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Original Article

Students and Tutors' Perspectives on the Effectiveness of Online Problem-Based Learning in Medical and Health Professions

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Abstract

Background: The unprecedented COVID-19 pandemic has caused a sudden shift toward online learning, enabling students to continue learning from their homes.

Objectives: This study aimed to investigate students' and tutors' perspectives on the effectiveness of online problem-based learning (PBL) in medical and health professions.

Methods: A descriptive online survey was conducted on the PBL tutors and undergraduate students from the Schools of Dentistry, Medicine, and Veterinary Medicine. Two online questionnaires (one for students consisting of 23 items and one for PBL tutors comprising 24 items) were developed to capture respondents' perspectives on the effectiveness of online PBL in medical and health professional education during COVID-19 pandemic. Data were analyzed using percentage and Chi-square tests in SPSS V.26 software.

Results: A total of 485 students and 39 tutors completed the questionnaires. The majority of the students (77.1%, $p<0.01$) and tutors (89.8%, $p<0.01$) were comfortable using online PBL. They felt that it was easy to use Blackboard Collaborate through University's Learning Management System (myeLearning). However, 71.5% ($p<0.01$) of the students reported being distracted in online PBL classes due to connectivity issues.

Conclusion: The study indicated that both students and tutors generally found online PBL effective, successfully utilizing all features of Blackboard Collaborate during classes. However, students encountered connectivity issues and had difficulty sharing videos, images, and PowerPoint presentations. Continuous and thorough monitoring is essential to identify and resolve issues with the University's Learning Management System to enhance the delivery experience of online PBL.

Keywords: Learning Management System; Problem-Based Learning; COVID-19; Medical and Health Professionals; Online Learning

Background

In recent years, online teaching has emerged as a pivotal force in shaping the landscape of health professions education (1). The digital revolution has transformed traditional pedagogical approaches and become an indispensable component in preparing future healthcare professionals. In a systematic review and meta-analysis, it was found that face-to-face teaching and online teaching are equivalent to improving the learning outcomes of undergraduate medical students. The study suggested that online teaching has its advantages for students' learning and therefore it should be considered an important delivery mode in medical education (2). In a study on UK medical students' perception of the role of online teaching during COVID-19, it was found that students scored their experiences online compared with face-to-face teaching to be lower. However, students stated that online teaching allowed them to learn from home at their own pace (3). The effectiveness of online teaching depends on several factors, such as access to the internet, technological infrastructure, computer or any other supporting device, technical knowledge, student self-motivation, and a properly designed curriculum and lesson plan (4-6).

The Faculty of Medical Sciences at the University of the West Indies, St. Augustine comprises six major undergraduate disciplines: dentistry, medicine, nursing, optometry, pharmacy, and veterinary medicine, run through five Schools. The School of Medicine, Dentistry,

and Veterinary Medicine each have 5-year undergraduate programs. In the first four semesters, the School of Medicine shares common courses where applicable with Dentistry and Veterinary Medicine utilizing a problem-based learning (PBL) delivery approach (7).

PBL is a student-centered approach in which students play a vital role in the entire learning process. A tutor is allocated for each PBL group who facilitates active learning, encourages critical thinking and promotes self-directed learning among students (8). Students volunteer to lead the group, and each member takes part actively in the brainstorming and discussion sessions (9). A PBL session lasts for approximately three hours in which a small group of students brainstorm a new problem, develop relevant hypotheses, generate learning objectives for self-study and construct new knowledge based on their prior knowledge (10).

The unprecedented COVID-19 pandemic has caused a sudden shift toward online PBL which enabled students to continue learning from their homes (11). During the survey, Blackboard Collaborate (BBC) through the official myeLearning online learning environment was used in the Faculty of Medical Sciences, St. Augustine, to conduct PBL and other didactic teaching sessions. The online PBL procedures implemented by the institution closely mirrored the traditional face-to-face PBL model employed prior to the onset of the COVID-19 pandemic.

