Title

The learner's perspectives of free, online, international CME in rehabilitation: a mixed methods analysis

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Abstract *(200 words)*

The COVID-19 pandemic spurred global engagement with continuing medical education (CME). The Canadian Advances in Neuro-Orthopedics for Spasticity Consortium's free online platform offering interdisciplinary expert lectures on spasticity saw parallel growth. We analysed 1733 responses from 41 post-session surveys to assess the learner's perspectives of online CME using a convergent mixed-methods design. The qualitative analysis produced four themes: [1] event value and satisfaction (subthemes: *quality and impact of speakers*, *accessibility of the online format*, *discussions and interactions,* and *the benefits of visual learning*), [2] increased competence (subthemes: *increased knowledge, intent to apply, and increased confidence),* [3] inspiring collaboration (subthemes: *need for multidisciplinary teams, international collaboration, and effective communication tools*), [4] considerations and recommendations (subthemes: relevance to developing countries, technical aspects, and academic level of content). Quantitative analyses supported these findings, showing high levels of satisfaction and perceived gains in knowledge. Notably, 88% of participants indicated intent to apply their knowledge, and 84% stated that it would enhance their competence. These results underscore the importance of interaction in online education and highlights a need for communication skills training to facilitate multidisciplinary teamwork. The findings revealed disparities in perceptions of the academic difficulty of CME, which warrants investigation into participants' CME selection.

Keywords

Mixed methods, virtual education, continuing medical education

Introduction

In January 2019, the Canadian Advances in Neuro-Orthopedics for Spasticity Consortium (CANOSC) was launched as a collaborative initiative aimed at advancing knowledge and treatment options for spasticity within the field of neuro-rehabilitation and neuro-orthopedics. CANOSC brings together interdisciplinary experts to address challenges, recent research, and innovative practices in spasticity management. To foster international collaboration and knowledge dissemination, the consortium's webinars are hosted virtually, freely accessible across the globe, both live and archived online.

The emergence of the COVID-19 pandemic in January 2020 marked a significant global health crisis, profoundly impacting medical education and training worldwide. There was a surge in engagement with continuing medical education (CME) during this period[1]. Engagement with CANOSC's CME webinars[2] concurrently expanded to over 2500 members in 60 countries. The consortium's webinars follow the Canadian Association of Physical Medicine and Rehabilitation's (CAPMR) CPD Activity Accreditation Standards for the Maintenance of Certification (MOC) Program Group Learning Activities (Section 1), including post-event surveys to assess the learning activity's effectiveness. Using this data, we aimed to evaluate participant perspectives of online CME programs within the context of CANOSC's virtual webinars.

Methods

Study Design

Using a convergent mixed-methods design, data from 41 post-session CME evaluation surveys were analysed, which simultaneously collected qualitative and quantitative data. The quantitative and qualitative results were analysed separately. Integration occurred during initial data collection, interpretation, reporting, and discussion

levels using a weaving approach[3]. Our institution uses the Arecci tool (see https://albertainnovates.ca/arecci-decision-support-tools/) to determine if REB assessment is needed. A score of 0 indicates no review or notification is required.

Study Participants

Participants included CANOSC webinar attendees. Qualitative responses (e.g., "As a medical student" "I am an experienced physiatrist) suggest that professors, physiatrists, neurologists, medical students and residents, researchers, and allied health professionals attended the CME sessions. However, as this data was shared voluntarily, there is no data on the frequency of each profession. Online surveys were conducted anonymously, and participants provided implied consent by completing and submitting the survey.

Survey tool and data collection

An anonymous online survey tool was used to assess the quality of the CME activities as per CAPM&R's requirements for section 1 activities[4] including both quantitative and qualitative questions (see Figure 1). Participant responses were collected through the online Alchemer survey platform (formerly SurveyGizmo).

Data Analysis

Quantitative data analysis was completed using descriptive statistics in Microsoft Excel and SPSS. An inductive thematic analysis was completed using a codebook approach. All narrative comments were independently coded by two authors (BS, ED). Codes were discussed as a group with the coding authors and two other authors (HD, PW) to provide investigator triangulation and increase the rigor of the analysis. The codebook was subsequently revisited and re-evaluated in light of these discussions.

