COVID-19 Pandemics and Impacts on Medical Educators in China

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Abstract

Background: Education informatization is still in the early stage in China. The sudden outbreak of the COVID-19 pandemic led medical educators passively incorporating information technology for remote medical teaching, in which challenges and opportunities have co-existed.

Objectives: The objectives of this study were to (1) explore the medical educators' perception and experience of online teaching in medical education before and after emergency remote teaching (ERT) experience during the COVID-19 pandemic; (2) illustrate the medical educators' satisfaction on the contribution of online teaching on medical teaching, and (3) reveal the main challenges medical educators met when they conduct the ERT during the COVID-19 epidemic, and to demonstrate whether the challenges are a different by age or gender including some other factors.

Methods: A web-based questionnaire was disseminated to the faculty of medical education departments at higher institutions in China. The collected quantitative data of the questionnaire were analyzed by using the SPSS software package. Descriptive statistics were conducted on demographic data and the perception and experience of medical educators before and after the COVID-19 were shown as the frequencies and percentages, while the teachers' opinions on contribution of online teaching on medical education were analyzed by descriptive statistics with means and standard deviations. Multiple response analysis combined with crosstabulation chi-square test was applied, and a P-value <.05 was considered to be statistically significant to exams the relationship between age as well as gender and difficulties met in online teaching respectively.

Results: A total of 26 medical educators (65.38%, n=17 female and 34.62%, n=9 male) were valid participants. Total 57.69% (n=15) of them had used web-based teaching before the COVID-19 pandemic, whereas 43.21% (n=11) had not. The agreement level on the teaching effect of online teaching was medium, with a mean value of 2.55 (range from 1-5). The first two difficulties medical teachers came across in online teaching were the web-based instructional design (27%), and the unfamiliarity with web-based teaching tools (25 %). No significant difference in the types of difficulties encountered by different ages (P=0.969) or gender (P = 0.873) in online teaching.

Conclusions: The majority of medical educators are open-minded to incorporating online teaching into their teaching practice in the future. However, medical educators in China commonly faced shared difficulties when they adopted online teaching during the COVID-19 pandemic. Identify these challenges and proposing some relevant suggestions to promote a further increase in the active adoption of information technology in medical education.

Introduction

The novel coronavirus disease 2019 (COVID-19) is one of the most unpredictable global public health crises of epic proportions in recent years [1, 2, 3], which has brought a profound impact on higher education [4]. Medical schools have been forced to dramatically restructure teaching and assessment to

adapt to the effect of the COVID-19 pandemic [5]. Considering the COVID-19 effect is unstable, medical learners cannot be in a direct clinical environment [6, 7]. While it is essential to minimize the spread of a pandemic within medical institutions, medical education and research activities cannot be stalled every time an epidemic occurs [8]. Moreover, practical skills are a crucial aspect in the medical education field, and the real-life clinical practice experience is hardly optimally replaced by digital virtual simulation learning for the time being. Under the intense pressure of the external environment, medical educators were passively formalizing the application of information technology to teaching activities, which has brought considerable challenges and opportunities for medical educators. Medical teachers were challenged by the inexperience and unforeseen online teaching and inadequate technical aid for ERT under the effect of the COVID-19 epidemic [9]. Therefore, how to quickly adapt to the teaching relationship of space-time separation, adjust teaching methods, and flexibly deal with the sudden online teaching situation, conducting a "big test" of teachers' ICT competency.

The accelerated development of information technology nationally and globally in the last couple of years has made a significant contribution to support adapting the effect of the COVID-19 pandemic. The use of information technology in medical classes has been increasingly ubiquitous [10, 11]. The rapid technology advancement in education has resulted in the adoption of learner-centered methods employed for educational use beyond traditional lectures micro class, massive open online course (MOOC), and flipped classroom, collaborative team learning, problem-based learning (PBL), case-based learning (CBL) [12, 13]. Importantly, many digital technologies have been considered or used in the educational field, such as virtual simulation teaching forms supported by technology [14–17] and video-based social media platforms [18, 19]. In recent years, some studies have proven that augmented reality (AR) and virtual reality (VR) can enhance students' engagement [20, 21]. Artificial intelligence (AI) has revolutionized technical medicine aspects; blending it with medical education can meet post-human demands [22, 23]. Under the COVID-19 epidemic, the provision of medical education needs to be maintained in the form of decentralized, remote, and technical support [8, 24]. However, it is observed that in China, teachers' information technology application ability is just at the primary level, and the innovation ability of information technology teaching is insufficient [25]. The deep integration of information technology and teaching is currently not enough.

