

Implementation and evaluation of a *B-Learning* modality in an undergraduate Obstetrics and Gynecology course for medical students

Implementación y evaluación de modalidad *B-Learning* en un curso de pregrado de Ginecología y Obstetricia para estudiantes de Medicina

Teo Feuerhake G.¹, Marisol Sirhan N.², María I. Barriga³, Jorge A. Carvajal⁴

Abstract

Introduction: The Medicine career at the Pontificia Universidad Católica de Chile has undergone subsequent adjustments in its study plan. In this context, the theoretical-practical course of Obstetrics and Gynecology changed according to current paradigms in Medical Education. This research aims to describe the implementation and evaluation (student satisfaction and learning) of a blended learning (B-Learning modality) course in Obstetrics and Gynecology for medical students. **Methods:** A retrospective and descriptive design was used. Student satisfaction and learning was analyzed comparing the B-Learning to the face-to-face teaching previously used. **Results:** Students with the B-Learning modality reported dedicating more time to the course, better achievement of learning outcomes, and better perception of assessment and feedback. The average achievement of students with the B-Learning modality was slightly lower than that of other students; however, they demonstrated better performance on more complex assessment questions. Student satisfaction with the learning process was higher for B-Learning than face-to-face classes. **Conclusions:** B-Learning students had a similar level of learning attainment compared with the face-to-face modality but showed better performance on assessment questions that required a higher level of integration. This information is vitally important in the context of the SARS-CoV-2 pandemic, as much medical education has had to be carried out remotely during this time.

Keywords: medical education; blended learning; distance learning; needs assessment; obstetrics; gynecology.

Resumen

Introducción: la carrera de Medicina de la Pontificia Universidad Católica de Chile ha experimentado ajustes sucesivos en su plan de estudios sustentados en un proceso sistemático de evaluación de la docencia. En este contexto, se llevó a cabo la reestructuración de un curso teórico-práctico de Obstetricia y Ginecología para solucionar problemas emergentes y optimizar el curso de acuerdo a paradigmas actuales en Educación Médica. La aplicación de una encuesta de necesidades de aprendizaje determinó la incorporación de la modalidad *blended learning* (B-Learning) al curso. El objetivo fue describir la experiencia de implementación y evaluación de un curso teórico-práctico de Obstetricia y Ginecología modalidad B-Learning y sus resultados según nivel de satisfacción y aprendizaje. **Métodos:** se realizó un estudio retrospectivo y descriptivo. Se comparó nivel de satisfacción y aprendizaje entre modalidades B-Learning y presencial tradicional. **Resultados:** los estudiantes con modalidad B-Learning consiguieron mayor tiempo de dedicación al curso y logro de objetivos de aprendizaje, a la vez que una mayor valoración de los docentes y el *feedback*. La calificación promedio de los estudiantes con modalidad B-Learning fue ligeramente menor, no obstante, demostraron un mejor rendimiento en preguntas de complejidad mayor. La satisfacción de los estudiantes fue mayor con modalidad B-Learning en comparación con modalidad presencial tradicional. **Conclusiones:** los estudiantes presentaron un nivel de aprendizaje similar con modalidad B-Learning en comparación con modalidad presencial tradicional, pero mostraron mejor rendimiento en preguntas de integración superior. Los hallazgos de este estudio son de importancia en el contexto actual de pandemia SARS-CoV-2, dado a que gran parte de la Educación Médica ha debido transitar a modalidades remotas durante esta contingencia.

Palabras clave: educación médica; blended learning; aprendizaje a distancia; evaluación de necesidades; obstetricia; ginecología.

Submission date: 2021-08-27 - Acceptance date: 2021-12-06

(1) Departamento de Anatomía Patológica. Escuela de Medicina, Pontificia Universidad Católica de Chile.

(2) Departamento de Gastroenterología y Centro de Educación Médica y Ciencias de la Salud.

(3) Departamento de Ginecología. Escuela de Medicina, Pontificia Universidad Católica de Chile.

(4) Departamento de Obstetricia. Escuela de Medicina, Pontificia Universidad Católica de Chile.

Corresponding Author: jcarva@med.puc.cl.



Introduction

Student training in health care careers has undergone significant changes during the last two decades, including the incorporation of emerging curricular themes, the redesign of curricula with an outcome-oriented approach, the reconceptualization of assessment, the incorporation of active learning methodologies, and the promotion of comprehensive personal development and professional identity (Dent & Harden, 2001; O'Sullivan *et al.*, 2012; Brauer & Ferguson, 2015). Throughout this process, a more frequent combination of traditional face-to-face and online modalities has been recommended. The latter increases programs' flexibility and facilitates the delivery of timely and individualized feedback, thereby increasing the effectiveness of the teaching and learning process (Woltering *et al.*, 2009). In particular, information technology usage has been perceived as a helpful resource for native digital students, promoting participation and facilitating more autonomous learning (Cook, 2007).

