

Medical education for undergraduate research: Proposals from the experience of two national student conferences of the Universidad de Valparaíso

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ABSTRACT

INTRODUCTION Scientific research promotes the development of essential skills for medical practice. However, student participation in research projects is low, with multiple limitations and students' perceptions of deficient research skills. This study aims to describe the organization of the two medical student conferences held by the Scientific Society of Medical Students of the Universidad de Valparaíso and to analyze the papers presented. Finally, we make recommendations for promoting scientific research among medical students.

METHODS An analytical cross-sectional study was conducted, including all the presentations given at the conferences.

RESULTS The conferences comprised four phases: registration, evaluation, selection, and presentation. A total of 399 papers were received. A total of 157 case reports and 12 cross-sectional studies were presented, including 797 authors (56.7% women) from 21 universities. Most of the first authors were women in the internship cycle at public universities. The specialties with the highest representation were internal medicine (32.5%), pediatrics (18.3%) and surgery (13%). In the case reports, the best-evaluated section was the title (6.66 ± 0.76), and the worst-evaluated section was the discussion (6.17 ± 0.84). The case reports from private universities scored significantly higher in six of the eight items assessed.

CONCLUSIONS Greater participation was represented by students in their internship cycle presenting case reports. The worst evaluated section was the discussion, which could reflect difficulties in the research process. It is crucial to increase student participation from the first years of the career and encourage their involvement in research. More studies are needed to evaluate student participation and barriers to scientific research.

KEYWORDS Education, Medical; Biomedical Research; Societies, Scientific

INTRODUCTION

In recent decades, there has been an exponential increase in scientific research. However, the number of physicians involved has decreased [1,2]. Likewise, in Chile, a decrease has been reported in the number of state-funded research projects led by physicians in the National Fund for Scientific and Technological

Development (FONDECYT) between 1984 and 2003 [3] and in the period from 2004 to 2013 in the National Fund for Health Research and Development (FONIS) [4]. At the undergraduate level, the number of papers presented at the Chilean Congress of Medical Students (CoCEM) has decreased [5], and low participation of medical students in national medical journal publications has been reported [6].

Research plays a fundamental role in training medical students, helping them develop skills such as critical thinking, teamwork, creativity, critical analysis of scientific literature, scientific writing, and leadership. These are essential competencies in the practice of medicine, as they improve clinical decision-making and enable better performance in their professional practice [7–9]. That is why many medical schools worldwide [10] and nationally [11] teach courses on scientific

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MAIN MESSAGES

- Scientific research is essential for medical training, as it enables the development of critical skills for professional practice.
- For this reason, many medical schools teach courses on scientific research methodology and evidence-based medicine.
- However, student participation in research projects continues to be low, and their perception of the development of undergraduate research skills is negative.
- Limitations of this work are the over-representation of participants from the organizing institution, which could make it difficult to extend these results to the national reality; the fact that almost all the works were case reports; and the fact that we were unable to evaluate the students' perception of their training in research and the possibilities of carrying it out, which constitutes valuable information regarding the problems discussed.

research methodology and evidence-based medicine. However, student participation in research projects remains low despite incorporating these subjects in medical curricula. Likewise, students' perception of the development of undergraduate research skills is negative [12].

In Latin America and particularly in Chile, student initiatives such as scientific societies and academies of medical students have increased [13]. The Scientific Society of Medical Students of the Universidad de Valparaíso (SOCEM-UV) is a nonprofit student organization that, as of 2024, has 52 years of experience. Its mission is to promote scientific research during undergraduate studies and the dissemination of knowledge in health sciences. In response to the aforementioned problems, in 2022, this society organized two national conferences to present scientific papers focused on clinical specialties and public health: the 1st and 2nd conference on medical research of the Universidad de Valparaíso.

Our research aims to describe the organization of both conferences, characterize the presentations and the participating students, and analyze the differences between the grades obtained by each university.

METHODS

An analytical cross-sectional study was conducted, which included all the papers presented at the 1st and 2nd versions of the conference on medical research of the Universidad de Valparaíso held on March 5th, 2022, and November 19th of the same year, respectively. This article follows the STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) guideline for cross-sectional studies [14].

