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Teaching trigonometry based on the meaningful learning theory and the conceptual field theory

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The present study sought to identify the previous knowledge a group of students possessed about trigonometry so that educational activities could be developed in order to teach, clarify and help students comprehend the related concepts. As an educator, I delved into Ausubel's and Vergnaud's theories in an attempt to help my students with conceptual and procedural difficulties to relate trigonometry to real life. Results show that identifying the students' previous knowledge and making the knowledge-in-action explicit results in a change of attitude both on the part of the student and on the part of the teacher.

Keywords: Mathematics education, high school, knowledge-in-action.

RESEARCH TOPIC

This applied study focused on the possibility of promoting learning in trigonometry by using a method based on the theory of meaningful learning and the theory of conceptual fields.

THEORETICAL FRAMEWORK AND METHOD

Ausubel and colleagues (1980) in his meaningful learning theory emphasizes the knowledge the learner possesses. According to it, teachers can identify the knowledge learners have in order to draw a map and outline a plan of how to teach them in an appropriate and significant way. Thus, meaningful learning is a process by which new information interacts with a structure of existing and specific knowledge, and as a result, there is a new piece of information, with new meaning. Vergnaud (2007) proposed a theory to provide a coherent structure and some basic principles to the study of the development of complex skills. Conceptual field is the set of situations, problems, relationships, contents, thoughts, and procedures that the

learners use to give meaning to a given topic to comprehend the real world. In this realm, both theories contribute to comprehend how empirical knowledge evolves into scientific one as well as how pedagogical activities support the process. A group of students from the 2nd year high school of a private institution answered a questionnaire with 6 questions aimed at clarifying the students' prior conceptions of trigonometry. The answers helped developing educational activities about (1) the definition of the trigonometric ratios; (2) the contextualization of the trigonometric ratios for the construction of an instrument capable of measuring heights; (3) the definition of the number π ; (4) the definition of the trigonometric functions in the trigonometric circumference; (5) the relationship between the congruous arches and the reduction to the first quadrant; and (6) the construction of plots for the sine, cosine and tangent functions. Right after the completion of each activity, there was a class discussion and the teacher intervened.

RESEARCH RESULTS AND IMPLICATIONS

Outcome analysis reveals that identifying the students' previous knowledge and making explicit the knowledge-in-action result in a change of attitude both on the part of the student and on the part of the teacher. The activities engaged the students, favored concentration as well as the clarification of doubts. They represented a possibility for the debate of ideas, an opportunity for reflection. Conceptual and procedural aspects of knowledge evolved from empirical knowledge into scientific knowledge.

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