The electronic learning (E-Learning) modality is understood as an educational intervention primarily designed for online learning to improve information access, communication, and interaction (Sangrà *et al.*, 2012). In contrast, the blended learning (B-Learning) modality corresponds to the combination of E-Learning resources with the traditional face-to-face modality (Harris *et al.*, 2009). B-Learning is as effective as, and perhaps slightly better than, the face-to-face modality in terms of student satisfaction and the acquisition of knowledge and clinical skills (Kelly *et al.*, 2009; Stewart *et al.*, 2013). The School of Medicine at Pontificia Universidad Católica de Chile has committed to a continuous process of curricular adjustment based on a systematic evaluation of the teaching and learning process. The principal focus has been developing competencies and learning outcomes and increased curricular efficiency; thus, the program has been shortened from 14 to 12 semesters. The other axes of this process have been the promotion of active learning methodologies that favor self-directive learning, early contact of students with patients, and the participation of students in their personal development and professionalism (Riquelme *et al.*, 2009).

Traditionally at Pontificia Universidad Católica de Chile, medical students have learned Obstetrics and Gynecology through a theoretical-practical course (6 weeks) in their 10th semester, just before their internship. The theoretical component consists of several face-to-face lectures with voluntary attendance; assessment includes weekly formative tests (multiple-choice questions with single answer selection) and two summative tests (60 multiple-choice questions with single answer selection, weighted 50% each). The practical component consists of supervised clinical practice with students distributed in small groups across five clinical fields (1:10 teacher-student ratio).

In 2014, a learning needs survey, presented to both students and teachers, suggested a need to redesign the theoretical component of this course due to emerging issues, such as a drastic decline in lecture attendance, time management troubles, and displacement problems related to geographic dispersion from clinical fields. The decision was made to create a B-Learning course that delivers the theoretical component through E-Learning sessions while maintaining supervised clinical practice. This study aims to describe and evaluate the implementation of a B-Learning modality and assess student satisfaction and learning.

Materials and Methods

Study population: Tenth-semester undergraduate students at the School of Medicine at Pontificia Universidad Católica de Chile were distributed into two groups: the 2012-2014 face-to-face group (351 students) and the 2015-2017 B-Learning group (374 students). A retrospective and descriptive design was used. It includes quantitative and qualitative data that consider assessments and evaluations routinely used at the School of Medicine; for this reason, the study did not require approval from the ethics committee or consent from the students.

Student satisfaction: At the School of Medicine at Pontificia Universidad Católica de Chile, the Center for Medical Education routinely administers an evaluation survey to students at the end of courses that consider quantitative and qualitative data; therefore, surveys were always applied immediately after courses have ended. This survey records the time spent on learning activities (hours/week), the achievement of learning outcomes (%) and student rankings of eight items using a Likert scale from one to seven (1 = poor and 7 = excellent): organization, methodologies, teachers, sources of information, feedback, assessment, infrastructure, and overall perception. The survey also allows free comments to identify strengths and improvement aspects. Free comments were analyzed and compared with quantitative results using a triangulation protocol for qualitative health research (Farmer *et al.*, 2006; O'Cathain *et al.*, 2010). This protocol explores convergence and dissonance throughout complementary data sources of the same research matter to understand a complex issue. Data was sorted, key themes were identified and discussed, convergence and dissonance were assessed, and results were compared for quantitative data feedback.

Learning: The final grades on the theoretical component were compared between students of both groups. Tests were assessed using a scale from 1 to 7, where 4 (the minimum passing grade) corresponds to 60% of the learning objectives (Angoff, 1984). Student performance on test questions was also analyzed according to Bloom's modified taxonomy, considering only knowledge and application due to the nature of the course (Anderson & Krathwohl,

2001). Additionally, students were followed for the next two years when they took the “Examen Único Nacional de Conocimientos de Medicina” (EUNACOM). The EUNACOM is a general medical exam required of all medical graduates in Chile since 2009. (Kunakov *et al.*, 2018) EUNACOM is an exam with 180 multiple-choice questions with a single answer selection covering seven subjects, one of which corresponds to Obstetrics and Gynecology (Kunakov *et al.*, 2018).

Statistical analysis: Analysis was performed using the Statistical Package for Social Sciences (SPSS) software v. 20.0. Statistics of central tendency (mean) and dispersion (standard deviation and range) were calculated. Student’s t-test for independent samples was used to compare quantitative variables, and a $p < 0.05$ value was considered statistically significant.

Results

B-Learning modality course

The transformation to the B-Learning modality was completed in 60 days. Twenty days were dedicated to the recording of audiovisual material. **Figure 1** shows the eight steps for online session preparation. **Figure 2** depicts the general structure of these sessions. A total of 38 sessions were prepared: 23 tutorials based on clinical cases, ten demonstrations of procedures, and five integrative colloquia on selected topics. Sessions were created using Articulate © software, which allows the creation and sharing of interactive content compatible with the Sakai © virtual platform used at the School of Medicine at Pontificia Universidad Católica de Chile in undergraduate courses. The “Fondo de Desarrollo de la Docencia” (FONDEDOC) funded the project. The Department of Obstetrics and Gynecology paid the designers’ fee. The approximate total cost was US\$ 11.000.