First, the organizational phases of the conference are described. Then, the presentations are characterized according to the following variables: type of work, either case report or research work; university category (public/state or private) according to its membership in the Consortium of Universities of the State of Chile (CUECH); sex and academic year of the first author; medical specialty area of the work; and ratings provided by the scientific committee reviewing the abstracts. Finally, the association between the ratings obtained by state universities versus private universities is analyzed. The data were extracted from the records and books of public abstracts of the Scientific Society.

The Stata 17 program was used for statistical analysis. Proportions, mean, and absolute numbers were used to describe the variables. The students' t-test was used to compare the means between the groups. A significance level of 5% was used.

RESULTS

Description of the conference organization

The conference consisted of four main phases: registration, evaluation, selection, and presentation.

1. Registration phase. The corresponding author had to register the paper with the following mandatory documentation:
 1. Abstract.
 2. Declaration of authorship.
 3. Informed consent if it corresponded to a case report.
 4. Approval of an ethical-scientific committee if it corresponded to a primary research work.

The organizing committee reviewed this documentation, and papers that did not adequately comply with it were excluded.

2. Evaluation phase. The papers accepted in the first stage were assigned according to thematic affinity to an evaluator from a committee of academics, mostly from the Universidad de Valparaíso. Thirty-five evaluators participated in the 1st conference, and a total of 30 in the 2nd conference. The evaluation was carried out using a rubric created by the organizing committee with a score from 1 to 7 for each item, based on the CAsE REports (CARE) [15] and STROBE [14] guidelines (Table 1).
3. Selection phase. The best papers were selected according to the score obtained through the arithmetic mean of all the items evaluated in the previous stage. On the first day, 50% of the places were reserved for students from the Universidad de Valparaíso, while on the second day, there was no distinction by university. The cut-off scores were 5.13 and 6.06 for the first and second days, respectively.
4. Presentation phase. During the first conference, one author of each selected paper presented in virtual mode, given the restrictions associated with the COVID-19

pandemic. The second conference was held at the Faculty of Medicine of the Universidad de Valparaíso. All the submitted papers were published in a book of abstracts that is publicly accessible [16,17].

Description of the submitted papers and participants

A total of 399 papers were received, and after the evaluation and selection phases, 169 papers were selected. Figure 1 shows the flow chart for selecting the papers for each day according to the different phases.

The characterization of the papers submitted is shown in Table 2. Twenty-one universities participated: nine were state or public, and 12 were private. Those with the highest number of papers submitted were Universidad de Valparaíso (38.5%), Universidad de Chile (9.5%), Universidad de Concepción (8.3%), Universidad Andrés Bello (8.3%) and Universidad San Sebastián (7.1%).

A total of 797 authors participated, of whom 56.7% ($n = 452$) were women. First authorship was higher among the female authors (56.2%), and almost all corresponded to students in the internship cycle (97.6%). Most of the submitted papers were case reports (92.9%), and the specialties that received the greatest number of papers were internal medicine (32.5%), pediatrics (18.3%), and surgery (13%).

Figure 2 shows the scores obtained in each of the case reports. The best-evaluated item was the title (6.66 ± 0.76), and the worst score was for the discussion (6.17 ± 0.84). When analyzing the data by type of university, private universities obtained higher scores overall and in each item, with six out of eight statistically significant results (Table 3).

Research papers represented a minority of the overall total (12/169), and their submission was distributed equally between state and private universities. The overall average was 6.55 ± 0.22 . When differentiated by type of university, the state universities obtained an average score of 6.52 ± 0.14 , while the private ones were 6.59 ± 0.29 . In both types of universities, the worst-rated items were results (6.0 ± 0.85) and discussion (6.25 ± 0.97). In contrast, the best-rated item for private universities was the title (7.0 ± 0.0); in state universities, it was both the title and keywords (7.0 ± 0).

DISCUSSION

A total of 169 scientific papers were submitted from 21 Chilean state and private universities. Most of the papers received were case reports in the area of internal medicine, followed by pediatrics and surgery. Most of the participants were women doing their internships at state universities. In the case reports, the best-rated item was the title, and the worst was the discussion. Case reports from private universities obtained a statistically significant higher score in six of the eight evaluated items.