Results

There were 1733 responses to the 41 surveys with a 79% completion rate. An average of 150 participants attended each session live. The analysis produced four themes: Event value & Satisfaction; Increased Competence; Inspiring Collaboration; and Considerations and Recommendations. Subthemes and salient quotes are summarised in Table 1.

Table 1. Showing a summary of themes, subthemes, and example excerpts from qualitative analysis, and inter-rater reliability (IRR).

Theme & subthemes	**Example from Responses**
Event value & Satisfaction	2007 codes, IRR 99.8%
Quality & impact of speakers	*excellent speaker! Very knowledgeable not only in surgical skills but also in explainting the pathophysiology.*
Accessibility of online format	*You have helped reach an international audience and I feel privileged to have learned from you!*
Discussions and interactions	*There were many interesting questions and discussions following these presentations. It may be helpful to schedule a session with experts to discuss treatment options for collaboration between specialists.*
Visual learning	*[translated]. Thank you for this presentation, I appreciated the videos showing the before and after. Very enriching.*
Increased Competence	837 codes, IRR, 96.9%
Increased knowledge	*Learned that nerve blocks can be safe and beneficial in evaluating if focal chemodenervation would be useful.*

Intent to apply	*I'll have a more concrete and systematic approach to patients who do not respond as expected to toxin injection.*
Increased confidence	*I feel more comfortable after hearing this discussion to incorporate into my practice*
Inspiring Collaboration	125 codes, IRR 94.4%
Need to develop MDTs	*Insisting on more communication from other HCP while dealing with people affected by spasticity. Insisting with parents to get the HCPs to fill in the MDT therapy book every session which will make collaboration much easier.*
Communication tools	*I learned that inability to communicate should not discourage referrals for ITB. I learned about when to consider referring for intravesical Botox injections*
International collaboration	*I feel the burgeoning technology and this CANOSC format will engage a new international enthusiasm... It will allow us to elevate the field of PMR and talk about outcome and cost effectiveness in a dynamic format and effect the global community. technology is the answer. this talk today showed me the possibility of achieving that goal. kudos to all of you*
Considerations & Recommendations	164 codes, IRR, 97%
Technical considerations	*The audio complications [due to live translation] prevented hearing the audio content, thus reducing the efficacy of the presentation.*

Relevance to Developing Countries	*As young physician in Cameroon working with spastic patients in rehab setting it is important to promote this therapeutic option for better functional outcome for patients*
Academic Level	*There was a lot of information and as I was new to this I struggled with some of the information as there was probably an assumed baseline level of knowledge that I don't have.*

Event Value & Satisfaction

The theme "event value and satisfaction" encompasses participants' perspectives on the most valuable elements of online CME, including speaker quality, discussions, online flexibility, the importance of visual content in learning. One attendee summarises:

Excellent speaker; Impressive knowledge and evidence presented; Answered questions very well; Nice cases, including images and videos

Speakers were highly regarded by the audience with feedback praising their expertise, ability to engage, and the personal impact of their presentations.

I appreciated the lecture and felt as if the speaker was speaking directly to me. It triggered some new ideas that I can put in practice in future.

The above quote illustrates that skilled lecturers can establish personal connections during online lectures, triggering new ideas and insights. As a result, 34% answered that the lecture content was the most valuable part of the event. Participants appreciated that lectures were, “Explained very thoroughly and can see passion on the subject.”

Illustrating the significance of audience interactions, 29% of responses demonstrated that discussions and Q&A sessions were the most valuable part of the event.

Thank you for responding so generously and rapidly to all of our questions asked in the chat during the presentation.

Participants valued online lectures for their accessibility, global reach, and engaging visual content. Attendees from over 60 countries accessed these resources, gaining information they might not have otherwise obtained. One participant valued:

That it was virtual, thank you so much for keeping that option open. I would not have been able to attend if it was not on Zoom. Thank you!

Answering what was the "most valuable" part of the lecture, 19% of responses stated that the lectures allowed them to "keep current" with a "snapshot" of up-to-date clinical research that provided good summaries of conferences and key topics. The accessibility allowed them to "continue clinical knowledge development" without "impact on ongoing service provision."

