Simulation of a Congress at the Chair of Biology II in Bioengineering

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Abstract. This work has been developed in the Chair of Biology II, the curricular contents of which correspond to Human Anatomy. This subject is taught in the second semester of the second year of studies in Bioengineering. Our main objective is that the students attending the course may integrate the syllabus contents of Anatomy with those of other subjects in the career. Ever since 1998 we have organized a congress named Congreso Intracátedra de Biología II (Intra Chair Congress on Biology II). This is the last assignment in the semester and is compulsory for regular students of the subject. It consists in simulating a scientific congress with international characteristics. The guidelines for the congress are made known to the students at the beginning of the semester. In groups of up to three members, the students must undertake a work that relates aspects of Anatomy with Bioengineering. Students are expected to investigate on diagnostic and/or therapeutic technology in order to write a paper that must be accepted in advance of the event. The presentation of the work must be made through PowerPoint. The originality of the research work done and the wide range of topics selected are surprising. Problems are tackled from the standpoints both of the various medical fields and of bioengineering despite the fact that they are just students of the second year in Bioengineering.

1- Introduction

This is a didactic experience carried out with students of Biology II of Bioengineering at the College of Engineering in the National University of San Juan (Facultad de Ingeniería, Universidad Nacional de San Juan). The subject is lectured in 17 weeks, 7 hours per week divided into 4 hours for theory and 3 for practical work at the laboratory. This is a subject from the first stage of the career, taught in the second semester of the second year. The contents of Biology II match those of Human Anatomy.

The specificity of the career and the prospects for professional job opportunities serve as a context to develop the objectives and contents of the subject. The aim is to learn anatomy not like a surgeon that would have to apply totally invasive practices in the human body in order to perform his work. Instead, the bioengineer should have the skills to support medical doctors in their practices, offering them technical assistance while using last generation instruments both in diagnostic and therapeutic practices. Additional activities carried out by bioengineers are to supply biomaterials, to design prostheses or simply to repair instruments that physicians use in their profession. On account of this, it is essential that the students be acquainted both with the use of proper technical vocabulary and the
interpretation of images in medical practices such as magnetic resonance, computed tomography, centellogrammes, to name a few of them.

In training the student to interpret these images, it is not expected that he will produce a medical diagnosis. However, he must be able to interpret the quality of the image in order to detect problems that may appear during the use of the technology. To do this, he must be acquainted with the structure of the section of the human body under study. The adequate use of medical vocabulary will help the bioengineer to work in an environment that differs much from that of engineering. In this new field his workmates may all belong to the field of medicine. Consequently, the lexis they communicate with will surely be quite different from that he is used to deal with in the field of engineering.

Due to the reasons above, during the development of the subject, the above reasons demand that the teaching material be designed differently from that used to train health professionals. Here, instead of giving priority to the study of human anatomy with corpses and dissections, other means are used. Human bones and some anatomic pieces of animal source (cow or pork) are used in order to study their shape and so that the students can visualize their colors as well as the conformation of live tissues, among other features. Attention is focused on imaging material captured by X-rays, tomographies, resonances, echographies, endoscopies and the like.

Through enquiries, the teachers get knowledge about the students’ preconceptions and doubts on the scope of bioengineering. A common question is how biological subjects are related to those of engineering, what the activities the bioengineer must perform, which his field of competence is, how an engineer may come into the medical milieu.

For the professors and physicians involved in teaching this starting subject, it is rather difficult to design a syllabus the contents of which are greatly related to Biology in a way that helps to clarify doubts as to bioengineering.

In this sense, a compulsory activity has been designed for regularly-attending students and an optional activity for all those under non-regular condition. This is the last assignment of the subject and has been carried out ever since 1998 under the name of “Congreso Intracátedra de Biología II”.

2. Methodology

The Intra Chair Congress on Biology II consists in the simulation of a scientific congress with international characteristics. We have celebrated it ever since 1998. For this assignment, the following aims have been formulated

- To motivate the students’ interest to search information either from bibliographic or other sources such as the internet, visits to professionals and health centers.
- To raise the students’ interest on research methods.
- To make them integrate anatomy and bioengineering
- To initiate the students in the construction of written reports for congresses
- To initiate the students in the design of oral presentations for congresses
- To provide for training practice in public presentations

In the first class at the start of the semester the students are given information about the characteristics of the event. Also, the guidelines are published for the presentation of papers and attendance to the event through various media such as notice boards at several sites in the college building, the Chair Webpage and news spread with the help of the students unions. An electronic mail address is created for the students to make consultations. A “triptych”, that is, a series of three units of course notes has been prepared to serve as a guide for the students. In this triptych, the topics for the congress are stated, instructions are given to the prospective authors, and the schedule is given for
presentation and acceptance of papers. Also, detail is given as to the date and time of the event. In “Instructions to the Authors”, detail is given as to the characteristics the written work must feature to be accepted for the congress, that is, title, authors, abstract, key words, letter type and font, text and graphics organization, margins, bibliography.