Although institutions that would conduct face-to-face teaching in the classroom or campus may resume the traditional teaching model to a certain extent, the ERT they implemented during the COVID-19 pandemic would leave a lasting trace [26]. The benefits found in the ERT would prompt further acceleration in the expansion of digital learning in educational evolution. Many researchers have conducted a review or evaluation of the ERT from students' perspective or a reflection of the emergency teaching methods [6, 24, 27, 28] while paying less attention to the educators' aspect. This paper had three main objectives: (1) To explore the medical educators' perception and experience of online teaching in medical education before and after ERT experience during the COVID-19 pandemic; (2) Illustrate the medical educators' satisfaction with the contribution of online teaching on medical teaching; (3) To reveal the main challenges medical educators met when they conduct the ERT during the COVID-19 epidemic and demonstrate whether the difference in age or gender distinguishes the challenges.

Identifying those research questions arising in ERT from medical educators' perspective and evaluating their perception of online medical teaching methods can provide referential suggestions for future medical education reform and improvement.

Methods

Study Design and Participants

The participants were medical educators, who were teaching medicine courses in "211"," 985" (they are top-listed universities in China), or other colleges and universities in China, with an experience of conducting online medical teaching activity under the effect of the COVID-19 pandemic. To ensure the survey's validity and reliability, we delivered our survey to a specific group of educators deliberately, those who have different background information, i.e., age, gender, and educational background. Thirty online questionnaires were delivered through WeChat or email. Both the English version and the Chinese version of the questionnaire were provided to the participants. The quantitative data collection started on April 14 and lasted for three months.

Questionnaire Development

The online questionnaire was developed through "SO JUMP" and delivered to the participants, involving open-ended and closed-ended questions (see Appendix 1). In this exploratory study, we administered this online survey following different topics with various questions sets: (1) the first question to ensure volunteer to take part in the questionnaire, and 7 following questions set up for knowing about the personal background information; (2) 12 closed-ended questions with options of "yes or no" multiple-choice questions, and 2 open-ended questions to explore medical educators' perception and experience toward the online teaching method before and after the COVID-19 epidemic, as well as medical educators' perspectives toward further integration of online teaching and medical education; (4) 11 five-point Likert items on a scale of 1-5 (1=strongly agree, and 5=strongly disagree) were comprised, and choosing "strongly agree" and "agree" represented that medical educators agreed that online teaching has a vital contribution on teaching effect; 5) a multiple question to learn about the main difficulties met by medical educators during the pandemic.

Evaluation and Statistical Analysis

The quantitative data were downloaded from the “SO JUMP” platform into a Microsoft Excel spreadsheet. The collected quantitative data of the questionnaire were analyzed by using the SPSS software package (Statistical Package for the Social Sciences, version 26 for Mac, IBM Corporation). Firstly, descriptive statistics were conducted on demographic data with continuous variables--age and gender for the chi-square test later, which were endowed with (male=1, female=2) and (1=age>30; 30<=2=age<40; 40<=3=age<50; 4=age>=50) respectively. The perception and experience of medical

educators before and after the COVID-19 pandemic were displayed as the frequencies and percentages. Besides, the data of teachers' satisfaction on the usefulness of online teaching on medical education were analyzed by descriptive statistics (means and standard deviations). Multiple response analysis combined with crosstab chi-square test was applied, and a P-value of <.05 was considered to be statistically significant to determine whether there existed a relationship between (a) gender and difficulties met in online teaching; and (b) age and difficulties met in online teaching.

Ethical Considerations

Ethical permission for the research was obtained from the human research ethics committee (HREC) of the University of Hong Kong. The reference number indicated in the letter of approval for ethical clearance issued by the HREC is EA1909007. Medical teachers were informed the research purposes, confidentiality and their right to quit the survey. To safeguard the confidentiality of the participating teachers, the names of teachers will be coded as teacher A, B, C.