Several studies have been conducted on students' and teachers' perspectives of online teaching in medical and health professions education (3, 12-15). In a survey of 33 students and 11 teachers from a dental school of the University of the West Indies, Trinidad and Tobago, students were similar to teachers' perceptions, as both were positive about online teaching during the COVID-19 pandemic. However, both groups expressed concerns about the clinical training through online delivery mode (16). In another study conducted at Lumbini Medical College, Nepal, two-thirds of the students (n=226) rated online classes to be poorer than the traditional classroom and when they were asked about their preferred mode of teaching in the future, 77.8% of them were in favor of traditional face-to-face teaching (17, 18). In the dental school of Justusl-Liebig-University, Germany, students stated that participation in online learning was easier compared to face-to-face teaching. Similar to students, most lecturers considered online teaching a good alternative during the unprecedented COVID-19 pandemic (15).

As highlighted above there is growing literature focused on the effectiveness of online learning in the healthcare training programme. However, studies rarely explore students' and tutors' perspectives of online PBL. Therefore, this study was designed to investigate students' and tutors' perspectives on the effectiveness of online PBL in medical and health professions during the COVID-19 pandemic.

Objectives

This study aimed to investigate students' and tutors' perspectives on the effectiveness of online problem-based learning (PBL) in medical and health professions.

Methods

Design and setting: A descriptive survey study was conducted at the Faculty of Medical Sciences, the University of the West Indies, St. Augustine Campus, Trinidad. The online survey was conducted on the PBL tutors and undergraduate students from the school of dentistry, medicine, and veterinary medicine. Ethical approval was obtained from the St Augustine Campus Research Ethics Committee of the University of the West Indies with the reference numbers Ref: CREC-SA.0536/10/2020.

Participants: The online questionnaires on Google Forms were sent to the students and PBL tutors via emails between 15th November and 23rd December 2020. Students from schools of medicine (years 1-3), dentistry (years 1 & 2), and veterinary medicine (year 1) in the Faculty of Medical Sciences at the University of the West Indies, who studied the basic health science courses through online PBL, as well as all PBL tutors, were included in the study. The sample size was calculated using the formula $n = N/(1 + N * e^2)$, where n: The sample size to be determined, N: The total population size and e: The margin of error (1. Using the formula, with a population of 853 students with a 95% confidence interval and a 5% margin of error, the sample size needed for the study was at least 272 students, and we considered 485 students for the present study. Furthermore, for a population of 43 tutors with a 95% confidence interval, we considered collecting data from at least 39 individuals to ensure the results were statistically significant.

The participants were fully informed about the objective of the study. Participation in the study was voluntary, and there was no penalty if they declined to participate. To minimize the possibility of non-response bias, three email reminders were sent to the participants.

Only fully completed questionnaires were included in the data analysis.

Measures: Two online questionnaires (one for students and one for PBL tutors) were developed deriving ideas from related literature. Both the questionnaires aimed to capture the following three areas: The first part of the questionnaire collected data on the demographic details of respondents (Students: gender, age, nationality and device used during PBL; Tutors: gender, year of experience as PBL tutor, nature of appointment and device used during PBL). In the second part, questionnaires on respondents' perspectives on the effectiveness of online PBL in Medical and Health Professions during the COVID-19 pandemic. The questionnaires consist of 23 items for students and 24 items for PBL tutors which cover respondents' perceptions on the use of technology, comfortableness of learning from home, tutor's role, teamwork, and communication skills in virtual PBL. The questionnaires were rated on a 4-point Likert scale ranging from 1 = strongly disagree to 4 = strongly agree. In the third part, responses for two open-ended items were collected and underwent thematic analysis whereby responses were categorized. The content validity of the instruments for both students and tutors was measured based on the feedback of five experts, all experienced PBL tutors. The experts' recommendations were incorporated to ensure grammatical accuracy, correct word usage and proper word order in items. Additionally, two items were discarded from the student version of the questionnaire based on their suggestions. Cronbach's Alpha showed acceptable reliability of the questionnaires for students (α=0.91) and tutors (α=0.89).

