

# THE DEVELOPMENT AND CHARACTERIZATION OF A SEQUENCE OF TEACHING ON SCIENTIFIC ARGUMENTATION IN THE IMMUNOLOGY CLASSES FOR HIGH SCHOOL STUDENTS IN HEALTH

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## **ABSTRACT**

The development of logical argumentative writing in science classes is an important skill in scientific literacy. Here we developed a sequence of Immunology classes that with reading, interpretation, analysis and development of a scientific text in the immunology classes of the Nursing course. The analysis of the material produced by the students showed an increase in the percentage of development of written arguments.

**Keys Words:** scientific writing; teaching of scientific arguments; immunology teaching.

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## 1. INTRODUCTION

The ability to formulate logical arguments is an important skill and competence in scientific literacy. Research in the field has shown the strategies to promote classroom argumentation by teaching students how to argue using structures from the argument of *Toulmin's Argument Pattern* (TAP) (ERDURAN *et al.*, 2004; SIMON *et al.*, 2006; SÁ & Queiroz, 2007). Immunology is an area of biological sciences that presents topics of high relevance in science classes for the training of critical health professionals, for example, on the importance of vaccines and global public health in the prevention of infectious diseases and epidemics. Here our aim was to develop and characterize a sequence of Immunology classes with the teaching of written argumentation for students of higher education in the health area.

## 2. METHODOLOGY

The sequence of the Immunology classes was carried out in 4 days with a total of 12 hours/ classes taught in the first year for 2 distinct classes of the Nursing course (122 students total). The activity of argumentation was prepared from the preparation by the professor of a text on "History of the vaccine" based on Lombard *et al.* (2007). To evaluate the development of the argumentative writings of the students, an activity card was constructed. This card consists of two exercises. A first aim exercise is that students recognize the parts of the structure of a logical argument: *Data*, *Justifications* and *Conclusions*, based on the structure of the argument proposed by Toulmin (2001), in sentences before and after reading the proposed text on vaccines; in the second exercise the students were engaged in writing a dissertation-argumentative text based on the question: "The Importance of Vaccines for Public Health." These exercises were applied twice in a similar way to the students, before teaching the structure of the argument denominated activity 1 (A1) and after teaching the structure of the argument, activity 2 (A2) (Table 1). The material of A1 and A2 were collected and analyzed for computation of the correct percentages of the objective questions and quantification of the percentage of the appearance of the structure of the argument in the writings produced by the students.

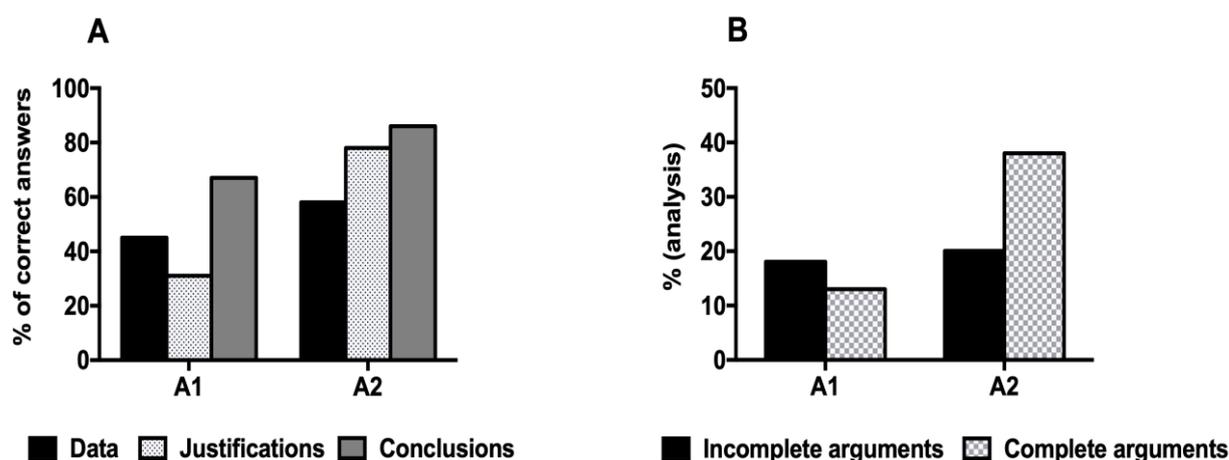
**Table 1.**

Structure of the activity of analysis and production of argumentative writings in the science and health classes of higher education.

Sequence of lessons	Procedures in class	Learning goals
1	A1: resolution of the exercises and essay 1 essay-argumentative: "The importance of vaccines for public health	<ul style="list-style-type: none"> <li>• Identify the structures of an argumentative text;</li> <li>• Write a dissertation.</li> </ul>
2	Presentation of the structure of the scientific argumentation, reading and analysis of the text: History of the vaccine: from the discovery to the challenges of mass immunizations in the 21st century "	<ul style="list-style-type: none"> <li>• Discuss the importance of scientific argument;</li> <li>• Interpret a scientific text;</li> <li>• Discuss scientific knowledge.</li> </ul>
3	A2: resolution of the exercises and essay 2 argumentative-essay: "The importance of vaccines for public health	<ul style="list-style-type: none"> <li>• Identify the structures of an argumentative text;</li> <li>• Write a dissertation-argumentative text</li> </ul>
4	Discussion on the importance of scientific writing	<ul style="list-style-type: none"> <li>• Validate the importance of scientific writing;</li> <li>• Evaluate the writings produced.</li> </ul>

### 3. RESULTS, DISCUSSION AND CONCLUSION

The analyzes of the exercises and writing produced by the students in the classes showed that the sequence of teaching of argumentation proposed helped increase the development of the percentage of written scientific arguments completed by the students when writing about the importance of vaccines for public health in classes Immunology. These data can be related to the increase of the percentages of identification of the argument structures (data, justifications and conclusions) performed by the students in the exercises (Figure 1A and B). The data obtained from our activity and analysis agree with the findings of McNeill *et al* (2006), Campaner and De Longhi (2007) and Sá *et al.* (2014) that the teaching of the argumentative structure propitiated the development of the argumentative capacity of the students in science classes.



**Figure 2.** Analysis of student writing. In A it is shown the percentage of correctness of the identifications of the structures of the argument of Toulmin by the students; in B is shown the percentage of the appearance of incomplete and complete arguments based on the structure of Toulmin produced in the writings of the students in the classes of Immunology.

In conclusion, teaching structure of scientific argument in immunology classes has been shown to be significant in the written argumentative development of students in nursing.

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