

LINEAR ALGEBRA AND COMMUNICATION AND MULTIMEDIA STUDENTS

Mariluce Silva^{1,}, Paula Catarino², Maria M. Nascimento^{2*}

¹Instituto Federal de Educação da Bahia, Campus Lauro de Freitas, Brazil and University of Trás-os-Montes e Alto Douro, UTAD, Portugal

²University of Trás-os-Montes e Alto Douro, UTAD and Research Centre on Didactics and Technology in the Education of Trainers, CIDTFF/LabDCT-UTAD, Portugal

ABSTRACT

Linear Algebra (LA) is a mathematical subject in almost all university programs. However, it has always proved difficult for students to learn. The main criticisms pointed out by students of the LA course concern the excessive use of formalism, the number of new definitions and results involved in learning a concept, and the lack of connection with mathematical knowledge already acquired. Also, some studies refer to emotional factors - attitudes and anxiety. In this context, to identify errors and difficulties and understand the students' reasoning when solving questions considered preparatory for learning LA, a questionnaire was given to 54 1st-year students who attended the LA course of Communication and Multimedia (CM) at a university in Portugal. This work was based on the framework of ontosemiotics by Godino and colleagues (OSA), who defined algebraization levels as the algebraic manipulations needed to develop algebraic thinking. In addition, we also considered elements of algebraic thinking: generalized arithmetic (GA), functional thinking (FT), modelling language (ML), abstract algebra (AA), and algebraic proof (AP). The questionnaire was given to establish the errors and difficulties in algebraic thinking through its elements. This qualitative, interpretative, and descriptive research aimed to identify which algebraic thinking elements the students had achieved. However, we found the presence of features of algebraic thinking in these CM students. The first question, referring to FT, had the highest percentage of correct answers (52 percent). In the following, the rate of correct answers decreased, and, above all, the absence of the requested justifications for the answers was noticeable. In the last two questions, referring to AP, less than two percent of the students did the appropriate algebraic manipulations but with incorrect justifications or arguments. Thus, students of this subject in higher education do not have the right level of algebraic thinking for learning LA.

Keywords Algebraic thinking · Algebraization levels · Questionnaire

References

- Dorier, J. L. and Sierpinska, A., Research into the Teaching and Learning of Linear Algebra. In: Holton, D., Artigue, M., Kirchgräber, U., Hillel, J., Niss, M., Schoenfeld, A. (Eds). The Teaching and Learning of Mathematics at University Level. New ICMI Study Series, Vol. 7. Springer, 2001. Dordrecht. https://doi.org/10.1007/0-306-47231-7-24
- [2] Godino, J. D., Batanero, C., and Font, V., The Onto-semiotic approach to research in mathematics education. ZDM - The International Journal on Mathematics Education, 39(1-2): 127–135, 2007. https://doi.org/10.1007/s11858-006-0004-1

^{*}*Corresponding Author's E-mail: mmsn@utad.pt*

VI International Conference on Mathematics and its Applications in Science and Engineering (ICMASE 2025)

- [3] Kaput, J. J., Teaching and learning a new algebra. In Mathematics Classrooms that promote understanding (pp. 133–155), Routledge, 1999. https://doi.org/10.4324/9781410602619
- [4] Pitta-Pantazi, D., Chimoni, M. and Christou, C., Different Types of Algebraic Thinking: an Empirical Study Focusing on Middle School Students. International Journal of Science and Mathematics Education, 18(5): 965–984, 2020. https://doi.org/10.1007/s10763-019-10003-6