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Laboratory practices in medical education: teaching perceptions and pedagogical challenges.

Prácticas de laboratorio en la enseñanza de la Medicina: percepciones docentes y desafíos pedagógicos.

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Summary.

Laboratory practices constitute a fundamental component of medical training, as they allow for the integration of theoretical knowledge, technical procedures, and skills related to future professional practice. This study aimed to analyze the social representations of faculty members at a School of Medicine regarding these practices, identifying the meanings attributed to these activities, the main obstacles to their implementation, the modifications considered necessary, and their contribution to professional training. An exploratory-descriptive study, predominantly qualitative with quantitative components, was conducted with the participation of 18 faculty members from the School of Medicine at the University of the Republic, Uruguay. Data collection was carried out using a single instrument administered virtually, consisting of a word recall and ranking technique, incomplete sentences, and a Likert-type scale. The results show that laboratory practices are primarily represented from a technical-normative perspective, focused on hygiene and safety standards, materials, and procedures. Scientific knowledge and positive attitudes occupy peripheral positions, while teaching and learning are absent from the group's overall representation. Among the most frequently cited obstacles are large student populations and limited resources; however, when proposing improvements, faculty members emphasize the need to revise the teaching model, promoting greater student autonomy, participation, and leadership. It is concluded that, although laboratory practices are highly valued in medical training, it is necessary to strengthen their pedagogical dimension so that they are not limited to technical execution but rather foster meaningful learning, reflection, and informed decision-making.

Keywords: medical education, laboratory practices, university teaching social representations.

Resumen.

Las prácticas de laboratorio constituyen un componente fundamental de la formación médica, en tanto permiten articular saberes teóricos, procedimientos técnicos y competencias vinculadas al futuro ejercicio profesional. Este estudio tuvo como objetivo analizar las representaciones sociales del profesorado de una Facultad de Medicina sobre dichas prácticas, identificando los sentidos atribuidos a estas actividades, los principales obstáculos para su implementación, las modificaciones consideradas necesarias y su aporte a la formación profesional. Se desarrolló un estudio exploratorio-descriptivo, de predominio cualitativo con componentes cuantitativos, en el que participaron 18 docentes de la Facultad de Medicina de la Universidad de la República, Uruguay. La recolección de

datos se realizó mediante un instrumento único administrado virtualmente, compuesto por una técnica de evocación y jerarquización de palabras, frases incompletas y escala tipo Likert. Los resultados muestran que las prácticas de laboratorio son representadas principalmente desde una lógica técnico-normativa, centrada en normas de higiene y seguridad, materiales y procedimientos. El conocimiento científico y las actitudes positivas ocupan posiciones periféricas, mientras que la enseñanza y el aprendizaje quedan por fuera de la representación del grupo en general. Entre los obstáculos más señalados se destacan la masividad estudiantil y las limitaciones materiales; sin embargo, al proponer mejoras, los docentes enfatizan la necesidad de revisar el modelo didáctico, promoviendo mayor autonomía, participación y protagonismo estudiantil. Se concluye que, aunque las prácticas de laboratorio son altamente valoradas en la formación médica, resulta necesario fortalecer su dimensión pedagógica para que no se limiten a la ejecución técnica y se favorezcan aprendizajes significativos, reflexión y toma de decisiones fundamentadas.

Palabras clave: educación médica, prácticas de laboratorio, docencia universitaria, representaciones sociales.

1. Introduction

Laboratory practices occupy a strategic place in medical training, as they articulate theoretical knowledge with applied experiences linked to the use of procedures, problem-solving, and the development of professional competencies, in addition to fostering meaningful learning and the connection between scientific principles and clinical reasoning (1). However, their educational value depends not only on their curricular presence but also on the decisions of institutional stakeholders and the conditions under which they are implemented. In this sense, various studies have indicated that laboratory practices can take very different forms depending on the didactic decisions that guide their implementation. While some approaches promote active student participation, problem-solving, and decision-making, others are organized under highly structured formats, focused on the reproduction of pre-established procedures (2). Despite the potential attributed to experimental work, "recipe-type" practices frequently persist, in which students follow instructions without participating in the discussion of procedures, results, or their relationship to theoretical frameworks (3-4). Consequently, various authors point out that the educational value of laboratory practices depends not only on their execution, but also on the pedagogical intent behind them and the opportunities they offer to foster conceptual understanding, scientific thinking, and the connection between theory and clinical practice (5). In this regard, understanding faculty perspectives on experimental practices is particularly relevant, as these perspectives, as a fundamental assumption, guide pedagogical decisions and the organization of experimental work. From this perspective, the study is justified by the need to understand how faculty members conceive of laboratory practices in a Faculty of Medicine, what challenges they identify in their implementation, and what improvements they consider possible.