Finally, 8% responded that the visual content in the presentations as the "most valuable" learning tool. One states, "visual aids for teaching, priceless" while other remarks that it was the "cherry on top of the cake" of an "excellent presentation."

Figures 1(a) and 1(b) summarize high ratings for speakers and lecture content on a five-star scale. Figure 1(c) illustrates the distribution of codes in the content analysis of responses to "What was the most valuable part of the event?"

Impact on Competence

The theme "impact on competence" includes increased knowledge, intent to apply, and increased confidence. The subtheme of "increased knowledge" encompasses new learnings listed by participants. Numerous participants specifically mentioned that the courses "enhanced/increased their knowledge" and shed light on areas where they previously felt "in the dark." Other participants noted that the webinars boosted their confidence and reinforced their professional practice.

"The program enhanced and enforced what I have been doing"

Intent to apply learning was expressed in 584 codes, with participants using verbs indicating their readiness to implement strategies or re-evaluate their daily practice based on new knowledge. Many participants found this approach "helpful for clinical decision-making."

More accurate decision making re hip pain this is one of the few lectures I have heard that will change what I do immediately […] Synthesis was truly outstanding and clarifying raised my level of awareness

Other participants were inspired by the lectures to delve deeper into reviewing the evidence and actively seek out new learning opportunities.

Will read up on relevant literature to eventually incorporate into practice

There are many topics that I will now be looking more into following the conference.

The implementation of knowledge extended beyond clinical techniques and encompassed improvements in documentation practices, enhanced communication within multidisciplinary teams (MDTs), and more effective counseling to patients. Participants expressed a desire to collaborate with colleagues to perform procedures, citing their improved understanding as fostering "better understandings for discussion with my surgeon".

Other participants expressed their intent to improve "counselling to patients" by "relaying expectations to patients" and "educating patients on their options" which help them to "set clear and realistic goals with patients."

Improve communication to patients about expected rollercoaster of spasticity, to manage expectations as well as maintain clear dialogue in how to adjust treatment and use adjunctive treatment as needed

Knowledge to share with patients as I have been in the dark

New learning was linked to physicians stating that they gained "more confidence" and "more skill" which will allow them to provide "better support" and "improve the delivery of

care" as they believed it would lead to "better outcomes". One participant mentioned that doctors are "always striving to improve outcome of our treatments" while another expressed that the learning gave them "more comfort in handling earlier, more severe cases." Feeling that treatments were "safe" left them with "less hesitation to treat earlier" as the lectures "provided evidence to support which I have thought for a long time and have experienced as well." These qualitative results are reflected similarly in Appendix A.

The applicability of these lectures beyond clinicians extended to researchers:

> *From a researcher's perspective, these workshops are very educational and helpful in guiding us working directly with persons with SCI in research studies.*

and lecturers shaping the future generation of physicians:

> *I am retired from clinical practice but this new information will contribute to my teaching*

The diverse audience that they can be applied to is reflected in participant ratings of the applicability of the lectures to the CANMEDS roles in Figure 3.

Inspiring Collaboration

The theme, "inspiring collaboration" highlights participants' willingness to "embrace the Multi-Disciplinary Team (MDT) approach" as they were inspired by the "collegial" international collaboration between speakers during the lecture series.

Within 45 codes, participants highlighted the need to "develop interdisciplinary teams", indicating intent to enhance collaboration through referrals, discussions, and improved team coordination. One participant states the importance of collaborating with "surgical colleagues for spasticity, even in for those cases that seem hopeless". Another notes that such collaboration leaves a "multitude of options available," while a third expressed a commitment to being "more helpful with surgery".

While understanding the importance of interdisciplinary collaboration and the treatment opportunities it offers, several participants identified communication as a barrier to effective multidisciplinary work. One participant states, "I learned that the inability to communicate should not discourage referrals. I learned when to consider referring for ITB." Despite acknowledging communication barriers, they have learned to prioritize the importance of referrals for the patients' benefit.