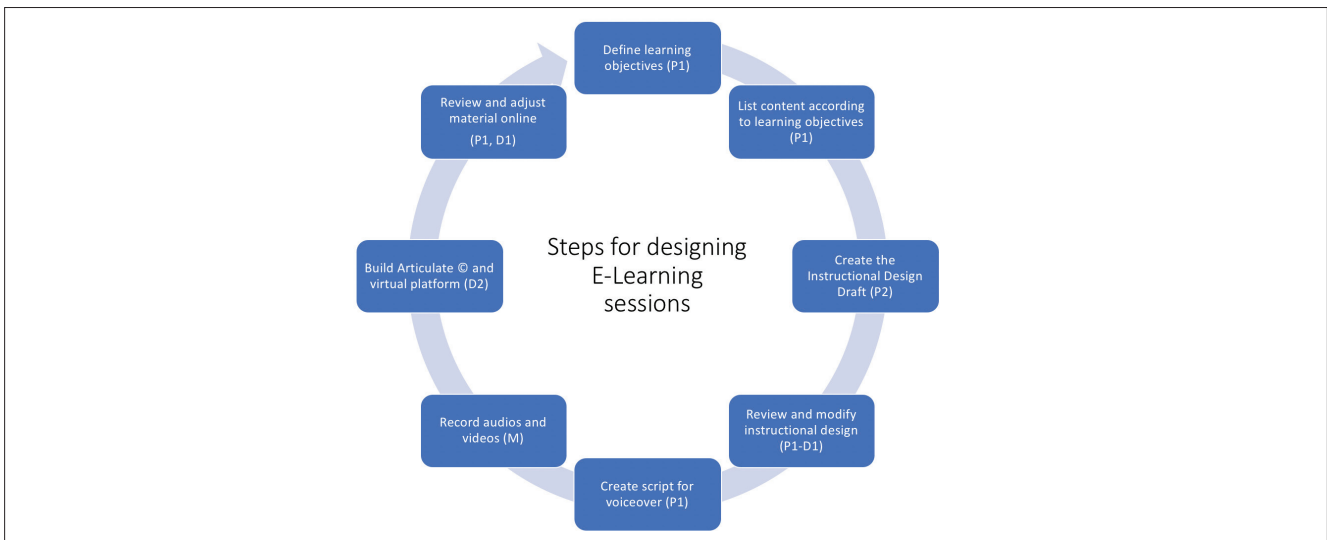


Figure 1: Steps for designing E-Learning sessions. P1 = Professor in charge of the course; P2 = Teacher in charge of the class; D1 = Instructional designer; D2 = Graphic designer; M = Multimedia Agency.

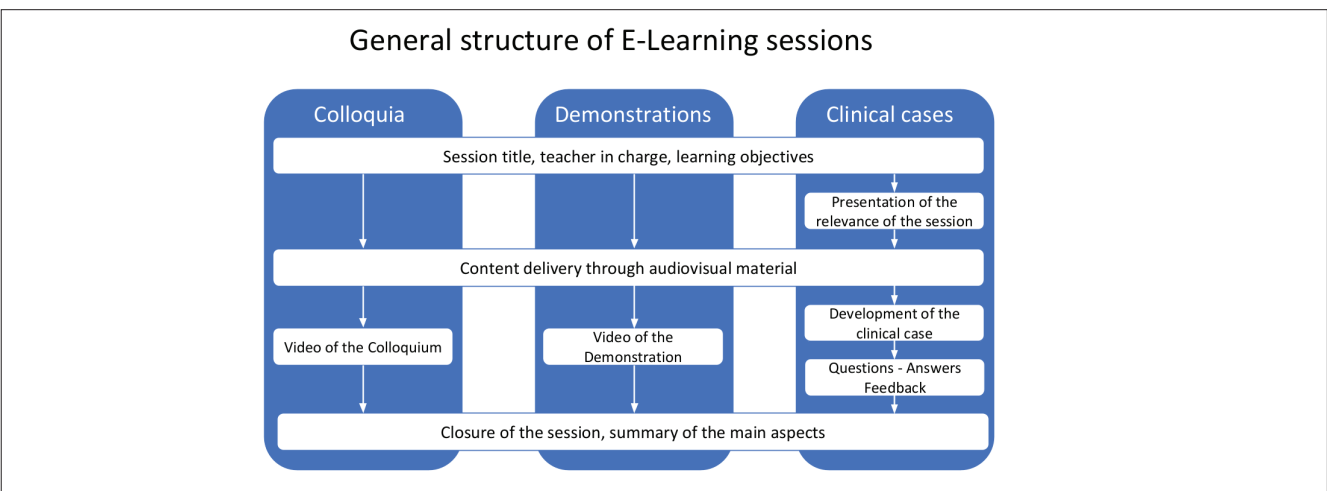


Figure 2: General structure of E-Learning sessions.

