ACTIVE METHODOLOGY IN THE DIDACTIC TRAINING OF MASTERS AND DOCTORS: A DIFFERENTIATED PRACTICE FOR THE DEVELOPMENT OF TRANSVERSAL COMPETENCES

M.A. Motta Barreto, E.J. Candido Moraes, D.S. Giordani
EEL-USP (BRAZIL)

Abstract

Our society has undergone countless and varied influences coming from the scientific, technological and sociological scope. These influences reshape the behavior and motivation of young people, which points to the increasingly urgent need to train professionals with a critical capacity to properly analyze the messages they receive and to make responsible decisions at all levels. Being an inherent process of society, teaching is impelled to reformulate old practices, from basic to advanced levels. In this trend, it is fundamental that the university environment be stimulating and replace practices of exclusive transmission of knowledge. Thus, new teaching practices have been developed in recent years. Based on several of them, this work had the objective of reporting an experience of didactic-pedagogical training of future masters and doctors in the area of engineering, sensitizing them to issues related to new methodologies of teaching and learning, from their own experiences with a differentiated method. This is a program of the University of São Paulo, applied at the School of Engineering of Lorena, where the programmatic content is put into practice in an unusual way. The results, obtained from the statements of graduates of the discipline, indicate a great acceptance of the practice and perception of real development of abilities favorable to the current demands of teaching excellence.

Keywords: active methodologies, higher teaching, transversal competences, teaching-learning process.

1 INTRODUCTION

The current society is changing at a very fast pace, which is due, in large part, to the great amount of information transmitted by all the media. This is reflected directly in the teaching process, at various levels, from the basic to the higher and, in our case, at the graduate level, is also similar.

Due to these changes, the teaching-learning process has been remodeled and can no longer be restricted to the traditional methods used, often indiscriminately. Starting from the traditional teaching model, where the teacher holds the knowledge to be transmitted and the students are passive receivers of contents, often separated from their everyday reality, we have been, in the last decades, moving towards the consideration of more innovative aspects of educational practices. The emphasis on promoting information-based learning may have been appropriate for previous generations, but fails to meet the demands of students in this contemporary society [1].

Particularly in the area of sciences, it is necessary to emphasize and train problem solving, scientific thinking, the use of multiple languages and argumentation [2], which requires the use of new teaching strategies. Thus, thinking about the professional training of young people who will soon enter the world of work, it is necessary to promote, more and more, the approximation of academic reality with the reality of the labor market outside the university. Significant learning, according to Auzubel [3], becomes a goal in the various teaching practices.

In the case of professionals who will be in contact and in action in the training of other professionals, since these are future masters and doctors who will follow the academic career, which involves research and teaching, care must be taken so they can develop critical thinking, creativity, cooperative work, and other skills, called transversal. Such competencies can be recognized as a grouping of resources that can be triggered to solve various problems, considering the integration of the cognitive, emotional and social dimensions. Such grouping encompasses theoretical knowledge, diverse personal resources and ethical principles duly situated in the context to be considered [4], [5], [6], [7].

In order to achieve the objective of favoring the development of such competences, it is fundamental that the differentiated teaching practice is established, more and more, based on the concept that the
teacher has the role of guiding and directing the students’ activities, being a mediator in their performance [8].

In this sense, this work exposes the practice of acting in a didactic teaching discipline with groups of master and doctoral students in the area of exact sciences. In the case of a pedagogical preparation discipline, the objective is to sensitize and provide subsidies for a future teaching practice in tune with the contemporary principles of teaching performance.

The course is part of an educational improvement program, developed by one of the largest Brazilian universities, offered for postgraduate students (master’s and doctoral). In this case, we reported the experience in a university unit that offers postgraduate courses in: Materials Engineering, Industrial Biotechnology, Chemical Engineering and Educational Science Projects.

2 METHODOLOGY

For the present study a survey was made from the spontaneous report of students who did the didactic preparation internship and the supervised internship, in the years 2016, 2017 and 2018. All the students considered here completed the two stages of the program of improvement of teaching. The first step, that of didactic preparation, is the one that serves as the basis for this article and refers to a discipline called Didactics and Practice of Engineering Teaching.

The course provides a maximum of 30 students per entry, and has been offered annually. Students, who may be enrolled in any of the postgraduate courses, offered by the university, have diverse training, namely: Bachelor of Marine Biology, Bachelor of Biochemistry, Bachelor of Biotechnology, Bachelor of Biological Sciences, Bachelor of Engineering in Agribusiness, Bachelor in Technological Chemistry, Bachelor of Engineering Bioprocesses and Biotechnology, Bachelor of Food Engineering, Bachelor of Metallurgical Engineering, Bachelor of Chemical Engineering, Bachelor of Chemistry, Bachelor of Environmental Chemistry, Bachelor of Mathematics, Biochemistry, Biological Sciences, Dental surgeon, Agronomist Engineer, Biochemical Engineering, Biotechnology Engineering, Chemical Engineer, Food Engineering, Industrial Chemical Engineer, Materials Engineering, Mechanical Engineering, Nutritionist, Physical Engineer, Industrial Microbiology, Zootechny.