This activity is intended not only for those who take the subject as regular students but it is also opened to all those who may be willing to submit a written work. The topic must be related to the syllabus of the subject Biology II. It is expected that the participants will investigate on technology to be used on various zones of the human body either for diagnostic or therapeutic purposes. The papers must consist of a brief anatomic description followed by the technological application section. In this, a description should be given of the devices to be used either for detecting alterations or illnesses in the anatomic region in question or for carrying out or to practice invasive therapeutic practices. Description should also be given of the biomaterials to be used in the practice, prosthesis made of various materials and for various locations, artificial organs, digitalization of images in medicine and their application. Conclusions must be given and references must be quoted.

The students may arrange in teams of up to three members to conduct the research work, the topic being freely selected by them. Monitoring of the groups is made through the electronic mail or through personalized consultations during the construction of the work.

Some days before the congress, the various groups must send their papers through the electronic mail for evaluation by the members of the teaching staff of the Chair who decides whether the work will be accepted for presentation at the congress or whether amendments should be made. The presentation must comply with a given format. Both a printed copy of the work and its magnetic version should be submitted to be compiled into a book of proceedings of the congress and in a CD, both of which will contain all of the papers and presentations at the congress. A copy is provided to all those students who may be interested.

On a previously set date, the presentations are given at the conference room of the Institute of Automatics where the student authors may use a computer and an electronic slide projector. After credentials are distributed both to presenters and attendants, the Congress is officially opened and papers are then presented. Each group has twenty minutes for presenting their paper after which there is a short period for questions. After each presentation, a debate on the topic follows that takes about ten minutes. The whole activity usually takes an entire morning.

Both presenters and attendants are extended a certificate for their participation in the congress since the activity is promoted by the Department of Electronics and by the Teachers Council of the College of Engineering.

When the presentations have finished and the attendants have left, the head professor gives feedback to the presenting groups. Weaknesses are made known to the students; however, emphasis is given to the strengths of the presentations. Observations are made as to the rhetoric and the performance of the presenter in public. The design of the PowerPoint presentation is also discussed.

3. Results

When the characteristics of the activity are communicated to the students at the start of the semester, most of them show reluctance to participate and some others do not thoroughly understand the task targets. During course progression, they grow interested in particular topics, start making inquiries about the topic they would like to investigate, ways of approaching it, the sources they will have to consult and the professionals they would have to visit in order to request for information and advice on the given topic.

The range of topics selected is highly varied. The most frequently selected topics are those related to the cardiovascular system, the second most frequent being those related to the osteomuscular system, especially all about traumatology (Fig. 1). This is probably due to the fact that these are parts of the body undergoing pathologies the students are most familiar with; moreover, these are fields of
medicine in which diagnostic and therapeutic possibilities are highly varied. The students find a wide range of topics to choose, from cardiac valves to last generation defibrillators, from external immobilizers to prostheses for the vertebral column.

Further topics favoured by the students are those related to new instruments in use in medicine especially all that is referred to as “medicine of high diagnostic and therapeutic complexity”. The nervous system is a most frequent topic in these papers followed by the urinary system, the reproductive system and the sense organs. Despite the fact that the digestive system is a vast field for research, there are only a few papers dealing with this topic.

Most of the papers show high quality levels as to content and originality to approach the topic. One of the difficulties usually faced by the students is that of complying with the format specified for the written presentation. It turns out to be difficult for them to synthesize the contents of their work in only four pages. Another problem is related to the bibliography since in general this is omitted by the students or is incorrectly quoted.

Due to their lack of practice, students feel generally highly intimidated by having to speak in public. For most of them this will be their first time in addressing an audience. Moreover, their experience in sitting for oral examinations at this stage of their career is quite scanty. Most of them have never sat for an oral examination and there are those who have done it only on few occasions. However, their PowerPoint presentations are quite good.

We have already celebrated nine of these congresses and we are already preparing for the X Intra Chair Congress of Biology this year. In the early congresses the activity was not compulsory. However, despite the high response on the part of the students in the early years, some of them would not participate on account of a number of reasons. This is a time of the school year during which term evaluations take place, which are decisive for the students being passed or failed in a subject. A failure implies that they will have to sit for a regular examination or that they will have to restart the subject. There are also those students who simply do not feel willing to work and take part in the activity and, naturally, there are those who do not even feel interested in the task at all. After the fifth year of celebration of the congress simulation the teaching staff has decided to give it the character of a compulsory assignment. Consequently, the ratio of papers to the number of students has risen in the last few years (Fig. 2).