Student satisfaction

The survey response rate was 90% for the face-to-face group and 99% for the B-Learning group. Students' number of free comments was 100 for the face-to-face group and 182 for the B-Learning group. Compared to the face-to-face group, the B-Learning one

exhibited higher satisfaction with feedback and teacher quality. The remaining indicators did not reflect any changes, except for the sources of information item, which decreased. Both the time dedicated to the course and the percentage of learning outcome achievement increased (**Table 1**).

Table 1: Comparison of the results of the teaching evaluation survey based on the perception of the students according to face-to-face modality (2012 - 2014) and B-Learning (2015 - 2017) cohorts.

Indicators	Face-to-face (2012-2014)	B-Learning (2015-2017)	p value
Dedication time (h)	17,94 ± 7,62	20,85 ± 11,56	< 0,005
Achievement of Outcomes (%)	88,84 ± 8,43	89,63 ± 10,01	< 0,005
Methodology	6,60 ± 0,64	6,53 ± 0,81	NS
Teachers	6,73 ± 0,53	6,83 ± 0,47	< 0,05
Information sources	6,77 ± 0,48	6,58 ± 0,84	< 0,005
Feedback	6,49 ± 0,75	6,71 ± 0,66	< 0,005
Assessment	6,74 ± 0,56	6,64 ± 0,83	NS
Organization	6,77 ± 0,54	6,79 ± 0,55	NS
Infrastructure	6,80 ± 0,62	6,79 ± 0,70	NS
Global Calcification	6,74 ± 0,49	6,70 ± 0,54	NS

The indicators are measured on 1 to 7 scale, average and standard deviation are displayed. The satisfaction survey had 91% response rate in the face-to-face cohort (319 of 351 students) and 99% in B-Learning cohort (369 of 374 students).

In general, free comments were numerous and highlighted several perceived strengths of the B-Learning modality; **Table 2** presents examples of those comments. **Table 3** summarizes the triangulation protocol of all the comments with the analysis of quantitative

results. There is an agreement in the trends of six indicators: time spent, outcome achievement, teachers, information sources, feedback, and infrastructure. There is dissonance in three indicators: methodology, assessment, and organization.

Table 2: Examples of positive free comments on the B-Learning cohort.

Indicator	Free comment
Dedication time	"One of the best courses I have ever had, due to the distribution of time and confidence in students and their capacity for self-learning."
Achievement of Outcomes	"You can see concern, which translates into a better way of achieving outcomes and facilitating learning."
Methodology	"I really liked the online class method because they complement the information in the texts very well."
	"Promotes self-study and proactivity."
	"The online system was a real success, and a lot was learned regarding managing of each other's time"
	"Very good online system, I studied more per day, and the study is systematized"
Feedback	"I loved that they [teachers] actually do give feedback."
Organization	"Course's organization was very well thought out."

Table 3: Triangulation of free comments analysis and the grading given to indicators in the teaching evaluation survey.

	Qualification	Convergence	Face-to-Face		B-Learning	
			Weaknesses	Strengths	Weaknesses	Strengths
Indicators						
Dedication time (h)	↑	Agreement	0	0	0	7
Achievement of Outcomes (%)	↑	Agreement	0	0	0	1
Methodology	=	Dissonance	28	0	30	58
Teacher	↑	Agreement	0	10	0	10
Information sources	↓	Partial agreement	16	7	25	13
Feedback	↑	Agreement	4	0	0	2
Assessment	=	Dissonance	6	4	1	3
Organization	=	Dissonance	0	22	0	39
Infrastructure	=	Agreement	3	0	0	0

↑ the grading was better; ↓ lower grading; = similar grade in B-Learning compared to face-to-face. The number of comments referring to weaknesses (aspects to be improved) or strengths referred to each indicator is shown.

Learning

There was a small but significant reduction in the B-Learning final grades compared with the face-to-face group (5.86 ± 0.43 vs. 6.13 ± 0.59 ; $p < 0.001$). According to Bloom’s taxonomy, student performance analysis showed a significantly higher performance of the

B-Learning group regarding learning application (**Figure 3**). In the two-year follow-up, student performance on the Obstetrics and Gynecology component of the EUNACOM showed no differences between groups, as shown in **Figure 4**.