The perspective from which this article approaches the study of teachers' thinking toward laboratory practices corresponds to the theory of social representations. In Moscovici's words, social representations (hereafter SR) "are an organized body of knowledge and one of the psychic activities through which people make reality intelligible" (6). SRs guide action and provide a framework for interpreting reality; they are socially constructed and shared knowledge (7), and therefore their study makes it possible to address the conceptions that guide the decisions and practices of different social groups. Both definitions show SRs as a set of knowledge that allows human beings to understand and interpret the world.

From a structural perspective (8), every social representation (SR) is established around a central core and a peripheral system. On the one hand, the central core is the system that gives meaning to the SR and is characterized by its stability, rigidity, and continuity, which allows for the permanence and

stability of the representation. On the other hand, the elements that make up the peripheral system are more influenced by the immediate social context in which the subjects operate, and are therefore more malleable and unstable, more vulnerable to pressures from elements external to the predominant SR. This peripheral system is responsible, among other things, for protecting the core by incorporating and assimilating new information, as well as anchoring the representation to the context.

The characteristics of social representations (SRs) make it a flexible theory applicable to multiple contexts and objects of research. Because of this, research on various topics has been reported in multiple countries, with health and education being among the main thematic areas (9). In this context, the importance of studying SRs in educational settings is highlighted, since the SRs constructed by educational actors guide the course of their practices (10).

Taking into account the theoretical perspective of social responsibility (SR) and consistent with the exploratory-descriptive purpose of the study, this research aimed to answer the following questions: What are the SRs of faculty members in a School of Medicine regarding laboratory practices? What are the main obstacles they identify for their implementation? What transformations do they consider necessary to optimize their design and development? And how do they value the contribution of laboratory practices to the training of future professionals?

2. Methods

This study employs an exploratory and descriptive design and was conducted with the participation of 18 faculty members from the Faculty of Medicine at the University of the Republic (Uruguay). Participant selection was based on a purposive criterion of relevance to the study's objective, as the aim was to gather the social reflections (SRs) of faculty members directly involved in or closely connected to the development of laboratory practices within the context of medical training. In this regard, the participation of faculty members attending a continuing education seminar provided access to an institutionally situated group engaged in reflecting on teaching within the Doctor of Medicine program. Because this is an exploratory-descriptive study focused on analyzing the SRs of a specific group, the sample was not defined according to statistical representativeness criteria, nor was the findings intended to be generalizable to other faculty groups. Its interpretive scope is therefore limited to the participating group and the institutional context in which the research was conducted. The training of these teachers included graduates in Biochemistry, physicians, and PhDs in Chemistry and Biological Sciences. The teaching experience of the participants was heterogeneous, as 5 of them reported having between 0 and 10 years of experience, 8 had between 10 and 20 years of experience, and the remaining 5 declared having more than 20 years of teaching experience.

It is worth noting that, in terms of methodological approach, the study is characterized as predominantly qualitative, although it incorporates quantitative elements in the analysis of frequencies and measures of central tendency. Furthermore, it proposes a combination of techniques, reflecting a multi-methodological approach aimed at capturing the complexity of the object of study. This allows for the integration of different dimensions of teachers' social perceptions of laboratory practices and the construction of a more comprehensive understanding of the phenomenon. Within the framework of social perception theory, the purpose of the study was not to achieve statistical generalizations, but rather to characterize the organization of meanings constructed by the participating group around a specific social object. From this perspective, social perceptions constitute forms of knowledge whose significance is understood in relation to the group that produces them and the context in which they circulate (6-8). Consequently, the criterion of theoretical saturation, typical of other qualitative designs oriented toward the progressive construction of substantive theory, was not the main validation criterion for this study. Instead, methodological

consistency was maintained through the explicit delimitation of the analyzed group, the suitability of the techniques to the structural approach, the triangulation between researchers during the categorization process, and the limited interpretation of the results to the participating group.

