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Students' scientific production: a proposal to encourage it

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Abstract

The scientific production of medical students in Latin America, is poor and below their potential. The reason for this is the low theoretical and practical knowledge of scientific writing, a low margin for new knowledge generation, a heavy academic and clinical load, and the expected profile of the medical school graduate. In the present short communication, we propose teaching courses in research methodology, scientific writing in English and Spanish, a personalized search for students and mentors with research aptitudes. Also, we propose academic and material stimuli for publishing, rewards for the best papers made by students and the development and support of scientific student journals. Other proposals are the requirement to publish a paper for graduation, and sharing the most outstanding experiences.

Introduction

The development of scientific abilities of medical students during their professional training is as important as the development of their clinical abilities since the knowledge of the scientific method and research is essential in medical care [1]. The selection of the best evidence available is medullar for the care of patients allowing them to receive the most up-to-date and pertinent treatment.

Numerous investigations developed in Latin American countries as: Colombia [2], Peru [3],[4],[5], Chile [6] and Cuba [7],[8] inform that, although students are motivated to carry out investigations, few of them end up presenting their works in a congress or publishing them in an indexed journal. This is one of the indicators, somewhat questioned, used to measure the quality of scientific production. Then, the question arises: how to stimulate student scientific production?

Cause analysis

Before enumerating the possible causes that limit the students´ scientific production in health sciences, it is essential not to confuse the initiation, motivation and the use of research in the clinical method with the training of researchers. For the university student it is favorable to identify the search engines of scientific information to be updated about the medical panorama and to develop abilities that allow him or her to write their own experiences from the observations.

However, to coach a researcher is not possible only through courses of research methodology. The training of a researcher requires firstly the student's personal characteristics: aptitude and specific interests. However, this is necessary but not enough. It is also necessary a personalized accompaniment through a mentor who needs to be a researcher himself and should have the will and time for the personalized medical student formation.

The causes of the low scientific student production in Latin America are multiple, complex and include scarce time to carry out research due to the academic overload. Furthermore, there are lacks of research education in the medical study programs in the different countries because the formation in health care is generally favored.

It is outstanding to carry out an exhaustive analysis in order to identify how the students receive the competitions in research methodology, this is a practical and systematic subject directed to the solution of clinical-assistance problems. The placement of research skills in the study program of the medical degree should be in function of what universities want as the profile of medical graduates. In general, it is true that the medical career has as its fundamental objective the training of a graduate who is capable of solving health problems of the population.

Possible solutions

The scientific research methodology should be taught in an appropriate moment. Placing it at the beginning of the career, would allow the student to appropriate the necessary tools to undertake a scientific investigation from his first years of university studies. Numerous students begin in research work at the end of the undergraduate level; thus, they waste time to generate science. However, placing it at the beginning of the degree may have the risk of not being considered essential by most students, who face more demanding subjects of attention. It is necessary that each university take into account the profile that the future professional will have. In line with this, the most appropriate time for its placement in the curriculum should be considered, be it in the clinical phase or in the stage of basic and preclinical sciences.

The integration of the students in research groups favors the scientific production in both the basic and clinical area [9]. The Cuban study plans have gone through different improvement periods that have been named in alphabetic order. Currently, the medical sciences are quickly introducing plan E. In this plan the center of attention is the student rather than the professor since the student must have a key role in the construction of its own knowledge, a fact that favors research.

This approach has been followed in many developed countries where each student adapts the curriculum to his or her interests along with obligatory subjects. If the student is responsible for the construction of its own knowledge, it implies a bigger role in the formation of its own curriculum. In case of students that lean toward research, with the help of tutors and mentors, they will be able to achieve a formation compatible with their research interests and of those of the society for health professionals.

There is insufficient knowledge about research and an inadequate attitude toward it, due to the bad relationship between what is taught and what is required by research. A consequence of this situation is the low number of papers published by students [10]. It would be favorable to stimulate the student motivations toward research by making it an attractive matter. For students with aptitudes, the creation of scientific associations could increase the interest in research and publishing and it could be a solution. Some Cuban institutions are promoting the professional qualification in scientific writing.

The student participation in scientific congresses favors the exchange of experiences with other researchers and the creation of collaboration networks, which can be evolve into scientific societies. The massive attendance of students to congresses in their countries and abroad is very common in some Latin American countries.

The tutor's role

Seventy-five percent of student scientific publications generated in Peru are jointly authored with professionals. This demonstrates the effectiveness of the binomial student-tutor. The active role of the tutor is decisive in the quality of the student research process, since the contribution of personal and professional scientific experiences nurtures the research team. The foregoing favors the formation of the student as a researcher [11].

