Teaching strategies for meaningful learning of histology and embryology contents in a subject of the degree course of dentistry.

Andrea Tanevitch
Susana Batista
Gabriela Llompart
Adrián Abal
Patricia Perez
Pablo Felipe
Lila Licata
Jorge Llompart
Glenda Morando
Graciela Durso

aratanevitch@gmail.com

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Facultad de Odontología - Universidad Nacional de La Plata
SPU Incentive Program, Ministerio de Educación de la Nación Argentina

INTRODUCTION

Modern teaching systems consider that establishing a logical, current and meaningful order of contents contributes to improve learning processes (Diaz Barriga, 2005). Moreover, these systems focus on students' integration and anchoring of learning contents based on experimental activities using the data studied (Alves Mattos, 2007).

Jerome Bruner (Bruner, 1962) states that all information tends to be forgotten unless it is expressed within a structure of concepts. Learning constitutes an active process in which learners construct new ideas or concepts based upon previous knowledge. The student selects and transforms information, constructs hypotheses and makes decisions relying on a cognitive structure. The cognitive structure (schema or mental models) provides meaning and organization to experiences and allows the individual to go beyond the information given. Simplifying, generating new propositions and increasing the manipulation of information show to be good methods for structuring knowledge (Bruner, 1959).

Learning occurs through the learner's experiences, that is to say, through the learner's reaction to the environment. Ralph Tyler (Tyler, 1998) considers that the phrase *learning experience* does not refer to the contents of a particular course, or to the activities done by the teacher, but to what is learnt by the learner's active behavior, since the student learns through what he does. The teacher's responsibility is to provide the students with different situations that will provoke expected experiences in them. Learning does not only imply speaking about topics, but also demonstrating what can be done with those topics.

Edgar Morín (Morín, 2002) refers to *pertinent knowledge* as that capable of locating all the information within its context and he adds that knowledge progresses mainly not because of sophistication, formalization or abstraction, but because of its capacity to contextualize and totalize.

At university, knowledge occupies a privileged place whose purpose is the formation of youth so that they learn the contents of the subjects in a deep, meaningful and long-lasting way (Ortiz, 2006).

The course of studies of Dentistry at the National University of La Plata (UNLP) is founded on a program based on the principles of multidisciplinary integrated approach, theory-practice articulation, a teaching-service model and a critical reflective teaching methodology. The planning reflects a department structure according to areas of knowledge, this being a design capable of overcoming education fragmentation. The subject Histology and Embryology is organized into two departments, Oral Rehabilitation

and Biology as well as Basic and Applied Science, thus representing an *integrated subject*. It corresponds to the first and second years of the course of studies.

The concept of integration implies, in any body of study, that the knowledge acquired within the framework of different scientific disciplines, can be of simultaneous and even undifferentiated use for the solution of the problems of each specialty (Vicedo Tomey, 2009). The integration of knowledge presents a dual characteristic: an objective aspect that manifests itself in the curriculum and program design and in books, and a subjective aspect that is expressed in the student's mind and acting.

For Edith Litwin (Litwin, 2007), *to integrate*, according to the teachers, means that students give meaning to the knowledge previously acquired, that is to say, recognize the origin, value and link to other topics or problems. Learning specific contents becomes meaningful according to how it can explain problems and how it relates to other topics avoiding disarticulation into fragmented concepts. When knowledge is presented in fragments, the student will be responsible for integrating it since in many occasions loose and disperse knowledge cannot be utilized (García Martel, 2006).

Mora Solano (Solano, 2004) quotes two ways of integrating contents in the curriculum:

- Sum of subjects: this is not just putting together contents of different subjects. It is the teacher who establishes the links among the topics and the meaning of that. If the teacher stops showing these connections, the student will stop integrating knowledge.
- Interdisciplinary approach: the emphasis is on the links among areas with the intent of sharing the viewpoints of different disciplines about a topic (Solano, 2004).

However, the importance of teaching with a disciplinary approach cannot be denied, since it allows investigating and going into detail about a particular object of study.
One of the problems that motivated this work was that students frequently express 'not perceiving clearly the meaning or benefits of the contents to be learnt', especially in basic subjects attended in the first years of the course, or else they reach the last years 'without remembering the contents of the basic subjects'.

Our concern in relation to the problem of theory-practice and basic-clinical articulation in the training of healthcare university undergraduates has led us to propose the research project called Areas of integrated knowledge in the curriculum of the Faculty of Dentistry of the National University of La Plata: Basic knowledge and its recovery in the clinical subjects. The objective of the project is the identification and analysis of the ways of articulating the basic contents in the clinical subjects, based on the case of the subject Histology and Embryology, the entity performing the project being the Instituto de Investigaciones en Educación Superior (IIES).

Within this context, the present experience emerges with the objective of promoting meaningful learning and the integration of basic-clinical contents through the application of an innovative teaching strategy in a group of students of the subject Histology and Embryology. Different activities were proposed, in which students should recognize the benefits and approach of the contents of Special Histology and Embryology (Oral Healthcare) in the literary sources referred to clinical specialties. In addition, the academic performance of the course accreditation was compared.

