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Effectiveness of professional-identity-formation and clinical communication-skills programs on medical students' empathy in the COVID-19 context: comparison between pre-pandemic in-person classes and during-pandemic online classes

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Abstract

Background Enhancing students' empathy is critical in medical school education. The COVID-19 pandemic necessitated a shift from in-person to online classes. However, the effectiveness of online classes for enhancing medical students' empathy has not been investigated sufficiently and the evidence is limited. This study compared the effectiveness of enhancing empathy between pre-pandemic in-person classes and during-pandemic online classes among medical students in Japan using pre-pandemic and during-pandemic data.

Methods This is a retrospective observational study. This study measured students' empathy using the Japanese translation of the Jefferson Scale of Empathy-Student Version (JSE-S) before and after the special programs for professional identity formation and clinical communication among first- and second-year students who matriculated from 2015–2021. This study categorized the matriculation year groups as "pre-pandemic" and "during-pandemic" groups for the first- and second-year students. This study estimated the adjusted mean score differences of the JSE-S and 95% confidence intervals (CIs) from the pre- to post-program between the pre-pandemic and during-pandemic groups in the first and second years using linear regression analysis.

Results This study's participants included 653 first-year students and 562 second-year students. In the first year, the during-pandemic group had a significantly higher mean score difference from the pre- to post-program compared to the pre-pandemic group. The adjusted regression coefficient (95% CI) was 7.6 (5.7 – 9.5), with the pre-pandemic group as the reference. In the second year, there were no significant differences between the two groups.

Conclusions The results suggest that online classes are not inferior to in-person classes or even slightly better in enhancing medical students' empathy, which should be clarified by further studies. This study's findings have important implications for medical education and implementing hybrid class formats to enhance students' empathy.

Keywords COVID-19 pandemic, Empathy, Jefferson Scale of Empathy, Medical students, Online class

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Background

Empathy is considered an important component of physicians' overall clinical competence [1]. The previous studies have highlighted the effectiveness of physicians' empathy toward positive outcomes in diabetic patients [2, 3], patient enablement [4], and patient satisfaction [5], and have reported an association between medical students' empathy and their clinical competence [6, 7].

In the context of this study, our medical school has provided medical students of all grades with a variety of special programs since academic year 2015 to develop professional identities. The traditional conception of professionalism as a list of individual traits and mutable attributes is underpinned by the assumption that identity formation is primarily an intrapersonal process [8]. The primary purpose of these programs is to develop students' professional identity formation (PIF) and improve their communication skills, which are important issues in medical practice. We have assessed the outcome of the programs to measure their empathy using the Jefferson Scale of Empathy-Student Version (JSE-S). Our previous research has shown that communication skills training improves the empathy of medical students in Japan [9, 10]. These programs were provided in an in-person format until 2019, before the COVID-19 pandemic. The pandemic resulted in the shift from in-person classes to online classes in many medical schools worldwide, including Japan.

Some previous studies compared students' academic performance between in-person and online classes, however, the findings were inconsistent across courses or knowledge areas. Some studies observed favorable outcomes in online classes compared to in-person classes [11, 12]. Several studies have shown that online education improves students' empathy [13, 14]. Anishchuk et al. (2022) showed that a virtual learning module improved dental students' empathy moderately in all domains of empathy, namely, perspective-taking, compassionate care, and standing in patient's shoes [13]. Yang et al. (2022) investigated the effectiveness of online communication skills training programs for nursing students and showed a slight improvement in overall empathy [14]. However, their studies did not directly compare the effectiveness of online education with in-person classroom learning. Thus, the evidence for this comparison among medical students is limited in the literature. Although the pandemic is coming to an end and the educational situation is returning to pre-pandemic condition, it is our mission to learn from past experiences and to apply them in a better way in the future. Therefore, we retrospectively investigated the difference in the effectiveness of enhancing empathy between pre-pandemic in-person classes and during-pandemic online classes among medical students in Japan using the JSE-S.

Methods

Study design and participants

This is a retrospective observational study. Our study participants included medical students enrolled at the medical school of Okayama University from 2015–2021. There are approximately 115 new matriculants in the medical school for each academic year.

