Pedagogical training profile of basic health sciences faculty in biomedical and related fields at Brazilian public and private higher education institutions

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INTRODUCTION

The first Brazilian universities were created in the 1920s, and their goal was to support scientists and to promote research (37). Changes in the political scenario in 1930 prompted the creation of the Education and Public Health Ministry and, subsequently, the National Education Plan, a document coordinating and overseeing teaching activities at all levels (40). In the same decade, the first Institutes of Education were created with the purpose of providing pedagogically prepared teachers for basic education (46, 50). At that time, faculty members were successful professionals in their respective professional field, without pedagogical preparation and for whom the only requirement was a Bachelor’s degree (13).

Currently, the Brazilian education system is regulated by Law 9,394/96. In the first draft of this law, a pedagogical training requirement for faculty was considered for the first time. However, the requirement was excluded in the final version of the law (32). Currently, the law states that a graduate degree, primarily a Master’s or PhD degree, is required to be a faculty member (4). In the National Education Plan (2014–2024), an increase in the number of faculty members with a Master’s or PhD degree is expected to improve higher education quality, regardless of their pedagogical training (5, 39). The absence of guidelines directed at the pedagogical training of faculty contributes to the idea that technical knowledge alone suffices to teach in higher education (19).

Nevertheless, the main activity involved in being a faculty member is to educate, and it, therefore, requires specific professional skills (31). Masetto (38) identified three classes of faculty competencies. The first refers to the specific knowledge required for any course, acquired during formal education and/or by professional activity. The second is pedagogical competency, which involves in-depth knowledge of the teaching-learning process and factors affecting its dynamic and results quality. This competency also includes establishing relationships with students, creating overviews of the curriculum, and using educational technologies. The final competency is political competency; hence, it is expected that a faculty member be aware of the social reality in which he or she acts and to have a critical view of education itself as part of the social process (38). Viewing teaching with professionalism is an international movement and a path that all educational actors tend to embrace (53); therefore, those working in or regulating this profession should be concerned about how faculty members are trained to be more effective in their work.

Institutionalized, periodic, formal pedagogical training for higher education teachers is a challenge in many places, not only in Brazil. To overcome the gap in faculty training, several
initiatives have been developed, either by teachers individually or by their institutions. These initiatives have been undertaken in several countries, and they are an attempt to improve the pedagogical skills of teachers at higher education. Such initiatives exist in the U.S. (7, 52), in many countries in Africa (42, 58) and Latin America (20, 49), and in some European countries (28, 48, 60). Therefore, understanding how Brazilian higher education structures pedagogical training for its teachers and the discussion around this issue should be of interest in any context where there are concerns about the pedagogical skills of the faculty members.

Currently, some organizations worldwide are engaged with pedagogical training of faculty, such as the Educational Intervention and Investigation Center in Portugal, the Support Network for Educational Management in Spain and Latin America, and the South Brazilian Network of Higher Education Investigators. Moreover, some higher education institutions (HEIs) have their own programs or centers for pedagogical development of faculty members, such as the Innovation and Development of Teaching and Learning Center at Minho University in Portugal and the Professional Development Institute at Barcelona University in Spain. In Brazil, we can cite three examples: the Teaching and Learning Development Center at Insper, the Teaching Improvement Program at São Paulo University, and the Faculty Internship Program at State University of Campinas.1 Certainly, there are many more initiatives similar to these, which demonstrates that the discussion on pedagogical training to improve teaching processes has prompted the development of initiatives on such themes, but they are still rare.

In addition, some international organizations related to basic health sciences, such as the International Union of Physiological Sciences, the International Union of Basic & Clinical Pharmacology, the International Union of Biochemistry and Molecular Biology, and the International Federation of Associations of Anatomists, have shown interest in advances in teaching.2 These associations promote periodic discussions about the teaching-learning process in their areas, and some of them even provide online material. As an example, in August 2017, the International Union of Physiological Sciences Teaching Workshop was held in Brazil, where Brazilian and international researchers and students exchanged teaching experiences and reflected on teaching practices (36).

This debate concerning better ways to teach in basic health sciences yielded many published articles about innovative methodologies (1, 3, 8, 10, 11, 16, 24, 33, 35, 51). If we think about the evolution of medical teaching, for example, it is possible to observe changes in the curriculum structure, which shifted from content-based instruction to a student-centered teaching (30, 44). Although the teaching-learning subject has grown in the basic health sciences field, recent data published in the area of physiology, for instance, showed that the research on teaching is still limited, with only five groups of researchers devoted to this theme in Brazil (34). Moreover, changes in the curriculum or in teaching methodologies raise the question of how faculty members are being trained to deal with the ever-changing teaching context.

