Scientific Open Access Journals
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Journal of Medical Education and Training

Research Article | Open Access

Learner Performance and Usability of the Medical Certification of Cause-of-Death (Mccod) E-Learning Intervention

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Received: 22 July 2021; **Accepted:** 28 January 2022; **Published:** 03 March 2022

Abstract

Introduction: We examined the effectiveness of a locally-developed medical certification of cause-of-death (MCCOD) e-learning intervention in improving knowledge outcomes among medical interns and clerks in the Philippines and evaluated its usability as an alternative method for MCCOD training.

Methods: A nonequivalent control group pretest-posttest quasi-experimental study was conducted. We recruited medical interns and clerks from seven accredited medical institutions from February to April 2020. Learners were conveniently assigned to intervention and control groups. Pretest and posttest data were collected using a 25-item questionnaire, while usability was assessed using a cross-sectional survey. We analyzed the effect of the MCCOD e-learning intervention on posttest score using analysis of covariance (ANCOVA), and the usability of the e-learning intervention through mean and standard deviation

Results: There were 1078 learners: 869 (80.6%) received intervention and 209 (19.4%) were controls. Results revealed that the e-learning intervention significantly improved the posttest score ($p = < 0.001$), with the intervention group having higher posttest score (M_{adj} = 19.934, SE = 0.080, 95% CI [19.778, 20.091]) than the control group (M_{adj} = 18.106, SE = 0.202, 95% CI [17.710, 18.501]). The e-learning intervention received a good usability score (M = 3.86, SD = 0.88) from the learners, with lowest dimension means noted in *Learning and Support* and *Interactivity*.

Conclusion: E-learning is an effective means of improving MCCOD knowledge outcomes among medical clerks and interns. Enhancing its usability is critical to maximize its impact on learning outcomes and improve its adoption.

Keywords: Online education; Vital statistics; Cause of death; Philippine

Introduction

Medical and public health scholarships have long been replete with literature on the importance of mortality statistics in shaping clinical and public health decision-making [1-3]. Despite considerable efforts to produce timely and accurate mortality statistics, both developed and developing countries have documented significant errors in the accuracy and completeness of cause-of-death documentation [3-9]. In the Philippines, recent studies show that 30 to 70% of medical certificates of cause of death (MCCOD) are incorrectly completed, with 25 to 40% of death certificates having major documentation errors [8-9]. One of the posited reasons behind the poor quality of MCCOD is the lack of training.

Scholars have advanced the need to introduce and standardize education on the correct MCCOD documentation [10] since educational interventions have been shown to improve death certificate completion and accuracy [8,11-14]. In 2018, the Philippines' Department of Health (DOH), with support from the World Health Organization, developed the *Post Graduate Interns Practicum Guidelines on MCCOD.* From February to December 2019, the DOH coordinated with the Association of Philippine Medical Colleges (APCM) and trained clinical training coordinators across the country, with the intent to echo learnings to their medical interns, who have yet to become licensed physicians. However, these seminar-workshops were limited in scalability, with only six DOH-hosted workshops conducted annually; echo sessions were not always carried out.

E-learning was a mode explored to ensure sustainability and promote wider reach. Thus, the DOH deputized the University of the Philippines Manila - College of Medicine to develop, implement, and evaluate an alternative learning model for MCCOD training that utilizes digital technologies instead of the usual classroom-type of instruction.

This article presents the results of the pilot implementation of a locally developed MCCOD online course implemented among medical clerks and interns across the Philippines. Specifically, we examined (a) the effectiveness of the e-learning intervention in improving MCCOD knowledge among medical interns and clerks, including differences in learner performance between demographic groups, and (b) the usability of the online course as an alternative method for MCCOD training. The contributions of our article are threefold: first, we provide a summative evaluation of a locally developed MCCOD online course. Second, this paper contributes to the growing body of scholarship on the use of e-learning in MCCOD training, especially in the education of medical clerks and interns in developing countries. Lastly, our findings also aim to contribute to addressing the paucity of available evidence on the best strategies to improve the adoption and sustainability of MCCOD educational programs.