Instruments

We used the Japanese translation of the JSE-S to assess the medical students' degree of empathy. The JSE is a validated psychometric instrument specifically developed to measure empathy in the patient care context among health professional practitioners and students. A detailed description of the JSE-S is available elsewhere [15]. The JSE-S is a 20-item validated questionnaire that measures medical students' orientation or attitude toward empathy for patient care. Each item is answered on a seven-point Likert-type scale. The possible range of scores is 20–140. The JSE-S comprises three dimensions; perspective taking (10 items, score range: 10–70), compassionate care (8 items, score range: 8–56), and standing in patient's shoes (2 items, score range: 2–14) [15, 16]. The Japanese translation of the JSE-S was developed using back-translation procedures, and its validity and reliability have been reported [17].

Procedures

Our school has conducted a series of special programs annually for each grade as a spiral curriculum since 2015. In the present study, we focused on the outcomes of the first- and second-year students. The contents of the first- and second-year programs are detailed below.

First-year program [Theme: professional identity formation (PIF)]

The first-year program was mandatory and provided immediately after the students' medical school enrolment. The number of lectures varied depending on the academic schedules for the year: 8 h of lectures in 2015–2019, 10 h in 2020, and 12 h in 2021. The theme of the program was to develop students' professional identity. The program included content on several topics to enable students to think about themselves (lectures on Erikson's psychosocial development and egograms by Eric Berne), understand others (lectures on gender, diversity and inclusion, and lectures from patients about their disease experiences), and complete some works (to score egograms and mention their visions and goals) (Supplementary-Table 1).

Table 1 Comparison of the difference from the pre- to post-scores of the JSE-S between the pre-pandemic and during-pandemic groups

	n	Mean (SD)		Score difference from pre- and post-programs (95% CI)	Adjusted mean score difference[a]	
		Pre-score	Post-score		Regression coefficient (95% CI)	*p*-value
1st-year						
Overall						
Pre-pandemic group[b]	487	110.9 (10.8)	112.1 (12.8)	1.2 (0.2 – 2.1)	(Reference)	
During-pandemic group[c]	166	111.7 (13.3)	120.7 (10.2)	9.0 (7.1 – 10.8)	7.6 (5.7 – 9.5)	< .001
Subgroup analysis						
Higher baseline score group[d]						
Pre-pandemic group[b]	236	119.7 (5.3)	119.0 (8.8)	−0.7 (−1.8 – 0.4)	(Reference)	
During-pandemic group[c]	80	121.5 (5.5)	125.9 (6.3)	4.4 (3.2 – 5.6)	4.8 (2.8 – 6.8)	< .001
Lower baseline score group[e]						
Pre-pandemic group[b]	251	102.7 (7.6)	105.6 (12.6)	2.9 (1.4 – 4.4)	(Reference)	
During-pandemic group[c]	86	102.6 (11.9)	115.8 (10.7)	13.2 (10.0 – 16.4)	10.1 (7.0 – 13.2)	< .001
2nd-year						
Overall						
Pre-pandemic group[f]	406	106.9 (13.1)	112.9 (13.2)	6.0 (5.0 – 6.9)	(Reference)	
During-pandemic group[g]	156	110.5 (13.8)	116.8 (14.2)	6.3 (4.3 – 8.3)	0.2 (−1.7 – 2.2)	.80
Subgroup analysis						
Higher baseline score group[d]						
Pre-pandemic group[f]	200	111.6 (11.9)	116.9 (11.1)	5.3 (4.1 – 6.6)	(Reference)	
During-pandemic group[g]	73	116.9 (13.2)	122.9 (9.5)	6.0 (3.7 – 8.3)	0.5 (−2.0 – 3.0)	.38
Lower baseline score group[e]						
Pre-pandemic group[f]	206	102.4 (12.5)	109.0 (13.8)	6.6 (5.2 – 8.0)	(Reference)	
During-pandemic group[g]	83	104.9 (11.8)	111.5 (15.4)	6.6 (3.4 – 9.8)	0.0 (−3.0 – 2.9)	.98

