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# How do engineering students in mathematics lectures accept application examples?

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## Theoretical Background

Mathematics lectures play an important role in most engineering university courses. However, engineering students often miss the reference to the engineering sciences and to applications (Harris et al., 2014). Integrating mathematical modelling into mathematics learning, though, faces a variety of constraints in current educational systems (Barquero et al., 2013). A first step in this direction might be to incorporate application examples into mathematics lectures. However, the construction of appropriate examples is very challenging, since they should be authentic and not too long (Wolf, 2017), so that the successful preparation and integration of an application example influence the students' acceptance of the example. Other factors may be the presenting person and the matching to the concrete study course of the student (Schmitz & Ostsieker, 2020).

Since mathematical views play a significant role in the individual learning and doing of mathematics, they may also be important for the acceptance of application examples. We use the construct of views established by Grigutsch and Törner (1998) restricted to the three aspects “mathematics as a process”, “application of mathematics” and “mathematics as a toolbox” as in Rooch et al. (2014).

## Research Focus

The focus of this study is an investigation of the relationship between students' mathematical views and students' acceptance of application examples. First, we analyse if there are different groups among students in terms of their mathematical views. Then, we examine the acceptance of the application examples in the groups.

## Method

In a mathematics lecture for three engineering degree programmes four application examples were presented. The acceptance of the examples was measured by a test instrument based on Wolf (2017). Sixteen statements interrogated the aspects “motivation”, “length”, “transferability” and “authenticity” and had to be rated on a six-point Likert scale. In addition, the students completed a questionnaire with fifteen statements about mathematical views (Rooch et al., 2014), to be rated on a five-point Likert scale. 143 questionnaires were evaluated.

## Results

By means of a cluster analysis the students can be divided into two groups with different profiles: The first group stands out due to a strong agreement to the process and application aspect of the

mathematical views, much stronger than the second group. The acceptance of the application examples is significantly better in the first group than in the second group, measured by the mean values of the items on the acceptance aspects.

## Discussion

Our analysis shows that the acceptance of application examples is better when students have process- and application-oriented views of mathematics, both views of “dynamic nature” (Grigutsch et al., 1998). This is in accordance with the fact that dynamic views are often related to more interest and motivation in mathematics and better performance in mathematical tasks (e.g. Köller, 2001; Tossavainen et al., 2021). The next step is to investigate correlations between mathematical views and the acceptance of application examples and take other factors into account.

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