Other participants highlighted that the lectures gave them tools to communicate with colleagues:

> *This program made it quite apparent to me that I need to try and identify surgeons in my area who may be willing to help the type of patients/conditions presented. I like the idea of explaining to them to just focus on the technical aspect of the procedure and allow me to help with the follow up.*

The above participant emphasizes that the lectures provided them with tools to communicate effectively with surgeons, helping to define roles within the MDT and ensure that they are not excluded from follow-up care. One participant valued learning, "how to interact with the surgeon and to know when to refer the patients for surgery", similarly, another appreciated that their "knowledge improved for collaboration and advocacy". These interactions extended beyond physicians to the allied health team:

> *As a physiotherapist, I found the hip presentation helpful as I frequently refer back to the physician if there are ongoing issues. It's helpful to learn about their assessment process.*

> *Many clients of Occupational Therapy need to do toxin, and getting to learn about the outcome and process is important.*

The lectures provided these participants with insights into how other disciplines function, enhancing their ability to "communicate more effectively with my colleagues who perform injections."

When asked about the most valuable aspect of the event, 16% of responses fell under the theme “Collaboration between international experts.” Participants valued receiving information through “collaboration instead of siloed information”. The discussions between professionals highlighted aspects that participants hadn’t considered during the presentations. One participant remarked, “I liked the fact that everyone was very respectful towards each other, open to collaborate and act as a team, learn even little things, in international context.” Several participants valued the “diversity of speakers” and that the lectures “allowed many to talk on the same topic” which facilitated the exchange of skills and ideas. The faculty embody the message of collaboration, demonstrating that collaboration within MDTs is possible in various international settings.

Considerations and Recommendations

The theme "considerations and recommendations" includes 164 codes, ranging from technical challenges to feedback on lecture difficulty, concerns about lecture generalizability across different countries or clinics, and suggestions for improving online lecture delivery. Technical difficulties were reported in 7 lectures including presentation breaking up, voice fade outs, or blurry slides. Certain tools, such as dynamic presentations or use of translators, do not translate as effectively on Zoom calls compared to their use in-person.

In two lectures where Prezi, a dynamic presentation software, was employed, participants reported that the presentation cut up, was challenging to follow, and experienced broken audio. These observations suggest that Prezi may cause bandwidth-related issues during online delivery.

In one webinar using a translator to facilitate concurrent English and French learning, 14 participants reported issues with “poor sound quality” which they described as “hazardous” for the lecture delivery.

> *I think translation should NOT be done in the future...Let the presentation be completely in french or completely in english. The translation seemed to be the problem for the terrible sound.*

Mixed feedback was received on the academic level of the lectures, certain participants (N=34) felt overwhelmed by lack of familiarity with the content and fast pace:

> *There was a lot of information and as I was new to this I struggled with some of the information as there was probably an assumed baseline level of knowledge that I don't have.*

The participant acknowledges that their lack of prior knowledge created gaps in their understanding. Another suggests, "some interaction session or task-specific session can be kept to judge the level of understanding of the audience." Conversely, other participants stated that "more technical perspectives could have been better" and that certain content, "while helpful for GPs, could probably shorten the history/physical exam information for PM&R specialists."

While participants found the lectures inspiring, 43 comments highlighted that these techniques are not readily available in many clinics, especially in low-income countries: "The technique appears too restrictive based on current technology to be used globally." However, others mentioned that despite lacking resources, they were grateful to have access to learning and stay current with international practices. One participant said, "Thanks for sharing the beautiful information with the less privileged." Another shared that while incorporating the learning into practice might not be possible “short-term, but overall, yes by keeping up to

date with the literature." Therefore, the lectures remained valuable to participants who aimed to improve within the constraints of their resources.

Participant "requests for future learning" are summarised in Table 2.