Result

Demographic Information of Participants

A total of 26 valid responses were received, involving 17 female and 9 male medical educators, out of the total 30 questionnaires delivered. The demographic background information of those 26 participants were statistically summarized in the descriptive Table 1. 50% of them were 30-40 years old, and at the age range 40-50 and over 50 shared the same percentage that was around 23%. Both clinical educators and basic medicine educators had equal share. 58% of participants have been teaching less than 10 years, while 27% of them have been teaching over 20 years. The participant form "211" university took up 81% approximately. As for the highest educational background, 70% of educators own a doctoral degree, and both those who got a master's degree and a post-doctoral degree have the same 15% proportion. The medical educators who have had or had not an oversea learning experience share an equal percentage.

Table 1. Demographic information of participants.

Items	Options	Frequencies	Percentage（%）
Gender	Female	17	65.38
	Male	9	34.62
Age	< 30	1	3.85
	30 – 40	13	50.00
	40 – 50	6	23.08
	> 50	6	23.08
Type of medical teacher	Clinical	13	50.00
	Basic Medicine	13	50.00
Length for teaching	1 – 10	15	57.69
	10 – 20	4	15.38
	> 20	7	26.92
University Affiliation	“985”	3	11.54
	“211”	21	80.77
	Others	2	7.69
Educational degree	Bachelor	0	0.00
	Master	4	15.38
	Doctoral	18	69.23
	Post-doctoral	4	15.38
Oversea learning experience	Yes	13	50.00
	No	13	50.00

Medical Educators’ Perception and Experience about Online Teaching before and after the COVID-19 Pandemic

Twelve closed questions with options of “yes or no” multiple choice questions were responded by 26 medical educators, shown in Table 2. The first four questions evaluated medical educators’ previous perception and experience of online teaching before ERT in the COVID-19 pandemic. Regarding the previous perception and experience about the online teaching, 15 (57.69%) medical teachers had had the online teaching experience before the pandemic, while 11 (42.31%) had not. Only 4 (15.38%) medical

educators used online teaching method regularly, and 50% medical teachers would actively choose online teaching method. 20 (76.92%) medical teachers had received relevant training before conducting online teaching.

As for the teaching experience and perception under the COVID-19 pandemic, 6 closed ended questions were conducted. 15 (57.69%) medical teachers agreed that online teaching can improve student's learning outcomes. 23 (88.46%) medical teachers have utilized online platform to create an interactive zone for students to discuss and communicate. 25 (96.15%) medical teachers have interacted with students through online platform, such as answering questions in discussion forums, and 22 (84.62%) medical teachers thought that the current online teaching method can adapt to students' work-life balance, flexibility in courses, study methods, and the access to teachers. 23 (88.46%) medical teachers considered that think the contemporary information technology in online teaching was appropriate, available, or reliable, and 24 (92.31%) medical teachers agreed that online teaching method was worthy.

When it comes to the future prospects on online teaching, all medical teachers (100%) believed that online teaching will be more and more widely used in medical teaching methods in the upcoming decade, and 24 (92.31%) of them think that online teaching needs to be integrated into all aspects of the institution and the curriculum with co-operation between departments and between software providers and trainers.

Table 2. Medical educators' perception and experience about online teaching before and after the COVID-19 pandemic

Items	Yes, n (%)	No, n (%)
Previous perception and experience about online teaching		
Have you ever taught on the web platform before?	15(57.69)	11(42.31)
Do you use online teaching method regularly (before the COVID-19 outbreak)?	4(15.38)	22(84.62)
Have you received relevant training before conducting online teaching?	20(76.92)	6(23.08)
Did you actively choose online teaching for teaching?	13(50.00)	13(50.00)
Teaching experience and perception under the COVID-19 pandemic		
Does the software chosen by you for online teaching provide discussion and communication platforms for medical students?	23(88.46)	3(11.54)
Do you interact with students online, such as answering questions in discussion forums?	25(96.15)	1(3.85)
Do you agree that online teaching can improve student's learning outcomes?	15(57.69)	11(42.31)
Do you think the current online teaching method can adapt to students' work-life balance, flexibility in courses, study methods, and the access to teachers?	22(84.62)	4(15.38)
Do you think the contemporary information technology in online teaching is appropriate, available, or reliable?	23(88.46)	3(11.54)
Do you think online teaching method is worthy?	24(92.31)	2(7.69)
Prospects		
Do you think online teaching will be more and more widely used in medical teaching methods in the next decade?	26(100.00)	0(0.00)
Do you think online teaching needs to be integrated into all aspects of the institution and into the curriculum with co-operation between departments and between software providers and trainers?	24(92.31)	2(7.69)

