

Open University for the School Community

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Learning within the biological sciences requires practical experience. However, traditionally, educational institutions have had limited resources and have lacked teaching laboratories. The Project "Open University for the School Community" aimed to open the doors of the Federal University of Sergipe to the student community from all over the state of Sergipe, in order to show the importance of theoretical and practical knowledge in an interdisciplinary way. From June 2008 to May 2009, community schools were encouraged to visit the university's laboratories and demonstrations of the microscopic anatomy of different types of cells and tissues, using modern microscopes, were arranged. After the visits, the profiles of the institutions and the real reasons for the visits were investigated using questionnaires. The data were quantified and analyzed. A total of 1700 students from 72 institutions throughout Sergipe were received. Students from private schools (76.39%) predominated, particularly at high school level (62.16%) and from the state capital (66.37%). The main reasons for coming cited by teachers were lack of knowledge and interest in the laboratories. The project expanded the scientific and practical knowledge relating to molecular and cell biology, and constituted an important link between the university and the academic community in this state.

Keywords: Cell Biology; Students; Interdisciplinary

Aprendizagem dentro das ciências biológicas requer experiência prática. No entanto, tradicionalmente, as instituições de ensino tiveram recursos limitados e faltou ensinar laboratórios. O Projeto "Universidade Aberta para a Comunidade Escolar" teve como objetivo abrir as portas da Universidade Federal de Sergipe para a comunidade estudantil de todo o estado de Sergipe, a fim de mostrar a importância do conhecimento teórico e prático de forma interdisciplinar. De junho de 2008 a maio de 2009, escolas da comunidade foram encorajados a visitar os laboratórios da universidade e demonstrações da anatomia microscópica de diferentes tipos de células e tecidos, utilizando microscópios modernos, foram organizadas. Após as visitas, os perfis das instituições e as razões reais para que as visitas foram investigados por meio de questionários. Os dados foram quantificados e analisados. Um total de estudantes de 1700 de 72 instituições em todo Sergipe foram recebidos. Estudantes de escolas particulares (76,39%) foi predominante, particularmente ao nível do ensino médio (62,16%) e da capital do estado (66,37%). As principais razões para vinda citados pelos professores foram a falta de conhecimento e interesse nos laboratórios. O projeto ampliou o conhecimento científico e prático, para a biologia molecular e celular, e constituiu um importante elo entre a universidade ea comunidade acadêmica neste estado.

Palavras-chave: Biologia Celular; Estudantes; interdisciplinar

1. INTRODUCION

The morphological sciences are becoming one of the pillars for the development of molecular and cell biology. Increasing knowledge about cells has come hand-in-hand with improvements in scientific investigation methods. Discoveries of new molecular biology and cytohistochemical techniques have made it possible to identify and locate many molecular and cell components. Alongside these developments, modernization of equipment with high resolving power, such as microscopes, has been extremely important for observing molecular

and cellular structures. These advances have led many researchers to choose to replace the term cytology, preferring the term cellular biology.

The rapid scientific and technological advancement that has taken place since the end of last century has opened up new perspectives within science, with effective ways to improve professional qualifications within various fields of the morphological sciences. These advances have been important in overcoming the difficulties posed by the lack of technical and methodological resources in schools at elementary and high-school levels, which in turn, have constituted hindrances to the development of research and learning.

Bruzzo (2004) studied teaching practices within biology, focusing on the use of images presented in textbooks. This author concluded that there was widespread use of illustrative diagrams interspersed throughout the text, rather than photographic images that would be closer to reality.

In modern teaching methods, it is considered important that theoretical studies should be accompanied by updates through practical classes, thereby leading students to understand the reality and overcoming their difficulties in understanding the tutorial teaching. The structure of didactic teaching has been insufficient, thus leading to a constant search for new practical and effective ways to teach the various disciplines that are part of the morphological sciences and, in particular, molecular and cell biology.

In Brazil, the National Education Basis and Guidelines Law (LDBEN/96) and National Education Council Resolution (CNE/98), which standardize the national curriculum guidelines for basic education provided in the various courses at middle level, state that in the teaching of natural sciences, school curricula should include specific course material arranged in series, under the conditions of scientific knowledge production. According to the law, the school must provide learning opportunities that enables students to understand science and technology as human constructs within their historical context [2]. In practice, elementary and high-school education institutions have great difficulty in acting upon the recommendations of LDBEN/96 because of lack of adequate physical infrastructure and laboratories to conduct practical classes on the course material that is taught.