Data Analysis: Data were analysed using Statistical Package for the Social Sciences (SPSS), version 26. The internal consistency of the questionnaires was measured by Cronbach's Alpha. Descriptive statistics were used to summarize the demographic characteristics of the participants. Percentage and Chi-square tests were used to see whether the distribution of frequencies of responses in each item was significantly different. A p-value of less than 0.05 was considered statistically significant. The responses collected from two open-ended items were collated and presented thematically.

Results

Students' perspective on the effectiveness of Online PBL

Of the total 853 students, 485 completed the questionnaires, resulting in a response rate of 56.86%. Among these respondents, 25.10% were male, 74.90% were female, and 0.62% preferred not to say. Students aged below 21 years (46.80%) and between 21 and 22 years (34.85%) accounted for the majority of the sample. Concerning nationality, most of the students were from Trinidad and Tobago (88.69%). Additionally, the majority of the students (88.07%) used a laptop, tablet, and mobile phone (Table 1).

Table 2 shows the questionnaire items on students' perspectives of online PBL, including the Chi-square p-value and percentage of responses for each item.

Regarding technical aspects, more than two-thirds of students (77.1%, p<0.01) found it easy to adapt to online PBL. However, most of them (71.5%, p<0.01) reported that they got distracted in online PBL classes due to connectivity issues. More than half of the students (52.4%, p<0.01) stated that their groups had some difficulties sharing videos, images, and PowerPoint presentations.

Students believed that online PBL allowed them to work collaboratively as a team. This explains why the majority of the students (73.6%, p<0.01) agreed that online PBL helped members of the PBL group to work as a team. The majority of the students (78.7%, p<0.01) felt they had the opportunity to express their ideas in their own words. However, 63.1% (p<0.01) of the students reported that online PBL made the less participatory students more passive. Additionally, 85.2% (p<0.01) of the students stated that they learned to search for reliable learning resources through online PBL. Furthermore, students were highly satisfied with the tutors' role in the virtual PBL mode. They believed that most of the tutors created a supportive and comfortable learning environment. The majority of the students (78.7%, p<0.01) agreed to recommend the continued use of online strategies in the teaching of PBL. Table 2 shows that Chi-square values for all the items were found to be statistically significant.

Tutors' perspective on the effectiveness of online PBL

Out of 43 tutors, a total of 39 completed the questionnaire, representing a response rate of 90.70%. Among these tutors, 56.42% were male and 43.59% were female. Of the total, 48.72% of the tutors had 5 years or less of experience as PBL tutors, and 56.4% were full-time faculty members. The majority of them (71.79%) used laptops, tablets, or mobile phones during PBL sessions (Table 1).

Table 3 represents the questionnaire items regarding tutors' perceptions of the effectiveness of online PBL, including Chi-square p-value and the percentage of responses for each item. Most of the tutors (94.9%, p<0.01) found it easy to use BBC through the University's

Learning Management System (LMS), i.e., my eLearning. Furthermore, 84.6% (p<0.01) of the tutors found their environment conducive to delivering online PBL.

Nearly half of the tutors (51.3%, p<0.01) agreed that online PBL was as effective as face-to-face communication for conveying information orally.

However, 48.7% (p=0.049) of tutors agreed that it was difficult to keep track of students' participation since they could not see their faces during the virtual classes.

Almost all the tutors agreed that students had the opportunity to generate issues, hypotheses, and objectives through online PBL classes. However, most of them (76.9%, p<0.01) did not agree with the statement that online PBL is more effective in improving the critical thinking and reasoning skills of the students than face-to-face sessions. The majority of the tutors (74.4%, p=0.023) stated that they did not have any challenges filling out the online PBL Assessment Rating Scale. Despite a few challenges, 79.5% (p<0.01) of the tutors were in favor of online PBL and were happy to recommend it for undergraduate medical and health professions students. Table 3 summarizes that the Chi-square values for all the items are found to be statistically significant except for one item: "Online PBL increased opportunities for quiet students to talk in audio mode."