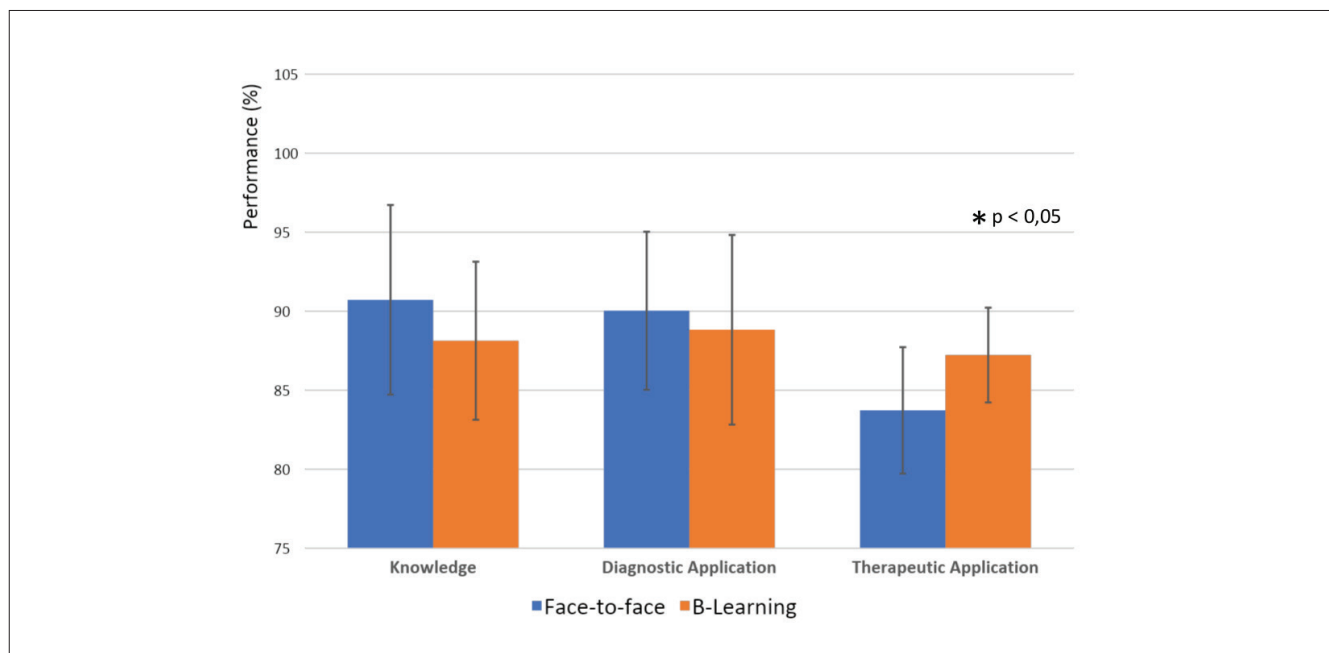


Figure 3: Performance analysis of knowledge test questions according to taxonomy. Average and standard deviation are displayed