Table 2. *Showing frequency of topics coded under the theme "Requests for Future Learning"*

Topic	N	%
Spinal Disorders	66	17
Botulinim Toxin	62	16
Spasticity	39	10
Cryoneurotomy	35	9
Diagnostic Nerve Block	32	8
Phenol	31	8
Surgical Techniques	29	7
Robotics	20	5
REDS	16	4
Patient-Oriented Approach	14	4
Tele-Health	12	3
INO Score	12	3
Percutaneous Needle Tenotomy	9	2
Therapeutic Adjunctives	9	2
Family	4	1
Total	390	

Discussion

The analysis yielded four main themes: event value and satisfaction, increased competence, inspiring collaboration, and considerations and recommendations. Participants expressed high satisfaction, particularly praising the speaker quality and flexibility of online delivery. Jang et al.[5] report similar satisfaction levels, 85.21%, with their CME program, indicating contentment with online education activities. Prazeres[6] highlights the advantages of online learning platforms in delivering education to a broad audience, especially given the shortage of doctors willing to teach in certain fields[7]. Our findings support this assertion as participants in developing countries expressed satisfaction with attending CMEs. Though limited by resources, they value staying updated with the latest practices.

Discussions among international professionals and interaction with the audience were among the most valued aspects of the lectures. Waltemeyer and Cranemore[8] argue that interactive discussion and prompt feedback from instructors are two ways that online education may surpass traditional learning opportunities. Cho et al.[9] found that while most faculty regard questioning techniques during lectures as crucial for engaging participants, 40.4% did not utilize such techniques. A comment in our results similarly states, “appreciated the Q&A. Not common in online lectures.” Dailey-Hebert[10] further notes that the popularity of online learning is increasing due to convenience and flexibility, but "lack of interaction" was the most cited reason for dissatisfaction among online learners. These findings appear to be cross-cultural, as 46% of healthcare workers across 13 countries in sub-Saharan Africa favored group discussions as a learning modality[11].

The results showed that participants were motivated to collaborate with colleagues and valued communication tools. Communication-skills training programs have been developed to improve patient outcomes[12]. In an interprofessional communication skills workshop, 92% of 518 multidisciplinary professionals intended to change their communication practices, with 87% reporting positive changes on follow-up[13]. Despite the

apparent effectiveness of communication skills training, it appears to be underutilized. Rosenbaum[14] underscores the breakdown of communication in healthcare education due to inadequate formal training, insufficient emphasis in workplace learning, a focus on content over relationships, and a lack of skilled clinical teachers. The prevalence of preventable errors due to suboptimal communication highlights the necessity for clinicians to become expert communicators[15]. There is, therefore, a need to provide adequate training to facilitate interdisciplinary collaboration in a healthcare landscape that increasingly demands it.

Our findings show mixed opinions on the academic level of CME activities, with some finding them too basic for specialists and others too difficult to follow. CME is most effective when tailored to participants' needs[16,17]. However, the fast-paced nature of one-hour sessions limits the opportunity for needs-based learning. Participants typically self-select CMEs based on information about the speaker and the learning objectives of the lecture. Learning objectives may, therefore, not adequately communicate the academic level of the webinars. Introducing a measure of recommended prior knowledge could assist participants in making more informed choices about CME courses. Further research could delve into the factors influencing participants' CME selections.

A summary of recommendations is included in Table 3.

Table 3. Reccomendations to Refine Virtual CME activities

Recommendation	Examples
1. Increase the use of discussion and interaction tools during in online CME	Discussions among international professionals and audience interaction were among the most valued aspect of the lectures. Lack of interaction is the most cited reason for dissatisfaction among online

	learners[8]. Group discussions are a favoured learning modality[9].
2. Add communication skills training courses to the curriculum for online CME	Results showed that participants were motivated to engage in collaborative efforts with colleagues and valued communication tools. 87% of multidisciplinary profesionals engaged in a interprofessional communication skills workshop reported positive changes on follow-up[11]. Inadequate formal training, focus on content over relationships, and lack of clinical teachers has led to a breakdown of communication in healthcare education[12]. There is a need to provide adequate training to facilitate interdisciplinary collaboration.
3. Add indicators of academic level of lectures or "recommended prior knowledge" to help participants assess the suitability of lectures to their academic level.	The findings showed varying opinions regarding academic level of CME activities. CME is most effective when tailored to participants' needs[14,15]. However, the fast-paced nature of one-hour sessions limits opportunities for needs-based learning. As participants self-select CMEs, indicators of academic level or recommended prior knowledge could assist participants in making more informed choices.
4. Limit the use of non-standard presentation tools such as Prezi or	Participant feedback frequently indicated issues with broken audio and blurred images in presentations using these tools.

live translation which create issues with band-width.	