Fig.1: Number of papers in relation to the thematic area favored by the students
The students soon start working hard on the search for information in the college library or on the Web or else request information from us about professionals either from the public or private health system that may be a specialist on the topic they have chosen; appointments are arranged with professionals during which they consult on the topic selected. The preparation for the work allows them to visit medical institutions of high complexity both public and private.

The professionals consulted usually reply with pleasure to the students’ inquiries and are highly cooperative with them by providing bibliographic information, images and even medical materials for them to carry out their work and oral presentation.

It is in this way that they start making sense of the career. They get enthusiastic about discovering that the task of the bioengineer is not solely limited to repairing instruments in health centers in the Public Health system but that they have a number of possibilities in an ample range of specialization fields in medicine.

On most occasions, the papers elaborated out of this research work are submitted for the Students SABI. The fact that the students have to write a paper and later present it in a congress, developed in an environment far beyond the scope of the chair of Biology II, turns out to be a most valuable experience for these students that have not finished the first cycle of their careers yet.

4. Conclusions

This activity is a source of highly enriching experiences both for students and professors. On the one hand, the students start feeling interest for certain topics and start finding an organization and sense of their careers that, at this stage of the studies, looks quite disorganized. The activity helps them both visualize the main aim of the career they are studying and value the essential role that bioengineering and the bioengineer play in the health field. For the professors, it is highly gratifying to perceive the interest of the students for the activity, an interest that is shown not only by those currently attending the subject but also by those that, having already passed the subject, keep on taking part in the activity year after year. The activity also serves as a means of breaking the gap existing between professors and students, facilitating the exchange of knowledge and allowing the students to acquire insights into topics that are really meaningful to them.
The range of topics and procedures selected for carrying out their work are quite interesting. Despite the fact that the time at which the congress take place is a time of the school year in which there are plenty of term-tests, make-up tests, extraordinary tests and final examinations, the response on the part of the students is quite good. It is felt that the objectives proposed for the activity are totally fulfilled. Our modern world imposes changes and we must be ready to accommodate our teaching to the social, institutional and classroom context so as to be able to establish, in a most suitable way, a relationship between students and professors, a relationship that is mediated by meaningful, hands-on knowledge.

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References

[1] Arias Galicia. “Introducción a la técnica de investigación en ciencias de la administración y del comportamiento”. pág 161.
[2] Ander Egg, E. (1987). “Técnicas de investigación social”. Buenos Aires. Humanitas.
[3] Blaxter Lorraine; Hughes Christina y Tigh Malcom. (2002). “Cómo se hace una investigación”. España. Ed. Geidesa
[4] Aiello, María (2003). “Concepciones epistemológicas del docente y su incidencia en la enseñanza de las ciencias”, Revista Colombiana de Educación, Segundo semestre 2004, Colombia.
[5] Blythe, Tina. Enseñanza para la comprensión. Guía para el docente. Paidos. Bs. As. 1999
[6] Camillioni, A. Y otras. “Corrientes didácticas contemporáneas”. Bs. As. Paidos educación. 1998
[7] Garcés, L. (2002) “Algunos problemas de la educación superior”, M. E., Informe final. C.O.N.E.D.U.S. San Juan. Argentina.
[8] Giordano, M. y otros, “Enseñar y aprender ciencias naturales”, Troquel. Bs. As, Argentina. 1991
[9] Guyot, Violeta. “Enseñanza de las Ciencias”. Alternativas N° 17, LAE. UNSL. Diciembre 2002.
[10] Guyot, Fiezzi, Vitarelli. “La práctica docente y la realidad del aula: un enfoque epistemológico”.
[11] Hernández Sampini,(1996) “Metodología de la Investigación”. México. Mc Graw Hill
[12] Latorre, A.; González, R. (1992). “El maestro investigador. La investigación en el aula”. España.
[13] Pita Fernandez, S.”Metodología de la investigación”. Coruña, España
[14] Sabino, Carlos (1998), “Cómo hacer una tesis y elaborar todo tipo de escritos”. Ed. Lumen, Bs. As. Argentina.
[15] Sabino Carlos (1989). “El proceso de investigación”. Buenos Aires. Ed. Lumen. Humanitas
[16] Stome Wiske, Martha (comp.) LA enseñanza para la comprensión. Colección redes de Educación, Paidos, Bs. As. 1999
[17] Zabala, V. A. “La Práctica Educativa. Cómo enseñar” Graó. Barcelona. 1997.