The categorical predominance of the participation of students in the internship cycle could be explained by the greater proximity to patients and specialists due to their clinical

practices, greater preparation by being in higher courses, and the incentive of presenting papers at scientific congresses as an item of relevance in the applications for medical specialties. On the other hand, only 2.4% of the participants were students in their first to fifth year. This fact could be associated with phenomena such as lack of interest in undergraduate research or insufficient preparation in the area by universities. Therefore, a major challenge is to achieve active participation of medical students in science communication since the first years. This would contribute to internalizing the value and practice of undergraduate research and would later result in specialists dedicated to clinical medicine [18–20].

On the other hand, the predominance of case reports as the most commonly used methodology could be explained by the greater proximity of students to patients and by the fact that it is less complex, particularly when considering the great care and academic load associated with the medical career and, especially, with the internship cycle. This is one of the main barriers to research during medical school, as reported by other studies [21,22]. Although case reports are recognized as an important educational strategy in the health sciences [23], a pending challenge is the participation of students in more complex primary research projects that generate a higher level of evidence. This could contribute to internalizing the value of research and better developing research skills [7,9,24], including creativity, teamwork, and the development of oral and written expression.

Four of the five specialties that received the greatest number of papers correspond to the mandatory internships of the Chilean medical curriculum: internal medicine, pediatrics, general surgery, and gynecology-obstetrics. Likewise, these results coincide with national [25] and international studies [26], corroborating that these are the medical specialties of greatest interest among the student body. In our conference, neurology, psychiatry, and public health stood out as the group with the second highest number of papers received, below the four specialties already mentioned. Psychiatry is also reported in these studies among the specialties of greatest interest, but neurology and public health are not.

Regarding women's participation in scientific research, historically, they have been underrepresented [27]. In the last decade, a low percentage of women were reported as first authors in high-impact journals [28]. During the last five years in Chile, according to data provided by the National Agency for Research and Development (ANID), the participation of women as lead researchers or project directors was only 40% [29]. When diagnosing gaps among universities of the Consortium of State Universities of Chile, in 2002, it was reported that only 36.2% of research projects were led by women and that only 29.2% of publications were made by women [30]. Interestingly, our findings show results in the opposite direction, reporting a higher participation of women as first authors.

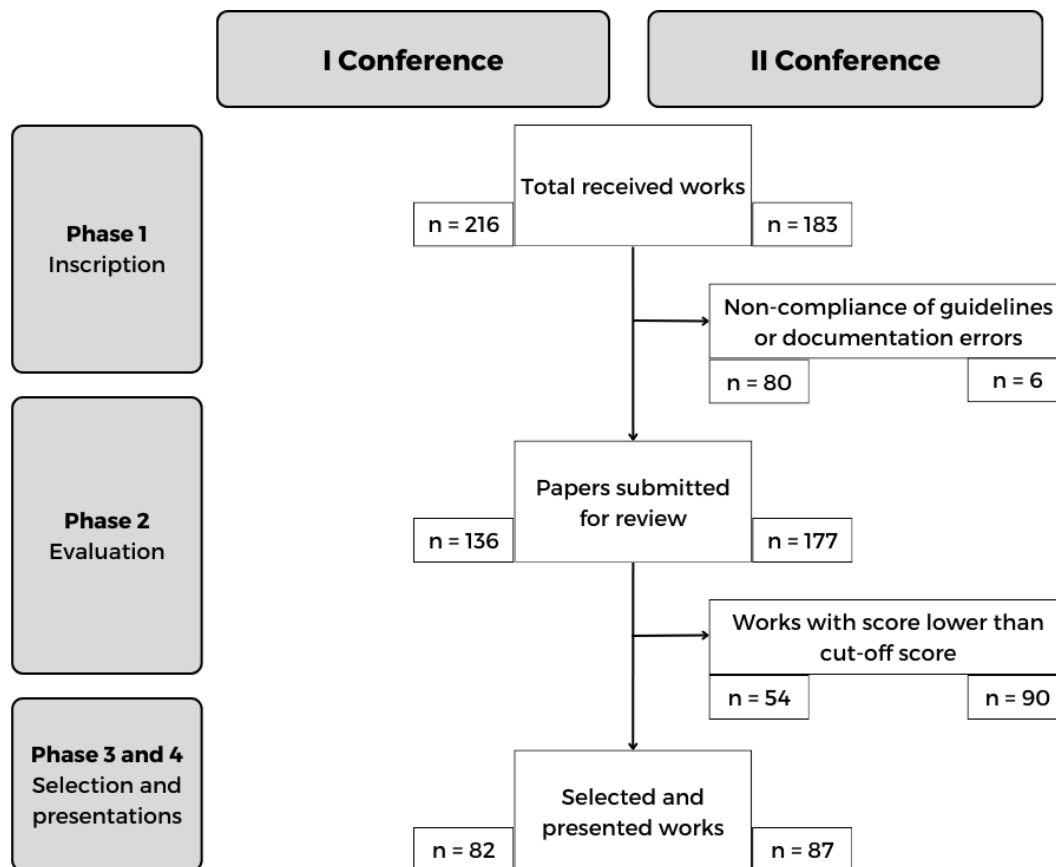
Medicine and teaching are intrinsically linked. The role of the physician-teacher is essential for training future physicians