Thus, a unique instrument was designed for data collection, integrating three complementary techniques: recall and ranking, sentence completion, and a Likert-type scale. The recall and ranking technique used the prompt "laboratory practices," asking participants to name five associated words or expressions and rank them from most important to least important ("Name five words you associate with LABORATORY PRACTICES, ordering them from the most important to the least important. Explain why you chose these words"). The sentence completion technique included two prompts aimed at identifying, firstly, the main perceived drawbacks of conducting laboratory practices ("Among the main drawbacks when conducting a laboratory practice, I can mention...") and, secondly, possible modifications to be introduced to the proposed practice ("The proposed laboratory practices should be modified..."). The Likert scale consisted of four statements regarding the contribution of laboratory practices to professional training, their impact on learning, the need to modify their working methods, and the teacher's self-perception of their ability to perform these activities: “I believe that the laboratory practices carried out contribute to the training of the future professionals for whom the subject is intended,” “The laboratory practices carried out during my course promote learning,” “It is necessary to modify the working methods in the laboratory,” and “My training allows me to perform adequately as the person responsible for laboratory practices.” The response options were structured on a five-point ordinal scale (from the highest degree of disagreement -1- to the highest degree of agreement -5-).

The selection of data collection techniques was based on their suitability for studying social representations (SRs) from a structural perspective. Within this framework, the recall and hierarchization technique allows for an approach to the content and internal organization of the SRs by combining the frequency of occurrence of the recalled terms with the importance attributed to them by the participants. This procedure is relevant for identifying central and peripheral elements of the SRs, as proposed in structural studies of social representations (8-11). In turn, sentence completion allowed for expanding the discursive and interpretive dimension of the representation, capturing obstacles, assessments, and proposed modifications expressed by the teachers. Finally, the Likert-type scale was used for a descriptive, not inferential, purpose: to characterize the intensity of certain attitudinal assessments associated with the representational object and to compare them with the qualitative results. The relevance of these techniques has also been documented in research on RS linked to objects in the field of health, in which this type of technique allows the reconstruction of core meanings shared by specific professional or population groups (12-13).

The instrument was administered virtually via the Google Forms platform in a single application. The form included a section for informed consent, which clearly outlined the study's objectives, the voluntary nature of participation, and the confidentiality conditions. It is important to note that, given the exploratory-descriptive nature of the study, its classification within the field of Social Sciences and Humanities, and the absence of experimental, clinical, or biomedical intervention on the participants, approval was not sought from an institutional ethics committee. However, the research was conducted in accordance with the ethical guidelines established by the National Scientific and Technical Research Council for research in the Social Sciences and Humanities, approved by Resolution No. 2857/2006 (14). In accordance with these guidelines, free and informed consent, voluntary participation, the possibility of withdrawing without consequence, confidentiality of information, and anonymization of the data used for analysis were guaranteed. This anonymization was carried out by coding the responses, safeguarding the identity of the participants at all times.

Data processing was carried out according to the nature of each technique. In the case of recall and ranking, the procedure proposed by Mazzitelli (15) was followed, which involved constructing categories by grouping the recalled expressions according to their meaning. To facilitate the traceability and replicability of the analysis, the processing of the recalls was carried out in successive stages. First, a matrix was created with all the words and expressions produced by the participants, preserving the ranking assigned by each one. Second, the expressions were grouped into categories constructed inductively based on their meaning (table 1).

Table 1. Analysis categories for the Evocation and Hierarchization Technique.

Category	Description	Examples
Scientific knowledge	Meanings that associate laboratory practices with the construction of scientific knowledge, critical thinking, and rational processes	Science - Reasoning - Knowledge - Thinking
Materials and procedures	Terms related to materials handling, equipment use, and the execution of standardized procedures	Technique - Instrumentation - Procedures - Protocol
Teaching and learning	Terms that express the relationship between the laboratory and educational processes, teacher mediation and the construction of meaningful knowledge	Learning- Teaching- Mentoring- Interaction
Hygiene and safety standards	Meanings associated with discipline, rules, and care for both the environment and people.	Order - Safety - Biosecurity - Hygiene
Attitudes and characteristics	Expressions that indicate characteristics of laboratory practices and attitudes associated with their development	Creativity - Fun - Entertainment - Motivation

For each category, the frequency of occurrence and the importance value derived from the ranking assigned by the participants were calculated. The structural classification was performed by combining both criteria: high-frequency, high-importance categories were considered components of the central core; those of lower importance, regardless of their frequency, were placed in the peripheral zone; and low-frequency but high-importance categories were interpreted as a contrast zone. This procedure allowed for the reconstruction of the internal organization of the RS while maintaining the correspondence between the original responses, the analytical categories, and their structural location.

