

CHAPTER 3.

**WRITING TO LEARN BIOLOGY
IN THE FRAMEWORK OF A
DIDACTIC-CURRICULAR
CHANGE IN THE FIRST YEAR
PROGRAM AT AN ARGENTINE
UNIVERSITY**

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Reading and writing are essential practices for learning disciplines. Based on this idea, at biology courses of the first year at University of Buenos Aires (UBA) we have been working for ten years with writing to learn cellular biology. In this article we present the difficulties that students face when writing about biology, we describe our work during the classes with writing tasks and also we mention the challenges we continue to face as professors committed to our students' learning. Giving writing a space in the classroom represents an effort not only for students, but also for the teachers, especially when our teaching is done in large classrooms. Nevertheless, the results that we are obtaining in terms of the number of students who pass the class, in the quality of texts they write and in the students' commitment to their own learning are evidence that it is a worthwhile endeavor.

In order to understand the concepts of any field of knowledge and education, it is necessary to appropriate languages and specific ways of explaining, relating, representing, debating and communicating them. In contrast to what most university professors hold true, we believe that the practices of reading and writing—which are essential to the learning of any discipline—cannot be learned until the student experiences situations of written production and bibliographical research within the area (Carlino, 2005)

Based on this idea, in our Biology course within the Basic Common Cycle (CBC) at the University of Buenos Aires (UBA), we have been working for more

than a decade on activities that incorporate writing as resources for learning about cellular biology, the discipline we teach. In this article, we present the difficulties that students face when writing about biology, the advances that we have made in implementing the didactic strategies aimed at facilitating such tasks, and the challenges we continue to face as professors committed to our students' learning.

THE INSTITUTIONAL CONTEXT

In 1985, the CBC was instituted as part of the democratic processes begun in 1983 in Argentina after a seven-year military government. The CBC is the first-year curriculum for the 70+ degrees offered by the UBA, the largest free public university in Argentina and also one of the most prestigious. At the CBC, twenty-two subjects are given each quarter; each student must take six of these subjects, based on the degree program that he or she has chosen. The student body of the CBC is heterogeneous in terms of its sociocultural level. In fact, the more than 50,000 students who enter the CBC each year come from both private and public high schools whose educational levels vary greatly. The students are distributed among ten different branches of the CBC in the capital city and Greater Buenos Aires. At each branch, the courses are organized by one or two professors and coordinated by a professor who is entrusted with establishing the educational guidelines.

In the last few years, CBC professors have reported that their students find reading and writing tasks more and more challenging. In spite of this problem, which can partially be attributed to the educational crisis at the high school level in Argentina, little has been done at the university to address it. Maybe one exception is the reading and writing workshop for students who choose a degree in the social sciences.

One of the subjects that is given at the CBC is biology, a class that is mainly focused on cellular biology. This subject is obligatory for all who are studying towards degrees related to living creatures, agricultural production, and health. Approximately 8,000 students take Biology each quarter at the ten branches of the CBC; the groups generally include over seventy students each. From the beginning, the teaching of this discipline was based on a reductionist approach to living structures and a transmissive didactical tradition. These concepts take form in lectures that involve scarce participation on the part of students, a great quantity of information on the subject and student examinations that are generally multiple choice.

This traditional approach to teaching biology sparks little interest among students, leading them to drop the class and evaluate the subject with disap-

proval. Due to our discontent with the results and our belief that what was being taught and the way it was being taught contributed little to educating students as citizens and future professionals, in 1996 the Biology professors at the North Region Branch of the CBC decided to work towards an innovative reform of the curriculum. This reform has been based on political, epistemological, and didactical considerations.

BASES FOR THE DIDACTICAL CHANGE IN THE CURRICULUM

First, we understand that as teachers committed to public education, it is our responsibility to facilitate the accommodation of a heterogeneous student body in the university sphere. At the same time, we should promote the learning of content important to their future careers and help them develop the cognitive abilities they require to do so.