Table 1. Evaluation rubrics.

Item	Heading	Description
1	Title	The title is concise and informs about the central content of the paper.
2	Keywords	At least three keywords are used, which are adequate and identify the central content of the work.
3	Introduction	The introduction defines and contextualizes the study problem.
4.1	Case presentation (only for case reports)	The presentation of the case describes the patient, indicates its origin or source, and clearly reports the main diagnosis(s), the distinctive clinical features, and/or the results of therapeutic interventions, if applicable.
4.2	Methodology (only for research papers)	The methodology is rigorous, explains clearly how the work was performed and allows for reproducibility.
4.3	Results (for research papers only)	The main results are presented in a clear and objective manner, facilitating their understanding.
5	Discussion	The discussion explains or clarifies the debatable aspects and indicates the main lessons derived from the work.
6	Originality	The importance and originality of the work are relevant and contribute to current knowledge.
7	Formalities	The work complies with spelling and writing standards and has a structured format.

Source: Prepared by the authors based on the study results.

Figure 1. Work selection flowchart.



Source: Prepared by the authors based on the study results.

and researchers [31]. However, teaching may be less valued than other roles in the medical profession, such as clinical care, management, and research [32]. One of the described barriers to student participation in research is the lack of adequate mentoring and guidance by a research faculty member [22,33]. In this regard, in both conferences, many

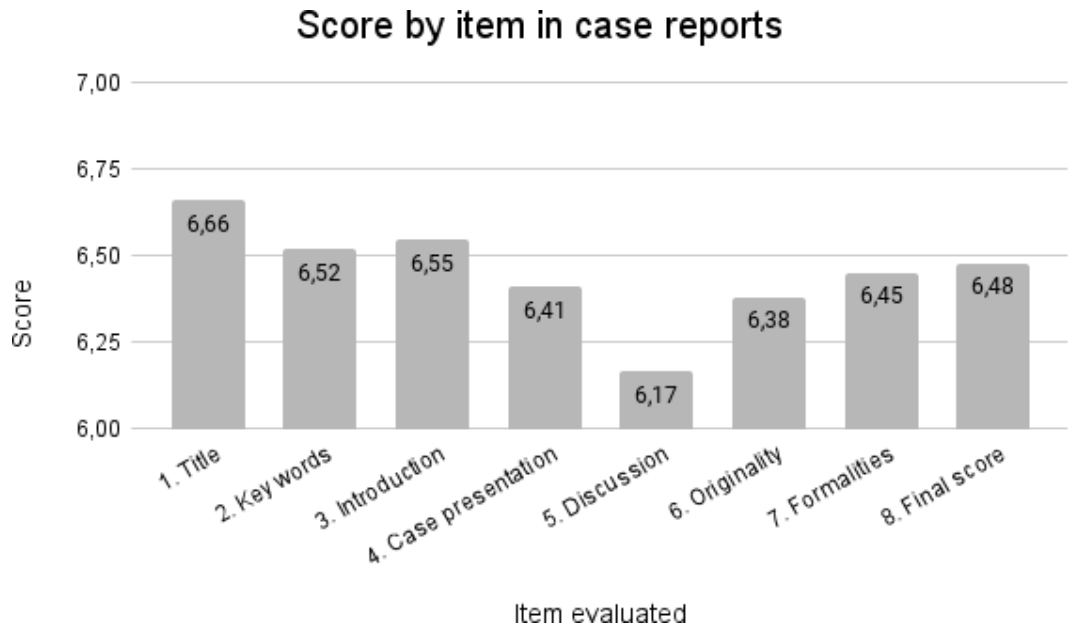
physicians and academics participated voluntarily, which may reflect the willingness and interest of the faculty. However, at the same time, it may also indicate the lack of relevant instances that facilitate the exchange between teachers, researchers, and students.