It is in this scenario of the recent and limited growth of research on teaching-learning in basic health sciences that our work is placed. Since the process of professional training should continue to be practiced in higher education, research about teaching in higher education is a necessary tool to improve professional practice and will help determine better pedagogical approaches. However, this field has been little explored (34, 43). Several authors have shown that pedagogical training is one path to improve teaching quality by promoting innovations to shape teaching structures (12, 54). Moreover, reflecting on the teaching practices is also a very important tool for teaching improvement (18). Through reflexive analysis of teaching practices, it is possible to identify positive and negative aspects of these practices and, therefore, create new strategies to improve teaching. Such activities must be done by both HEIs and faculty, and they must be encouraged by higher education regulation agencies (56).

Several questions directed this work. Who are the basic health sciences faculty members from public and private HEIs? What are their difficulties regarding professional activities? Are there differences according to the types of institutions they work for? Are basic health sciences faculty attending pedagogical training? What drives faculty to participate in pedagogical training? In summary, the aim of this work was to outline the profile of basic health sciences faculty teaching in biomedical and related fields in regard to their undergraduate and graduate backgrounds, as well as the initial and continuous pedagogical training in Brazilian public and private HEIs.

1 The following is a list of the pedagogical training program websites: Educational Intervention and Investigation Center in Portugal (https://www.fpce.up.pt/ciie/); Support Network for Educational Management in Spain and Latin America (http://edo.uab.cat/es/content/red-de-apoyo-la-gesti%C3%B3n/); Innovation and Development of Teaching and Learning Center at Minho University in Portugal (https://idea.unininho.pt/en/Pages/default.aspx); Professional Development Institute at the Barcelona University in Spain (https://www.ub.edu/web/ub/es/estudis/suport_docencia/suport_docencia.html); Teaching and Learning Development Center at Insper in Brazil (https://www.insper.edu.br); Teaching Improvement Program at São Paulo University (http://www.prg.upf.br/index.php/en/paolo-que-pae); Professor Internship Program at State University of Campinas in Brazil (https://www2.prrp.unicamp.br/ped/).

2 The following is a website list of international organizations that promote periodic discussions on the teaching-learning process: International Union of Physiological Sciences (http://www.iups.org/reports/education-committee/); International Union of Basic & Clinical Pharmacology (https://iuphar.org/sections-education/education-committee/); International Union of Biochemistry and Molecular Biology (https://iubmb.org/activities/educational-activities/past-education-al-events/); International Federation of Associations of Anatomists (https://www.ifaa.net/committees/anatomical-education-fpae/).

The research was observational and qualitative, consisting of the analysis of volunteers’ responses to questionnaires. Electronic questionnaires were used to obtain data and the opinions of basic health sciences faculty working in public and private HEIs. The participating institutions in this research were identified from a list of institutions on the official website of the Brazilian Ministry of Education (http://emec.mec.gov.br/). We considered only public and private HEIs that had at least two of the following on-site undergraduate programs: medicine, pharmacy, dentistry, nursing, biomedicine, or veterinary medicine.3 A total of 657 HEIs were identified, of which 94 were public (14.3%) and 563 were private (85.7%). From these HEIs, we obtained the e-mail addresses of basic health sciences faculty.

MATERIALS AND METHODS

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In Brazil, medicine and veterinary medicine are undergraduate fields of study.
Electronic questionnaire. An electronic questionnaire with 28 questions was created on the online platform SurveyMonkey. To validate the questionnaire and identify any errors (e.g., in writing, comprehension, adequacy, and interpretation), the questionnaire was reviewed by five other academicians not involved in this research. Next, the questionnaire was sent to faculty members and then was resent to those who did not respond, once after 1 wk and again after 15 days. The questionnaire was accessible on the SurveyMonkey platform for 5 mo (December 2017 until April 2018). The entire questionnaire is available in the Supplemental Material (Supplemental Data S1 is available in the data supplement online at the Advances in Physiology Education website).

Data analyses. Only data provided by faculty members who met the following criteria were analyzed: 1) agreed to answer the questionnaire and to participate in this research; and 2) teach at least one of the following courses: anatomy, biophysics, cellular biology, biochemistry, embryology, pharmacology, physiology, or histology. Data were expressed as a percentage of the frequency of a response for each question. All data were analyzed using the SurveyMonkey platform. The eventual association between different variables and the type of HEI (public or private) was analyzed using the χ² test or the Fischer’s exact test, with a significance level of 0.05.