Two single multiple questions explored the online teaching hours per week and the percentage of online teaching in the total teaching activities of medical educator during the COVID-19 pandemic (Figure 1 & Figure 2). Among the 4 medical teachers who regularly used online teaching before the COVID-19 outbreak, 3 of them used online teaching for teaching less than 2 hours every week, only 1 medical teacher used it for more than 10 hours every week, and the online teaching occupied 15.75% of the total teaching time. After the COVID-19 outbreak, all 26 medical teachers participated in online teaching, in which 5 (19.23%) of them used online teaching for less than 2 hours, 13 (50%) of them used online teaching for 2-6 hours every week, 6 (23.08%) of them used online teaching for 6-10 weeks, 2 (7.69%) of

them used online teaching for ≥ 10 hours, and the online teaching occupied 85.81% of the total teaching time.

Medical educators’ opinions on contribution of online teaching on medical education

The descriptive statistics of medical educators’ opinions on the contribution of online teaching on medical education was shown in Table 3. The agreed level on the teaching effect of online teaching was just around the medium level, with an average mean value of 2.55 (range from 1-5). The highest one was that online teaching is conducive to the development of new teaching methods (mean=2.00), while the lowest one located at the item that facilitates students' classroom focus (mean=2.92). Stacked-Column for the responsive proportion of 13 Likert items on a scale of 1-5 (1=strongly agree, and 5=strongly disagree), which indicated that most of choice were located at the “Agree” and “Neutral” level (Figure 3).

Table 3. Descriptive statistics of medical educators’ opinions on the contribution of online teaching on medical education

Questions You think online teaching is:	Total Number (%)	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)	Mean□SD□
Q1. Conducive to the realization of teaching goals.	26(100)	4(15.4)	11(42.3)	9(34.6)	1(3.8)	1(3.8)	2.38(0.941)
Q2. Conducive to the realization of teaching priorities and difficulties.	26(100)	3(11.5)	9(34.6)	10(38.5)	4(15.4)	0(0.0)	2.58(0.902)
Q3. Conducive to the presentation of teaching content.	26(100)	3(11.5)	14(53.9)	7(26.9)	2(7.7)	0(0.0)	2.31(0.788)
Q4. Conducive to the development of new teaching methods.	26(100)	4(15.4)	18(69.2)	4(15.4)	0(0.0)	0(0.0)	2.00(0.566)
Q5. Conducive to smooth teaching process.	26(100)	2(7.7)	12(46.2)	10(38.5)	1(3.8)	1(3.8)	2.50(0.860)
Q6. Conducive to creating a harmonious classroom atmosphere.	26(100)	2(7.7)	8(30.8)	13(50.0)	3(11.5)	0(0.0)	2.65(0.797)
Q7. Facilitates students' classroom focus.	26(100)	2(7.7)	7(7.7)	9(34.6)	7(7.7)	1(3.8)	2.92(1.017)
Q8. Facilitate classroom interaction between	26(100)	3(11.5)	8(30.8)	7(7.7)	6(23.1)	2(7.7)	2.85(1.156)

teachers and students.							
Q9. Improves the evaluation of learning outcomes.	26(100)	1(3.8)	12(46.2)	10(38.5)	3(11.5)	0(0.0)	2.58(0.758)
Q10. Conducive to the improvement of their teaching abilities.	26(100)	3(11.5)	10(38.5)	9(34.6)	4(15.4)	0(0.0)	2.54(0.905)
Q11. Conducive to producing good teaching results.	26(100)	1(3.8)	9(34.6)	12(46.2)	4(15.4)	0(0.0)	2.73(0.778)

Difficulties in the ERT for Medical Educators under the COVID-19 Pandemic

The medical teachers stated the major challenges that they met in the online teaching in COVID-19 pandemic (Figure 4). The first two difficulties medical teachers came across in online teaching were the web-based instructional design (14/26, 27.00%), and the unfamiliarity with web-based teaching tools (13/26, 25.00%). Only one person (2%) thought that leaders do not pay attention and support online teaching method. Multiple response analysis combined with crosstab chi-square test was applied to tested whether there existed relationships between two variables (gender and age) and difficulties met in online teaching respectively (Appendix 2), considering a P-value of <.05 was considered to be statistically significant. No significant difference in the types of difficulties encountered by different ages (P=0.969>.05) or gender (P = 0.873 > .05) in online teaching.