Abbreviations: JSE-S Jefferson Scale of Empathy-Student Version, *SD* standard deviation, *CI* confidence interval

[a] Adjusted for gender

[b] Participants enrolled at the medical school from academic year 2015–2019

[c] Participants enrolled at the medical school from academic year 2020–2021

[d] The group with baseline scores above the median of the respective matriculation year group

[e] The group with baseline scores at the median or less of the respective matriculation year group

[f] Participants enrolled at the medical school from academic year 2015–2018

[g] Participants enrolled at the medical school from academic year 2019–2020

Second-year program [Theme: developing clinical communication skills]

In the second-year program, students attended a medical interview workshop and received training on Humanitude®, both of which were mandatory and designed to enhance medical students' clinical communication skills. The effects of these trainings on improving medical students' empathy have been observed in our previous studies [9, 10].

The medical interview workshop lasted for 4 h and comprised 4 sections: (1) a lecture on communication and medical interviewing (55 min); (2) orientation about the next session (10 min); (3) roleplay as a student doctor with standardized patients (SPs) in medical interviewing sessions (160 min); and (4) feedback, discussion, and summary of the workshop (15 min). In the workshop's third section, students were divided into smaller subgroups of about eight students, owing to the capacity of each training room and to operational feasibility issues. Then, each subgroup used its own simulated examination room for five different medical interviewing sessions, and five to six different SPs with different chief complaints took turns entering the simulated examination room. For each SP, one or two students played the role of a doctor and conducted a medical interview with the SP for 10 min, while the other students in the same subgroup observed and assessed the interview.

Humanitude® training was provided in 2017 onward. The number of training hours varied from 3–7 h depending on the academic schedules of the year. In 2016, in place of the Humanitude® training, a 2-h lecture on Erikson's psychosocial development and a 2-h small-group discussion class were conducted. A detailed description of Humanitude® training is reported elsewhere [9]. The Humanitude® training program consisted of an orientation lecture and a workshop. The students learned the basic concept and philosophy of Humanitude®, its four basic pillars (i.e., gaze, touch, speech, and verticality), and its implications in clinical situations through the lecture, discussion, and workshop. In the workshop, the students experienced the four basic pillars of Humanitude® and learned multimodal comprehensive communication skills in patient care.

Class format

The programs were designed to be provided in an in-person format and were supplied in the same format until 2019. However, due to the COVID-19 pandemic, the classes were shifted to an online format for 2020 and 2021 to maintain social distance. Therefore, we prepared the contents of online classes and delivered them using the learning management system, Moodle. It is a web-based open-source e-learning platform widely used in educational institutions around the world including Japan. It has functions such as material distribution, video distribution, forums, quizzes, assignment submission, feedback, and attendance-taking [18]. The online lectures were given either in a synchronous (i.e., real-time) or asynchronous (i.e., on-demand) format, whereas the online workshop and group discussion were conducted in a synchronous format only.

In the first-year program, the pre-pandemic group who entered the medical school prior to the pandemic (matriculated in 2015–2019) attended the in-person classes, and the during-pandemic group who joined the medical school during the pandemic (matriculated in 2020–2021) attended the online classes. In the second-year program, the pre-pandemic group (matriculated in 2016–2018) attended the in-person classes, and the during-pandemic group (matriculated in 2019–2020) attended the online classes (Fig. 1).