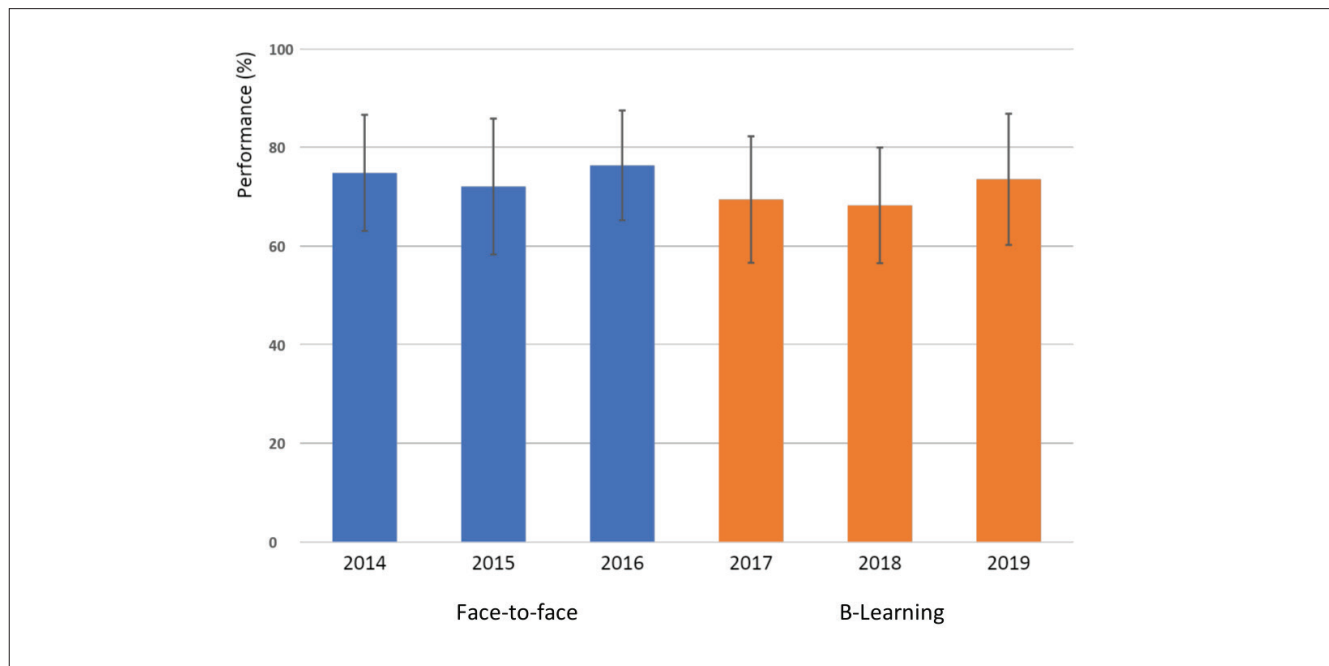


Figure 4: Student performance in the Obstetrics and Gynecology section of the National Single Examination of Medical Knowledge (EUNACOM). EUNACOM was taken two years after the course studied (face-to-face 2012-2014 → EUNACOM 2014-2016; B-Learning 2015-2017 → EUNACOM 2017-2019). Average and standard deviation are displayed.

Discussion

This article describes the experience of implementing and evaluating a B-Learning modality in the theoretical component of an Obstetrics and Gynecology course for medical students. Higher student satisfaction, consistent learning levels, and improved performance on more complex questions (regarding therapeutic application) were observed with the B-Learning modality.

Educational programs must be continuously updated in response to the curriculum and its components, the educational context, and the modifications that a study plan experiences (Hawick *et al.*, 2017). The periodic evaluation of educational programs, using a theoretical model as a conceptual framework, allows identifying emerging problems, planning improvements, and pursuing specific results to continue improving. Theoretical models such as the Kirkpatrick system focus on perceptions, learning, transfer of knowledge to medical practice, and its impact on other people and the organization (Frye & Hemmer, 2012). Furthermore, the adequate planning of courses with a B-Learning modality contributes to innovation in curricular and methodology areas in response to the frequent educational problems and challenges linked to the new generations' learning context. Examples of these problems and challenges include incorporating information technology, time flexibility, and improving communication among relevant actors (Ebeling *et al.*, 2020).

In general, student satisfaction and learning results were similar to those described in other studies that compare traditional face-to-face and B-Learning modalities in Medical Education. Students frequently show a stronger preference for the B-Learning modality (Chandrasinghe *et al.*, 2020; De Jong *et al.*, 2014; De Ponti *et al.*, 2020; Kim *et al.*, 2020; Schulz-Quach *et al.*, 2018). Learning achievement through this approach has traditionally been similar to the face-to-face modality (Mccutcheon *et al.*, 2015; Liu *et al.*, 2016; Kim *et al.*, 2020; Vallée *et al.*, 2020; Seifert *et al.*, 2021).

In this study, students' preferences, study time, and compliance with learning outcomes were superior in the B-Learning modality. Likewise, they assigned higher scores to their teachers and feedback. Free comments were generally favorable for the B-Learning modality, especially in organization, methodology, and assessment. This trend goes along with the general satisfaction described in the literature. Information sources had lower quantitative scores within the B-Learning modality, consistent with the complimentary comments that noted writing and spelling errors in the online resources. The triangulation protocol used helped to understand this kind of phenomenon.

Concerning learning, students in the B-Learning group earned slightly lower grades than those in the face-to-face group. This slight difference could be attributable to several variables, including adaptation to new methodologies, degree of student autonomy,

and initial versions of this modality. Similar results have been described (Kim *et al.*, 2020). However, an increase was observed in student performance on more complex questions regarding the therapeutic application. Furthermore, the two-year follow-up showed similar performance scores on the EUNACOM, suggesting that both modalities' overall level of learning was comparable. These results can be considered positive, as, during the SARS-CoV-2 pandemic, options are sometimes limited, and differences with the traditional modality are slight. It should be considered that there are also interventions where learning achievements with distant learning modalities have been significantly lower than traditional modalities (Foo *et al.*, 2021).

This study's strengths are evaluating a teaching innovation, using a triangulation protocol for quantitative and qualitative data, and focusing on differences between tests questions' taxonomy levels. The description of implementing a course with a B-Learning modality also reflects the spirit of updating educational programs according to the current paradigms in Medical Education. In this regard, several practical aspects of the implementation process are collected and synthesized to guide the development, implementation, and evaluation of a B-Learning modality in health care educational programs. A last strength of this study is that student satisfaction was evaluated using a validated and locally accepted survey (Pizarro *et al.*, 2015). The application of a learning needs survey addressing all relevant actors regarding course design (level 0), and the subsequent results (levels 1 and 2b) are consistent with Kirkpatrick's approach to program evaluation (Kirkpatrick & Kirkpatrick, 2006). Limitations of this study include the evaluation of only two levels of the Kirkpatrick system, a retrospective approach, and that the two groups compared were not contemporaneous in time, which can create uncertainty within results. Though the intervention described here is small, and its methodological limitations certainly have biases as the ones stated, its value relies on a scholarship-of-teaching-based local innovation rather than a general recommendation.