Advantages of Online PBL

There were two open-ended questions in the questionnaires, such as (a) List the challenges of Online PBL sessions and (b) List the benefits of Online PBL sessions. Using MS Excel spreadsheets, we initially created codes to capture key aspects of the data, such as "technical challenges", "technical proficiency", "engagement", "teamwork", 'peer interaction", "communication", "feedback", time management, "connectivity", "convenient", and "distraction". We then used another sheet to group similar codes into three overarching themes for both advantages and disadvantages, ensuring these themes accurately reflected the data. Here are some of the advantages identified by the students and the tutors:

Time Management: The students expressed their satisfaction with the online environment which allowed them to continue studying at home without any stress and anxiety. Both students and tutors were happy with the time taken to do the online PBL. The main advantages of online PBL appeared to be that it saved traveling time, it was more comfortable, and it made the students punctual. One of the students stated: "It is less stressful to wake up half an hour before a class then attend it than having to spend hours in traffic before reaching school on time (The extra sleep is appreciated) and personally, I think the process is a bit more relaxed when you are in the comfort of your own home."

Students' participation: The online PBL sessions ran smoothly, and participation increased greatly, especially from quieter students. It promoted teamwork and collaboration even with the lack of physical interaction. This is made evident from the following statement. "I felt more comfortable to speak. I have a soft voice, so people tend not to hear me so much in person... now people hear my voice a lot more clearly. I love the chat option. Many times, I find I express my thoughts better putting them into words and it is easier to see and remember and retain what everyone is saying. You can also copy and paste from the chat into the Google doc directly."

Convenient and Effective: The students and tutors universally acknowledged that the introduction of online PBL was a commendable initiative amid the challenges posed by the pandemic, allowing for the uninterrupted continuation of academic pursuits. Despite encountering initial hurdles in navigating the online platform, both students and tutors demonstrated remarkable adaptability, swiftly embracing the virtual learning process. The statement in favor of online PBL included the following: "I found it convenient and easy to speak as we got the opportunity to raise hands when we wanted to talk. Easy to handle the hardware and software. It was a less intimidating process which I believed aided the overall learning experience."

Barriers to effective online PBL

The absence of physical presence posed challenges to the nuanced dynamics of face-to-face communication and collaboration, elements that are integral to the traditional PBL experience. Despite this acknowledgment, both students and tutors emphasized the imperative to embrace online PBL as a pragmatic and essential measure during the unprecedented circumstances brought about by the pandemic. Here are some of the challenges of online PBL.

Technical Challenges: Some of the common technical problems were occasional connectivity issues, occasional malfunctioning of BBC, microphone problems and occasional power failure in some areas. Some participants had problems logging into myeLearning. The following statement revealed the challenges: "We experienced difficulties entering the myeLearning platform during peak hours and connection was dropping during the PBL session. There were audio issues as well and some students constantly had to refresh the page."

Distraction to PBL: Apart from technical difficulties, there were also too many distractions in the PBL delivery process. Students talking over each other, not hearing the persons during their presentations, family members talking during presentations, anxiety to present at home, and external sounds were some of the challenges of online PBL. The statement reflecting the distraction to PBL included the following: "Sometimes some members have mic issues, or connectivity issues, which prevent them from contributing as much as they would like to. I also find it difficult to continuously stare at my screen for such a period of time. Sometimes there is also unavoidable noise in my surroundings and I have to limit my mic use because of it."

Lack of Monitoring: In a virtual learning environment where cameras were either turned off for all participants or only the speaker's camera was active, tutors faced a considerable challenge in gauging whether students were actively engaged in the discussion or simply reading from their screens. This is made evident from the following statement given by a tutor: "It is difficult for me to assess when the student exits the class if it is genuine. It is hard to know if all are actively participating at all times due to visual turned off (from overload). With Audio only it is difficult when presenting the objectives if students are reading the information."