Methods

We used a nonequivalent control group pretest-posttest quasi-experimental design to evaluate the effectiveness of the e-learning intervention in improving learning outcomes. The usability of the MCCOD online course was assessed using a cross-sectional survey. The Single Joint Research Ethics Board of DOH, Philippines, ascertained the ethical soundness of this multi-center quasi-experiment.

The MCCOD E-learning Intervention

The MCCOD e-learning intervention was an online course developed based on the DOH-approved and previously MCCOD curriculum [15]. It has six modules: (1) Overview of MCCOD, (2) Death Registration: Legal Mandates, Rules and Procedures, (3) Understanding Medical Certification of Death and its Principles, (4) Guidelines for Reporting Causes of Death in Specific Groups and Conditions, (5) Reviewing the Certificate of Death, and (6) Verbal Autopsy. The last part contained a review on death certificate completion and an analysis of 10 cases. The e-learning course was hosted by UP Manila's Virtual Learning Environment, a Moodle-based course management system accessible through mccod.upm.edu.ph. Two MCCOD courses were made available: one for medical clerks and interns and another for licensed physicians. This paper only focused on the former.

Upon registration, learners were directed to the course homepage. They were required to answer a user profile form, an e-learning readiness survey and a 25-item pretest questionnaire prior to accessing the MCCOD modules. Each module ends with a set of reinforcement questions. After the course, learners were asked to apply MCCOD cognates by completing a 78-item case analysis questionnaire. Completion was a requirement to proceed to the posttest. The last part was the e-learning usability evaluation. A certificate of completion was generated thereafter.

Instruments

We used three data collection instruments: (a) user profile form to document learner characteristics, (b) pretest-posttest questionnaire to assess knowledge on MCCOD before and after the intervention, and (c) usability evaluation form.

The pretest-posttest questionnaire, consisting of 25-item, was developed by MCCOD subject matter experts and included *must-know* concepts based on the DOH-approved curriculum. This instrument has seven recall and comprehension items and 18 analysis and application items. The maximum score is 25 points, and the minimum passing level (MPL) is 16 points based on the Angoff method [16]. The questionnaire has an average facility index of 65.5% (test difficulty is about right for the average student) and a reliability coefficient of 0.68 (fairly reliable). A second version of the test with a 0.81 reliability was developed for nationwide deployment but was not implemented during the study.

To evaluate usability, we adopted a validated 36-item questionnaire [17], which assesses eight usability dimensions of e-learning: Content, Learning & Support, Visual Design, Navigation, Accessibility, Self-Assessment & Learnability, Interactivity, and Motivation for Learning. The reliability coefficient was at 0.93 (very good reliability).

Data Collection and Analysis

We recruited medical interns (i.e., individuals who have completed their four-year undergraduate medical curriculum and are undergoing the standard 12-month clinical internship) and medical clerks (i.e., students in their fourth year of coursework in an accredited undergraduate medical program in the Philippines and are about to go to the internship in the following school year) from seven medical universities and hospitals. Since this study has drawn its findings from a pilot deployment, we did not limit the number of study participants. However, we calculated for minimum sample size by adapting the formula (1) for estimating a population proportion [18]:

$$n = \frac{z^2 PQ}{d^2} \times adjustment for non-response rate$$

where z = 1.96 is the z-statistic set at 95% confidence level, P = 0.15 is the assumed proportion of learners who would erroneously identity the cause of death, Q (computed as 1 - P = 0.85) is the assumed proportion of learners who would correctly identify the cause of death, d is the margin of error set at 0.05, and *adjustment for non-response rate* = 1.1 accounts for the 10% assumed non-response rate. The value of P is based on the estimated 15–20% erroneous cause of death information documented in death certificates [19]. Using equation (1), our calculation suggests a minimum sample size of 216 or 108 for both intervention and control groups.

Data were collected from February to April 2020. Participants from four pilot sites were conveniently assigned to the intervention group, while participants from two sites were assigned as control. One institution had learners conveniently assigned to either intervention or control groups.