The next step is monitoring this intervention in the medium to long term, allowing to address higher levels of the Kirkpatrick system on a prospective basis, such as transfer of knowledge to practice, institutional impact, and return on investment (Kirkpatrick & Kirkpatrick, 2006). Second, the implementation and subsequent evaluation of activities that promote collaborative construction of knowledge and the resignification of learning in communities, aspects that are both at the heart of the E-Learning modality, are projected to be important in the future (Sangrà *et al.*, 2012).

The results shown here are highly relevant at present due to the SARS-CoV-2 pandemic and the consequent changes in how medical

schools around the world have implemented their face-to-face and E-Learning activities (Ashokka *et al.*, 2020; Lazzereschi & Kirtley, 2020; Roskvist *et al.*, 2020). However, the effectiveness of these activities is not always measured before implementation (García Vázquez *et al.*, 2020). The shown data reveals that the level of learning attained through the B-Learning modality is better or at least equal to that achieved through the face-to-face modality. Indeed, the two-year follow-up showed that long-term learning was similar between the two groups. The impact of distance learning on learning outcomes related to supervised clinical practice remains to be tested.

Conclusion

Teaching theoretical aspects of Obstetrics and Gynecology through E-Learning modality is satisfactory for new generations and produces similar or better knowledge development than traditional face-to-face lectures. Combining E-Learning with supervised clinical practice is also safer in the current pandemic conditions. This work seeks to provide evidence to promote the accelerated incorporation of active and pleasant modalities in study plans to promote improved satisfaction, learning, autonomy, and transfer of knowledge to clinical skills in students enrolled in health care programs.

Acknowledgements

FONDEDOC Teaching Development Fund, Vicerrectoría Académica, Pontificia Universidad Católica de Chile.

The authors declare that they have no conflict of interest.

Teo Feuerhake: data analysis, manuscript writing/editing. Marisol Sirhan: data analysis, manuscript writing/editing. María I. Barriga: project development, data collection, management. Jorge A. Carvajal: project development, data collection, management, data analysis, manuscript writing/editing. Special thanks to Mr. Marcelo Bilbao, who carried out a methodological review of online educational sessions; Mr. Rodrigo Rivas, who recorded videos and audios; and Miss Leticia Leiva, for creating sessions in Articulate ©.

References

- Anderson L. & Krathwohl D. (2001). *A Taxonomy for Learning, Teaching and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives: Complete Edition*. Longman, New York.
- Angoff WH. (1984). *Scales, norms, and equivalent scores*. Educational Testing Service, Princeton, N.J.
- Articulate Global (2021) Articulate® Rapid E-Learning Studio.