Discussion

Principal Findings

The results illustrated that the information technology for medical teaching had not been widely used before the outbreak of the COVID-19 epidemic, the teachers' ICT competency was generally insufficient, and the web-based teaching mode was imperfect in medical education. To adapt to the effect of the COVID-19 pandemic, educators had tried their best to redesign the curriculum and have adopted information technology in teaching. However, in doing this, medical educators have been faced with

many challenges. Some medical educators recognized that the online teaching method was just a short-term teaching approach under the temporary pandemic situation. It may be the fundamental reason that led to the satisfaction of the online teaching method's contribution presented slightly better than the medium level. Nevertheless, they still believed that it would be a definitive trend of integrating information technology with medical education in the future and holding a positive attitude towards it. Although the current circumstance of the integration is still in the early stage, the COVID-19 pandemic has accelerated the evolutionary scheme of medical education informatization to a reasonable extent.

The 26 participants of the study with varied demographic backgrounds have covered different age groups, length of teaching, and university affiliation types. It can enhance the study's reliability, creating a benefit for carrying an evaluation of the difficulties linked to ICT competency between different ages and different gender. However, the result demonstrated no significant relationship between the technical challenges and the diversity of age or gender. In other words, the main challenges medical educators met when they conduct the ERT during the COVID-19 epidemic would not be distinguished by the difference in age or gender. This result was slightly out of expectation because it was generally believed that the older people are, the more difficulties they may encounter in using information technology. The difficulties and challenges faced by medical educators in the use of emergency distance learning are universal. The biggest challenge for medical educators in ETR was web-based instructional design, which revealed that redesign the offline course would need medical educators' much effort and time, particularly for the clinical course, which is hard to be replaced by the online teaching model entirely. Therefore, in the future, the reformation of clinical courses would likely combine an online and offline teaching method. For instance, the offline teaching method will be conducted for medical students' practical demands, while the online teaching method will be conducted for the theoretical learning demand. The second biggest challenge was unfamiliar with the online teaching tools, which was reasonable under the unpredicted pandemic situation. The effect of COVID-19 led to the large-scale closure of medical colleges and emerged a sudden shift to online teaching, which limited the time for medical educators to get familiar with these new pedagogical online techniques. Fortunately, this difficulty can be solved by further training or within a long-term regular online teaching pattern. The next three difficulties were the challenging online teaching environment, the insufficient online teaching resources, and the limited ICT competency, respectively. Three of them shared a similar percentage, which indicated that all of them were the secondary challenges in the ETR, and they can be overcome through further training for educators and improvement in the online teaching circumstances. The least challenging one was the higher authorities or leaders giving no adequate attention to the ERT or supporting it, which intimated that the school supported medical educators to tide over the difficulties faced on online teaching.

Although many difficulties are encountered in ERT, they also co-exist with opportunities. When medical educators try to solve these difficulties, they promote the improvement and reformation of medical education. Comparing with medical educators' experience towards online medical teaching before the COVID-19, around half of them conducted online teaching for the first time, which enhanced the covered level of medical education informatization and identified more issues in online medical teaching. The time spent on online teaching dramatically raised though it was an external environment forced to

conduct online teaching. The more they used the online teaching method, the more familiar with it. Most medical teachers utilize online multimedia platforms to ensure the interaction with students. As for their perceptions, a majority of them believed that the online teaching method was beneficial for work-life balance and enhanced flexibility of the courses, study methods, and the interactive communicating way. Although the online teaching was new to most medical teachers, they regarded the contemporary information technology in online teaching as current accessible, reliable, and worthy. However, because the ERT shorten the preparation process of online teaching, in medical educators' opinions, the contribution level of online teaching method in medical education was average posited at the level of a little higher than the medium level. It has been undeniable that the ERT helped develop a new teaching method, and the online teaching method did contribute to medical education to adapt to the effect of the pandemic situation.