Table 2. Characterization of the presented scientific papers.

Variable	Description	Quantity	Proportion
University category	State or public	111	65.7%
	Private	58	34.3%
First author's sex	Female	95	56.2%
	Male	74	43.8%
First author's academic year	Internship (6th or 7th year)	165	97.6%
	Student	4	2.4%
Methodology	Case report	157	92.9%
	Descriptive cross-sectional study	11	6.5%
	Analytical cross-sectional study	1	0.6%
	Internal medicine	55	32.5%
	Pediatrics	31	18.3%
	Surgery	22	13%
Specialty	Gynecology and obstetrics	20	11.8%
	Neurology	20	11.8%
	Psychiatry	8	4.7%
	Public health	7	4.1%
	Other specialties (traumatology, urology, ophthalmology, dermatology)	6	3.6%

Source: Prepared by the authors based on the study results.

Figure 2. Scores per item in case reports.



Source: Prepared by the authors based on the study results.

Undergraduate research education is crucial for developing essential skills for medical practice, such as the critical analysis of scientific evidence [7–9]. In routine clinical practice, facing a patient who seeks medical advice for any clinical condition implies a systematized and critical approach that allows evaluating different diagnostic hypotheses and indicating treatments according to the best available evidence. Together, students and professionals should be relevant actors in generating new evidence, linking clinical reflection, the needs of patients, and the different health devices.

Although these competencies may be the objective of different subjects taken throughout the career, few universities involve integrative subjects of scientific research methodology and evidence-based health [11]. There is a persistent perception among students of low research skills and multiple limitations to engaging in research. Among these, the lack of knowledge, lack of teaching advice, and poor preparation and experience stand out [9,21,34]. In our conferences, the worst evaluated item for case reports and research papers was the discussion and the results section for research papers. These sections of the paper probably have the highest critical and reflective

Table 3. Comparison of ratings in case reports between state and private universities.

Evaluated item	State universities rating	Private universities rating	P value
Title	6.65	6.67	0.45
Keywords	6.36	6.84	0.0002 ¹
Introduction	6.46	6.71	0.025 ¹
Case presentation	6.27	6.69	0.0003 ¹
Discussion	6.04	6.40	0.0059 ¹
Originality	6.32	6.50	0.117
Formalities	6.31	6.73	0.0007 ¹
Final score	6.36	6.65	0.0001 ¹

¹Statistically significant differences.

Source: Prepared by the authors based on the study results.

Table 4. Recommendations for the promotion of research during medical careers.

Area	Proposal
Transversal and coordinated research training for each training cycle	Integrate research training in a transversal and coordinated manner during the course of their studies and not as isolated subjects, with a practical approach oriented to developing competencies. For example: First cycle (1st and 2nd year): period of basic science and public health courses. Conducting appropriate bibliographic searches, participating in preclinical studies, developing community-based public health work oriented according to the main methodological designs of clinical and population epidemiology, and developing research with qualitative methodology. Second cycle (3rd to 5th year): introduction to clinical subjects and formal courses in scientific research methodology and evidence-based health. Application of the theoretical knowledge of both disciplines in the formulation and execution of a research project coordinated with a clinical and/or medical specialty course. Third cycle (6th and 7th year): internship or professional practice period. Continuous and structured discussion and presentation of clinical cases and continuation of the execution of the research project presented in the second cycle.
Graduation requirements and incentives for medical specialties competition	Mandatory, as a graduation requirement, to participate in the publication of research work developed during undergraduate studies and its presentation at a scientific congress. Extend the incentives at the ministerial level for applying to medical specialties competitions, such as benefiting those who participate in publications of studies of greater methodological complexity or those published in journals of greater impact.
Institutional support	Promote and ensure spaces for participation in these activities. It is suggested that teachers be given protected time in their academic units to develop research functions and that they actively incorporate the student body.
Liaison between researchers and students	Facilitate the link between researchers and students from the early stages of their careers through conferences, allowing students to get to know the different centers, laboratories, and ongoing research projects in medical disciplines and related sciences. Medical student scientific societies and academies can play an essential role in this, acting as intermediaries.
Inclusion of students in competitive projects and funds	Encourage formal initiatives for students with greater interest in research projects, such as teaching assistant positions or elective courses. Also, promote as a policy of the different academic units internal competitions of competitive funds for research led by students and supervised by academics of the unit.