Ethical procedures. This research was approved by the Federal University of Rio Grande do Sul Research Ethics Committee (protocol no. 2.081.730). Only data provided by faculty members who agreed to participate in this research were used.

RESULTS AND DISCUSSION

Response rate. A total of 6,439 questionnaires were sent, and 1,413 (21.9%) responses were received. Only 763 (11.8% of 6,439) survey respondents met all of the criteria mentioned above, of which 507 (66.4%) were faculty from public HEIs and 256 (33.6%) from private HEIs. The difference between the number of all responses and the number of responses that met all criteria can be explained by the difficulty in obtaining only the e-mail addresses of faculty members who teach the courses previously mentioned. It was more difficult to obtain information for the faculty of private HEIs. The lack of information about faculty in these specific fields made it impossible to determine the exact population size in this work.

Using WinPepi software (version 11.63), the minimum sample size necessary to estimate a proportion was calculated. Because previous information on the matter was not available, a proportion of 0.5 was assumed, which maximized the sample size. Assuming a confidence level of 95% and a maximum acceptable difference of 5%, the necessary sample size was 385 subjects. Considering that this work obtained responses from 763 subjects, it is possible to verify an error margin (maximum acceptable difference) of 3.6%.

Nevertheless, such a low response rate is informative data. Some factors can be suggested to explain the high number of nonresponders: a lack of interest in pedagogical affairs by the faculty, a lack of time to respond to the questionnaire, mistrust regarding providing online information, difficulty in obtaining the faculty e-mails, and others. Additionally, there has been a decrease in response rates to surveys over the years (2). Therefore, the authors acknowledge the possibility of a biased sample, as it can occur in studies using volunteers’ responses, according to the type of respondents (2).

Profile of faculty members and their training. To build a profile of faculty members from public and private HEIs, we asked them about their sex, age, how long they had worked as professors in higher education, and their own education, including their undergraduate and graduate training. The results of those questions are shown in Table 1. For public and private HEIs, sex was not a variable associated with the HEI type, but both public and private HEIs showed a slightly higher percentage of women than men working as faculty members in basic health sciences (55.6 and 51.0% women, respectively). Additionally, most faculty members from public HEIs are older than 40 yr old (67.9%), while faculty members of this age group represent the minority in private HEIs (40.9%).

The Brazilian Census of Higher Education is conducted annually to research Brazilian HEIs and their courses, students, and faculty. Therefore, the census provides a broad picture of Brazilian higher education. The census data are not detailed by field, so a comparison of data from the census and this study demonstrates the degree of similarity of the results of the present study to those for the general faculty population. Data from the Brazilian Census of Higher Education showed a slightly lower percentage of women than men at both public (45%) and private (45.9%) HEIs, which is not very different from the data presented in this work. Regarding age, the Brazilian Census of Higher Education demonstrated that 50% of public HEI faculty members are between 36 and 53 yr old, whereas 50% of private HEI faculty members are between 35 and 51 yr old. These findings suggest that those working at public HEIs are slightly older than those working at private HEIs (22), as shown in this work.

Currently, in Brazil, there are three types of HEIs according to their academic organization: college, university center, and university. Institutions are accredited by the Brazilian Ministry of Education based on the Brazilian Law decree 9,235/17. In summary, all private HEIs begin as colleges and must fulfill certain requirements to achieve the status of a university center or university. To be accredited as a university center, an HEI must provide teaching and extension activities to offer at least

| Features                             | Public      | Private     | P Value |
|--------------------------------------|-------------|-------------|---------|
|Women                                 | 55.6 (278/500) | 51.0 (130/255) | 0.247   |
|More than 40 yr old                   | 67.9 (341/502) | 40.9 (104/254) | <0.001  |
|Bachelor’s degree                      | 76.2 (378/496) | 77.0 (194/252) | 0.813   |
|Undergraduate field of study          |             |             |         |
|Biolog y                             | 31.0 (148/477) | 18.0 (45/250) |         |
|Pharmacy                              | 22.6 (108/477) | 16 (40/250)  |         |
|Medicine                              | 9.2 (44/477)  |             |         |
|Phys ical Education                  |             | 18.4 (46/250) |         |
|Graduate degree                       |             |             | <0.001  |
|PhD                                  | 92.1 (467/507) | 58.6 (150/256) |         |
|Master                                | 6.1 (31/507)  | 33.2 (85/256) |         |
|Specialization                        | 1.8 (9/507)  | 8.2 (21/256) |         |
|Graduate field of study               |             |             |         |
|Physi ology                           | 23.4 (118/504) | 16.4 (42/256) |         |
|Biochemistry                          | 13.5 (68/504) | 7.4 (19/256) |         |
|Pharmacology                          | 9.3 (47/504)  |             |         |
|Morphology                            | 7.9 (40/504)  |             |         |
|Physical Education                    |             | 9.4 (24/256)  |         |
|Veterinary Medicine                   |             | 7.8 (20/256)  |         |
|Graduated >10 yr ago                  | 53.9 (272/505) | 20.8 (53/255) | <0.001  |
|Has worked as faculty member          |             |             |         |
|for >10 yr old                        | 66.3 (335/505) | 42.4 (108/255) | <0.001  |