The tutor is important because of his or her experience and knowledge, but it is essential to recognize the authorship of the student in the scientific publication, if he or her has really earned that right with his or her work. Valenzuela [12] together with Huamaní *et al.* [13], assert that having an advisor was associated with an adequate attitude toward research and good knowledge. These contribute to the student's education in ethical aspects and avoid inappropriate behavior due to ignorance.

The universities and the researcher professor's role

Universities, as training institutions for professionals and generators of new scientific knowledge based on research, must pay the utmost attention to undergraduate training. The reason that justifies the need to do research and publish in medical sciences universities, is to prepare students with new skills and knowledge with an adequate academic training, in a world in accelerated development. However, we must not forget that, in general, the professional profile of many Latin American universities is not that of graduating researchers.

For example in Cuba, the medical sciences universities, form a graduate capable of solving health problems, based on the clinical method. This will be enriched by the experience of contact with patients and diseases. Another effort implies that, after a tutorial work with researchers professors, the students be acquainted with the fundamental elements of science and are able to become scientists.

It has been proven that not every university professor is a researcher or a scientist. This has as an essential foundation the discernment of what is science and what is technique. It is necessary to address the issue of teacher training as researchers, since they are in direct contact with students most of the time. In this way they can actively participate in the training of competent and successful professionals.

The fact of sharing experiences of what the teacher has researched in the past, the projects he is currently developing and his or her future research plans will undoubtedly be an important source of learning for the undergraduate student. In this way, a favorable spirit towards research is generated, promoting this important practice [14].

In fact, their own research can become an example to be taken to the classroom, to the laboratories or to the community and to develop together with the students their interest and capacity to investigate. In other words, only a teacher who really investigates, because of his or her experience, will have the credibility to teach research methods. This, because that same experience will give him the wisdom to teach [14] and demonstrate by his or her example the advantages of scientific research.

The courses

The first thing is the motivation, when the research becomes a felt need of the student, teaching research methodology courses would favor the acquisition of the necessary knowledge to undertake a scientific research on the part of the students. In Mexico, the motivation for undergraduate student research is scarce and the offer of formal courses in research for medical students is limited; as in the rest of Latin America [15]. For its part, Brazil is seeking to encourage students to research from an early stage [16].

In several countries there are well-structured research methodology and statistical courses, where they offer the student the experience of collaborating in research projects. Chávez *et al.* [15] reported a six-week summer course on research, aimed at health sciences students in Mexico in 2012, 2013 and 2014. Their students have disseminated their research projects in different scientific forums and have published in indexed journals, which demonstrates the effectiveness of these courses.

Research scholarship

In Cuba, among the strategies aimed at linking students of medicine with scientific research, are the Heinrich Quincke Research Scholarships, which each summer summons the Central Laboratory of Cerebrospinal Fluid, an institution belonging to the Medical Sciences University of Havana. This experience had its sixth edition in 2017. More and more people are interested in scientific research in general, inside and outside the country, and not just medical students.

In the Heinrich Quincke Research Scholarships, students investigate from what is called "open science", since they work with primary data. This is an even greater challenge for them, since they have to arrive at the same conclusions as the project researchers [17]. In addition, this course provides general knowledge of neuroimmunology and scientometrics that arouse scientific interest and could define future lines of research.

Diagnosis of the interest toward the scientific research

In developed countries, unlike the Latin American environment, medical students consider research as a useful option to follow in the future and actively participate from the undergraduate years in the generation of knowledge. In various German institutions, for instance, students are listed as co-authors in approximately 28% of published articles [18]. In contrast, in Latin America the participation of students in the co-authorship is only 3.6% [19].

To modify this reality, at first it would be favorable to diagnose the students' interest in scientific research during pre and postgraduate studies, as well as the factors that limit it. From this, consistent strategies should be developed. We agree with Alarco *et al.* [11], who raise the need to reinforce the work of undergraduate student research groups; grant academic and material incentives as recognition for the publication; facilitate access to financing and implement the graduation modality by publishing articles in high-impact indexed journals.

In the curricula that do not contemplate it actively, it is proposed:

a) To enhance the interest in the student's scientific research from the undergraduate period.
b) Develop training courses with students of exceptional academic performance as future candidates for doctoral students, where the final evaluation is a proposal for publication.
c) Coordinate stays or rotations in research centers or biomedical scientific poles to link them directly to the generation of knowledge, and at the same time be architects of their own training in research.
d) Implement workshops on social and scientific networks such as Research Gate or www.academia.edu.
e) Coordinate scientific exchanges with prominent research professors.
f) Facilitate the publication of the awarded research in student scientific events.
g) Create an annual scientific publication award aimed at undergraduate students, to stimulate the publication of scientific articles.

