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# **The teaching and learning of relations and functions: A comparative study of Norwegian and Ethiopian textbooks**

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## **Introduction**

Comparative studies in mathematics include studies that document, analyze, contrast or juxtapose similarities and differences across all aspects and levels of mathematics education (Jablonka and Andrews, 2012). In this project, which is in an early phase, we intend to carry out such a study at the cross-national level. The rationale behind it is to identify similarities and differences between mathematics education in Norway and Ethiopia, to reflect on their practices in the light of international wisdom (Clarke, 2003), and to lay down grounds for further intervention studies, for example for the Norwegian NORHED project that will start in 2017. (<https://www.norad.no/en/front/funding/norhed/news/>).

We have started comparing textbooks, since textbooks are the main resources used in mathematics classrooms (Pepin, 2010) in many countries including Ethiopia and Norway. Textbooks are tools, or instruments, that facilitate the daily work of teachers. They also contribute to the field of mathematics by preserving and transmitting skills and knowledge (Rezat, 2008a). In general, Mathematics is a subject that has long been associated with textbooks and curriculum materials (Remillard, 2005). Therefore, it is important to look at textbooks as a source of comparison.

At this stage, emphasis is given to the teaching and learning of relations and functions as presented in the textbooks, partly due to students' difficulties with learning these topics (Denbel, 2015). As teacher educators working with students preparing to work in primary and middle school in Norway, we have also observed that many student teachers struggle to grasp these concepts and hence to teach them.

## **Method**

In this study we selected six textbooks in Norway and the one textbook from Ethiopia from lower secondary level which covers the concepts of relation and function. At this early phase of the study, definitions, examples, representations, exercises and problems, activities, group works, contexts and level of abstractions in the textbooks are being identified and compared.

## **Findings**

As mentioned above, the purpose of this poster is to communicate the beginning of our project, which will enable constructive sharing of knowledge and experience about the teaching and learning of mathematics between the two countries, and we hope with the international mathematics education community in the coming years. We report our findings to date as follows.

Among the selected textbooks, only two of them (one text from Norway and the textbook from Ethiopia) address the concept of relations directly by providing definitions, domain and range of relations and different representations, examples and exercises, without including the topic of function. The other Norwegian textbooks deal with the topic of function by taking for granted that students understand the concept of ‘relation’ in mathematics. Most of the books follow the teaching of functions by giving context-based definitions and examples, beginning with proportional relationships of variables, building to linear and then quadratic functions.

In The Ethiopian textbook (M9) the definitions of relations and functions are provided in terms of subsets of a Cartesian product of two sets. Examples and problems are consistently abstract and unrelated to any real context. In contrast, we find no single definition and representation in the respective Norwegian textbooks. In addition, the Norwegian textbooks include many real life related contexts that are accessible by the students, and they are full of different representations (graphs, symbols, words, tables and physical figures) for both concepts. With reference to this topic, the textbook M9 has a higher level of abstraction than its Norwegian counterpart. Symbolic and graphic representations are present in M9, but it is devoid of contexts and real life related examples and problems.

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