Chapter 21
Transformations of the Concept of Linear Function in Technological High Schools

Rebeca Flores Garcia
Instituto Politecnico Nacional, Mexico

ABSTRACT

The results shown in the following chapter come from a research that shows some of the transformations of the concept of linear function observed from its definition in mathematics when facing the written, intended and enacted curriculum. This study was developed in technological high school level, with the participation of three teachers of mathematics, who were teaching the course called Functions and Algebraic Thinking. A case study was considered as a practical research method to carry out the investigation, adopting various processes to gather evidence to describe, verify or create theory. Different sources of evidence were used to gather and analyze information, such as: the official program of the course, three textbooks, class recordings and the application of a questionnaire. The results show transformations in both, the concept of function and the concept of linear function, pointing out, in this way, an educational problem that should be solved by modifying not only the concept, but also the teaching and learning of it.

INTRODUCTION

Within the mathematical community, the function is acknowledged as the most important concept and it is also accepted as a strand that goes through the curriculum from the basic levels to university level. The studies related to the curriculum take into account the following elements: the official, intended, implemented and achieved curriculum (Díaz, 2008).

Researches about the notion of function show its evolution from an intuitive emergence to a formal approach of the object. It might seem that as there is a progress in the accuracy of the mathematical concepts, as well as an encouragement to understand them. However, this has not been possible, since such

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formalization and use of efficient notation lacking the intuitive basis that give rise to the mathematical concepts results in difficulties to learn them. Such is the case of the concept of function.

In the literature the four definitions that appear more frequently in textbooks of mathematics of the 20th century are: function in terms of the variable, function in terms of set of ordered pairs, function in terms of rule of correspondence, and function in Logo environment (Hitt, 2002).

Research shows the existence of difficulties and wrong conceptions from the students when learning the concepts of function and linear function related to: what is and is not a function, linearity and non-linearity, correspondence, continuous vs. discrete graphs, representations of a function graph, reading and interpreting graphs, concept of variable, and notation.

However, if the concept of linear function has been widely studied from a cognitive perspective, it is also true that there are areas from which it has not been studied enough yet, for instance, the corresponding area to strengthen the studies that come from the curriculum and focus on the teaching practice placed in a specific mathematical object.

Due to the opportunity mentioned above, throughout this chapter the following question arises: Which are the transformations of the concept of linear function noticed from its mathematical definition when facing the written, intended and enacted curriculum, in Mexican technological high schools during the second semester of the course called Functions and Algebraic Thinking?

This report includes the problem, literature review, theoretical framework, methodology, results, discussion, recommendations, future research directions, conclusion, and references that support this research. Regarding the results, it was found that there is an educational problem about the concepts of function and linear function and that due to its importance, it is necessary to take up the challenge of changing the vision and action about its concept, teaching and learning.

PROBLEM STATEMENT

The study of the concept of function in the teaching of mathematics in high schools plays an important role in students' learning, not only for the fact of being related to topics of different subjects, but also for the fact that it allows to represent real situations (Hitt, 2002). The different difficulties that arise when there are new studies related to the concept of function or to a type of function must also be emphasized.

Diaz (2008) notes that the curricular aspect of the concept of function is a kind of strand that goes from the basic education to university. He also warns about the difficulties the students face to understand this concept, as well as how this concept has generated a growing body of researches, like the ones that study the problem of teaching, the difficulties of learning, those that propose theoretical frameworks or even those that are focused on the diversity of interpretations of the concept of function.

There are several authors that have been devoted to work on the concept of function. During the 1980s, Leinhardt, Zaslavsky and Stein (1990) made a bibliographic revision, in which they showed the difficulties that students face when they try to conceptualize the idea of function, emphasizing issues related to the function such as rule of correspondence as well as its different representations, its reading and interpretation. On the other side, in the research done by Birgin (2012), linear functions are seen as a complex idea of multiple faces whose power and richness cover almost all of the mathematical areas. It is important to add that due to its several applications in the real world some topics of more advanced level, like those that come from calculus, can be reinforced.