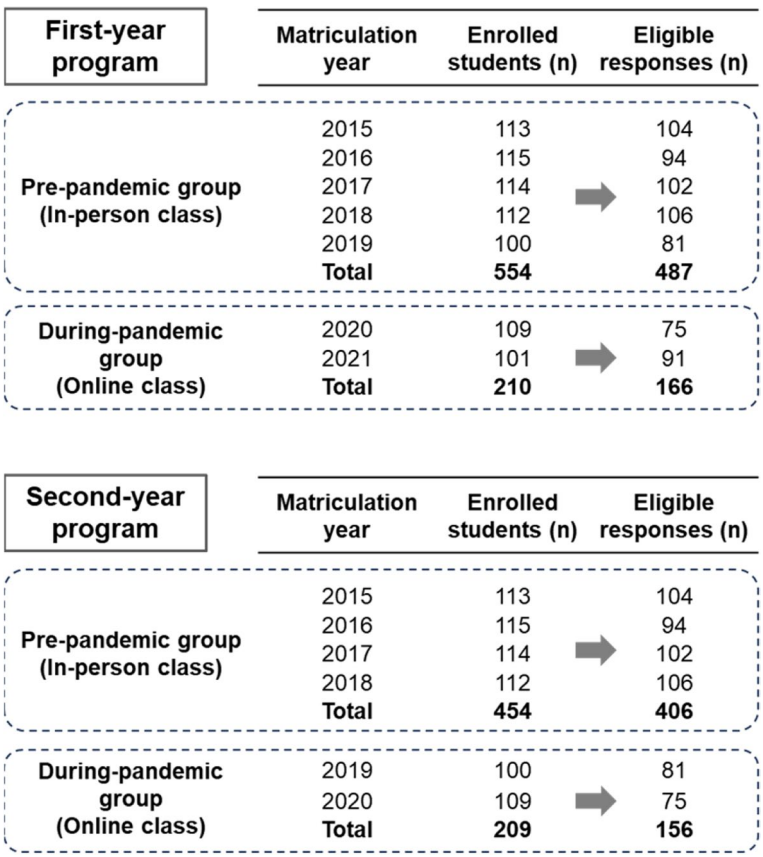

Fig. 1 Diagram of participation

Data collection

At the beginning of each program (either the in-person or online class), we explained the study to the students and asked them to participate, informing them that participation was completely voluntary and that their responses would be kept strictly confidential, would not affect their academic record, and might be used as aggregated data for statistical analysis. In the in-person class format (pre-pandemic), we distributed a hard copy of the JSE-S questionnaire to each student immediately before and after the program for the pre- and post-program surveys, respectively. The students who consented to participate in the study answered and returned the completed questionnaire. In the online class format (during-pandemic), we uploaded the study explanation and the web-based JSE-S questionnaire to Moodle, and informed the students about the study and asked them to access and answer the questionnaire on the system if they consented to participate.

The study protocol was approved by the ethics committee of Okayama University Graduate School of Medicine, Dentistry and Pharmaceutical Sciences, and Okayama University Hospital (Approval No. 826 and Ken 2207–024).

Statistical analysis

We considered returned questionnaires with missing information for more than four items (out of the JSE 20 items) as incomplete, and excluded them from the statistical analysis. If the missing items totaled four or less, we replaced each missing value with the mean score of the values for the completed items [19]. Based on the previous studies, we discarded answers with a total score of less than 50 as invalid [19]. Of the participating students at the baseline; that is, the pre-program survey in the first year ($n=764$; 113 in 2015, 115 in 2016, 114 in 2017, 112 in 2018, 100 in 2019, 109 in 2020, and 101 in 2021), we excluded those who did not answer or incompletely answered at least one survey up to the post-program survey in the second year among the 2015–2020 matriculants ($n=101$) or the post-program survey in the first year among the 2021 matriculants ($n=10$) (Fig. 1). The follow-up participation rates were 653 (85.4%) for all matriculation years, 104 (92.0%) for the 2015 matriculants, 94 (81.7%) for the 2016 matriculants, 102 (89.5%) for the 2017 matriculants, 106 (94.6%) for the 2018 matriculants, 81 (81.0%) for the 2019 matriculants, 75 (68.8%) for the 2020 matriculants, and 91 (90.1%) for the 2021 matriculants, and were included in the analysis.

The analyses of the first- and second-years' scores were conducted independently from each other. We estimated the adjusted mean score differences of the JSE-S scores and the 95% confidence intervals (CIs) from the pre- to post-program between the pre-pandemic and during-pandemic groups in the first and second years using multiple linear regression analysis adjusting for the participants' gender, with the pre-pandemic group as the reference. The gender adjustment was conducted based on the consistent findings of higher empathy scores in women students across previous studies. [17, 19, 20]. We also performed the subgroup analyses based on the baseline scores in the first year. We classified the baseline scores into two categories: the higher baseline scoring group and the lower baseline scoring group. We defined the higher baseline scoring group as the group with baseline scores above the median, and the lower baseline scoring group as the group with baseline scores at the median or less among the respective matriculation group. Similarly, we conducted dimension-wise analyses of the JSE-S. We considered two-sided p-values of less than 0.05 as statistically significant. We analyzed the data using Stata SE 17.0 for Windows (Stata Corp, College Station, Texas).