Medical clerks and interns from pilot sites were asked to register to access the course. Learners who signified their intention to participate in the study through digital informed consent were included in the analysis. Both intervention and control groups answered the user profile form and pretest questionnaire on their first day of course access. The intervention group was asked to complete the course in a week. On the other hand, the control group was only given access a week after the intervention group finished the course. After a week, participants from both study groups answered the posttest questionnaire. The intervention group was asked to complete the usability evaluation survey.

Data were analyzed using IBM® SPSS® Statistics 25, with statistical significance set at $p < 0.05$. We utilized a two-way analysis of covariance (ANCOVA) to examine the effect of the e-learning intervention in improving learners' posttest scores. As part of the ANCOVA, we selected the learners' institution, pretest score, previous eLearning experience, and previous training on MCCOD as covariates because of the imbalance baseline between the control and intervention groups in these variables. In addition, we also selected learners' institutions as a covariate to control possible clustering effects in our data analysis. We determined the usability of the e-learning intervention through mean and standard deviation.

Results

Characteristics of learners

Figure 1 shows the flow of learners participating in this study. A total of 1396 learners were recruited. Of which, 19 (1.38%) decided not to participate in the study. From the remaining 1377, we noted an attrition rate of 6.83%, with 94 learners failing to complete the

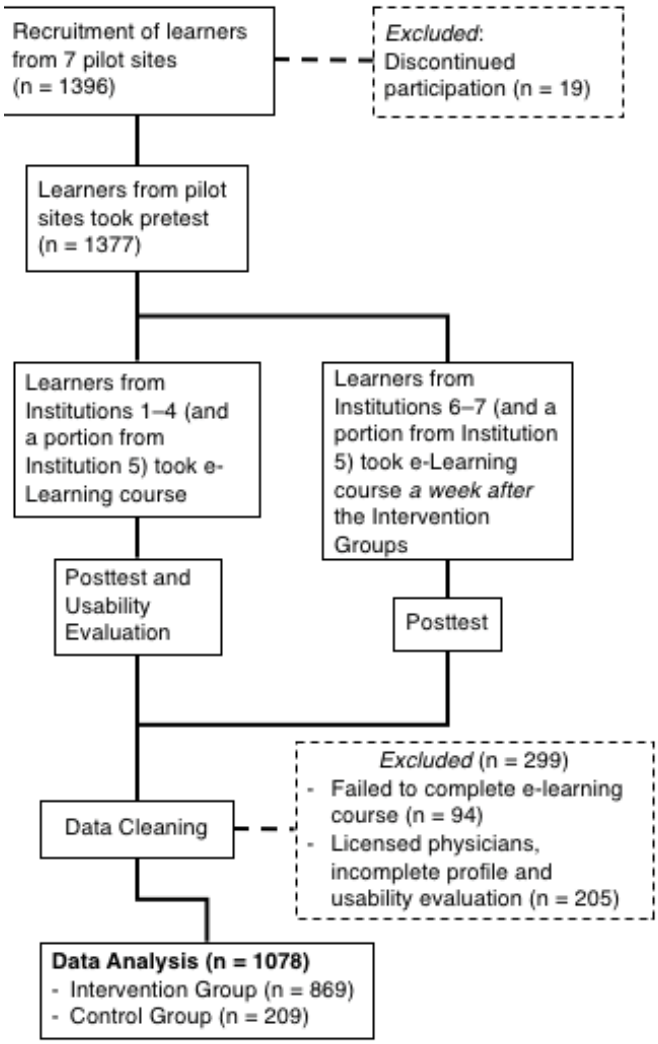

Figure 1: Flowchart showing learner participation in the study.

course until the posttest. Upon data cleaning, we further excluded 205 (15.98%) learners who were either licensed physicians who took the course intended for medical interns/clerks or who have an incomplete profile and/or usability evaluation feedback. In total, this study draws findings from 1078 learners.

As shown in Table 1, the mean age of learners was 25.88 years old *[SD=2.05]*. The majority were female (67.6%) and were medical interns (77.5%). Most learners reported unfamiliarity with the MCCOD guidelines (60.2%) and no formal training on MCCOD (63.8%). More than three-quarters (78.7%) have not experienced completing a death certificate. On the other hand, 25.79% of the learners have tried e-learning. When it comes to adopting and using new technologies, most of the learners were in the category of Early Majority (46.2%), while 3.7% were skeptics and laggards.