Values are in % (with n/total in parentheses); n: no. of responses. A specialization is a type of degree that has a lower status than a Master’s or PhD degree; it requires a minimum of 360 h of course work.
eight high-quality undergraduate courses, at least one-third of the faculty must have a Master’s or a PhD degree, and at least one-fifth of the faculty must work full-time. There is a larger list of requirements to be considered a university. Beyond those necessary to be a university center, a university must also have research activities, have at least one-third of the faculty working full-time, and regularly offer at least four Master’s and two PhD programs (6). This structure explains why there are a larger number of colleges than any other type of HEI in Brazil, representing >80% of all HEIs (22).

In this scenario, there are differences between the type of public and private HEI. As the most typical type of public HEI is universities, as expected, the majority of public HEI faculty members who answered our questionnaire work in universities (97.8%, n = 492/503, and 2.2%, n = 11/503, at university centers and colleges, respectively; data not shown). On the other hand, private HEI faculty responded that they work in different types of HEIs, with 39.4% from universities, 29.5% from university centers, and 31.1% from colleges (n = 254; data not shown). Thus, from the three different types of private HEIs, different indicators were found for private HEI faculty. One of these indicators was the age profile. Whereas at colleges and university centers, the majority of faculty are in the 20- to 39-yr age range (75.9 and 66.2%, respectively), at universities, faculty members are mostly older than 40 yr (59.0%; data not shown), showing a similar profile to those who work in public HEI.

Another similarity between the two groups of faculty members is the kind of undergraduate degree they earned. Most public and private HEI faculty have a Bachelor’s degree (76.2% and 77.0%, respectively), with variation in the field in which the undergraduate degree was obtained. For faculty from public HEIs, the three most common fields are biology (31.0%), pharmacy (22.6%) and medicine (9.2%). In contrast, in private HEIs, the faculty mostly have degrees in physical education (18.4%), biology (18.0%), and pharmacy (16.0%). The fact that most faculty members have Bachelor’s degrees in the health sciences shows that, since their undergraduate training, they have received no specific training for teaching in higher education, and their undergraduate training prepared them to perform a specific profession, such as a physician or a pharmacist. In other words, their undergraduate education trained them as professionals, but not as faculty members (43).

Nevertheless, it is important to highlight that this work is qualitative and, therefore, is not representative of all faculty members, because our sample is a small fraction of the total number of basic health sciences faculty, and it may be biased by many factors as discussed before.

Based on the analysis of the graduate degrees of the faculty, the majority of public HEI faculty have a PhD (92.1%), whereas in private HEIs, only 58.6% have a PhD degree, 33.2% have a Master’s degree, and 8.2% are specialists. The most common graduate fields for public HEI faculty are physiology (23.4%), biochemistry (13.5%), pharmacology (9.3%), and morphology (7.9%). For private HEI faculty, the main graduate fields are physiology (16.4%), physical education (9.4%), veterinary medicine (7.8%), and biochemistry (7.4%). Most of these fields relate to basic health sciences courses, which is the focus of this work. Interestingly, faculty members from public HEIs are mostly educated in the basic health sciences, whereas private HEI faculty have a more diverse background. At this point, it is not possible to determine whether faculty from private HEIs teach in their specific areas in related areas. This question can be addressed in future investigations.

In Brazil, graduate programs are responsible for providing training to higher education teachers, as stipulated by Brazilian law number 9,394/1996. However, the only funding agency that requires a period of teaching internship is the Coordination for the Improvement of Higher Education Personnel (CAPES) (9). The required internship is limited to 60 h at the PhD level and 30 h at the Master’s level; therefore, it provides only brief, superficial experience with teaching activities (57). Thus, in many cases, from the beginning of their teaching activities, faculty members act without a deep reflection on what it means to teach. Frequently, they organize their pedagogical practices based on a common pedagogical view developed from their experiences as students, on the exchange of ideas with other faculty members, or even on what society idealizes as their role (21).