Discussion

The present study investigated students' and tutors' perspectives on the effectiveness of online PBL in medical and health professions during COVID-19 pandemic. The swift transition to online learning posed initial challenges for both students and tutors. However, as time progressed, both groups found it increasingly manageable to adopt online PBL through the use of the BBC platform. Consistent with earlier studies, the current findings underscore the favorable perceptions and receptiveness exhibited by both tutors and learners in the context of online instruction (15, 19, 20). However, the results are in contrast with the studies conducted in Jordan and Uganda where the majority of medical students had negative attitudes toward online teaching (14, 21).

The outcomes of our study indicate that virtual PBL was a suitable and convenient delivery mode because tutors and students did not have to travel during the lockdown, and they comfortably took part in the learning activities from different geographical locations. In response to the open-ended question of our study, some students expressed satisfaction with studying virtually from home, noting their enhanced ability to concentrate fully. These findings are consistent with previous studies, wherein the participants preferred virtual learning mode for reasons of convenience and reduced costs (22, 23).

The findings of our study revealed that students exhibited a highly positive attitude toward the performance of tutors in online PBL. They agreed that tutors were very supportive, created a comfortable learning environment, encouraged students to actively participate in the PBL process, and provided constructive and timely feedback. Prior research has similarly affirmed the pivotal role played by tutors in students' learning and the overall effectiveness of PBL (24, 25).

The present study revealed that online PBL allowed students to work collaboratively as a team, enhanced their critical thinking skills, and facilitated the creation of new knowledge. In a study conducted at the College of Medicine, Qassim University, Saudi Arabia, it was found that online PBL enhanced collaborative learning and critical thinking (26). In contrast, our tutors believed that face-to-face PBL sessions were more effective in improving the critical thinking and reasoning skills of the students than online sessions. Tutors' preference for in-person PBL may stem from their ability to engage in both verbal and nonverbal communication with students. In this setting, tutors can interact with each group member individually, free from distractions.

In the present study, students engaged in online PBL demonstrated effective communication by expressing diverse ideas in their own words and actively participating in group discussions. However, in a previous study, it was found difficult to communicate either with instructors or with peer students in doing distance learning (12). In our study, the number of students in each PBL group was between 12 to 15 and duration of teaching was three hours. Since interaction and discussion were integral parts of PBL, each student had time and opportunity to take part in the PBL process.

In addition to its clear benefits, online PBL introduces certain drawbacks. Connectivity issues, distractions from external noise, voice interruptions caused by poor audio quality, occasional malfunctions of the BBC platform, and the absence of nonverbal communication emerged as notable barriers that must be addressed to ensure the effective implementation of online PBL. These challenges align with findings from other studies where students encountered various difficulties, including poor connectivity, technical

issues, and external disturbances during online teaching (12, 27, 28). Coiada et al., 2020 indicated that students in online PBL were at a higher risk of distraction due to increased screen time and access; thus, the tutor must play a significant role in keeping the students engaged and focused on the learning process (26). In spite of these challenges, both students and tutors expressed satisfaction and were enthusiastic about recommending the continued use of online PBL.

The limitations of the present study include the generalizability of the study by the use of data from a single institution. Another limitation is that our study covered a short period, which did not allow for long-term effects to be assessed. We could not measure educational outcomes linked to online PBL and did not compare them to face-to-face PBL.

Conclusion

The study indicated that both students and tutors generally found online PBL effective, successfully utilizing all features of Blackboard Collaborate during classes and engaging themselves actively in the online sessions. However, students encountered connectivity issues and had difficulty sharing videos, images, and PowerPoint presentations. Continuous and thorough monitoring is essential to identify and resolve various issues within the online learning process, particularly those related to the University's Learning Management System, to enhance the delivery experience of online PBL. Additionally, further research is needed to thoroughly evaluate student performance in online PBL settings

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Table 1. Distribution of the participants' profile