Conclusions

Participant feedback on CME surveys indicates high satisfaction and increased knowledge gained during the lectures. Interactive discussions were praised as effective learning tools. While technology posed minimal challenges, certain tools, such as Prezi and the use of a translator, may not function well in online sessions. The webinar format facilitated an international audience and collaboration, offering flexible, convenient, and cost-effective access to high-level speakers. Future research should explore how participants select their CMEs and assess whether they correctly assess academic level.

Strengths & Limitations

Originally designed as a quality improvement initiative, the survey was created prior to the research, resulting in non-standardized questions that were not tailored to explore emerging themes in depth, and its fixed structure further restricted the depth of inquiry. Consequently, it was not intended for broader applicability and the analysis followed an inductive approach where data-driven observations were used to identify patterns and generate overarching themes. Despite these limitations, the large sample size supported the identified themes. Future research could benefit from smaller, more focused studies using in-depth interviews or focus groups to gain qualitative data which allows for a more nuanced understanding of the themes.

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414 **Figure & Table Legends**

415 Table 1. Showing a summary of themes, subthemes, and example excerpts from qualitative
416 analysis, and inter-rater reliability (IRR).

417

418 Table 2. Showing the frequency of topics requested by participants for future webinars.

419

420 Table 3. Recommendations to refine virtual CME activities.

421

422 Figure 1. Showing survey questions, the number of surveys in which each question was
423 included, and the number of responses to each question.

424

425 Figure 2. Showing participant responses to the following questions: (a) Do you intend to
426 apply what you have learned? (b) Did this course enhance your competence? (c) Will this
427 course influence your practice? (d) Will this course impact your patient outcomes. Part (e)
428 shows participant perception of their knowledge, attitude, and skill to the topic learned pre-
429 and post-lecture.

430

431 Figure 3. Showing participant ratings of the relevance to CanMEDS roles.

432

433 **Figure 1.**

	Question	% Surveys (N)	N Responses
(Quantitative) Quality of activity	Met the stated learning objectives ☆☆☆☆☆	98% (44)	3335
	Enhanced my knowledged ☆☆☆☆☆	98% (44)	2448
	Satisfied my expectations ☆☆☆☆☆	98% (44)	2430
	Conveyed information relevant to my practice ☆☆☆☆☆	98% (44)	2406
	Allocated at least 25% of time for questions ☆☆☆☆☆	95% (43)	2294
	Was free of commercial bias ☆☆☆☆☆	95% (43)	2243
(Quantitative) CANMEDS Roles	☐ Medical Professional ☐ Scholar ☐ Collaborator ☐ Communicator ☐ Leader ☐ Professional ☐ Health Advocate	100% (45)	
(Quantitative) Speaker Ratings	Overall effectiveness ☆☆☆☆☆	98% (44)	2730
	Content Relevance ☆☆☆☆☆	98% (44)	2725
	Used effective teaching methods ☆☆☆☆☆	98% (44)	2734
(Quantitative) Will this course	Will this course enhance your competence? ☐ yes. ☐ no.	40% (18)	1188
	Do you intend to apply your learning? ☐ yes. ☐ no.	22% (10)	421
	Will this course influence your practice? ☐ yes. ☐ no.	40% (18)	1174
	Will this course impact your patient outcomes? ☐ yes. ☐ no.	40% (18)	1172
(Quantitative) Rate your level of comfort	Knowledge (before) ☆☆☆☆☆ (after) ☆☆☆☆☆	20% (9)	678
	Attitude (before) ☆☆☆☆☆ (after) ☆☆☆☆☆	20% (9)	671
	Skill (before) ☆☆☆☆☆ (after) ☆☆☆☆☆	20% (9)	671
(Qualitative) Open ended questions	What did you learn or how will this event impact your practice?	66% (27)	863
	Speaker feedback (asked per speaker)	98% (40)	1614
	Additional comments	95% (39)	230
	Suggestsion for future activities	98% (40)	482
	What was the most valuable part of the event?	22% (9)	219
	Will this course enhance your competency?	32% (13)	206
	Will this course influence your practice?	32% (13)	192
	Will this course impact your patient outcomes?	32% (13)	134
	Describe how you would apply learnings into your practice	24% (10)	219
	How did this course impact your knowledge?	2% (1)	18
	How did this course impact your attitude?	2% (1)	15
	How did this course impact your skill?	2% (1)	11

