EXPLORATIONS WITH LINEAR ALGEBRA LEARNING

ASUMAN OKTAÇ

Cinvestav-IPN

This talk will report on the results of an ongoing research project about the learning of linear algebra concepts. It will be organized into three main sections. In the first part some mathematical ideas will be explored in relation with notions such as linear transformations, eigenvectors and eigenvalues, bases and vector spaces; in some cases a dynamic geometry software will help or guide the exploration. The second part will focus on providing evidence from students' work as to how they think about these concepts and how they work on solving related problems. The third part will serve to explain possible ways to construct these concepts and difficulties associated to their learning, as well as to make pedagogical suggestions.

Examples of mathematical ideas: When working on the vector space concept a special emphasis needs to be placed on the distributive laws involving both operations at the same time, since through these laws coordination between the two vector space operations is achieved, which in turn sheds light into the vector space structure. Not all linear transformations are easy to "decode" in the sense of describing how they transform the space, even when working in R^2 or R^3; explorations with eigenvectors and eigenvalues can help to discover the nature of a linear transformation.

Examples of mathematical situations to work on: Connecting different representations of the same problem, generalizing properties from a lower dimension to a higher dimension, choosing representative regions in order to visualize the effects of a transformation.

Theoretical considerations: APOS Theory provides an initial approach in describing how linear algebra concepts can be constructed and linked with each other. Beyond programming activities which have been at the center of computer use within this framework, the role that dynamic environments may play in the construction of concepts is of interest.

The goal of this project is to keep converging towards an understanding of how linear algebra concepts can be learned and to propose resources that may help in that direction.