Second, innovation is based on a systemic conception of living beings which, unlike the reductionist approach, conceives of them with a two-fold epistemological approach: as a whole with a historical, spatial dimension that interacts with its environment, and as the result of a great number of metabolic and physiological processes (Meyer et al., 1979; Morin, 1990; Lewontin, Rose, & Kamin, 1996). Our curriculum is based on analyzing cellular processes in order to understand the properties of the living beings, the relations among living beings, and connections between such beings and their environment. In this regard, instead of emphasizing the acquisition of a great quantity of information and terminology applicable to cellular biology, we organize relationships in hierarchies (organisms, cells, molecules) and on the articulation of different curricular topics in order to explain specific biological events. We are thus able to establish a dialectical relationship between theory and practice (Lucarelli, 2009).

Finally, our teaching rests on a constructivist conception of learning, which we understand as an event that results from continual, repetitive interaction between the experience of the subject, the student's previous knowledge, his/her emotional and cognitive structure, and the object of learning. In the process of learning a discipline, the following all play fundamental roles: the significance of the content to learn, its functionality, and the development of cognitive and meta-cognitive abilities and strategies (Giordan & De Vecchi., 1997). In addition, and based on the idea that the construction of disciplinary knowledge is a social event that involves appropriating a conceptual and methodological system, the learning of an area of knowledge requires that students develop a

verbal language for the communicative interaction with others (Jorba, Gómez, Prat, 2000).

COMMUNICATION PRACTICES IN THE BIOLOGY CLASSROOM

Given the importance that we assign to communication in learning a discipline, we have organized different channels for oral and written communication in our classrooms. With respect to orality, we alternate moments of work-related lecture with small groups whose productions are then discussed in the lecture hall. These strategies make the class more dynamic and give students a feeling of belonging, facilitating the flow of information. However, there are several obstacles that make it difficult for individual learning to occur in large classes. On the one hand, few students dare to express their ideas before their classmates. In addition, oral communication allows for little time to reflect on what is heard and said. This feature of oral communication is counterproductive for a population of students who are unaccustomed to thinking before giving their opinions and to answering questions whose response requires some type of elaboration.

For their part, reading and writing are two important methods for accessing knowledge at the university level. However, it is generally believed that students at this level do not require guidance in order to read class texts or to produce academic papers. In our subject, we have been focused for many years on helping students utilize the written word in an interpretative way, and not as a labeling system that involves an endless list of processes, structures, and molecules (Sutton, 2003). To achieve this interpretive learning within the subject of the school and our assessments, we confront students with different problems and challenge them to write about these problems. Some of these activities are aimed at relating a certain molecular process with other events that occur in the same cell, in other cells within the organism, or in other living beings. Others are meant to have students explain biological events and/or justify whether statements on certain disciplinary issues are true or false. We believe that in activities of this kind, writing can become a practice with epistemic potential, an unbeatable resource in learning the subject from a systemic viewpoint.

For the biology professors, analyzing the texts of students and reflecting on the contributions that we can make to facilitate writing was a process of denaturalization, one that involved critical reflection on our own practices as writers and editors of biology-related texts. On this path, we established fruitful contacts with other university professors who incorporate writing practices

when teaching their subjects. At the same time, some of the professors began post-graduate studies on writing and reading. Thus, through a recursive process between reflexive teaching practice and theory, we worked to construct a corpus of knowledge and questions that guided our work as professors.

WRITING IN BIOLOGY: OBSTACLES, DIDACTIC STRATEGIES, SUCCESSES AND CHALLENGES

For a long time, our only access to the written productions of students was through written examinations. By evaluating these products, we were able to identify different kinds of difficulties related to (a) the construction of disciplinary concepts, (b) the use of these concepts to explain specific biological cases, (c) the lack of knowledge of ways to explain that were characteristic of the natural sciences, and (d) linguistic problems that do not allow the professor to understand what it is that the student wants to communicate.

With the goal of helping our students confront these difficulties, five years ago we began to promote writing assignments throughout the quarter. This task was accompanied by suggestions on the possible strategies to be utilized as resources to plan the assignments. Some strategies are geared toward coming up with guidelines for relating different subject-related concepts. These include putting together a network that functions as a textual plan and the drafting of a conceptual aura of a certain term, a concept used by Giordan and De Vecchi (1997) to refer to expanding a concept. Other strategies are aimed at clarifying the characteristics of explicative texts and putting them into practice to streamline their use.