For the analysis of incomplete sentences, emergent categories were developed from the participants' responses. These categories were defined as non-mutually exclusive, allowing the same response to be included in more than one category in order to preserve the complexity and richness of the teachers' discourse. This analysis aimed to identify both the perceived obstacles and the proposed improvements related to laboratory practices. It is worth noting that, to strengthen the validity of the qualitative analysis, the process of constructing and revising the categories was carried out through triangulation among researchers. Initially, the responses were examined independently by team members, who identified units of meaning and proposed preliminary categories. Subsequently, sessions of comparison and joint discussion were held to review the relevance, internal consistency, and interpretive scope of each category. Discrepancies were resolved by consensus, striving to preserve fidelity to the content expressed by the participants and avoid imposing categories external to the empirical material. Furthermore, to facilitate the traceability of the coding process, records were kept of the analytical decisions that allowed the original responses to be linked to the constructed categories. For example, expressions referring to the “excessive number of students,” the “massive

scale of the class," or the "difficulty for everyone to handle materials" were grouped under the category Number of Students, while mentions of the "lack of supplies," "scarcity of equipment," or "limited budget" were included under Material Limitations. Similarly, regarding the necessary modifications, responses related to "greater student autonomy," "more participation," "fewer predetermined instructions," or "more discussion during practice" were coded under the category Teaching Model.

Regarding the Likert scale, a descriptive analysis was performed based on calculating the median response for each statement. From these values, an attitudinal profile graph was constructed, where the x-axis represents the variables included in the scale and the y-axis the possible response options, allowing visualization of the median teacher ratings, a measure of central tendency suitable for use with this type of scale (1, 6). To complement the analysis, two indicators compatible with the ordinal nature of this type of variable were calculated: the mean absolute deviation from the median and the interquartile range. These statistics were chosen because, in ordinal scales, the median is a more robust measure of central tendency than the mean, as it does not strictly presuppose equivalent metric intervals between categories. Consequently, analyzing the dispersion of responses with respect to the median allows for assessing the degree of concentration or heterogeneity of the responses without relying exclusively on parametric assumptions. The mean absolute deviation from the median was calculated by estimating, for each individual response, the absolute distance between the value assigned by the participant and the median of the corresponding item. These distances were then averaged to obtain a synthetic measure of deviation from the central value of the distribution. The interquartile range was also calculated as the difference between the third and first quartiles. This indicator allowed for estimating the range of the central 50% of responses, providing a robust measure of dispersion less sensitive to extreme values.

The results obtained were initially shared with the study participants, who provided their perspectives, thus allowing for a more in-depth analysis. This strategy aligns with Weisz's assertion that the identification of social representations should be considered a co-construction process involving both the researcher and the social subjects (17).

3. Results

The results obtained for each of the techniques comprising the research instrument are presented below. Their presentation follows Cuevas's suggestions (10) to provide clarity to the presentation and analysis of the identified social responses.

3.1 Evocation and prioritization technique

The analysis of the recall and hierarchization technique reveals a representational structure (Figure 1) organized around a central core composed of the categories "hygiene and safety standards" and "materials and procedures," a periphery comprised of "scientific knowledge" and "attitudes and characteristics," and a zone of contrast corresponding to "teaching and learning." From a structural perspective, this configuration highlights a hierarchical organization of meaning, in which the central elements guide the practices and the meaning of the object of study—in this case, laboratory practices —while the peripheral elements provide flexibility and adaptation to the context.

The representation focused on hygiene and safety standards, along with materials and procedures, indicates that laboratory practices are primarily conceived as regulated spaces, where adherence to protocols, proper instrument handling, and biosafety safeguards constitute the organizing principles of the activity. This configuration reveals a technical-normative logic that defines the laboratory as an operational device oriented toward the precise and controlled execution of procedures. The normative dimension is not limited to a contextual requirement but acquires a

structuring character, incorporating references to ethics, quality, and control. These elements are non-negotiable when planning and implementing laboratory practices.