A study by Oliveira and Rezler (2006) among biology teachers in high schools showed that, in general, education was limited to amassing of theoretical knowledge. Practical demonstrations were constrained by the lack of material resources in the schools, in addition to difficulties in updating the content. They also concluded that although teachers said that they were in favor of insertions of new scientific knowledge, in practice they did nothing to implement such changes.

Within this context, opening up university-level educational institutions to visits by students at elementary school, high school and vocational education levels, in order to provide technical and scientific studies that might enable adjustments to and practical demonstration of school subjects relating to the biological sciences, is extremely important. The Federal University of Sergipe, in Brazil, was aware of its role within the community, and therefore developed a project through which it was sought to interest students at high school, elementary school and vocational education levels in the state of Sergipe, in the study of morphological sciences. Through this, their view of the world of scientific experts and professionals within different areas of the life and health sciences would be broadened.

2. MATERIALS E METHODS

The Open University Project for the School Community was carried out from June 2008 to May 2009, at the Laboratory of Cellular and Structural Biology, Department of Morphology, Federal University of Sergipe. The target audiences were students at elementary school, high school and vocational education levels, and teachers at educational institutions in the state of Sergipe.

Visits by groups from different educational institutions were scheduled in advance. During each visit, presentations on the theory and practices relating to various cell types and tissue and molecular components were made, using the microscopic slides and appliances belonging to the

laboratory. Practical work on microscopy was performed, starting from the theory. Each visitor received a roadmap of content that would be addressed, in order to achieve dynamic and efficient understanding and interdisciplinary learning.

At the ends of the visits, questionnaires were administered to the teachers and students in order to assess their degree of satisfaction, detect the real motives for the visit and ascertain students' perceptions about the images they had viewed microscopically. The questionnaires also sought to construct a profile of the educational institutions that asked to participate in the Open University Project for the School Community, by asking the teachers questions about the institutions that they represented. We sought to identify the type of institution (public or private), the type of education offered (elementary school, high school or vocational education), location (capital/elsewhere in the state) and whether the institution had a laboratory to conduct practical lessons.

Quantitative data were tabulated in Microsoft Office Excel where it was made simple and often will be presented in the table. The characteristic qualitative data were analyzed using the technique of content analysis of Bardin[4].

This study was conducted in accordance with resolution 196/96 of the National Research Ethics Commission (CONEP). All participants signed a free and informed consent statement and full anonymity of the research subjects and institutions was respected.

3. RESULTS AND DISCUSSION

Between June 2008 and May 2009, the Open University Project for the School Community, at the Laboratory of Cellular and Structural Biology of the Federal University of Sergipe, received visits that were arranged by 72 schools at elementary, high-school and vocational education levels belonging to the municipal, state and federal authorities, along with private institutions, both from the state capital and from neighboring municipalities. In total, approximately 1,700 students made visits.

During the visits, demonstrations on the microscopic anatomy of various types of cells, tissues and molecules were made, and these provided interactions with the issues seen by students in the theoretical syllabus, within the disciplines of science, cytology and histology of their respective schools or vocational courses, thereby explaining the differences in structural organization that occur in these biological materials.

The interdisciplinary interaction between the Open University Project for the School Community and the target audience was evident at each visit. We found great interest among students and teachers, with active participation in the experimental demonstrations, in observations under microscopes and even in expository explanations.

The profile of the educational institutions that showed interest in participating in the project can be seen in Table 1.

Table 1. Profile of visitors to the Open University Project for the School Community – June 2008 to May 2009.

Mains	N	%
<i>Type of institution</i>		
Public	17	23.61
Private	55	76.39
All	72	100.00
<i>Type of education offered</i>		
Elementary school	25	33.78
High school	46	62.16
Vocational education	3	4.05
All	72	100.00
<i>Location</i>		
State capital	48	66.67
Elsewhere in the state	24	33.33
All	72	100.00
<i>Does the institution have a laboratory?</i>		
Yes	8	11.11
No	64	88.88
All	72	100.00

The interest in these educational activities among the participants in the project was evident. Most of the visitors came from private schools that were located in the city of Aracaju (the state capital). The significant lack of participation from public schools in itself reflects the unsatisfactory state of affairs prevailing in the educational sector in Brazil and also in Sergipe. Six public educational institutions and two private schools had laboratories, i.e. a total of eight institutions. Poor and inadequate infrastructure may have been the predominant determinant of the poor public sector participation.

The teachers representing the participating institutions demonstrated their awareness that there is great lack of adequate infrastructure for satisfactory education with practical experience. This continues into the tertiary level in the fields of medicine, life sciences and other health-related areas. The situation is markedly worse in public institutions.