We also analyzed how long it had been since these faculty members had finished their graduate studies. We found that most of the public HEI faculty finished their graduate studies more than 10 yr previously (53.9%), whereas the minority of those from private HEIs finished in the same period of time (20.8%). When we analyzed the length of time they have worked as higher education teachers, we found that the majority of those who work in public HEIs do so for 10 yr or more (66.3%), whereas only 42.4% of those who work in the private HEIs do so for the same amount of time. Once again, the type of HEI could be responsible for this difference between public and private HEIs. Stratifying the private HEI results, colleges and university centers have mostly faculty members with fewer than 10 yr of professional experience (75.9 and 64.0%, respectively), whereas private university faculty have more than 10 yr of teaching experience (61.6%; data not shown). Therefore, public and private university faculty show some similarities, such as in the age profile and professional experience. When colleges and university centers are included in the analysis, the private and public sectors present differences in the characteristics shown before (i.e., age profile and professional experience).

Although these faculty members have graduated and are experienced in the profession, very often there is an absence of pedagogical training in their professional careers, which can result in a lack of knowledge on what constitutes the teaching-learning process (46). Such voids in their teaching training can make them act intuitively or based on their experience as students in the classroom (12). In this way, some faculty members, even those with substantial experience in teaching, make pedagogical mistakes in their professional activity, such as seeing students as an information depository and the teaching-learning process as a simple transference of knowledge (12).

Professional performance profile. To comprehend the professional experiences of faculty from public and private HEIs, we asked about their workload, their job duties, and the main problems they face in teaching. The first difference observed was regarding their undergraduate teaching workload. The majority of private HEI faculty members (67.5%) spend more than 15 h per week in undergraduate classes, unlike those
working in public HEIs, where only 18.9% have a similar workload (Fig. 1).

Another difference between public and private HEI faculty is that a small percentage of those who work in public HEIs also work somewhere else (15.1%), whereas 53.7% of private HEI faculty do so (Fig. 2). These results are similar to those reported by the Brazilian Higher Education Census (22). According to the census, the majority of public HEI faculty work full-time at the institution, whereas those in private HEIs work part-time or are paid per hour. The difference in the work schedule makes private HEI faculty members seek employment elsewhere as a way to complement their personal income.

Although we observed differences regarding the undergraduate teaching workload and employment relationship between public and private HEI faculty, both groups presented similarities in the time spent on weekly activities. When asked about the activities to which they dedicate the most time each week, faculty from both public and private HEIs indicated the two principal activities to be “undergraduate teaching” (70.4 and 84.8%, respectively) and “research” (51.5 and 21.5%, respectively; Fig. 3). Although the two main activities are the same for public and private HEI faculty, the percentage of public faculty members who indicated research as the second-most common activity is more than twice that among private HEI faculty. Once again, this difference is explained by the HEI types. Universities necessarily promote research activities, whereas colleges and university centers do not have an obligation to do so. Therefore, this approach of private HEIs focuses the importance of research for faculty members working in universities (25.0%; data not shown); this percentage decreases when universities are analyzed in combination with colleges and university centers. All the same, many more public HEI faculty members attributed a prominent position to research.

Although “undergraduate teaching” is the main activity for both public and private HEI faculty, it does not occupy a prestigious position within the Brazilian higher education system, where research has been considered more important (15). Faculty members who stand out as researchers are rewarded financially by the government with productivity scholarships (14), and there are no parallel initiatives for excellent higher education teachers, for example. Such an imbalance in the levels of appreciation for teaching and research is observed not only in public policies, but also in the internal evaluations of faculty of each HEI, which reflects on faculty members’ commitment to teaching (57).

Since this work focuses on undergraduate teaching, faculty members were asked about their classroom environment: one question on their main difficulties, and one on which changes in their environment could improve their classes. In both questions, they could select up to three options. Public HEI faculty pointed to the following main difficulties: 1) demotivated students (56.0%); 2) classes with too many students...
HEI faculty indicated the following factors: (24.0 and 34.0%, respectively, Fig. 4). Faculty from public and private HEIs thought that their courses have insufficient teaching hours to cover the amount of content (50.3%); and 3) inappropriate environments due to factors such as noise, heat, lack of space, or discomfort (25.5%). Faculty from private HEIs pointed to similar difficulties: 1) demotivated students (49.6%) and 2) classes with too many students (48.1%). However, the third option was different from public HEI faculty: 3) insufficient time to prepare classes (35.2%). Faculty from public and private HEIs thought that their courses have insufficient teaching hours to cover the amount of content (24.0 and 34.0%, respectively, Fig. 4).