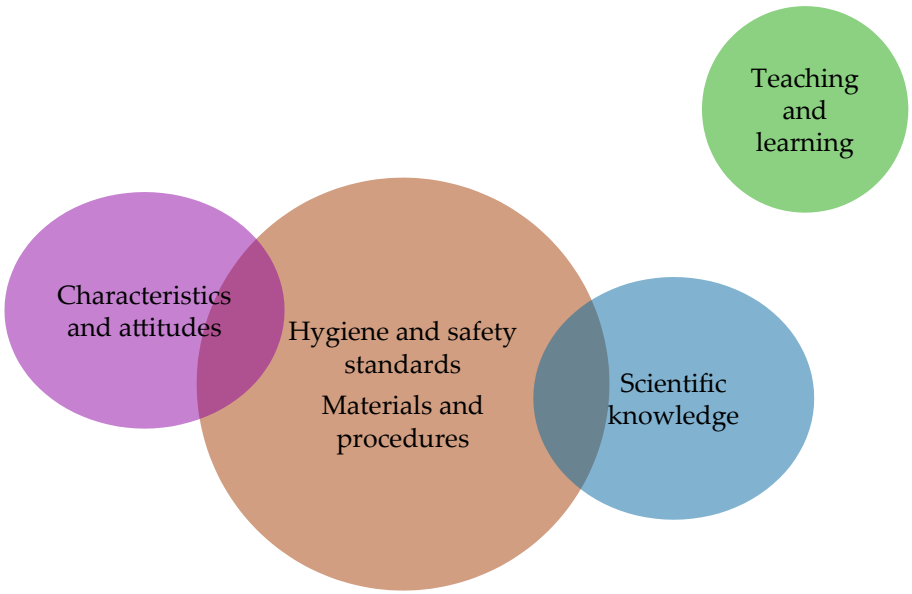

Figura 1. Estructura de la Representación Social de prácticas de laboratorio.

On the other hand, scientific knowledge occupies a peripheral place, suggesting that, although its link to laboratory practices is acknowledged, it does not constitute the organizing principle of their meaning. The laboratory thus appears more associated with the application of knowledge than with its production or problematization. Attitudes and characteristics linked to experimentation are also situated on the periphery. This category acquires a particular nuance, since it is composed exclusively of positive valuations, introducing a value-laden dimension that contributes to constructing a favorable image of the laboratory as a learning space. Thus, laboratory practices are perceived as a desirable and enriching activity in attitudinal terms, but these valuations do not displace the technical-normative logic that defines their functioning; rather, they are conditioned by the meaning of the core. The placement of the teaching and learning category in the contrast zone introduces a tension between the core and peripheral zones of the representation, highlighting the presence of a minority perspective that conceives of the laboratory as a pedagogical space—that is, it does not center its representation on the categories identified in the core of the predominant representation. This position suggests that this conception, while significant for some, fails to consolidate itself as an organizing principle of shared understanding. Consequently, two ways of understanding the laboratory coexist: a dominant one, focused on technical execution and regulatory compliance, and a less widespread one, which emphasizes its formative potential.

The implications of this configuration for medical training are significant. On the one hand, the centrality of technical and regulatory aspects fosters the development of skills associated with the precise execution of procedures, but it can limit a deep understanding of the underlying scientific principles, promoting rote learning. This latter point stems from the peripheral position of scientific knowledge, which also suggests difficulties in integrating theory and practice, a situation that can affect future professionals' ability to interpret results, make informed decisions, and cope with uncertainty. On the other hand, the strong presence of hygiene and safety standards, while indispensable in the healthcare field, can lead to over-regulation of practice, limiting the development of professional autonomy. Strict adherence to protocols can hinder adaptation to the non-

standardized contexts that are common in clinical practice. Finally, the limited centrality of the pedagogical dimension reduces the potential of the laboratory as a space for the active construction of knowledge in the context of initial professional training, restricting the teacher's role to supervisory functions rather than cognitive mediation.

3.2 Incomplete sentences technique

The analysis of the incomplete sentences technique applied allows for a deeper understanding of the meanings attributed to laboratory practices based on two complementary axes: the main problems that teachers identify for their implementation (Figure 2) and the transformations they consider necessary in their design and implementation (Figure 3).