- Ashokka B, Ong SY, Tay KH, Loh NHW, Gee CF. & Samarasekera DD. (2020). Coordinated responses of academic medical centres to pandemics: Sustaining medical education during COVID-19. *Med Teach* **42**, 762-771.
- Brauer DG. & Ferguson KJ. (2015). The integrated curriculum in medical education: AMEE Guide No. 96. *Med Teach* **37**, 312-322.
- Chandrasinghe PC, Siriwardana RC, Kumarage SK, Munasinghe BNL, Weerasuriya A, Tillakaratne S, et al. (2020). A novel structure for online surgical undergraduate teaching during the COVID-19 pandemic. *BMC Med Educ* **20**, 1-7.
- Cook DA. (2007). Web-based learning: pros, cons and controversies. *Clin Med (Lond)* **7**, 37-42.
- De Jong N, Savin-Baden M, Cunningham AM. & Verstegen DM. (2014). Blended learning in health education: three case studies. *Perspect Med Educ* **3**, 278-288.
- Dent J & Harden R. (2001). *New horizons in medical education. A practical guide for medical teachers*. Churchill Livingstone, Edinburgh, Scotland.
- De Ponti R, Marazzato J, Maresca AM, Rovera F, Carcano G. & Ferrario MM. (2020). Pre-graduation medical training including virtual reality during COVID-19 pandemic: A report on students' perception. *BMC Med Educ* **20**, 1-7.
- Ebeling PA, Dent DL. & Kempenich JW. (2020). The millennials have arrived: What the surgeon educator needs to know to teach millennials. *Surgery* **167**, 265-268.
- Farmer T, Robinson K, Elliott SJ. & Eyles J. (2006). Developing and implementing a triangulation protocol for qualitative health research. *Qual Health Res* **16**, 377-394.
- Foo C chung, Cheung B. & Chu K man. (2021). A comparative study regarding distance learning and the conventional face-to-face approach conducted problem-based learning tutorial during the COVID-19 pandemic. *BMC Med Educ* **21**, 1-6.
- Frye AW. & Hemmer PA. (2012). Program evaluation models and related theories: AMEE guide no. 67. *Med Teach* **34**, e288-299.
- Garcia Vazquez A, Verde JM, Dal Mas F, Palermo M, Cobianchi L, Marescaux J, Gallix B, Dallemagne B, Perretta S. & Gimenez ME. (2020). Image-Guided Surgical e-Learning in the Post-COVID-19 Pandemic Era: What Is Next? *J Laparoendosc Adv Surg Tech A* **30**, 993-997.
- Harris P, Connolly J. & Feeney L. (2009). Blended learning: overview and recommendations for successful implementation. *Ind Commer Train* **41**, 155-163.
- Hawick L, Cleland J. & Kitto S. (2017). Getting off the carousel: Exploring the wicked problem of curriculum reform. *Perspect Med Educ* **6**, 337-343.
- IBM Corp. (2011). IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.
- Kelly M, Lyng C, McGrath M. & Cannon G. (2009). A multi-method study to determine the effectiveness of, and student attitudes to, online instructional videos for teaching clinical nursing skills. *Nurse Educ Today* **29**, 292-300.
- Kim JW, Myung SJ, Yoon HB, Moon SH, Ryu H. & Yim JJ. (2020). How medical education survives and evolves during COVID-19: Our experience and future direction. *PLoS One* **15**, 1-12.
- Kirkpatrick DL. & Kirkpatrick JD. (2006). *Evaluating training programs: the four levels*. Berrett-Koehler, San Francisco, CA.
- Kunakov PN, Moraga L. & Ortiz L. (2018). [A collaborative objective structured clinical examination for title revalidation by foreign medical graduates in Chile]. *Rev Med Chil* **146**, 232-240.
- Lazzereschi L. & Kirtley D. (2020). Provision of e-learning programmes to replace undergraduate medical students' clinical general practice attachments during COVID-19 stand-down: a student perspective. *Educ Prim Care* **1**.
- Mccutcheon K, Lohan M, Traynor M. & Martin D. (2015). A systematic review evaluating the impact of online or blended learning vs. face-to-face learning of clinical skills in undergraduate nurse education. *J Adv Nurs* **71**, 255-70.
- O'Cathain A, Murphy E. & Nicholl J. (2010). Three techniques for integrating data in mixed methods studies. *BMJ* **341**, c4587.
- O'Sullivan H, van Mook W, Fewtrell R. & Wass V. (2012). Integrating professionalism into the curriculum: AMEE Guide No. 61. *Med Teach* **34**, e64-77.
- Pizarro M, Solis N, Rojas V, Diaz LA, Padilla O, Letelier LM, Aizman A, Sarfatis A, Olivos T, Soza A, Delfino A, Latorre G, Ivanovic-Zuvic D, Hoyl T, Bitran M, Arab JP. & Riquelme A. (2015). [Development of MEDUC-PG14 survey to assess postgraduate teaching in medical specialties]. *Rev Med Chil* **143**, 1005-1014.

- Riquelme A, Oporto M, Oporto J, Mendez JI, Viviani P, Salech F, Chianale J, Moreno R. & Sanchez I. (2009). Measuring students' perceptions of the educational climate of the new curriculum at the Pontificia Universidad Católica de Chile: performance of the Spanish translation of the Dundee Ready Education Environment Measure (DREEM). *Educ Health (Abingdon)* **22**, 112.
- Roskvist R, Eggleton K. & Goodyear-Smith F. (2020). Provision of e-learning programmes to replace undergraduate medical students' clinical general practice attachments during COVID-19 stand-down. *Educ Prim Care* **1**.
- SAKAI (2021) Sakai © Collaboration and Learning Environment (CLE) 2.8.2
- Sangrà A, Vlachopoulos D. & Cabrera N. (2012). Building an inclusive definition of e-learning: An approach to the conceptual framework. *Int Rev Res Open Distrib Learn* **13**, 145-159.
- Schulz-Quach C, Wenzel-Meyburg U. & Fetz K. (2018). Can elearning be used to teach palliative care? - Medical students' acceptance, knowledge, and self-estimation of competence in palliative care after elearning. *BMC Med Educ* **18**, 1-7.
- Seifert T, Becker T, Büttcher AF, Herwig N. & Raupach T. (2021). Restructuring the clinical curriculum at university medical center göttingen: Effects of distance teaching on students' satisfaction and learning outcome. *GMS J Med Educ* **38**, 1-8.
- Stewart A, Inglis G, Jardine L, Koorts P. & Davies MW. (2013). A randomised controlled trial of blended learning to improve the newborn examination skills of medical students. *Arch Dis Child Fetal Neonatal Ed* **98**, F141-144.
- Vallée A, Blacher J, Cariou A. & Sorbets E. (2020). Blended Learning Compared to Traditional Learning in Medical Education: Systematic Review and Meta-Analysis. *J Med Internet Res* **22**, e16504.
- Woltering V, Herrler A, Spitzer K. & Spreckelsen C. (2009). Blended learning positively affects students' satisfaction and the role of the tutor in the problem-based learning process: results of a mixed-method evaluation. *Adv Health Sci Educ Theory Pract* **14**, 725-738.