Experience has shown that students become committed to writing when the teacher is able to explain the importance of the task, provide students with continual feedback, and thus convince them and stimulate them to write. We are currently working with two types of texts written by students: (a) productions that are the result of some of the activities of the course material, geared to connecting subject-related concepts and (b) questions that the professor asks students to prepare after completing each subject unit in order to gather information on pending doubts and/or questions. With respect to the first type of writing, the assignments are returned with comments by the professor. Over time, we have varied the kind of feedback we provide as professors: at the beginning, we simply made corrections, but we now avoid intervening in the texts and instead make footnotes with suggestions, encouraging students to rewrite when necessary. Most of the suggestions are related to conceptual errors, lack of relevance, cohesion and/or coherence of certain parts of the text, and the lack

of punctuation. For their part, the questions posed by the students are a very useful resource for the professor because questions give him/her a view into the aspects that have not been sufficiently explained during classes. After being analyzed, the questions are answered in the following class.

The students who respond favorably to the writing instructions and who read the professor's feedback express that writing helped them learn biology. Through semi-structured surveys, some of them stated that writing was useful when learning concepts, because it made them familiar with the subject-related vocabulary; for their part, the teacher's observations assisted them in detecting their mistakes. In addition, "When preparing the texts, it is necessary to reread the concepts and better understand them, and relate them with other processes." To put it differently, writing this type of text "helps [me] to relate the terms and thus better understand the concepts." Other students mentioned that writing offered them a different way to study than that which they were accustomed to; generally, they were limited to studying "book texts without providing my own explanations"; in these cases, texts were "simply memorized if I couldn't understand the explanation." On the other hand, this systematic work "helps me to avoid postponing." In addition, students admitted that writing helped them "be clearer and more coherent in terms of determining what is most important, what is least relevant, and also to express myself better." Similarly, teacher comments helped them "give the reader a context...not just act as if they already knew things, but explain everything." Finally, students valued the chance to prepare questions on the aspects they had not understood about each area and get answers to these questions because "I may have some of the same doubts as the other students."

In spite of the success in establishing writing as a way to learn biology, there are at least two challenges that remain which merit additional actions in the future. In the first place, we still have not managed to get all of the teachers in the course to address writing with their students. It appears evident that it is difficult for professors to diverge from the teaching models they learned and that doing it requires much critical reflection on the teaching practice. In this process, the joint work of two professors in each classroom proved highly useful. However, having two teachers in a classroom is not always possible due to institutional limitations; making this possible would help professors who are not as committed to their students' writing learn the strategies used by colleagues who are more aware of the importance of writing to learn.

The second challenge is related to the comments we make on students' written assignments. The form and content of the comments vary from professor to professor, depending on their own experiences as writers and their implicit

or explicit conception of the role of professors in facilitating student tasks. This disparity necessitates activities aimed at reflection, perhaps in conjunction with specialized professionals who can help us give a name to the methods used by different professors in order to discuss and prepare a more rational strategy on which professors all agree.

CONCLUSIONS

The construction of knowledge is a social process in which communication and dialogue play fundamental roles.

The experience of professors and students suggests that in response to guidelines established in the subject in the framework of a didactical-curricular change, the practice of writing can have important epistemic value. This value grows when writing is inscribed in a dynamic dialogue: students write and professors return the papers with comments and/or suggestions or with verbal answers.

By concerning themselves with the writing of their students, the challenge for professors is twofold: it involves making students familiar with the kinds of writing within our subject area and denaturalizing our practices as “expert” writers to identify the strategies that we use and thus be able to teach them.

Finally, giving writing a space in the classroom represents an effort not only for students, but also for the teachers, especially when our teaching is done in large classrooms. Nevertheless, the results that we are obtaining in terms of the number of students who pass the class, the quality of texts they write, and the students’ commitment to their own learning are evidence that it is a worthwhile endeavor.

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