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# **The mathematical competence of vocational teachers with a focus on economics - an empirical comparison between prospective teachers with and without mathematics as a subject**

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## **Theoretical background**

Percentage calculation is one of the most important mathematical topics for everyday life and work (Parker & Leinhardt 1995). Vocational teachers focusing on economics use it in their teaching, but little is known about their own knowledge of it. It is likely that they may draw on their mathematical knowledge from school and their training does not usually include any mathematics education content on percentage calculation. Initial studies indicate that their understanding is incomplete (Bradtke 2018). Therefore, we are investigating the research question: Do vocational teachers focusing on economics, who do not specialise in mathematics, have a professional mathematical knowledge of the content percentage calculation?

In German research on mathematics education, the existence of an adequate understanding of the concept is examined by checking whether the normative Grundvorstellungen (desired ideas about a mathematical content) are present and can also be applied situationally. To test this, vocational teachers focusing on economics were asked to solve tasks involving percentage calculation. It is argued that if they can solve the tasks, it is likely that they have the appropriate Grundvorstellungen, otherwise, deficits are to be expected. Furthermore, the Grundvorstellungen of a mathematical concept are considered sustainable if they can be activated in different situations (Padberg & Wartha 2017). Compound interest also plays a special role in commercial calculations but only with solid/broad Grundvorstellungen is one competent in dealing with the mathematical content. Difficulties with this operation are also increasingly reported in Anglo-American countries (Parker & Leinhardt 1995).

If we look at the essential mathematical activities of vocational teachers focusing on economics in commercial education, then the teacher should be able to solve the tasks him/herself as well as recognise errors in the processing of tasks and describe the error. Along these three contexts, we have set twelve tasks involving compound interest in order to determine how viable the conceptions of this term are.

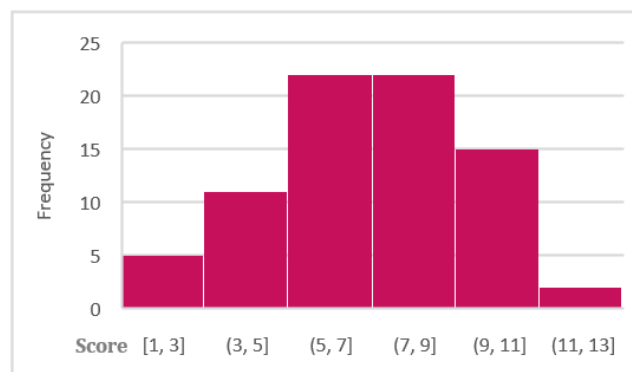
## **Methodology**

In a pilot study, 77 secondary school student teachers' mathematics was surveyed (semester: mean 3.44; standard deviation 1.93). The pilot study took place in the winter semester 2021/2022 at the University of Kassel. No vocational teachers with a focus on economics were surveyed, as they were

held back for the main study due to their low numbers. Participants in the pilot study were secondary school student teachers with mathematics as a subject. It is argued if they have difficulties with the concept of compound interest, then it is very likely that vocational student teachers without mathematics as a subject do as well. The study was designed as an online achievement test. The invitation link was sent to prospective students on our course on mathematics education in the first secondary school via Moodle. Participation in the study was linked to compensation opportunities for academic performance.

## Results

Compound interest was tested through nine tasks with varying demand situations. On average, 7.4 tasks could be solved with a standard deviation of 2.54. The scale formed an alpha coefficient of  $\alpha = .755$ . For three items, the item discriminatory power is slightly below .3. These are to be revised in the next pilot study. The distribution of scores is as shown in the histogram (see Figure 1).



**Figure 1: Results on the viability of the Grundvorstellungen for multiple changes of the original size**

## Discussion

The secondary school student teachers with mathematics as a subject do not seem to be able to solve compound interest problems in all contexts. This suggests that they do not recognise the problem type of compound interest in some contexts and therefore cannot apply the Grundvorstellungen associated with this problem type. If student teachers with mathematics already have this difficulty, then it can be assumed that this is even more serious for vocational student teachers without mathematics as a subject. Whether vocational teacher have difficulties in this regard will be investigated in a further study.

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