Effectiveness of E-Learning intervention in improving MCCOD knowledge outcomes

As shown in Table 2, the intervention group (M_{adj} = 19.934, *SE* = 0.080, 95% CI [19.778, 20.091]) received higher adjusted mean posttest score than the control group (M_{adj} = 18.106, *SE* = 0.202, 95%

Table 1: Characteristics of learners.

	Control		Intervention		Total	
	n	%	n	%	n	%
Institution						
Institution 1	0	0.0%	314	36.1%	314	29.1%
Institution 2	0	0.0%	117	13.5%	117	10.9%
Institution 3	0	0.0%	234	26.9%	234	21.7%
Institution 4	0	0.0%	100	11.5%	100	9.3%
Institution 5	34	16.3%	0	0.0%	34	3.2%
Institution 6	54	25.8%	104	12.0%	158	14.7%
Institution 7	121	57.9%	0	0.0%	121	11.2%
Total	209	100.0%	869	100.0%	1078	100.0%
Age in years (Mean ± SD)	26.63 ± 2.176		25.70 ± 1.979		25.88 ± 2.05	
Sex						
Male	59	28.2%	290	33.4%	349	32.4%
Female	150	71.8%	579	66.6%	729	67.6%
Total	209	100.0%	869	100.0%	1078	100.0%
Designation						
Medical Intern	192	91.9%	643	74.0%	835	77.5%
Medical Clerk	17	8.1%	226	26.0%	243	22.5%
Total	209	100.0%	869	100.0%	1078	100.0%
Previous training on MCCOD						
Yes	5	2.4%	385	44.3%	390	36.2%
No	204	97.6%	484	55.7%	688	63.8%
Total	209	100.0%	869	100.0%	1078	100.0%
Perceived familiarity with DOH's Guidelines and Procedures on MCCOD						
Yes	24	11.5%	405	46.6%	429	39.8%
No	185	88.5%	464	53.4%	649	60.2%
Total	209	100.0%	869	100.0%	1078	100.0%
Experience in completing death certificates (with or without supervision)						
0, no experience	151	72.2%	697	80.2%	848	78.7%
1 to 10 death certificates	48	23.0%	169	19.4%	217	20.1%
10 to 20 death certificates	5	2.4%	2	0.2%	7	0.6%
> 20 death certificates	5	2.4%	1	0.1%	6	0.6%
Total	209	100.0%	869	100.0%	1078	100.0%
Previous eLearning Experience						
Yes	26	12.4%	252	29.0%	278	25.8%
No	183	87.6%	617	71.0%	800	74.2%
Total	209	100.0%	869	100.0%	1078	100.0%
Attitude on Technology Use and Adoption*						
Innovators: I love new technologies and am among the first to experiment with them	35	16.7%	167	19.2%	202	18.7%
Early Adopters: I like new technologies and use them before most of the people I know	41	19.6%	180	20.7%	221	20.5%
Early Majority: I usually use new technologies when most people I know do	97	46.4%	401	46.1%	498	46.2%
Late Majority: I am skeptical of new technologies and only use them when I have to	29	13.9%	88	10.1%	117	10.9%
Laggards: I am usually one of the last people I know to use new technologies	7	3.3%	33	3.8%	40	3.7%
Total	209	100.0%	869	100.0%	1078	100.0%

Note. *adapted the categories of technology adopters of Rogers 1962, Diffusion of Innovations Theory [21]

Table 2: Means, Adjusted Means, Standard Deviations, Standard Errors, and Confidence Interval for Posttest Scores.

	n	M	SD	M_{adj}	SE	95% CI [LL, UL]
Control	209	18.29	3.387	18.106	0.202	[17.710, 18.501]
Intervention	869	19.89	1.881	19.934	0.080	[19.778, 20.091]
Total	1078	19.58	2.339			

Note. *M* and *SD* are used to represent mean and standard deviation, respectively. Likewise, M_{adj} represents the adjusted mean, and *SE* represents the standard error. Finally, LL and UL indicate the lower limit and upper limit of the confidence interval (CI)

Table 3: Analysis of Covariance for Posttest Scores by Study Group with Institution, Pretest Scores, Previous e-learning Experience and Previous Training on MCCOD as Covariates.