Results

Table 1 shows a comparison of the difference from the pre- to post-scores of the JSE-S between the pre-pandemic and during-pandemic groups in the first and second years. In the first year, the pre-program scores were not significantly different between the groups (pre-pandemic group: 110.9, during-pandemic group: 111.7, $p=0.46$). However, the during-pandemic group had a significantly higher score difference between the pre- and post-program compared to the pre-pandemic group. The adjusted regression coefficient (95% CI), with the pre-pandemic group as the reference, was 7.6 (5.7 – 9.5). Positively significant mean score differences were also observed in both subgroup analyses of the higher and lower baseline scoring subgroups, and the adjusted regression coefficients (95% CIs) were 4.8 (2.8 – 6.8) and 10.1 (7.0 – 13.2), respectively. The difference was more prominent in the lower baseline scoring subgroup. Among second-year students, conversely, the mean pre-program score was slightly higher by 3.6 points in the during-pandemic group. However, the score difference between the pre- and post-program was not significantly different between the pre-pandemic and during-pandemic groups, including the subgroup analyses.

Table 2 and Fig. 2 show the dimension-wise comparison of the JSE-S score differences from the pre- to post-programs between the pre-pandemic and during-pandemic groups. Among first-year students, the during-pandemic group had a significantly higher improvement in all three domains. In the domain of standing in patient's shoes, the mean score decreased after the program in the pre-pandemic group, whereas the mean

Table 2 Dimension-wise comparison of the difference from pre- to post-scores of the JSE-S between the pre-pandemic and during-pandemic groups

	Total score				Perspective taking				Compassionate care				Standing in patient shoes (2 items, score range: 2–14)			
	Mean		Score difference from pre- and post-programs	Adjusted mean score difference[a] (95% CI)	Mean		Score difference from pre- and post-programs	Adjusted mean score difference[a] (95% CI)	Mean		Score difference from pre- and post-programs	Adjusted mean score difference[a] (95% CI)	Mean		Score difference from pre- and post-programs	Adjusted mean score difference[a] (95% CI)
	Pre	Post			Pre	Post			Pre	Post			Pre	Post		
First-year program																
Pre-pandemic group ($n = 487$)	110.9	112.1	1.2	Reference	57.2	58.2	1.0	Reference	46.4	47.0	0.6	Reference	7.3	6.9	−0.4	Reference
During-pandemic group ($n = 166$)	111.7	120.7	9.0	7.6 (5.7 – 9.5)**	58.2	63.1	4.9	3.8 (2.5 – 5.0)**	45.9	50.0	4.1	3.3 (2.4 – 4.3)**	7.6	7.6	0.0	0.5 (0.0 – 1.0)*
Second-year program																
Pre-pandemic group ($n = 406$)	106.9	112.9	6.0	Reference	55.1	58.6	3.5	Reference	45.0	47.0	2.0	Reference	6.9	7.3	0.4	Reference
During-pandemic group ($n = 156$)	110.5	116.8	6.3	0.2 (−1.7 – 2.2)	57.5	60.7	3.2	−0.5 (−1.7 – 0.8)	45.8	48.2	2.4	0.3 (−0.7 – 1.4)	7.1	7.9	0.8	0.4 (−0.1 – 0.9)

Abbreviations: JSE-S Jefferson Scale of Empathy-Student Version, *Pre* pre-program, *Post* post-program, *CI* confidence interval