Scientific information searches

It is recognized that students need to learn to conduct relevant searches for consistent, up-to-date and useful information. Students who are prepared to search for scientific information use more bibliographic references of good quality in their research. In Cuba, in the Study Plan E, it is contemplated that the student can manage databases as an essential element to find new knowledge that is not found in textbooks. Of course, this has to be guided by the university, based on knowledge that the student appropriates.

Scientific writing
It is recognized that the final step of all research consists of its publication in a scientific journal. Although training in the methodology of scientific research is fundamental, it is also necessary to write correctly so that communication of the results of a specific research process is effective within the medical community. By virtue of students publishing their research effectively, not only must they master their specialty and research methodology, but also scientific writing. It is based on four basic pillars: precision, correctness, clarity and conciseness [20].

The incorporation of formation strategies in scientific writing in the biomedical undergraduate curriculum, as well as the implementation of continued education courses in this topic for the professionals are fundamental to increase the number of successful writers in the health sciences [21].

Domain of the English language
At the present time, the necessity of English language is an essential aspect in a globalized world, where it has become the communication language par excellence [22]. Although there are medical schools or faculties that include this language in their curriculum, either as a compulsory or elective subject, a cognitive deficit is still observed in the students [23].

The learning of this language as a tool of knowledge and constant training is essential for the medical profession. For this reason, the establishment of inclusive teaching strategies is imperative, so that it becomes a common language among Latin American students who are not native speakers of English [22].

Although the teaching of English for communicative purposes is relevant, it is essential to develop the ability to write it for specific purposes in medical sciences. Students must be able to write and publish the results of their research in journals published in this language. The foregoing is supported by the study published by Chávez *et al.* [24], conducted with medical students of the 2015-2016 academic year. In this study, the lack of English-language writing skills was confirmed and, as a result, methodological actions were developed to fill this gap.

Thesis in scientific paper format
For medical sciences in Cuba, what is regulated is that students graduate from a state exam. This implies that until the graduate doctor does not become a specialist, he does not have to write a scientific text.

In several Latin American medical universities, the development of a thesis is required as an essential requirement to obtain the degree. Although this is positive because it necessarily requires acquiring scientific writing skills; once obtained the title, many times their results never come to materialize through scientific publication.

Faced with this reality, some universities have developed a different proposal regarding the format of how to do the thesis, by changing its structure so that it is written in the format of a scientific article, and even sent to publish in a quality journal. These theses are research works and should be published in scientific journals [25]. This alternative has had a positive impact on the number of published investigations [26],[27], and it would be favorable to extend it to the universities that have a requirement to be awarded a thesis.

The role of the student scientific journals
It is necessary to encourage publication from the undergraduate level, as well as the creation of student scientific journals, in countries where they do not exist, and to strengthen existing ones. Currently, in Latin America there are several journals that disseminate the scientific results of students of health sciences.

The Latin American Federation of Scientific Societies of Medical Students brings together these publications and ensures that they maintain their objectives. This institution has as a means of scientific dissemination, the journal *Ciencia e Investigación Médica Estudiantil Latinoamericana (CIMEL)* (Latin American Medical Student Science and Research Journal) created in 1995. Another example is the ANACEM Journal, published by the National Scientific Association of Medical Students of Chile [28].

In the Cuban experience, within the different journals of biomedical profile there are two made entirely by student editors specialized in publishing from and for the undergraduate: the *Revista Estudiantil Universitaria Médica Pinareña* and *Revista 16 de Abril* (Pinar del Río Medical University Student Journal and the April 16th Journal). The latter is the national scientific-student body. Currently, an initiative is promoted in the IMBIOMED database (www.imbiomed.com.mx), where there is a special section that groups the main scientific journals whose editorial committee is made up of undergraduate students [1]. This helps create a culture of scientific publication in students and improves dissemination.

Conclusions

The training of researchers from the undergraduate period is a complex and important task, because they will be responsible for innovating in different areas of knowledge in favor of the health of populations.

Scientific activity must be assumed as an essential component in the comprehensive education of medical science students from the undergraduate level.

Any strategy aimed at stimulating student scientific production is necessary, especially in Latin America. This, because it is one of the regions with the lowest scientific production in the world.
The road is long and full of limitations. However, the task belongs to everyone and the will exists.

Notes

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