434

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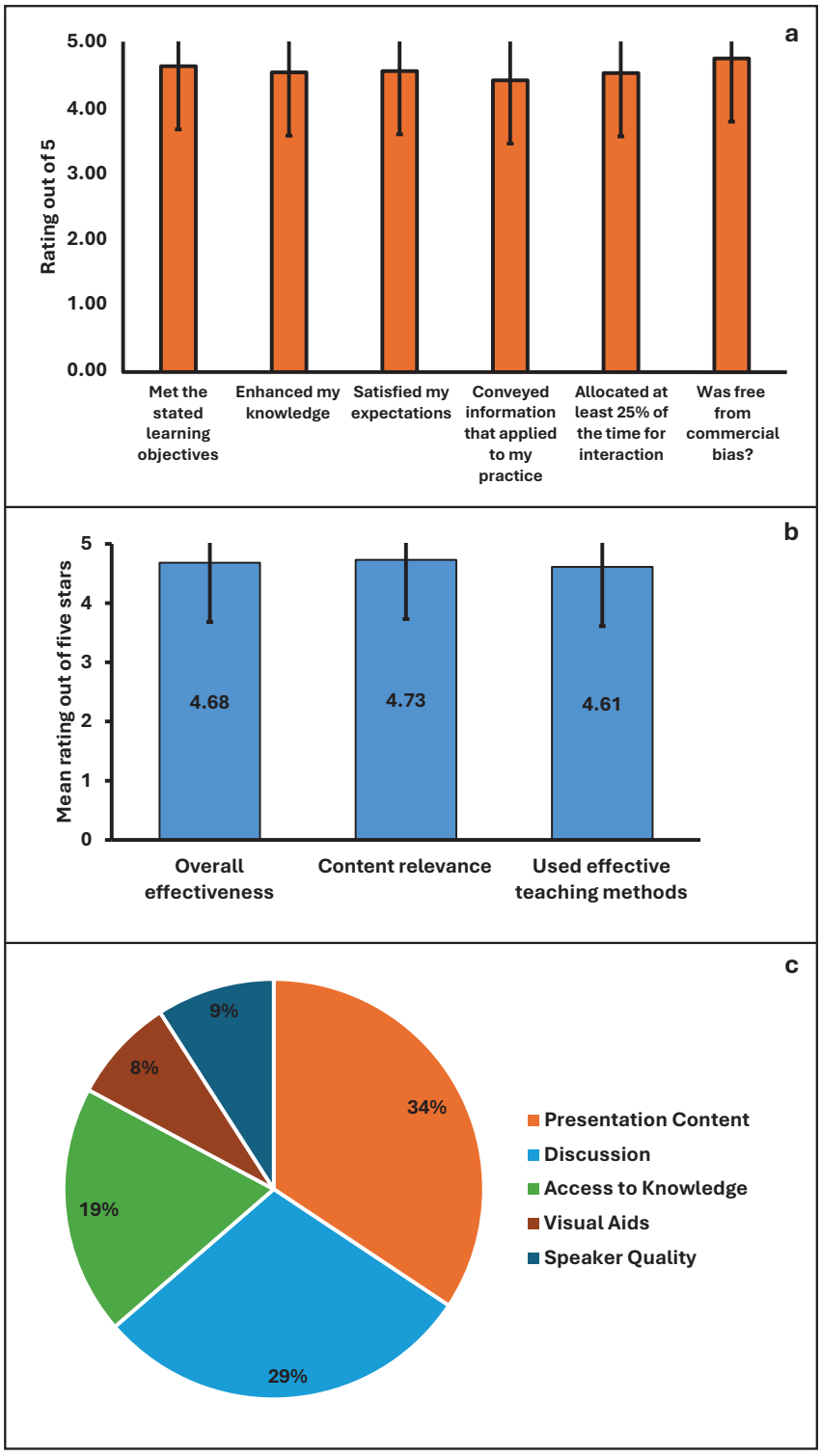
436 **Figure 2.**



437