* $p < .05$; ** $p < .01$

[a] Adjusted for gender

[b] Participants enrolled at the medical school from academic year 2015–2019

[c] Participants enrolled at the medical school from academic year 2020–2021

[d] Participants enrolled at the medical school from academic year 2015–2018

[e] Participants enrolled at the medical school from academic year 2019–2020

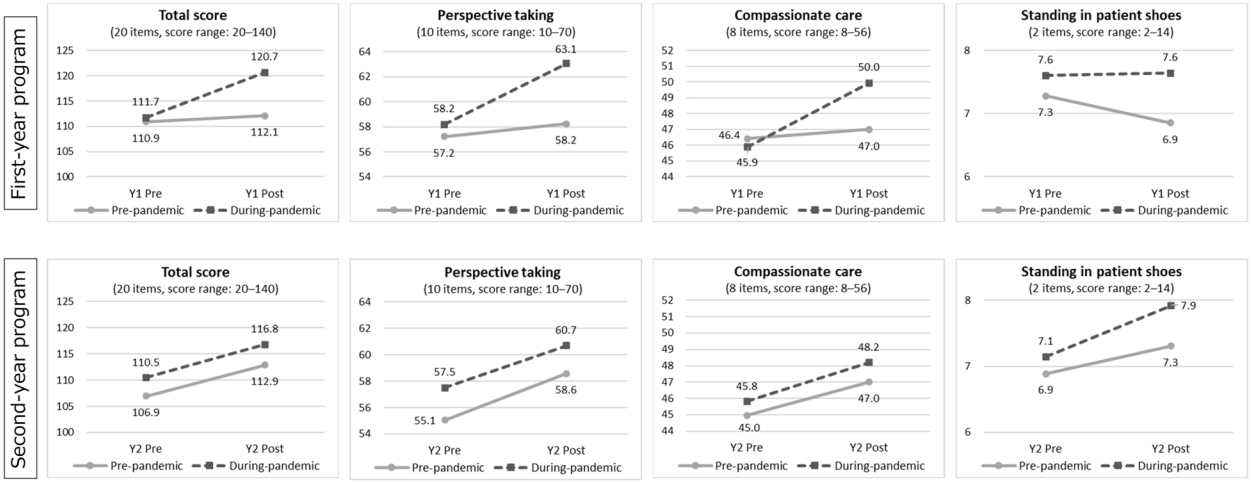

Fig. 2 Comparison of the difference from the pre- to post-scores of the JSE-S between the pre-pandemic and during-pandemic groups

score of the during-pandemic group remained almost the same after the program. Among second-year students, both groups had higher mean scores after the program in all three domains; however, the score increases were not significantly different.

Discussion

COVID-19 necessitated a shift from in-person classes to online classes in medical schools in Japan. Our results demonstrate that the effectiveness of online classes in enhancing medical students' empathy is not inferior to that of in-person classes at a national medical school in Japan. In the first-year program, which focused on the theme of developing students' professional identity, the online classes achieved significantly higher empathy scores than the in-person classes. In the second-year program, in which the students undertook medical interviews and Humanitude® training, the in-person and online classes increased students' empathy scores almost to the same degree.

These findings are partially consistent with those of previous studies that have investigated the effectiveness of online training modules or programs in improving empathy among health professions students and have shown that online programs improve students' empathy [13, 14, 21]. An interventional study in Ireland conducted for undergraduate dental students ($n=37$) found that the use of a virtual learning module increased the students' empathy. However, the study did not use a control group and was unable to compare the educational effects on improving empathy between virtual and in-person learning modules [13]. A quasi-experimental design study in South Korea ($n=56$) investigated the effectiveness of an online communication skills training program among fourth-year nursing students [14]. The study observed that the intervention group who had taken the online program showed significantly higher improvement in empathy compared to the control group who did not receive any program. However, the study did not consider the comparison of training effects on improving empathy between online and in-person training. A meta-analysis (4 studies with 472 students) that examined the effectiveness of digital education on communication skills among medical students demonstrated that the impact of digital education on communication skills was not significantly different from traditional learning (i.e., in-person learning) in post-intervention communication skills scores [21]. However, the studies included in the meta-analysis varied in interventions, comparators, outcomes, and measurements, thus yielding low-quality evidence. Overall, it is difficult to directly compare our study's findings to those of these previous studies.