When asked about what could improve their classes, public HEI faculty indicated the following factors: 1) more motivated students (55.8%); 2) fewer students per class (47.5%); and 3) more interaction with related area courses (45.6%). Similarly, private HEI faculty indicated the same two first options: 1) more motivated students (51.0%) and 2) fewer students per class (43.1%). However, unlike the public HEI faculty members, as the third option, private HEI faculty said that 3) having more time to prepare their classes (40.4%) could improve their classes (Fig. 5). The responses of both faculty groups to this question were similar to those of the previous question in that some of the problems faced in private and public HEIs are similar; however, it is possible to highlight one difference. Whereas public HEI faculty stressed difficulties in the infrastructure and interactions with related area courses, private faculty reported that they do not have enough time to prepare their classes. This lack of time can be explained by the large undergraduate teaching workload that private HEI faculty have, as previously shown in this work (Fig. 1 and 2).

Interestingly, although public and private HEI faculty pointed to students’ demotivation as a difficulty in their classes, “relationship with students” was the least selected option by public and private HEI faculty members (2.0 and 1.2%, respectively). Both students’ motivation and faculty-student relationships are part of a broader construct known as engagement. According to Kahu (25; see p. 764), engagement does not have a unique definition, but it can be taken as a set of individual, social, and situational factors that contribute to students’ success. One of the situational factors is faculty and “their willingness to engage dialogues with students, the enthusiasm for the subject, and the professionalism with the teaching process.” Alongside good student-teacher and student-student relationships, HEIs can contribute in several ways to students’ motivation. Some of them include providing a challenging learning environment; a good institutional infrastructure; a flexible curriculum; activities that are integrated with the social, academic, and professional aspects of students’ lives; and activities that promote meaningful learning (26). Any of these factors can be absent in some Brazilian HEIs and can be involved in the faculty’s perception of students’ demotivation. Differences between the way faculty learned when they were students and how students learn today can also be an explanation for the faculty’s perception of students’ demotivation. There is no longer a necessity for knowledge centralization in one person, namely, the teacher. With the advent of the internet, many sources of information and distractions are available (17). The large amount of information available calls for a change from a teacher-centered to a student-centered teaching-learning paradigm, focusing on the process of learning rather than passing on information as a package (17). Such a change is not easy to make, and in many cases, the permanence of a teaching-centered paradigm can provoke students’ apathy, which can be perceived as demotivation.

**Pedagogical training.** According to a bulletin released by UNESCO in 2009, access to higher education has increased; achievement of higher education must be encouraged and improved by preparing faculty to better teach to ensure that everyone has access to high-quality, regulated education (55).
Furthermore, the profile of higher education students, including their ages, socioeconomic backgrounds, and expectations, is changing over the years (56). In this new configuration, faculty and students must deal with a generation gap that influences how students accept hierarchy, make decisions, work in groups, handle technology, and communicate (27). In addition, recent changes in education and the increasing ease of access of information has increased the challenges in the pedagogical field for faculty. At this point, faculty not only are required to teach the specific content of their courses, but also are encouraged to teach students how to learn. Therefore, new tools are necessary, and pedagogical knowledge must be developed to improve teaching quality in this new scenario (56). In this regard, it is necessary to develop pedagogical competency, as highlighted by Masetto (38), during the entire professional career (12), either through pedagogical training activities (PTAs) (43) and/or through reflection on teaching practices (18, 45).

Being aware of this reality, faculty were asked if they have attended any PTAs for higher education. The majority (57.6%) of public HEI faculty have not participated in any PTAs, whereas 64.2% of private HEI faculty said that they have attended a PTA (Fig. 6).

When those results were stratified and only the responses from faculty members who have participated in such activities were analyzed, other differences emerged between public and private HEI faculty; for instance, the amount of time spent on those activities was different. Private HEI faculty have spent more time on PTAs than public HEI faculty, with most of them (56.4%) having attended activities for 80–360 h, whereas the majority of public HEI faculty (55.1%) have attended activities for up to 40 h. The most notable differences between faculty from public and private HEIs were between faculty who have spent 20 h on PTAs (30.8 and 20.3%, respectively) and those who have spent 120 h (6.5 and 14.7%, respectively). Another point of interest was the response option for 360 h of PTAs, since this number of hours corresponds to a specialization course in Brazil (41). Fewer faculty members from public HEIs than from private HEIs marked this option (17.3 and 21.5%, respectively, Fig. 7A).