Source: Prepared by the authors based on the study results.

demands, which could reflect the results of the previously discussed problems. Other barriers that have been described for developing undergraduate research are the lack of time due to academic and care overload, the lack of funding, the absence of an adequate research culture that fails to internalize its social and professional value, and the lack of interest from universities [12,22,34]. To address these challenges, multiple actors must coordinate action and recognize research as a pillar in medical training. In Table 4, based on the presented results and the reviewed literature, we propose a series of recommendations for promoting scientific research in the medical career.

Among the limitations of this study, we can mention that, given the inclusion criteria for the first conference, there

was an overrepresentation of participants from the organizing institution (38.5% of the papers came from the Universidad de Valparaíso), which could make it difficult to extend these results to the national reality. On the other hand, almost all the papers corresponded to case reports. In addition, only the abstracts were evaluated and not the complete article; thus, the sections could not be analyzed in greater depth. Finally, this work did not evaluate the students' perception of their training in research and the possibilities of accomplishing it, which is valuable information regarding the problems discussed.

CONCLUSIONS

The higher participation of internship students compared to students in lower years, as well as the higher prevalence of case reports as opposed to other types of studies, together with the evaluation results that point to discussion as the lowest rated item (section with the highest critical and reflective demands), may reflect several problems described in the literature. These include deficient research skills and multiple barriers to becoming involved in research from the early stages of the career or participating in studies with a higher level of evidence. These include a lack of time due to academic and care overload and a lack of knowledge in developing a research project. In light of our findings, it is necessary to encourage student participation from the first years of the career and their involvement in projects with a higher level of evidence. Therefore, we propose a series of recommendations that include transversal and coordinated research training for each training cycle, updating the requirements for graduation and incentive to medical specialties competitions, ensuring adequate institutional support, facilitating the link between researchers and students, and encouraging student inclusion in projects and competitive funds.

On the other hand, further studies are needed to analyze in greater depth the participation of medical students in scientific research projects, presentations at congresses, and publications in scientific journals. In addition, more studies with qualitative methodology are needed to help identify the barriers and elements that facilitate developing undergraduate scientific research.

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Educación médica para la investigación en pregrado: propuestas desde la experiencia de dos congresos estudiantiles nacionales de la Universidad de Valparaíso

RESUMEN

INTRODUCCIÓN La investigación científica fomenta el desarrollo de competencias esenciales para la práctica médica. Sin embargo, la participación estudiantil en proyectos de investigación es baja, con múltiples limitaciones y percepción de habilidades investigativas deficientes por parte de los estudiantes. Los objetivos de este estudio son describir la organización de las dos jornadas de estudiantes de medicina realizadas por la Sociedad Científica de Estudiantes de Medicina de la Universidad de Valparaíso y caracterizar los trabajos presentados. Finalmente, se realizan recomendaciones para la promoción de la investigación científica en estudiantes de medicina.

MÉTODOS Se realizó un estudio transversal analítico que incluyó todos los trabajos presentados en las jornadas.

RESULTADOS Las jornadas comprendieron cuatro fases: inscripción, evaluación, selección y presentación. Se recibieron 399 trabajos. Se presentaron 157 reportes de caso y 12 estudios transversales, incluyendo 797 autores (56,7% mujeres) de 21 universidades. Mayormente, los primeros autores fueron mujeres cursando el ciclo de internados en universidades estatales. Las especialidades con mayor representación fueron medicina interna (32,5%), pediatría (18,3%) y cirugía (13%). En los reportes de caso, la sección mejor evaluada fue el título ($6,66 \pm 0,76$) y la peor evaluada la discusión ($6,17 \pm 0,84$). Los reportes de caso provenientes de universidades privadas obtuvieron una calificación significativamente mayor en seis de los ocho ítems evaluados.

CONCLUSIONES La mayor participación estuvo representada por estudiantes cursando el ciclo de internados que presentaron reportes de caso. La sección peor evaluada fue la discusión, lo que podría reflejar dificultades en el proceso de investigación. Es crucial aumentar la participación estudiantil desde los primeros años de la carrera y fomentar su involucramiento en investigación. Se requieren más estudios para evaluar la participación y las barreras estudiantiles en investigación científica.



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