Participants	Variables	Categories	Frequency	Percentage
Students	Gender	Male	121	25.10
		Female	361	74.90
	Age group	< 21	227	46.80
		21-22	169	34.85
		23 & above	89	18.35
	Nationality	Trinidad and Tobago	435	89.69
		Others	50	10.31
	Devices used for online PBL classes	Laptop, Tablet and Mobile	432	89.07
		Desktop	53	10.93
Tutors	Gender	Male	22	56.41
		Female	17	43.59
	Years of experience as PBL tutor	5 years and below	19	48.72
		6-10	6	15.38
		11 and above	14	35.90
	Nature of appointment	Full time	22	56.41
		Part time	17	43.59
	Devices used for online PBL classes	Laptop, tablet, mobile	28	71.79
		Desktop	11	28.21

Table 2. Students' perspective of the effectiveness of online PBL (n = 485): Values in parentheses indicate percentages

Dimensions	Items	Strongly Disagree	Disagree	Agree	Strongly Agree	P-value
Technical Aspect	I found it easy to adapt online PBL.	14 (2.9)	97 (20)	263 (54.2)	111 (22.9)	<0.001
	I was able to use all the features of BBC properly to make my online PBL better.	16 (3.3)	99 (20.4)	261 (53.8)	109 (22.5)	<0.001
	I got distracted in online PBL classes due to an internet connectivity issue.	45 (9.3)	93 (19.2)	181 (37.3)	166 (34.2)	<0.001
	Our group had some difficulties sharing the videos, images, and power points.	53 (10.9)	178 (36.7)	174 (35.9)	80 (16.5)	<0.001
Learning environment and teamwork	I had a dedicated space and required devices to learn from home.	21 (4.3)	63 (13)	219 (45.2)	182 (37.5)	<0.001
	It helped members of the PBL group to work as a team	24 (4.9)	104 (21.4)	243 (50.1)	114 (23.5)	<0.001
	It enhanced commitment to the group task	32 (6.6)	135 (27.8)	219 (45.2)	99 (20.4)	<0.001
	The duration of the online PBL session was enough to get the benefits that I needed.	26 (5.4)	82 (16.9)	269 (55.5)	108 (22.3)	<0.001
Communication and participation	In online PBL, it was easy to communicate information orally in a clear manner.	46 (9.5)	130 (26.8)	217 (44.7)	92 (19)	<0.001
	We got an opportunity to express our ideas in our own words.	12 (2.5)	77 (15.9)	285 (55.8)	111 (22.9)	<0.001
	Online PBL made the less participatory students more passive.	35 (7.2)	144 (29.7)	180 (37.1)	126 (26)	<0.001
	It facilitated active participation in the PBL group discussion within and outside of the PBL session.	30 (6.2)	126 (26)	236 (48.7)	93 (19.2)	<0.001
	It helped me to lead the group in PBL sessions.	26 (5.4)	151 (31.1)	220 (45.4)	88 (18.1)	<0.001
Self-directed learning	Online PBL improved my critical thinking and reasoning skills.	30 (6.2)	101 (20.8)	238 (49.1)	116 (23.9)	<0.001
	It helped me integrate prior knowledge when generating issues.	19 (3.9)	79 (16.3)	271 (55.9)	116 (23.9)	<0.001
	I got an opportunity to formulate clear learning objectives.	15 (3.1)	58 (12)	290 (59.8)	122 (25.2)	<0.001
	I learned to search for reliable learning resources through online PBL.	15 (3.1)	57 (11.8)	273 (56.3)	140 (28.9)	<0.001
Role of the tutor	The tutor had the good technical knowledge to run online PBL.	13 (2.7)	52 (10.7)	230 (47.4)	190 (39.2)	<0.001
	The tutor created a supportive and comfortable learning environment.	20 (4.1)	48 (9.9)	223 (46)	194 (40)	<0.001
	The tutor stimulated students to formulate clear learning issues, hypotheses and objectives.	19 (3.9)	47 (9.7)	217 (44.7)	202 (41.6)	<0.001
	The tutor encouraged participation by all members in the PBL process.	24 (4.9)	76 (15.7)	196 (40.4)	189 (39)	<0.001
	The tutor provided constructive and timely feedback to the group as a whole.	23 (4.7)	63 (13)	200 (41.2)	199 (41)	<0.001
Overall satisfaction	I would recommend the continued use of online strategies in the teaching of PBL.	34 (7)	69 (14.2)	232 (47.8)	150 (30.9)	<0.001