A follow-up study on the effect of pedagogical training in higher education performed at the University of Helsinki showed that relatively long, noncompulsory courses can positively change teachers’ approaches to teaching and self-efficacy beliefs (48). The University of Helsinki provides three sequential but separate types of pedagogical training, and teachers are not obliged to attend all three. The first is 4–6 mo in duration and aims to provide basic teacher training and enable teachers to use a student-centered teaching approach. The second is a 1-yr course that aims to provoke changes in teachers’ conceptions of teaching and learning, as well as their pedagogical thinking. The last is a 2-yr course in which teachers practice in their own work and in other institutions; at this point, teachers also conduct research regarding higher education. Researchers found that, after attending pedagogical training courses, teachers of diverse backgrounds transitioned to a student-centered approach significantly more than those teachers who did not have pedagogical training. The effect was more pronounced as the teachers attended more pedagogical training courses. This study also showed that teachers with less teaching experience improve their self-efficacy beliefs by attending pedagogical training courses.

In light of this study, it would be possible to suggest that faculty of private HEIs could be more prepared using a student-

![Fig. 6. Attendance in pedagogical training activities by basic health sciences faculty from public (n = 505) and private (n = 254) higher education institutions (P < 0.001).](http://advan.physiology.org)
centered approach. However, our study does not investigate how these pedagogical training courses were structured or the effects of it on public or private HEIs faculty. In fact, to truly change teaching practices, it is vital that pedagogical training focuses on changing teachers’ conceptions of what teaching is rather than just their techniques (47).

Our study also investigated whether faculty participated in PTAs recently and the frequency with which faculty members attended these activities. Only the responses of faculty members who claimed they had attended PTAs in the previous question were considered (Fig. 6). The questionnaire asked how many times they participated in PTAs during the last 2 yr, except their graduate training. Interestingly, different results for public and private HEI faculty members were observed (Fig. 7B). While the former group answered that they did not attend any PTAs in the previous 2 yr (36.0%) or attended them twice at most (38.3%), 41.7% of the private HEI faculty members said they attended PTAs more than five times in the last 2 yr.

Since many faculty members had not attended PTA and given the importance of such activities in professional development, they were asked what would stimulate them to participate in PTAs. They could select up to three important factors that would incentivize them to participate in PTAs. The answers of both groups were similar, with the top two indicated factors being the same for public and private HEI faculty: 1) offering activities with topics related to my classroom practice (67.4% of public and 68.6% of private); and 2) internal and/or external recognition for faculty members showing good pedagogical performance (48.1% of public and 66.5% of private). Nevertheless, the third most important factor was different. For public HEI faculty members, the third most important factor was “higher frequency of these activities” (47.1%), and for those working in private HEIs, it was “wage increase for faculty members who regularly participate in these activities” (48.8%). Another interesting finding is that very few faculty members indicated PTAs as unnecessary activities, showing that they recognize their importance in their improvement as higher education teachers (Fig. 8).

Nóvoa (45) suggested that reflecting on teaching practices is more important than creating or stimulating a pedagogical training “market,” with pedagogical training courses formatted in a static way. The reflection process facilitates new experiments and pedagogical innovations, making it possible for the faculty member to be an investigator of his or her own practices. Such a process can be performed alone, but it is more effective when performed at study groups in reflexive seminars (43). Thus, to achieve a successful Brazilian higher education, a collective reflection about the teaching-learning process with the involvement of faculty, HEIs, and institutions that regulate higher education is necessary (56).

Given the importance of reflecting on their teaching practices, faculty were asked about what makes them engage in such reflection. In this question, they could choose up to two items, and again, both groups had similar answers. “Students’ feedback at the end of the course” and “discussion with other faculty members about teaching methodologies” were the two top answers for public (79.3 and 58.9%, respectively) and private (70.7 and 56.3%, respectively) HEI faculty. Moreover, both groups said that reading about the teaching-learning process is important to reflect on their practices: 36.2 and 30.9% of public and private HEI faculty, respectively. Interestingly, 44.5% of the private HEI faculty reported that periodic meetings to discuss pedagogical issues promoted by the HEI where they work were important to reflect about their practices as higher education teachers. The same was not
verified by the public HEI faculty, only 9.3% of them selected this option, showing that HEI institutional politics may be a key factor in faculty members’ pedagogical training (Fig. 9).