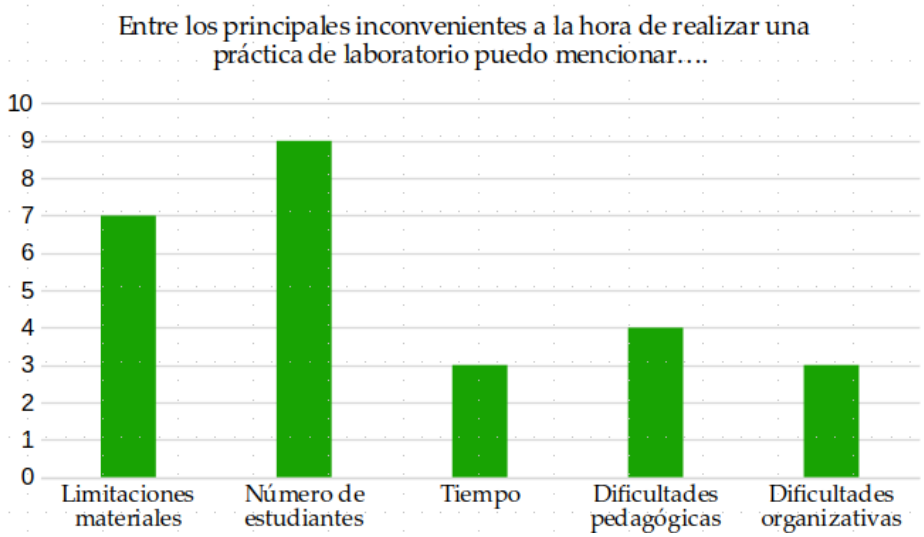

Figure 1. Answers to main problemswhen doing a laboratory practice.

The first area of analysis, concerning the difficulties encountered in conducting laboratory practices, reveals a clear perception of institutional obstacles that hinder their development. Figure 2 shows that the most frequent category is “Number of students,” with 9 mentions, followed by “Material limitations,” with 7. Less frequently mentioned are “Pedagogical difficulties,” with 4 mentions, and both “Time” and “Organizational difficulties,” with 3 mentions each. The large number of students is particularly relevant in the responses, as this scale is described as a factor that hinders effective participation, limits individual handling of materials, and reduces the possibility of all students having equal access to the practical experience. The instructors indicate that the high number of students affects not only the dynamics of the experimental work but also the possibility of providing pedagogical support, as it hinders instruction, monitoring, and individualized attention.

Material limitations constitute the second major problem and refer to the scarcity of resources, supplies, equipment, and budget necessary to adequately develop the practical exercises. The recurrence of these issues shows that teachers perceive a tension between the educational value attributed to the laboratory and the concrete conditions that make its implementation possible. This tension is significant, as it compromises both the frequency and quality of the experiences offered. In several cases, the responses indicate the need to adapt the practical exercises to the available resources, suggesting that experimental planning is conditioned by external constraints rather than by purely pedagogical or curricular decisions.

Pedagogical difficulties also play a significant role, although they are considered less important than the aspects already analyzed. This category includes references to a lack of prior study, limited student engagement, and the need for preparatory activities that foster a deeper understanding of the practical application. This set of responses is particularly significant because it shows that teachers do not attribute all obstacles to the educational process itself, but also identify challenges related to students' preparation and willingness to participate effectively in the laboratory. Consequently, the educational value of these practices appears to be linked not only to the availability of material resources, but also to the development of prior pedagogical frameworks that guide the experimental work and give meaning to the activity.

The categories "Time" and "Organizational Difficulties" complete the map of perceived obstacles. References to time refer both to the inadequacy of practical opportunities and the lack of time to design appropriate procedures, while organizational difficulties allude to problems of order, traceability, and protocol definition. Although less frequent, these mentions are relevant because they show that the implementation of laboratory practices depends not only on resources and infrastructure, but also on planning and organizational conditions that ensure the activity's effective operation.

The second axis of processing (Figure 3), referring to what should be modified in the proposed laboratory practices, offers a particularly illuminating overview of the change priorities of the teachers. The most frequent category is "Teaching Model," with 9 mentions, followed by "Frequency" and "Organization," both with 3 mentions, while "Resources" appears with 1 mention, and 2 teachers' responses are coded as "No response." The predominance of the "Teaching Model" category is especially significant, as it indicates that the main demand for transformation is not aimed at improving external conditions, but rather at revising the internal logic of the teaching approach used to design the practices. The responses grouped in this category emphasize the need to give students a more prominent role, broaden their decision-making scope, foster creativity, allow for discussion, and reduce the overly structured nature of the instructions. There are also explicit references to the need to increase student autonomy and to recognize that the formative value of practice lies not only in achieving a correct final result, but also in the process itself. The predominance of this category suggests that improving laboratory practices depends not only on resolving structural deficiencies, but also on transforming their pedagogical purpose. At this point, the analysis reveals a conception of the laboratory that goes beyond its technical function and positions it as a potential space for developing autonomy, practical thinking, and meaningful learning.