In our study, there are several possible reasons why the online classes were more effective in enhancing students' empathy than the in-person classes in the first-year program. First, the content of the first-year program was more suitable to be studied online. The theme of the first-year program was to develop students' professional identity. For that purpose, content that could stimulate students' self-reflective thinking was incorporated in the program. Since the students needed to concentrate on the "self" in this program, the online environment was more suitable. Moreover, the students could access Moodle at their convenience and could view the lecture videos repeatedly.

The second reason relates to the COVID-19 pandemic. The students lost out on many opportunities during the pandemic, such as communicating with their friends

directly. When the students reassessed the importance of communicating with others as a result of the pandemic, they realized that the online classes provided opportunities for them to communicate with their classmates and teachers via the Internet. The online classes would have had less of an impact in a normal situation, as the students would have been able to communicate with others in person rather than online. As such, during the pandemic, these online communication opportunities impacted their empathy.

It should be noted that even in the second-year program, in which the students learned communication skills in patient care with SPs and their classmates, the online classes were as effective as the in-person classes in increasing students' empathy. The possible factors for this could be the availability of a satisfactory Internet environment as well as the careful and thorough preparation for online classes in order to provide the students with enough opportunities to observe and interact with the SPs and their classmates online.

Next, looking at the results of dimension-wise analyses, we discuss how the program contents contributed to improving medical students' empathy. The first-year program included lectures on patients' experiences of illnesses and other contents that would contribute to standing in patient's shoes, which were limited to only one or two classes out of the total number of classes. Also, some students were rather shocked to hear about patients' realistic experiences and felt the difficulty of standing in patient's shoes. For these reasons, it is assumed that the contents of the first-year program did not contribute to the increase in standing in patient's shoes. Conversely, the contents of the second-year program focused on clinical communication, and the students had experienced role-plays with the help of SPs, which might have contributed to the improvement of empathy in all the dimensions.

The students who matriculated in 2019 experienced in-person classes in the first year and online classes in the second year. The students who matriculated in 2020 only experienced online classes in the first and second years. Considering this, we performed additional analyses that compared the score improvements after the first- and second-year programs between the 2019 and 2020 matriculation groups. Among first-year students, the pre-program JSE-S scores were not different between the matriculation groups. However, the score improvement after the program was significantly higher in the 2020 matriculants who had online classes compared with the 2019 matriculants who had in-person classes. Among second-year students, the pre-program scores were higher in the 2020 matriculants. The score improvement after the program was also higher in the 2020 matriculants although not significant. Higher improvement of the 2020 matriculants in the first year might have influenced the pre-program scores and score improvement after the program in the second year (data not shown).

We observed that the second-year pre-scores of the JSE-S decreased compared with the first-year scores in both the pre-pandemic and during-pandemic groups. As demonstrated by our previous study [10] and a US study [22], the level of medical students' empathy is likely to decline during their course of study. The possible factors for this decline include a high volume of learning materials, time pressure, and technology-oriented course curriculum such as elements, organs, and diseases. Therefore, additional empathy-reinforcing people-oriented educational programs could help to sustain empathic orientation toward patients.

Our methodological advantages include its longitudinal study design and the use of continuous surveys for seven years, which allowed for a comparison of the effectiveness of in-person and online classes on medical students' empathy. In this study, the in-person and online formats were considered equivalent in terms of content and student engagement, thereby comparable, based on the following reasons. For content equivalence, almost the same faculty members and lecturers delivered the programs from 2015 to 2021, ensuring consistency in teaching style and approach. For student engagement, students' class attendance was monitored for both formats. In addition, we collected student feedback through annual class satisfaction surveys to assess students' perceptions and confirmed no significant differences between the formats.