Source	Sum of Squares	df	Mean Square	F	p	partial η^2
Institution	34.171	1	34.171	7.487	0.006*	0.007
Pretest Score	470.041	1	470.041	102.982	0.000*	0.088
Previous e-learning experience	25.830	1	25.830	5.659	0.018*	0.005
Previous Training on MCCOD	35.813	1	35.813	7.846	0.005*	0.007
Study Group	272.290	1	272.290	59.656	0.000*	0.053
Error	4892.995	1072	4.564			
Total	419161.000	1078				
Corrected Total	5890.639	1077				

Note. indicates $p < 0.05$.

CI [17.710, 18.501]). The ANCOVA results in Table 3 confirmed that the E-learning intervention significantly affected the difference in the posttest score between the intervention and control group [$F(1, 1072) = 59.656$; $p = < 0.000$; partial $\eta^2 = 0.053$], using the learners' institution, pretest score, previous eLearning experience, and previous training on completing death certificates as covariates. While the adjusted means and ANCOVA results suggest that the e-learning intervention is effective in improving the learners' MCOOD knowledge outcomes, the partial η^2 showed that only 5.3% of the variation in the posttest scores could be explained by the study group membership (following Cohen's guidelines on effect size [20]).

Usability Analysis

The overall mean usability score of the MCCOD online course is 3.86 (*SD* = 0.88). Table 4 reflects the usability dimensions, specific parameters or items per dimension and corresponding average scores per item and dimension.

Of the eight usability dimensions, *Visual Design* and *Navigation* got the highest dimension average at 3.99. Both *Content* and *Self-Assessment & Learnability* achieved a mean score of 3.92. The remaining usability dimensions were noted to have mean values lower than the overall usability mean score of 3.86. *Learning and Support* received the lowest average score among all usability dimensions. Item-wise, *Interactivity* Q1 scored the lowest at 3.63.

Discussion

The e-learning intervention was developed to provide a more standardized, sustainable and scalable way of MCCOD education. Results show that the MCCOD e-learning course is an effective and user-friendly intervention that may improve knowledge outcomes of medical interns and clerks. Learners who completed the course achieved significantly higher posttest scores ($p < .001$) compared to controls. While our findings are consistent with current evidence suggesting the effectiveness of e-learning in training medical students [13,14,17] and other health professionals [8,22], *practice* effect or *test-retest* learning effect may also influence gains in posttest scores. Practice effects are improvements in succeeding tests attributed to prior exposure to testing materials and learning contents [23,24]. Using ANCOVA, we controlled the potential practice effect of covariates (i.e., the previous exposure to pretest, MCOOD training, and e-learning) to our learners' posttest scores.

Our study also assessed user experience and potential for technology adoption by evaluating the online course's usability. The MCCOD e-learning intervention received an overall mean usability score of 3.86 (*SD* = 0.88), indicating good usability. Of the eight usability dimensions, the online course received the highest rating in *Visual Design* and *Navigation*. Both *Content* and *Self-Assessment & Learnability* also achieved an above-average value of 3.92. While the learners positively rated the course in *Motivation to Learn* (*M* = 3.82), *Accessibility* (*M* = 3.80), *Interactivity* (*M* = 3.75), and *Learning and Support* (*M* = 3.75), their average scores were lower than the overall usability mean. This may indicate the need for further improvements in these four dimensions. The lowest ratings were noted in *Interactivity* items Q1 and Q2 (i.e., Q1: The course uses games, simulations, role-playing activities, and case studies to gain the attention and maintain the motivation of learners; Q2: The course provides access to a range of resources appropriate to the learning context and for use in the real world), and *Learning and Support* items Q1 and Q3 (i.e., Q1: The course motivates learners to request feedback from instructors, experts and peers, through email or other online communications.; Q3: The course offers tools that support learning). These four lowest-scoring items point to a need for interactive activities and additional MCCOD learning resources/tools.