The categories "Frequency" and "Organization," although less frequent, complement this overview. The comments gathered under "Frequency" express the need to increase the number of practical sessions and expand their presence within the training program, indicating that teachers consider their current curricular integration insufficient. Meanwhile, the "Organization" category includes references to order, both in terms of the structuring of the activity and the relationship between students and teachers, as well as in aspects of monitoring and feedback. These responses suggest that the quality of the practical sessions depends not only on their general pedagogical orientation but also on specific organizational conditions that allow for a clear, well-structured, and pedagogically productive implementation.

The low frequency of the "Resources" category, with only one mention in this second axis, is a relevant finding. Unlike when teachers describe difficulties—where resources appear frequently—when proposing modifications, the emphasis shifts to the pedagogical and organizational aspects. This suggests that, although material constraints are recognized as a significant obstacle, they do not exhaust the participants' vision for change. Rather, teachers seem to indicate that even within limited

contexts, there are possible avenues for intervention in the instructional design of their practices, especially regarding student engagement and the proposed work methodology. Furthermore, the difference in the frequency of this category in this axis compared to the previous one could be due to where the responsibility for change lies, given that improvements related to resources are a responsibility that extends beyond the teacher's role.

Figure 3. Frequencies for categories of the sentence "In the proposal of laboratory practices, it must be modified…."

Based on the above, it is evident that teachers have a complex understanding of laboratory practices. On the one hand, they identify institutional obstacles that condition their implementation, most notably large class sizes and material limitations. On the other hand, when considering necessary modifications, they shift their focus to transforming the teaching model, emphasizing the need for more frequent, better-organized, and, above all, more open practices that foster autonomy, creativity, and active student participation. This suggests that the main tensions surrounding laboratory practices lie not only in the conditions of implementation but also in how these practices are pedagogically conceived.

3.3 Likert Scale

As can be seen in Figure 4, the analysis of the Likert scale applied to teachers allows us to identify a pattern of responses characterized by a high level of consensus around the positive assessment of laboratory practices.

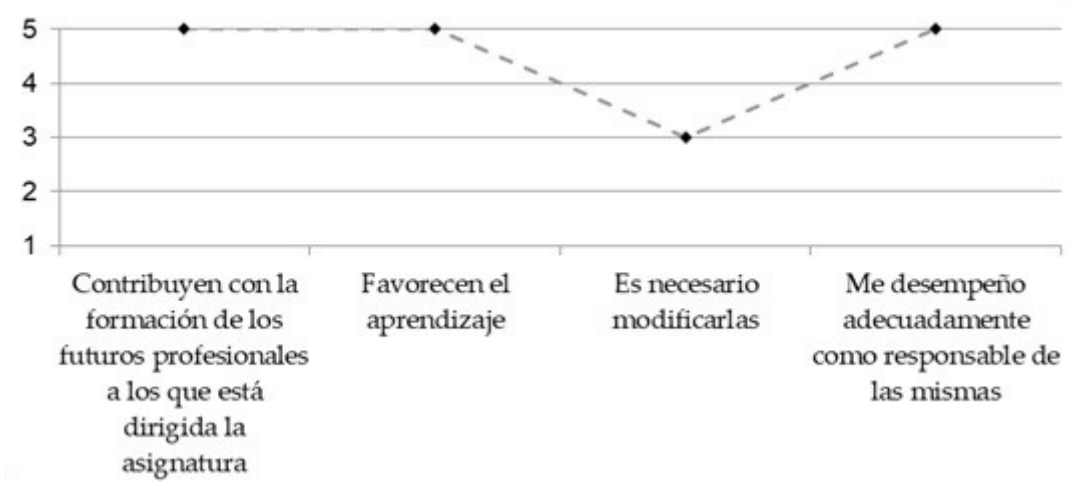

Figure 4. Distribution of Likert responsen.

In particular, statements related to the contribution of practical sessions to the training of future professionals and their capacity to enhance learning in the subjects reached the highest level of agreement (5), indicating a widely shared perception of their positive contribution to training. This result demonstrates that, from the teachers' perspective, the laboratory constitutes a significant component within the educational process, both in terms of knowledge acquisition and preparation for professional practice. Consistent with this assessment, the statement regarding their own performance as those responsible for laboratory sessions also reached the highest level of agreement (5), suggesting that teachers perceive themselves as sufficiently qualified to carry out these types of activities. This finding is relevant because it indicates that the positive assessment of the laboratory is accompanied by equally positive perceptions of teacher training and performance.