MATERIALS AND METHODS

The study was descriptive transversal. The students were attending Course II of the subject Histology and Embryology (first four-month term of the second year of the course of studies). The group of students to be assessed was named Group A (21 students) and other groups attending classes at the same time were selected (Group B and Group C), but the teachers in charge applied a different methodology. In all the cases the methodology was working with small groups of 4-5 students.

The contents selected corresponded to the following topics: *stages of tooth development, dentin-pulpar complex* and *periodontal protection*. Each topic was approached following specific instructions. The topic *stages of tooth development* was first covered in a practical work using the literary sources recommended in the course of Histology and Embryology. Then students should consult a clinical bibliography on Pediatric Dentistry and establish the differences and similarities between the concepts of histology and embryology presented in the subject and those in the textbook consulted. Moreover, they had to establish the clinical applicability of the topic addressed. The conclusions of the activity were shown in the group.

The topic *dentin-pulpar complex* was approached in class from the point of view of its histological structure. Then, students were instructed to find a scientific article in Spanish or in English, in print or electronic journals, approaching that histological content but with a clinical viewpoint. The selected article had to refer to the use of materials or to the study of the clinical behavior of those tissues. As a requirement, it had to contain images of light and/or electron microscopy of the topic indicated, in which students should identify the histological structures. Brainstorming consisted of an oral presentation using digital resources with the instruction of quoting the article, mentioning the objective and methodology used and analyzing the images.

The work on the topic pr*otective periodontium* consisted in the elaboration of a comparative chart of the contents *gingiva, junctional epithelium, Nasmyth's membrane and alveolar mucosa* mentioned in the clinical and topographical description, histological (epithelium/lamina propria/submucosa) and histophysiological structure, using clinical bibliography on Periodontology and the Oral Histology and Embryology book recommended. In this practical work the teacher explained only the general aspect of the topic and students independently developed the contents presented. The brainstorming of the chart was done establishing similarities and dissimilarities in the description of the different contents.

The work done was evaluated in groups and individually. During the process, it was assessed as group work with a report presented by every group in every practical work, and the result was assessed with the personal opinion of every student of the strategy presented at the end of the course. Apart from that, the academic performance of that group was compared with that of other groups attending classes at the same time (named Group B and Group C) whose teacher had not applied the same methodology. The examination model used for the integrated instance of the subject was written, with structured questions, images and diagrams to recognize and complete, while in the other groups the examination model was oral.

RESULTS

It was observed that, in general, students were able to identify similarities and dissimilarities between the terminology used to approach the same contents in the different literary sources. In the topic about *tooth development* they found differences in the classification terminology used in the bibliography recommended by the Department Chair and the one used in the specialty Pediatric Dentistry, for example, the *cap* in the so called *cap stage of tooth development* is referred to as *casquete* in the basic literature and *caperuza* in the specialized literature. Likewise, students observed a greater amount of images of histological sections and more detailed diagrams in the book of the basic literature. It was pointed out that in both literary sources the contents were completely developed. One group made the comparison using two histology textbooks, evidencing they had not understood the instructions.

The work done with scientific articles by the students was quite appropriate, as regards the usefulness of the histological knowledge in research work. Students were able to interpret the methodology and the histological techniques used and were able to recognize the histological structures in the images presented.

With relation to the topic pr*otective periodontium* students mentioned different terms to name and *Nasmyth's membrane were replaced* by *adamantine membrane* or *cuticula dentis*. Some groups were not able to establish the relationship between these last terms and pointed out that the Nasmyth's membrane was not explained.

In all the cases the clinical-pathological approach of the topics was recognized in the specialized literature. Moreover, students could establish that the contents studied that corresponded to the subject Histology and Embryology were described more deeply and in more detail than in the clinical bibliography. It was also recognized that basic knowledge is necessary for clinical application.

With respect to the personal opinion assessment, it was done by 17 students, 13 of which expressed that the methodology employed had been interesting since it had allowed them to see other points of view, get more involved in the topic, appreciate how fundamental histology is. Two other aspects could also be recognized, the most closely-related points in different subjects and knowing that what we are learning is important for our future. Some commented that this methodology makes the student interact and makes the lesson more dynamic.

Furthermore, it was also highlighted that anyway, the teacher's explanation is necessary; the teacher's explanation in class is convenient and interesting, so that afterwards we can deal with the work conscientiously.

However, 4 students manifested their dislike when working with other books as they expressed I prefer to be explained the issue or that a structural lesson should be tried and then compared to a different lesson or that they like dealing with histology topics in detail.

The academic performance of this group (Group A) at the moment of taking the integrated examination (2nd partial exam) at the end of the four-month term was the following:

- out of 21 students, 6 students were promoted (with grades *7*, *8* and *9),* 12 were regular and 1 student received credit after the first retake. The non-regular students were 2 since they did not appear for the retakes.

In the other groups the following final scores were obtained:

- **Group B:** out of 20 students who were present for the integrated examination, 2 students were promoted (with grades *7* and *9)*, 7 students were regular, while 11 students obtained their regularity at retakes.