The majority of the teachers (80.56%) reported that the motivation for their visit to the university was the lack of resources in the schools where they taught, which prevented them from adopting new approaches using field classes or practical classes. This information corroborates the findings reported by Oliveira and Rezler (2006), who concluded that this is a major obstacle preventing science teachers from meeting the determinations of LDBEN/96, with regard to the quest for interaction with new issues of technological scope.

We consider that it is appropriate to quote some excerpts from the words of the teachers interviewed:

"The school where I teach does not have any of this. There are no audiovisual resources, let alone a laboratory with a microscope" (P11).

"The situation at the school where I teach is very precarious. If you want something different, the solution is to seek the university (...)" (P6).

"The law says that we have to give quality education, but there is not enough investment and resources for us to provide this (...)" (P3).

"(...) Labs are something that private schools have" (P32).

Although many teachers at public schools expressed the notion that laboratories equipped for practical classes are a resource limited to private schools, it was found that only a total of eight (11.11%) of the institutions represented had laboratories. Therefore, there is a general lack of such structures among schools in the state of Sergipe.

It is worth mentioning that, during the visits, many teachers claimed to be searching for deeper knowledge for their students, in view of the importance and complementary nature of practice exercises for assimilation of the theoretical content of their disciplines. This is especially the case with biology, in which viewing of cells, tissues and other structures are only possible with the use of specific devices or microscopes.

"I made the decision to visit the university, not to make a tour or excursion with my students, but so that they can better learn the material they were given in class. I want my students to have extracurricular practical activities. It is very important to broaden their knowledge" (P67).

"I decided to come to the university to show my students how the experiments are done in practice. I'm interested in giving them the possibility of acquiring new knowledge and putting into practice everything that I showed in the classroom" (P21).

"(...) It is very important to tie theory to practice. This makes the subject more interesting and easier to learn (...)" (P41).

"(...) If all classes were like this, with theory and practice, students would not lose interest (...)." (P33).

Among the teachers, a minority (6; 8.33%) reported that the real interest in visiting the university laboratory was limited to merely making a trip from the school in which they worked, in order to complete the curriculum in terms of extramural activities performed. This finding demonstrates the state of demotivation and discouragement prevailing in some segments of the education profession, such that some educators remain outside of the important role that teachers have as professionals who are preparing new generations for the challenges of technological and scientific advances. This shows that they are ignoring the suggestions of experts, who advise teachers to seek opportunities to become aware of their professional value by finding the ways and means necessary for practice and training [5]. Teachers cannot be limited to the physical space of the classroom, giving theory classes while ignoring the technological resources available in schools and possible ways of integrating them with their educational practice in a balanced and innovative manner. It is essential that the teacher also undertake field classes (visits and trips), educational play activities and discussions of important and current topics, using an appropriately broad range of features and spaces so as to provide meaningful learning [3].

It was noteworthy that, from the questions and comments made by the majority of the students, they were surprised by the types and quality of images observed under the microscope, compared with the illustration found in textbooks that they used for the discipline in question.

This confirms the problem raised by Bruzzo (2004), who drew attention to the fact that the illustrative figures and diagrams in textbooks are very different from the reality observed in microscopic images.

4. CONCLUSION

The Open University Project for the School Community not only expanded the horizons of the academic and scientific professionals working in various areas of the life and health sciences, but also established a link between the Federal University of Sergipe and the school community in our state, through encouraging and supporting the study of cells, which are microscopic structures that are fundamental to the constitution of all living beings. The interdisciplinary nature of the project allowed students and teachers to experience the course material found in textbooks and in lectures given in educational institutions, through observations under microscopes. Projects of this nature tend to strengthen the social role of universities as institutions capable of fulfilling three major pillars of education (teaching, research and extension), thereby indicating the importance of learning in a dynamic, practical and up-to-date manner.

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1. BRUZZO, C. *Biologia: Educação e Imagens. Educ. Soc.* v. 25, n. 89, p. 359-1378, 2004.
 2. BRASIL. Ministério da Educação. *Diretrizes Curriculares Nacionais para o Ensino Médio. Parecer CEB 15/98 01/06/98.* Brasília, 1998.
 3. OLIVEIRA, V. L. B. de; REZLER, M. A. *Temas contemporâneos no ensino de biologia do Ensino Médio. Acta Scientiae.* v. 8, n. 1, p. 95-104, 2006.
 4. BARDIN, L. *Análise de Conteúdo.* Lisboa: Edições 70, 2002.
 5. PERRENOUD, P. *Dez novas competências para ensinar.* Artes Médicas Sul, 2000.