I go over online lectures I don't pay as much attention to it, and that's the perception I have as a student too." Group 2 – Student 5*

	"I don't think e-learning can replace [traditional learning]... it [e-learning] can facilitate and be a tool to help students to learn. To get what the main points of the topics are and know what the teacher wants them to learn. But I don't think it can replace all the interaction during the classroom time and peer support environment during the real lecture." Group 3 – Student 2
Interface design	*"Interface is very important to me. The quality, if it's made well, looks well, and I enjoy clicking through it then I'll be more inclined to finish it and not go randomly clicking through to get done with it." Group 2- Student 1*
Resource Support	*"We are already in 2018, and everything seems outdated because, with e-resources, it takes a lot to maintain. However, then this is what [supposed to] make e-resources stand out - it's they're easily updated. This is a must with e-resources or e-learning, to sustain say, updating interfaces and making it quicker, clearer every year, instead of staying the same." Group 2- Student 6* *"I think the quality of e-learning (resources) is also very important. Just like the e-lectures from last year, the voice is very discouraging. The tone is very flat and makes me want to sleep. But actually, in year 3 there are many lectures recorded, and I always use them because I think they were more useful compared to the e-lectures last year, I can fast forward to a point (using recorded lectures)." Group 2-Student 2* *"... I think back in year 3; we did have lecturers who in the middle would be like 'I'm gonna play this YouTube video to show how it works,' especially like DNA translation and application. It's much easier to see a video of enzymes attaching on this strand and (the teacher) kinda explaining. I think the teachers' role is just to help the students learn. And it's not limited to using the original materials; I think it's fine to borrow from other things [sources] to explain, to get the message you want across." Group 2 – Student 5*
Technological	*"I think if the professors can't even adjust the lectures' microphones or have no idea about the projections I have no idea how they could cope with e-learning. Because the technological gap is quite huge sometimes. And then people age, and they have never seen some things before. Obviously, the iPhone has now been out for ten years, and now we have to use it for learning. If people don't catch up, it's really hard to push this e-learning thing, even if it's there." Group 2-Student 6* *"It's always going to progress, so it requires effort to keep up. Because it requires a lot of effort to keep up. So, I saw them, very often, Blackboard or any web page, if it lacks maintenance, if it stays stagnant, then everything that was once cutting-edge technology would become very old-fashioned in just a few years." Group 2 –Student 6*

	"I think we really needed to update the application that runs the e-lecture. The one in Blackboard is good but the one uploaded in MCU is very bad because when I want to return back to a point when I click it, it sometimes has to reload the whole video. So, I think it's very annoying." Group 2-Student 2
Evaluation	*"E-learning 有個特點就係 allow 咗個 Evaluation 嘅途徑 ，可以 evaluate 返我哋學成點 。即係 say online quiz, questionnaire, question bank 又好。即係可以畀我哋 Evaluate 返自己嘅學習進度，呢個其實係好緊要 。因為 learning 呢個 procedure 其實係有幾個 step 㗎嘛。即係除咗 receive information 重要 evaluate 自己 receive 幾好, 先至可以知道 你需唔需要 receive 去 定係可以 switch to other topics 。咁其實呢個 evaluation 嘅 tools 一直都冇咗我哋啲鎖匙之外 "Group 1-Student 1* ***Translation:*** *Evaluation is a characteristic of e-learning, it can allow us to evaluate our learning process using an online quiz, questionnaire or question bank. This is very important as learning involves several steps, apart from receiving information, we also need to evaluate how well we can receive the information so that you can choose to review again or switch to other topics.*