Table 3. Tutors' perspective of the effectiveness of online PBL (n = 39): Values in parentheses indicate percentages

Dimensions	Items	Strongly Disagree	Disagree	Agree	Strongly Agree	P-value
Technical aspect	I got technical support to perform online PBL.	4 (10.3)	7 (17.9)	22 (56.4)	6 (15.4)	<0.001
	It was easy for me to use Black Board Collaborate (BBC).	1 (2.6)	1 (2.6)	19 (48.7)	18 (46.2)	<0.001
	BBC was just as easy for students to use based on my observations during sessions.	2 (5.1)	3 (7.7)	20 (51.3)	14 (35.9)	<0.001
	There were no or minimal connectivity issues for the tutor and students while delivering online PBL.	1 (2.6)	21 (53.8)	14 (35.9)	3 (7.7)	<0.001
	There were no or minimal delays in audio relay during PBL.	0 (0.0)	18 (46.2)	18 (46.2)	3 (7.7)	0.003
	Our group experienced difficulties sharing the videos, images and Power Points.	4 (10.3)	21 (53.8)	12 (30.8)	2 (5.1)	<0.001
Learning environment and teamwork	I felt comfortable using online PBL.	0 (0.0)	4 (10.3)	20 (51.3)	15 (38.5)	0.006
	My home environment was conducive to deliver online PBL	2 (5.1)	4 (10.3)	20 (51.3)	13 (33.3)	<0.001
	My office environment was conducive to deliver online PBL	6 (15.4)	2 (5.1)	18 (46.2)	13 (33.3)	0.001
	Learning via online PBL is as effective as face-to-face PBL.	6 (15.4)	17 (43.6)	11 (28.2)	3 (7.7)	0.015
	Online PBL is more time-consuming and it has increased my workload.	6 (15.4)	18 (46.2)	10 (25.6)	5 (12.8)	0.013
	Students find the PBL sessions easier to do at home.	9 (23.1)	8 (20.5)	18 (46.2)	4 (10.3)	0.013
Communication and participation	Online PBL was as effective as face-to-face to communicate information orally.	3 (7.7)	16 (41)	18 (46.2)	2 (5.1)	<0.001
	It was difficult to keep track of students' participation since I could not see their faces.	4 (10.3)	16 (41)	11 (28.2)	8 (20.5)	0.049
	Online PBL increased opportunities for quiet students to talk in audio mode.	4 (10.3)	10 (25.6)	16 (41)	9 (23.1)	0.059
	I encouraged students to actively participate in PBL	1 (2.6)	0 (0.0)	18 (46.2)	20 (51.3)	<0.001
Self-directed learning	Online PBL is more effective in improving the critical thinking and reasoning skills of the students than face-to-face sessions.	10 (25.6)	20 (51.3)	8 (20.5)	1 (2.6)	<0.001
	Students had the opportunity to generate issues, hypotheses and objectives.	0 (0.0)	0 (0.0)	29 (74.4)	10 (25.6)	0.002
	I intervened only when students' discussion was going off track or when necessary.	1 (2.6)	1 (2.6)	28 (71.8)	9 (23.1)	<0.001
	Students gathered researched information from authentic and reliable resources.	4 (10.3)	1 (2.6)	27 (69.2)	7 (17.9)	<0.001
Feedback and evaluation	I gave feedback to the students at the end of each class.	0 (0.0)	4 (10.3)	22 (56.4)	13 (33.3)	0.002
	I was able to assess all criteria listed in the PBL assessment rating scale	2 (5.1)	8 (20.5)	20 (51.3)	9 (23.1)	<0.001
	It has become easier for me to fill online PBL Assessment Rating Scale.	6 (15.4)	4 (10.3)	14 (35.9)	15 (38.5)	0.023
Overall satisfaction	I would recommend online PBL.	1 (2.6)	7 (17.9)	22 (56.4)	9 (23.1)	<0.001