Based on the challenges and opportunities that have been discussed above, some suggestions are proposed for future medical education reformation. Firstly, emphasizing knowledge and experience, the clinical clerkship course is an essential part of medical education. Unlike the traditional clerkship that happened in a physical place or hospital, the current online teaching was not advanced enough to provide the same clerkship experience on an online platform, which waves the demand for an advanced and standardized online medical teaching system in China. It would be helpful if China can refer to some other advanced countries' practices or suggestions in online medical education [25]. For example, in the UK, they have proposals for a "networked" medical school based on district general hospitals and the corresponding community [29]. Although facing many challenges in online teaching, medical educators still hold a strongly positive attitude towards the medical education informatization in the future and believed that the broad application of modern technology in medical education needs the cooperation and joint efforts of various stakeholders to promote the application of digital technology in medical education reformation. Concrete leadership and practical policy are essential for the implementation of modernizing medical education. We believe that catastrophes like the COVID-19 pandemic may repeatedly come and pass in the future, just like all human history records. What can we do to reduce the damage to the medical education system? We believe that developing an advanced and better online teaching system is one of the answers.

All in all, students and teachers generally accept the online teaching of medical courses during the pandemic period because of its advantages of flexibility, information accessibility, global reach, and efficiency. However, online education also has shortcomings, including the lack of teacher-student interaction, the presence of distractions, and the decrease of students' self-discipline. Especially for online medical education, there is still a problem of technological constraints. Students cannot participate in the laboratory and clinical practice. As to teachers, a big challenge for them is that they are not adapted to change of teaching methods well and dissatisfied with the construction of some online course platforms, which is the main reason that affects the teaching quality. The paper focuses on the current situation and future trend of online education in medical courses, consistent with earlier findings showing that online courses will play an essential role in many schools' long-term survival. However, our analysis neglects several potential conditions. An important direction for further work might be to study how to realize

remote clinical practice teaching better. Online education will continue to play an important role, an emerging trend, and become the next normal in the post-COVID-19 pandemic. The results of this research may help educators to progress current education form. By incorporating artificial intelligence and mobile education, online education will co-exist with traditional education to provide more education options, promote education equity, and enhance education innovation.

Limitations

We acknowledge that this study has limitations, which related to the aspects of the participants. The number of the participants may not be significant enough, and a limited amount of young medical teachers. Our participants were mainly from the Guangdong province of China, and most of the medical teachers enrolled work in top-listed universities in China (“985” or “211”). Therefore, our analysis may not be representative of all medical educators in China.

Conclusions

In conclusion, this study provided quantitative evidence for online medical education under the COVID-19 pandemic from educators’ perspectives. The majority of medical educators are open-minded to incorporating online teaching into their teaching practice in the future. Undeniably, medical educators were facing unprecedented challenges and opportunities under the effect of the COVID-19 pandemic, which is a chance for transforming medical education. It is no doubt that the evolution of medical education in different periods is adapted to the development environment of the times, from the social environment to the technological conditions. Medical education itself is constantly experiencing a slow transformation. However, in every reformation stage, both challenges and opportunities are co-existed. Identifying these challenges and opportunities and proposing some relevant suggestions to enhance further the active adoption of information technology in medical education are significant.

Abbreviations

COVID-19: coronavirus disease

PBL: problem-based learning

ERT: emergency remote teaching

UNESCO: the United Nations Educational, Scientific and Cultural Organization

HREC: the Human Research Ethics Committee

Declarations

1. Ethics approval and consent to participate

The permission/approval for the study and data collection at Jinan University in this study was obtained from the Human Research Ethics Committee (HREC) at the University of Hong Kong, with a reference number issued by the HREC of EA1909007. The informed consent was obtained from all subjects, and all subjects are over 18 years old. The participants were informed about the study's purpose, their anonymity and withdrawal rights, and all other ethical principles were observed. Before the conduction of experiments on humans, informed consent is obtained from the participants. All methods were carried out in accordance with relevant guidelines and regulations.

