

THE ROLE OF TECHNOLOGY IN THE STUDY OF SEMIOTIC REPRESENTATIONS IN MATHEMATICS

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We assume that, in the realm of mathematics, a *representation* is a symbolic, graphic or verbal notation to express concepts and procedures, as well as their more relevant characteristics and properties. According to these properties, representations can be classified in *semiotic registers of representation* (Duval, 1999). In this work, we reflect on the role that technology plays into cognitive processes, and its relation with the semiotic systems of representation, which constitute the key point to understand the way in which students construct mathematical knowledge. We will consider the calculator as a mediating tool in that knowledge construction process.

A repeated argument against the use of technology in mathematics teaching is that student forget and drop what they do with paper and pencil, and that this fact is considered as a damage for the quality of their education. But in the same way that the writing is not an obstacle for mental calculus, neither the calculator is. Instead, the representations supported by this tool have features which makes them especially productive for the learning of mathematics. They are *executable representations*, that is, they can simulate cognitive actions independently of user of calculator.

The power of technology is mainly epistemological, as its impact is based in a reification of mathematical objects and relations (Balacheff & Kaput, 1996, p.469): the calculator allows them to be regarded as "manipulable" objects, and gives us the possibility of working "about" them. A calculator as the TI-89 or TI-92, supply a big number of representations of mathematical objects in different registers, and they allow making conversions between registers, and this is a valuable tool in mathematics education. In the environment supplied by this technology, we can obtain mathematical properties very different of those possible with paper and pencil.

This comes to emphasise the notion of executable representations. The abstract ideas and concepts of mathematics become to be real with use of calculator: they can be mathematically manipulated and transformed, as we will see in many examples.

References

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- DUVAL, R. (1999) *Semiosis y Pensamiento Humano*. Universidad del Valle, Colombia. Translation of the original French published by Peter Lang in 1995.