Efforts toward making PTAs institutionalized are important; their institutionalization promotes a sense of teaching support and appreciation (48, 59). Some progress is taking place at HEIs in Brazil in the form of isolated cases, since there is no national guidance. However, a recent study of one Brazilian university showed that, although there was an institutionalized pedagogical training program, it focused mostly on administrative and technical issues rather than on changes to the very core of teachers activities (59). Nevertheless, the program mentioned is relatively new, approximately 10 yr old, and it has made improvements over the years since its creation (59).

A previous study on pedagogical training at two Brazilian universities showed that, although there were institutionalized programs, a barrier between pedagogical and specific knowledge was present, since pedagogical programs were structured by professionals of the pedagogical field (29).

The two studies mentioned identified issues with PTAs that should be addressed: 1) what is discussed in these programs? and 2) how can the content of these activities be related to specific fields of knowledge? As discussed before, institutionalized programs of pedagogical training per se are not a guarantee of success in changing teaching practices. It is necessary for these programs to identify the central issues regarding teachers’ perspectives about their profession and performance and their goals as teachers. It is also necessary that activities within the pedagogical field can cross talk with other fields so that professionals in other areas can take advantage of these opportunities.

Final considerations. Several authors have demonstrated the importance of pedagogical training for higher education teachers to improve teaching quality (12, 43, 46). This pedagogical training must be performed during the faculty members’ entire career, not only as periodic activities, but as frequent reflections about their practices, to constantly improve the teaching process (18, 23, 45). Such an approach toward higher education should be stimulated by the institutions where faculty work and by the national regulatory agencies (56).

To outline the profile of basic health sciences faculty in regard to their undergraduate and graduate training, as well as the initial and continued pedagogical training in Brazilian public and private HEIs, an electronic questionnaire was sent to faculty members in the fields of anatomy, biophysics, cellular biology, biochemistry, embryology, pharmacology, physiology, and histology. Although the sample size was adequate for this study, a larger response rate was expected due to the research focus and its relation with the population analyzed. Therefore, the low response rate to the questionnaire shows how this issue is underexplored and how few faculty members in this knowledge area are concerned with it. Nevertheless, many faculty members who answered the survey reported in the commentary section how important they thought the research was, and how the questionnaire itself triggered them to think about their practices.

Therefore, the greater contribution of this work was to generate a reflection on the importance of pedagogical training for basic health sciences faculty of Brazilian public and private HEIs. In doing so, it was observed that this theme is still rarely addressed, especially at public HEIs, where fewer faculty members have performed PTAs than at private institutions. Such a pronounced difference may be due to the distinct types of HEIs. As most public HEIs are universities and, therefore, perform research, their faculty are more qualified in terms of graduate degrees. On the other hand, private HEIs are more
diverse, varying from colleges and university centers to universities and thus focusing primarily on undergraduate teaching, which shifts their efforts toward pedagogical training for its faculty.

These results reaffirm the relevance of an institutional approach toward teaching appreciation and thus to an investment in faculty members’ pedagogical training, leading to better quality higher education, regardless of whether the institution is public or private. Nationally, it is important to invest in pedagogical training for faculty through public policy establishment to achieve improvements in higher education. Another important change for regulatory agencies is the development of incentive programs or projects to improve the teaching-learning process. In summary, to improve higher education quality, the culture of its institutions and its regulatory agencies should change to better value teaching. Although this research is linked with the Brazilian context, as pedagogical training for higher education teachers is a worldwide issue, this work contributes to a broader discussion; hence, other countries concerned about the quality of their higher education can draw parallels.

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DISCLOSURES
No conflicts of interest, financial or otherwise, are declared by the authors.

AUTHOR CONTRIBUTIONS
G.A.D.O. and M.F.M.R. conceived and designed research; G.A.D.O. performed experiments; G.A.D.O., M.B.C.F., L.N.N., and M.F.M.R. analyzed data; G.A.D.O., M.B.C.F., L.N.N., and M.F.M.R. interpreted results of experiments; G.A.D.O. prepared figures; G.A.D.O. drafted manuscript; G.A.D.O., M.B.C.F., L.N.N., and M.F.M.R. edited and revised manuscript; G.A.D.O., M.B.C.F., L.N.N., and M.F.M.R. approved final version of manuscript.

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