A major critique against remote learning is the limited interaction between the learner and the instructor and between fellow learners. Our learners especially observed this gap, who mostly experienced classroom and peer learning in their medical education. Face-to-face learning allows learners to ask questions in real-time and discuss with their instructor or peers to understand the subject matter further. This is limited in the MCCOD online course, where learning and assessments are done individually. Thus, to maximize the potential of e-learning, we recommend the adoption of strategies that enhance interactivity, such as the use of games [25], question-and-answer sessions [26], virtual discussion rooms [27], or immediate feedback mechanisms [28]. Moving towards a blended learning approach by adding face-to-face discussions with the instructor [29,30] can also be considered. Ensuring means to provide and receive feedback remains an essential component of remote education in refining students' competencies [31,32]. In e-learning, feedback can be automated, such as in assessments or evaluations, where explanations or references can be provided as pop-ups when a correct or wrong answer is selected. Feedback, which would inform students of best and erroneous practices alike, is well received, even if delivered online. The latter can also address another identified gap: the need for additional tools that support learning.

In developing countries, Internet access is often a challenge.

Table 4: Usability evaluation* (n = 869).

Usability Dimension	Item	Item Mean ± SD	Dimension Mean 95% CI [LL, UL]
Content	Q1: The terminologies used are consistent and easy to understand throughout the e-learning course.	3.90 ± 1.07	3.92 [3.36, 3.99]
	Q2: Abstract concepts (principles, formulas, rules, etc.) are illustrated with concrete, specific examples.	3.82 ± 1.08	
	Q3: The material in the course is accurate and current.	3.93 ± 1.09	
	Q4: Vocabulary and terminology used are appropriate for the learners.	3.98 ± 1.08	
	Q5: Learning objectives of each module are quite clear to the learners.	3.98 ± 1.10	
	Q6: Content is organized in an appropriate sequence and in small modules for flexible learning.	3.91 ± 1.11	
Learning and Support	Q1: The courses motivate learners to request feedback from instructors, experts and peers, through email or other online communications.	3.68 ± 1.12	3.74** [3.67, 3.80]
	Q2: Feedback given at any specific time is tailored to the content being studied, problem being solved, or task being completed by the learner.	3.73 ± 1.08	
	Q3: The courses offer tools that support learning.	3.67 ± 1.15	
	Q4: Wherever appropriate, higher-order assessments (for example case studies) are provided rather than lower-order assessments (simple quiz).	3.80 ± 1.08	
	Q5: The course provides support for learner activities to allow working within existing competence while encountering meaningful chunks of knowledge.	3.80 ± 1.09	
Visual Design	Q1: The most important information on the screen is placed in areas most likely to attract the learner's attention.	3.88 ± 1.07	3.99 [3.93, 4.06]
	Q2: Text and graphics are legible (readable).	4.05 ± 1.06	
	Q3: Fonts are easy to read in both on-screen and in printed versions.	4.04 ± 1.06	
	Q4: The online help or documentation is written clearly.	4.00 ± 1.06	
Navigation	Q1: Learners can choose (easily) what parts of the course to access, the order and pace of studying.	3.95 ± 1.08	3.99 [3.92, 4.06]
	Q2: Learners always know where they are in the course.	4.01 ± 1.04	
	Q3: The courses allow the learner to leave whenever desired, but easily return to the closest logical point in the course.	4.01 ± 1.09	
Accessibility	Q1: The pages and other components of the course download quickly.	3.84 ± 1.08	3.80** [3.73, 3.87]
	Q2: The course is free from technical problems.	3.76 ± 1.14	
Interactivity	Q1: The course uses games, simulations, role-playing activities, and case studies to gain the attention, and maintain motivation of learners.	3.63 ± 1.15	3.75** [3.69, 3.82]
	Q2: The course provides access to a range of resources appropriate to the learning context and for use in the real world.	3.65 ± 1.16	
	Q3: The course engages learners in tasks that are closely aligned with the learning goals and objectives.	3.89 ± 1.01	
	Q4: Media are used appropriately so as to assist in highlighting and learning critical concepts rather than merely entertaining or possibly distracting learners.	3.84 ± 1.08	
Self-Assessment & Learnability	Q1: Learners can predict the general result of clicking on each button/link.	3.84 ± 1.03	3.92 [3.86, 3.98]
	Q2: Learners can start the course (locate it, install plug-ins, register, access starting page) using only online assistance.	3.92 ± 1.03	
	Q3: It is clear to learners what is to be accomplished and what will be gained from its use.	3.92 ± 1.00	
	Q4: The course provides opportunities for self-assessment (posttests and other assessments) that advance learners' achievements according to the learning objectives.	3.99 ± 0.97	
Motivation to Learn	Q1: The course incorporates novel characteristics.	3.78 ± 1.06	3.82** [3.75, 3.88]
	Q2: The course stimulates further inquiry.	3.85 ± 1.05	
	Q3: The course is enjoyable and interesting.	3.76 ± 1.08	
	Q4: The course provides instruction/training that matches with the learners' experience.	3.81 ± 1.05	
	Q5: The course meets learners' needs.	3.84 ± 1.03	
	Q6: The course provides the learner with frequent and varied learning activities that increase learning success.	3.84 ± 1.03	
	Q7: The course provides learners opportunities to use new skills in authentic situations.	3.87 ± 1.04	
	Q8: The course assists learners to have positive feelings about their accomplishments.	3.80 ± 1.09	