The timetable of the didactic preparation stage is sixty hours, including face-to-face and non-face-to-face study hours, distributed in fifteen weeks of class.

The first lecture is used to present the program, the methodology and to introduce and explain important concepts about the teaching and learning process. In this lecture, information about learning theories and cognitive aspects of human behavior are presented.


The discipline development methodology foresees that, in the first lecture, topics are distributed to groups composed by students and that each week a different group plan, prepare and lead the development of a two-hour class. In addition to planning and preparing the class, it is mandatory that all members of the group individually lead the class at a certain time and that there is interaction with the other students in the room.

The content to be presented by the group is randomly chosen by the teacher in the first lecture. Clipping, bibliography, and presentation strategies are the responsibility of the group. As requirements to be considered in the classes are: oral presentation of content on slides, use of short videos illustrative and / or enlightening, data from recent research on the subject and activities to be developed in the classroom applied to all students.

After each presentation, the evaluation of the group takes place. At first, all students evaluate the presentation, from an individual evaluation form that must be completed in all classes. In this sheet, the preparation and presentation of the slides, the ability of each student, selection of the information, if appropriate and current, logical sequence of the presentation, observation of the guidelines for
presentation of the subjects, among others, are considered and punctuated. Later, the students are reunited in the groups to which they belong and give the feedback of the group that presented itself.

Feedback is an immediate, objective, and direct response on group performance. It addresses the positive aspects of the presentations and all those that should be different and need to be improved. The group itself evaluates and also provides feedback to the class. This is one of the most important moments from the point of view of regulating behavior. To each group, after feedback, the improvement in student performance is noticeable.

In the week following the presentation of the proposed content, the same group is responsible for evaluating the learning of the other students in the classroom, developing, applying and correcting a written evaluation. The evaluation is composed of several questions and answers elaborated by the group, sent to the responsible teacher in advance, for correction and selection of the questions that will effectively be present in the test. On the day of the evaluation, the selected questions are presented and, after correction, which is done by the group itself, the responsible teacher makes the sample correction to guarantee the standardization.

At all stages, the teacher responsible for the discipline accompanies and guides the students. This monitoring is done in person, in the teacher's office, or by e-mail.

The last stage of evaluation happens at the end of the semester, when the students deliver an article on the subject: Teaching in the Graduation that, together with the grades of each individual evaluation that happened during the semester, plus the grade of the presentation, composes the final grade of each student. We consider, in developing this stage, that the methodological strategies chosen and employed in the teaching process are as important as the content to be taught [9]. Thus, regardless of the practices already known, critical thoughts and analyzes on them, developed in a differentiated way, attribute the novelty to the process and allow more action of the students. After the didactic preparation stage the student can apply for an internship in any compulsory subject of undergraduate courses, earning a scholarship. If the student fails to earn a scholarship, he/she can do it on a voluntary basis, without receipts. It may happen if they do not meet the requirements established in the public notice or the number of scholarships offered in the semester is less than the number of those interested in the internship. The practice of the internship includes the fulfillment of a plan approved by the supervisor, who is the teacher responsible for the discipline, and generally contemplates the monitoring of all the activities of the teacher during a semester, from the preparation of the classes, assessments, exercises, including corrections and guidelines. In addition to the follow-up, the intern is allowed to develop a class, under supervision, for the class in which he/she is performing the internship.

After the end of the second stage, both the intern and the supervisor must complete a report and an evaluation form, respectively. Both contain a field for comments and suggestions. It is from this field that the considerations stated here have been withdrawn.

In addition, it is mandatory to present the experience with the internship after the end of it, in an event in which all interns and supervisors participate.

3 RESULTS

The reports of ninety students who participated in the first phase of the educational improvement program between 2016 and 2018 were considered.

The reports were drawn from two sources: the presentation made at the end of each semester and the final report that the students deliver after the second stage of pedagogical preparation, which is the stage in which they properly accompany a teacher during a semester. In this monitoring, they assist in the preparation of classes, choice of methodologies, in the elaboration, application and correction of exercises and exams, registration and update of grades and in the planning and conduction of a class in undergraduate level, always in the presence of the teacher responsible for the accompanied discipline.