2. Consent for publication

Informed consent for publication was obtained from all the participants. All data included in the manuscript are applicable for publication. All authors of the manuscript have read and agreed to its content and are accountable for all aspects of the accuracy and integrity of the manuscript in accordance with ICMJE criteria. The manuscript is original, has not already been published, and is not currently under consideration by another journal.

3. Availability of data and materials

The datasets used or analysed during the current study are available from the corresponding author on reasonable request.

4. Competing interests

The authors declare that they have no competing interests.

5. Funding

No funding was used for the conduct of this study.

6. Author's contributions

MC and W-KM contributed to the original conception of the study and the administration of the project. MC and SZ contributed the first draft version of the manuscript. SZ and W-KM made online questionnaire. MC, SZ and SW contributed to the quantitative data collection, analysis and interpretation. BA and W-KM reviewed the manuscript. All authors contributed to the interpretation of the results and the final manuscript. All authors discussed and agreed on the implications of the study findings and approved the final version to be published.

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Figures

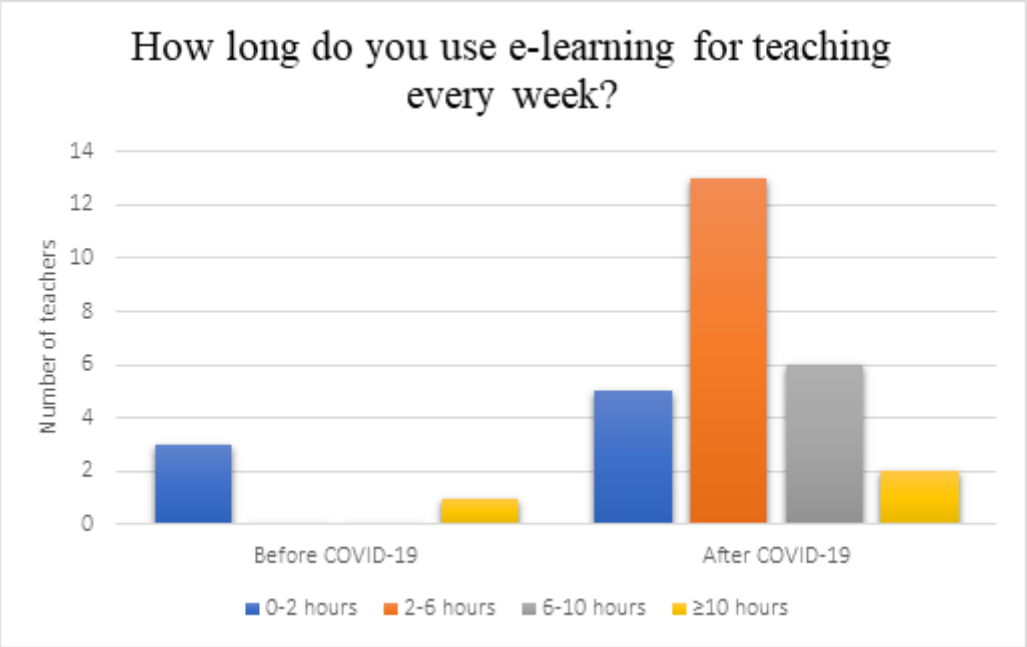

Figure 1

Online teaching hours per week

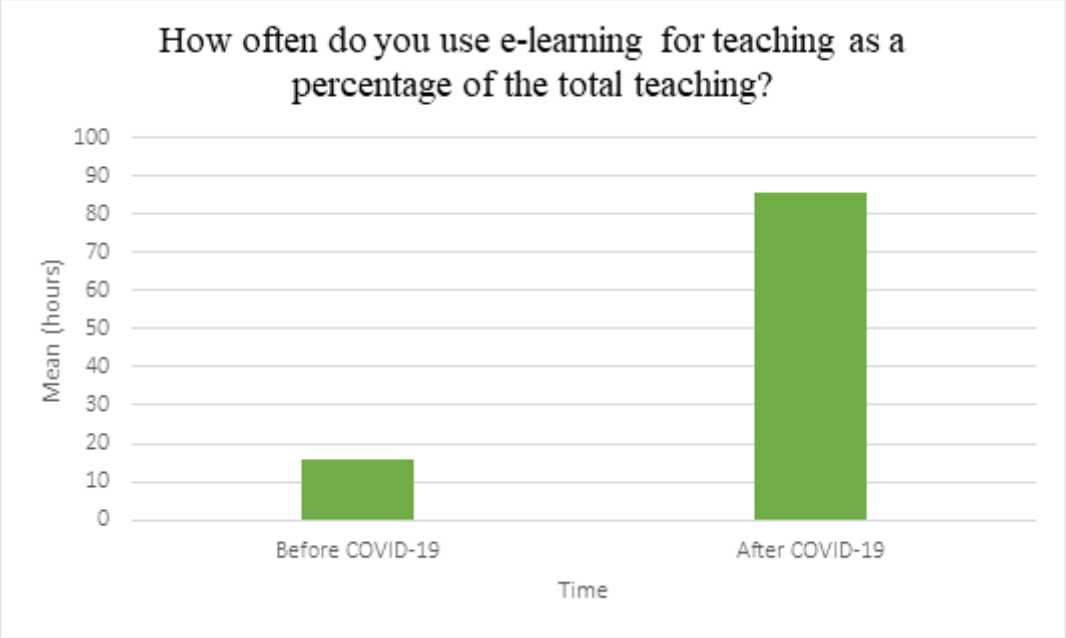

Figure 2

The percentage of online teaching in the total teaching activities

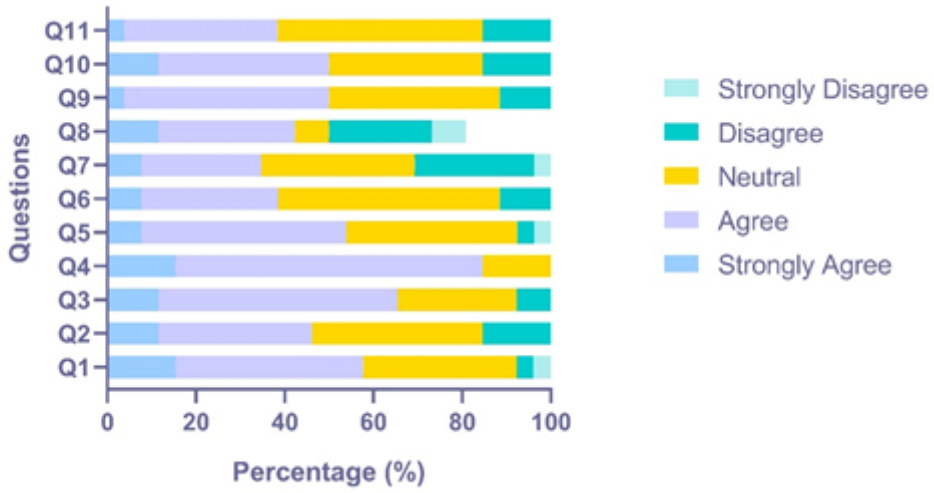

Figure 3

A five-point Likert scale evaluating impact of online teaching method on medical education from educators' perspective

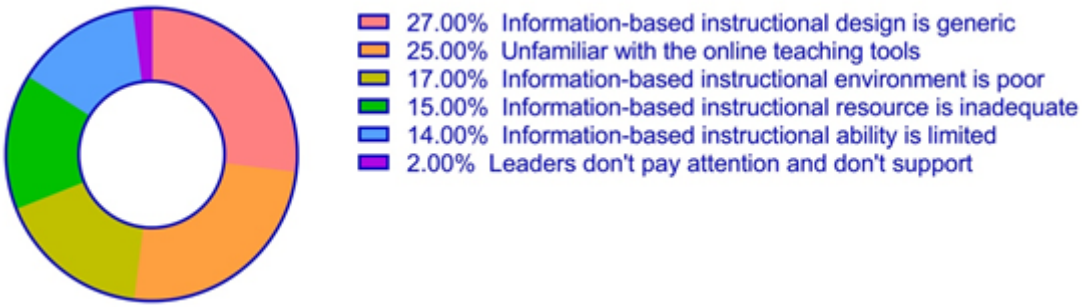

Figure 4

Main challenges medical educators came across during the COVID-19 pandemic

Supplementary Files

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- MultimediaAppendix1.docx
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