UMEÅ UNIVERSITET

Does language matter?

Sources of inequivalence and demand of reading ability of mathematics tasks in different languages

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Akademisk avhandling

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Abstract

Practicing mathematics is not possible without the use of language. To communicate mathematical content, not only words in natural language are used but also non-verbal forms of communication such as mathematical symbols, graphs, and diagrams. All these forms of communication can be seen as part of the language used when doing mathematics. When mathematics tasks are used to assess mathematical competence, it is important to know how language can affect students' possibility to solve the task. In this thesis, two different but related aspects of the relation between language and mathematics tasks are investigated. The first aspect concerns linguistic features of written mathematics task that can make the task more difficult to read and/or to solve. These features may result in unnecessary and unwanted reading demands, that is, the task then partially assesses students' reading ability instead of their mathematical ability. The second aspect concerns differences between different language versions of mathematics tasks used in multilanguage assessments. These differences may cause inequivalence between the language versions, that is, the task may be more difficult to solve for students of one language group than students of another.

The purpose of this thesis is to investigate some of the effects that language can have on written mathematics tasks, in particular, on the validity of mathematics assessments. The thesis focuses on unnecessary reading demands and inequivalence in multilanguage assessments. The data in this thesis are obtained from tasks of the Programme for International Student Assessment (PISA) 2012. The task texts and the student results on these tasks are analyzed quantitatively to identify the occurrence and possible sources of unnecessary reading demands and inequivalence. In addition, think-aloud-protocols and task-based interviews of students who had worked with some of the tasks serve to qualitatively identify possible sources of reading demands and inequivalence, respectively. The results showed both unnecessary reading demands and inequivalence in some of the tasks. Some linguistic features were identified as possible sources of these reading demands, while others were not related to them. For example, sentence *length* was not related to reading demands of tasks in Swedish, whereas sentence *structure* was identified as a possible source of unnecessary reading demands. Some linguistic differences between different language versions of mathematics tasks were also identified as possible sources of inequivalence, and in addition there were curricular differences that were such potential sources. The findings of this thesis have implications for designing mathematics tasks both in one language and in multilingual settings. They may help to ensure validity of mathematics assessments, but also to make mathematics texts easier to understand for students in general.

Keywords
Mathematics tasks, reading, equivalence, DIF, multilingual assessments, PISA

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