In contrast, the statement “It is necessary to modify the working method in the laboratory” presents a neutral position (3), suggesting the absence of a clear consensus regarding the need to transform the working method. In this sense, the apparent neutrality does not necessarily imply an absence of critical reflection, but rather could reflect tensions between a positive assessment of the laboratory and the recognition of difficulties and potential areas that would need improvement, as identified from the data of the other techniques.

On the other hand, it is worth noting that items 1 and 2 show reduced dispersion, with mean absolute deviations from the median of 0.56 and 0.39, respectively, and an interquartile range of 1 in both cases. This indicates a significant concentration of responses around high values on the scale, especially in item 2, which shows the greatest degree of consensus. Item 3 presented a mean absolute deviation of 0.44 and an interquartile range of 0, suggesting that the central 50% of responses were concentrated exactly at the median value, corresponding to 3, although some peripheral responses explain the observed average dispersion. Item 4, meanwhile, showed the greatest heterogeneity, with a mean absolute deviation of 1.00 and an interquartile range of 2. This result indicates that, although the item's median was high, the responses were more widely distributed, reflecting less consensus among participants compared to the other items. Taken together, the results of the scale allow us to complement the interpretation of the qualitative techniques, by showing that the positive assessment of laboratory practices coexists with tensions linked to their didactic design and their implementation conditions.

4. Discussion

The results suggest that the research practices of the group in this study are organized around a technical-normative logic, where biosafety, protocol adherence, and the correct execution of procedures take center stage in defining these practices. From the perspective of research practice theory, this way of conceiving the laboratory not only guides pedagogical decisions but also its educational scope, prioritizing its operational character over its potential as a learning space—that is, a space for knowledge construction. In this sense, the fact that scientific knowledge and the pedagogical dimension occupy less central positions could reflect a tension in the articulation between theory and practice, which is relevant for considering medical training.

The interplay between the instrument's various components allows for a more nuanced interpretation. The Likert scale data reveals a highly positive assessment of laboratory practices regarding their contribution to learning and professional development, as well as a favorable self-perception of teaching performance. However, when considered in conjunction with the structure of the RS (Reflection Scale) and the responses to the incomplete sentences, this assessment does not eliminate the identified tensions, but rather clarifies them. Indeed, the recognition of the laboratory's formative value coexists with a predominantly technical-normative representation, with institutional obstacles pointed out by the teachers, and with demands for a review of the teaching model. Within this framework, the neutral stance regarding the need to modify the work methodology can be interpreted as an expression of tension between the positive assessment of existing practices and the recognition, particularly evident in the open-ended responses, of aspects that could be improved.

While significant, the implications of these findings must be interpreted within the framework of the exploratory-descriptive nature of the study and the declarative data collected. On the one hand, the centrality of normative aspects fosters the acquisition of fundamental technical skills in the health field. On the other hand, when this orientation is not sufficiently integrated with opportunities for reflection, analysis, and justification, it could restrict opportunities to promote skills related to interpretation, decision-making, and understanding the scientific basis of procedures. Furthermore, placing teaching and learning outside the prevailing regulatory framework suggests a risk that some practices may be geared more toward procedural reproduction than understanding. Added to this is the tension between institutional conditions and pedagogical aspirations, which highlights the need to develop strategies that address both levels in an integrated manner.

Regarding limitations, the study relies on a small, intentionally selected sample, which restricts the applicability of the results to other contexts. Furthermore, while the combination of techniques allowed the phenomenon to be addressed from different dimensions, the design does not permit establishing causal relationships with the development of practices in context.

Overall, despite the aforementioned limitations, the results indicate that proposals for improving laboratory practices should consider both the material conditions and the underlying design principles. In particular, strengthening the pedagogical dimension emerges as a key aspect for enhancing its contribution to medical training.

5. Conclusions

- Laboratory practices are valued by faculty as fundamental to medical training, although approaches focused on safety, procedures, and the correct use of materials predominate. There are proposals to strengthen their pedagogical dimension to promote understanding, reflection, and the rationale behind procedures.
- The main difficulties identified are not limited to a lack of resources or a large number of students, but also include the need to revise the teaching model. It is proposed to promote

greater student participation, autonomy, and active knowledge construction by combining improved institutional conditions with appropriate pedagogical decisions.

- The study encouraged teachers to reflect on their own practices and made visible the social representations that guide the organization and development of laboratory activities. It also opened a space to rethink the laboratory as a space for knowledge construction and pedagogical transformation, beyond its technical function.
- In conclusion, the laboratory should be conceived not only as a space to correctly execute techniques, but as a formative opportunity to understand, substantiate and critically reflect on procedures in the context of medical training.

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