The disciplines that were part of the internship, in the three years considered, were the ones indicated in Table 1 below:
It is possible to observe that, every year, more teachers are accepting interns. The reasons identified in the final reports and placements made at the closing meetings attest to the acceptance that both the supervisor and the intern positively evaluate the experience in the program. In fact, some of the interns choose to take a new internship even if they do not receive a scholarship, since there are sometimes more candidates than vacancies. This situation corroborates the positive evaluation done by the trainees and supervisors in the final report. As for the reports of the trainees, we highlight those that have a direct relationship with the stage of teacher preparation. In the reports there is a frequent complaint about the practice of being able to conduct a single class. Many interns say they would like to apply more than one class, the maximum number allowed by the program. They claim that more than one class would improve their performance, similar to feedback in the preparatory stage. We observe here that the use of this evaluation strategy is considered positive in the change of behavior.

Another aspect that stands out is the application, in practice, of what is seen in the discipline of pedagogical preparation. The reports state that many of the classroom activities could be used in the preparation of the lesson and could be observed in the performance of the supervising teacher of the

<table>
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<tr>
<th>Year</th>
<th>Receiving disciplines for trainees between 2016 and 2018.</th>
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| 2018 | Linear Algebra, Biology, Biochemistry I, Experimental Biochemistry I, Experimental Biochemistry II, Materials Science, Materials Science, Entrepreneurship, Enzymology, Chemical Process Engineering I, Basic Ecology, Quality Engineering I, Chemical Process Engineering I, Transport Phenomena II, Physics I, Fundamentals of Organic Chemistry, Foundations of Economic Engineering, Hydrometallurgy, Impacts and Environmental Adequacy, Introduction to Polymeric Materials, Introduction Materials Science, Reading and Writing of Academic Texts, Laboratory of Biochemical Engineering, Laboratory of Chemical Engineering I, Laboratory of Materials Engineering IV, Experimental Microbiology, Microbiology, Modeling and Simulation of Biotechnological Processes, Pyrometallurgy, Environmental Pollution I, Processes Industrial Chemistry II, Industrial Biochemical Processes, Experiment Planning, Mechanical Properties, Organizational and Work Psychology, Environmental Analytical Chemistry I, Inorganic Chemistry, General Experimental Chemistry, General Chemistry I, General Chemistry II, Environmental Analytical Chemistry II, Experimental Inorganic Chemistry, Inorganic Chemistry I, Polymer Chemistry, Organic Chemistry II, Experimental General Chemistry, Organic Chemistry II, Chemical Reactors, Fermentative Processes Technology, Production Engineering I, Microstructural Analysis Techniques, Materials Characterization Techniques, Chemical Thermodynamics Applied II, Biochemistry, Biochemistry, Applied Chemistry Thermodynamics I, Applied Chemistry Thermodynamics I, Biological Treatment of Effluents, Food Science and Biotechnology, Food Science and Biotechnology, Food Science and Biotechnology, Food Science and Biotechnology, Food Science and Biotechnology, Food Science and Biotechnology, Food Science and Biotechnology, Food Science and Biotechnology, Food Science and Biotechnology, Food Science and Biotechnology, Food Science and Biotechnology, Food Science and Biotechnology, Food Science 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internship discipline. This coherence and extrapolation are part of meaningful learning, which is desirable in teaching situations, as pointed out by Auzubel [3].

Another information brought by the interns is the fact that the observation that they begin to make in the discipline that they follow-up is remodeled by the learning that they obtained in the pedagogical preparation stage. The fact that they have to observe, point and evaluate the performance of the groups improves the ability to observe the undergraduate students who are part of the group in which the internship is developed.

Regarding the evaluation processes, they report that the criteria and types of evaluation learned, as well as the opportunity to elaborate, apply and correct evaluations were differential in understanding the complexity of regular evaluations.

Finally, many students claim to have been sensitized to new practices in teacher performance. The fact that they had contact with different teaching methodologies, and having practiced according to the methodology used in the classroom during the pedagogical preparation, made them more critical about the possibilities of teaching performance.

4 CONCLUSIONS

The educational improvement program, according to the participants’ notes, has been achieving its objective. Being carried out in two stages, it prepares and allows the practical evaluation of the application of the teachings developed in an active and direct way.

Each year, more teachers are interested in opening the doors of their disciplines to the interns and more interns demonstrate motivation to participate in the activities.

The participation of students in class during the pedagogical preparation stage is active and constant. Several activities are carried out, which together lead to a simulation of teaching practice.

The feedback made by all reflects the good use of the preparatory teaching activities.

In particular, the pedagogical preparation stage, which is the object of this study, is seen as facilitating the performance of future teachers, and the teaching strategies employed are designed as promoters of differentiated teaching practices.

REFERENCES


