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Editorial

Special Issue on Basic Sciences and Mathematics Teaching

This special issue of Acta Scientiae, focused on basic sciences and mathematics teaching and learning in engineering courses from different perspectives, offers readers an overview of contemporary national and international discussions on the theme. Composed of eight articles, this issue has the participation of 25 researchers, 19 from Brazil, four from Chile, one from Colombia and one from France. Thirteen different higher education institutions are present in the investigations, of which seven are Brazilian, four are Chilean, one is Colombian, and one is French.

In three articles, the analyses focus on cognitive aspects. In "*Teorema Fundamental del Cálculo: Requisitos Cognitivos y Limitaciones en el Aprendizaje de Tareas Matemáticas, uma investigação de cunho teórico*" [Fundamental Theorem of Calculus: Cognitive Demands and Learning Limitations on Mathematical Tasks], a theoretical investigation, the authors seek to analyse the levels of cognitive demand that are put into action from task statements, in exclusively intramathematical contexts, for teaching the fundamental theorem of calculus and the limitations in learning - errors, difficulties, and obstacles – that may result from such statements. "*Abordagem contextualizada da matemática na engenharia sob a perspectiva das disfunções cognitivas*" [Contextualised Approach to Mathematics in Engineering from the Perspective of Cognitive Dysfunctions], resulting from field research, present an analysis of the cognitive dysfunctions evidenced by students when solving a problem in which they articulated the real functions of a real variable to the study of the characteristic curve of a semiconductor diode, content linked to the analogue electronics. In turn, "*Mapas Conceituais: Instrumento de Avaliação da Aprendizagem Significativa de Estudantes de Engenharia na Disciplina de Pré-Cálculo*" [Conceptual Maps: A Tool for Assessing the Meaningful Learning of Engineering Students in a Pre-Calculus Course], present the results of an investigation in which a didactic sequence was constructed, experimented and analysed using problem situations from the area of science, technology, engineering and mathematics (STEM), to help engineering course newcomers to learn first-degree, exponential, and logarithmic polynomial functions. To identify signs of significant learning on the part of future engineers, the authors resorted to conceptual maps they prepared at different moments of their intervention.

The concern to provide opportunities for future engineers to build knowledge in the STEM area is also evidenced in the article "Integration of STEM Education in Differential and Integral Calculus classes: Aspects Evidenced in a Mathematical Modelling Activity". In the research that gave rise to this article, the authors, aiming to promote an educational environment conducive to the integration between the curricular units of basic sciences and mathematics in engineering, developed – from the question: *How do fixed radars found in urban areas and on highways work?* – mathematical modelling activities in a virtual environment within the scope of a differential and integral calculus course. There is also, among the texts that make up this special issue, another article in which reflections related to mathematical modelling are presented: "*Articulación entre el Ciclo de Modelización de Blomhøj y Espacios de Trabajo Matemático. Análisis de uma Tarea en Educación Superior*" [Articulating the Blomhøj Modelling Cycle and the Mathematical Working Spaces. Analysis of a Task in Higher Education], the result of an investigation aimed at analysing the possibility of complementing the theoretical framework mathematical workspaces with Blomhøj's modelling cycle. Based on data produced with the implementation, together with engineering students in an integral calculus course, of a mathematical modelling task developed from a real problem of high cognitive demand and covering the formulation, systematisation, and part of the mathematisation of the problem, the authors characterised the modelling activity from the network constituted by Blomhøj's modelling cycle and mathematical workspace.

Two articles in this special issue propose debates on assessments. The authors of "Concepção de Objetos de Aprendizagem com *Feedbacks* para a Autorregulação da Aprendizagem de Conceitos Matemáticos Necessários para o Cálculo Diferencial e Integral" [Conception of Learning Objects with Feedback for Self-Regulation of Learning Mathematical Concepts Necessary for Differential and Integral Calculus] present the design and evaluation of a learning object with immediate feedback related to mathematics concepts necessary for differential and integral calculus. They intend to promote individual student learning while using learning objects through which, by becoming aware of their errors, students expand the ability to think and solve problem situations, creating hypotheses and, thus, acquiring new knowledge. In "*Enunciações de estudantes de engenharia acerca da avaliação e seus papéis em disciplinas de física e de cálculo*" [Engineering Students' Utterances about Evaluation and Its Roles in the Courses of Physics and Calculus], the authors problematise, based on the testimonies of a group of engineering

students, the assessment practices developed by calculus and physics teachers and the purposes of such practices in the context of remote teaching.

Physics is also the theme in focus in the article "*Educação em engenharia: práticas pedagógicas interdisciplinares na engenharia civil*" [Engineering Education: Interdisciplinary Pedagogical Practices in Civil Engineering], in which the authors describe and analyse the results of an approach to physics based on interdisciplinary pedagogical practices, developed with an extension bias in the initial semesters of a civil engineering course, to enable students to play a more significant role in their learning processes.

Although the call for articles in this special issue included possibilities for reflections on the teaching and learning of other basic sciences in engineering courses, remarkably, six of the eight approved articles focus on mathematics. One of the remaining papers discusses assessment in mathematics and physics, and another article focuses exclusively on physics. We notice, therefore, that of the sciences that form the basis of engineering, the investigations presented in this special issue consider only two of them as objects of study: mathematics and physics. This same scenario has been observed in the meetings of the Basic Sciences and Mathematics in Engineering Working Group, linked to the Brazilian Association of Engineering Education and coordinated by the guest editors of this issue. In the discussions about teaching and learning in engineering, the engagement of many teachers and researchers in mathematics is evident, but a still rather timid presence of representatives of other basic sciences.

Therefore, we hope that the articles that compose this special issue can inspire teachers and researchers in mathematics education to continue their investigations on the teaching and learning of mathematics in engineering by reflecting from other perspectives. We also hope to encourage greater engagement in educational research on the part of those teachers and researchers whose focus of interest is the teaching and learning processes of other basic sciences in the education of future engineers. Enjoy the reading!

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