Note. * denotes that the responses included in the usability evaluation are only from the intervention group (n = 869). ** suggests that dimension mean value is lower than the overall usability mean score (M = 3.86, SD = 0.88). LL and UL indicate the lower limit and upper limit of the confidence interval (CI).

Although the MCCOD online course has received a very good rating in *Accessibility*, asynchronous e-learning should be considered to improve access and sustainability of the training program. Our study sites were institutions with existing resources and infrastructure to support e-learning. And thus, ease of access may be different in remote areas where Internet connection is unavailable or intermittent. The Philippines ranks 57th and 82nd among 100 countries studied in terms of availability and affordability [33]. For nationwide deployment, using asynchronous e-learning that allows students to access the modules even offline, at their own convenient time, in the comforts of spaces conducive to study, will be of great value.

Overall, learners agree that the MCCOD online course has good usability. This is further supported by the high completion rate of the course, with only around 6–7% attrition rate. However, the latter may also be attributed to the sudden shift to online learning during the study period due to COVID-19. In addition, the disruptive consequences of the pandemic to medical education have caused e-learning to rapidly receive attention as a viable alternative to traditional models of person-to-person didactics, lectures, and chalk talks [34-37]. As a result, participating medical clerks and interns may have found themselves with more time to complete this online learning, while educators may have become more open and interested in promoting e-learning to their students.

In conclusion, our study shows that e-learning effectively improves knowledge outcomes on MCCOD among medical clerks and interns. E-learning is an acceptable alternative to face-to-face training on MCCOD. It has the potential to provide remote education and complement, augment, and transform a traditional classroom pedagogy. Enhancing the usability of the MCCOD e-learning intervention is critical to maximize its impact on learning outcomes and improve its adoption.

The limitations of this study are generic to most social science research associated with quasi-experiments. Although ANCOVA allowed us to control the potential effects of covariates, the study does not allow for random sampling and random assignment of subjects to study groups. Furthermore, the study duration of four months limited the number and type of post-intervention evaluations that can be done. Thus, we advise modest generalization of our findings. Nevertheless, follow-up studies can be conducted using true experimental designs to produce highly generalizable results.

Authors' Contributions

MCA devised the study concept, designed the study, supervised the intervention, data collection and analysis, and critically revised the manuscript. AJA contributed to the study design, participated in the data collection and study coordination, performed the analyses, and drafted the manuscript. RLM participated in the coordination of the study, data collection, drafting and revision of the manuscript. PGM contributed to the study concept, reviewed and critically revised the manuscript.

Funding

This study was funded by the Philippines' Department of Health (DOH) Knowledge Management and Information Technology Service. The funders had no role in the study design, data collection and analysis, decision to publish, or preparation of the manuscript.

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