However, our study has some limitations that should be considered when interpreting the results. First, loss to follow-up should be considered. Of the 764 participants at the baseline, we excluded 111 participants from the first-year analysis as loss to follow-up due to non-responses or incomplete responses. Similarly, of the 663 participants at the baseline, we excluded 101 participants from the second-year analysis. The loss to follow-up rate was significantly higher in the during-pandemic groups than the pre-pandemic groups—21.0% and 12.1% in the first-year analysis ($p=0.002$), respectively, and 25.4% and 10.6% in the second-year analysis ($p<0.001$), respectively. Previous studies demonstrated that medical students' empathy is generally higher in women than men [15, 23]. In the present study also, the baseline mean scores were higher in women than men (data not shown). We found no significant difference in gender distribution among the excluded participants between the pre-pandemic and during-pandemic groups. In addition, their mean baseline scores were not different between these two groups. Also, the mean baseline scores were not different between the retained and excluded participants. Therefore, the difference in the loss to follow-up rates between

the pre-pandemic and during-pandemic groups would not have substantially affected the results.

Second, the variability of the class hours and contents for the first- and second-year programs differed between 2015 and 2021. There were more classes in the first-year program for the during-pandemic group than for the pre-pandemic group—10 h for the matriculants of 2020 and 12 h for the matriculants of 2021 compared to 8 h for the pre-pandemic group (matriculants of 2015–2019). The higher increase in empathy in the during-pandemic group might have been partially due to there being more classes in the first-year program. In the during-pandemic group, the matriculants of 2021 had a higher increased score than the matriculants of 2020 by 2.3 points. The classes of the matriculants of 2021 were 2 h longer than those of the matriculants of 2020. However, the difference in the mean increased scores between these two matriculation year groups was not statistically significant ($p=0.137$). Therefore, it is unlikely that the observed difference in scores between the pre-pandemic and during-pandemic groups could be solely attributed to the differences in class hours. For the second-year program as well, class hours and contents, excluding medical interview workshop, varied from year to year. While this variability of class hours might have influenced the results, it was random throughout the years 2015–2021. Therefore, it is unlikely that it had a substantial influence on the results.

Third, data on participant details are not available except for gender which was adjusted in the analyses as a covariate. Empathy may be influenced by students' age, experience before joining medical school and academic performance. However, as most Japanese students join medical school immediately after or within a few years of completing high school [24], we assume that these variables would not substantially influence the results. In addition, the admission process did not change in our medical school during the survey period, even during the pandemic.

Fourth, the pandemic altered students' learning environments including internet access, study space, and the nature of social interactions. As we did not collect data on these learning environmental factors, it was not possible to control these factors in the analyses. Another study in Okayama University showed that the medical students' subjective mental health status worsened after the national state of emergency in Japan [25]. We consider that these environmental and mental factors would have influenced the results to some degree.

Finally, the generalization of our findings may be limited, as our study was conducted at a single institution. Although the medical school of Okayama University is typical of national medical schools in Japan in terms of matriculants' mean age and gender distribution [26], the content and volume of similar educational programs in in-person and online classes may differ depending on the school. Further studies are needed in other medical schools to support our findings' external validity.

Conclusions

Our results reveal that online classes are not inferior to in-person classes or even slightly better in enhancing medical students' empathy. However, further studies are required to clarify the difference in the effectiveness of improving medical students' empathy between in-person and online classes along with its possible reasons. It should be noted that online learning practices had been already operational for many years and seemed to have been repackaged during the COVID-19 pandemic. Educators have a lot to learn from literature on online learning modalities and their utilities for various domains of learning. Our findings have important implications for medical education and implementing hybrid in-person and online classes to enhance students' empathy.

Abbreviations

CI	Confidence interval
JSE-S	Jefferson Scale of Empathy-Student Version
SP	Standardized patient

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12909-024-06597-3.

Supplementary Material 1.

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Authors' contributions

HK designed the study protocols. HK, CF, MW and MO collected the data. AT analyzed the data. HK and AT prepared the manuscript. All the authors read and approved the final manuscript.

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Data availability

The de-identified datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

This study was conducted in accordance with the World Medical Association Declaration of Helsinki guidelines. The study protocol was approved by the ethics committee of Okayama University Graduate School of Medicine, Dentistry and Pharmaceutical Sciences and Okayama University Hospital (Approval

No. 826 and Ken 2207–024). The authors confirmed that all the methods were carried out in accordance with the relevant guidelines and regulations. Informed consent was obtained from all participants.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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