- **Group C:** out of 22 students, 4 were promoted and 7 students were regular at the time of the integrated examination; at retakes 10 students remained regular and one student non-regular.

DISCUSSION

According to Águila [(Águila, 2002)] the topic contents should be organized into activities favoring globalization. It is expected to overcome learning fragmentation so that the student constructs strategies that allow establishing new significant relationships among varied contents, thus being able to learn meaningfully.

The teaching strategies presented in this work differ from others since, based on the histological knowledge, they evidence the relationships of that knowledge in the specialized clinical and scientific field. Likewise, the student values the importance of basic knowledge for understanding aspects that will be approached in their future training.

Mora Solano [(Solano, 2004)] states that the teacher is the one who should establish the relationships and links among the contents so that the student can integrate them. In this experience, students expressed the relationship existing between histology and embryology contents and the contents of clinical specialties.

Eleonora Badilla Saxe [(Badilla, 2009)] proposes a curricular construction where contents could *be repeated* in the different units but caring that the perspective was different in each unit. In this case, students acknowledged that histology and embryology contents are present in the clinical literature, but they are approached with different depth levels and the focus corresponding to the specialty. As the subject Histology and Embryology is studied in the first years of the course, it is necessary to design learning strategies that develop in the student the capacity of elaborating and organizing information, fostering a deeper understanding and more efficient retention of it [(Elosúa, 1993)]. In this way, the information stored in long-term memory is likely to be recovered to be used in different situations. The recovery procses will closely depend on the processes carried out in the elaboration and organization of contents, so that when images, diagrams, categories, and the like are used, contents will be facilitated. The strategy employed consists in relating the histology and embryology contents with contents that are part of the different specialties in dentistry, thus showing the relevance of the basic knowledge. Even though in other teaching strategies used for this subject the use of specialized literature is considered, it had not been approached from that perspective for the student to recognize the basic knowledge, the similarities and differences in terminology, the utility, approach and need of recovery in the last years.

A graphic way of expressing the conceptual structure is a trunk and its branches, where all new information needs to be connected with the branches of information preexisting in the individuals. The interaction between both modifies the initial structure and is called *learning* [(Diaz Barriga, 2005)]. As students make progress in their training course, they need the previous knowledge of the basic disciplines for the acquisition of the new knowledge, especially with relation to specialties. It is important to consider that for the recovery of knowledge it is necessary to indicate the terminology problems among different disciplines. In a previous work [(Goin, 2007)] that analyzed the difficulty faced with the different terminology used in the textbooks related to the microstructure of tooth enamel, the need of finding a univocal nomenclature of the words and concepts is

shown, not only because of its theoretical importance but also because of its consequences in the dental praxis. The consistent use of terms and concepts related to histology and embryology contents becomes also interesting for the recovery of basic knowledge in the clinical subjects.

It is possible that students of the same class can live different experiences even when the external conditions are the same, as Tyler (Tyler, 1998) poses. This becomes evident because some students *did not like* the methodology applied. Morán Oviedo (Morán, 2004) claims that there is an implicit contract in university education that is expressed in the formula *lesson-notes-exam-credits* and that it should be replaced by *self study-tutoring-work-evaluation-satisfaction.* At this point, the way the teacher acts becomes relevant, since the teacher's mission is to provide the situations and experiences that allow the acquisition of knowledge for the academic development and the professional practice, in an atmosphere of interpersonal relationship and taking into account that in many occasions the teacher needs to re-educate, and then to educate. The student should get involved in learning with the activities proposed by the teacher and not only with the repetition by heart in order to obtain credit for a course. As Elosúa suggests, in learning, apart from the cognitive factors and strategies there exist other motivational factors (Elosúa, 1993).

We highlight in the academic performance in group A expressed at the student's final instance that 18 students out of 21 (85. 7%) were present to take the end-of-year exam and passed it, and one student passed in the first retake. In the other groups (B and C) 45% in group B and 50% in group C passed in this instance. Even though the number of students in this experience was reduced, we can infer that the work in class, together with the student´s commitment in the topic favored the accreditation at the end of the course. In the other groups, students had to resort to retakes to pass the exams.

CONCLUSIONS

This teaching strategy constitutes an alternative that allowed the student to know the utility of the Oral Histology and Embryology knowledge in an interrelated context with a clinical approach, bearing in mind the way in which those contents will be recovered in the higher courses. Students expressed that in the subject Histology and Embryology knowledge was dealt with more deeply and in more detail than in the literature of clinical specialties, which is necessary to understand the clinical knowledge and transcendental for the future. Unlike other methodology modalities, the emphasis of this proposal was more on the histology and embryology knowledge than on the clinical perspective. Likewise, it becomes necessary to overcome the terminology problems derived from translations or concepts. In this sense, the teacher´s role and the interdisciplinary approach acquire significance.

We highlight the commitment the student acquired with the activities proposed, which resulted favorably in the final examination of the course. We consider that this and other strategies that promote the active participation of the students are motivating and reinforce learning.

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