# Teachers understanding of appropriate vocational mathematics knowing

Hanna Knutson

Gothenburg University

This presentation reports on tentative findings of a phenomenographic interview study, aiming to explore various ways of seeing, what vocational mathematics knowing, appropriate for vocational students, entail. Semi- structured interviews, based on a set of geometry tasks, related to a construction work context, were carried out with both vocational teachers and mathematics teachers. The analysis resulted in an outcome space of six categories of description, showing, for example, that ‘appropriate vocational mathematics knowing’ could be perceived as: Memorized facts and procedures. Context bound understanding. Vocationally relevant mathematical concepts. And, integrated mathematical and vocational knowing. The categories are seen as complementary approaches, representing different facets of the phenomenon.

## Introduction

Vocational mathematics is a sub field of mathematics education in which the context, by definition, plays a critical role. Previous research within the field, describe the contrast between, doing mathematics at work, and doing mathematics at school, pointing at its’ different purposes, goals and priorities, and highlights essential features of vocational mathematics (e.g. Hoyles 2010; Muhrman, 2016). According to Bakker (2014), vocational mathematics has been underrepresented in education research, and further studies, concerning characteristics of vocational mathematical knowledge is therefore requested (FitzSimons & Boistrup, 2017; Bakker, 2014). This study aims to make a contribution to the knowledge within that area.

## Method

The empirical data was generated, in line with the phenomenographic methodology, through in-depth semi-structured interviews (Marton & Booth, 1997), starting from a set of geometry tasks, representing a constrained mathematical topic (geometric similarity), and a specific vocational area, (construction work). The tasks included, for example, scale drawings and slope calculations. In relation to the tasks the interviewees were asked, for example, how they would describe the content, what they found particularly important for students to understand, and how they would explain it. The interviewees were teachers in vocational subjects (C) or mathematics (M) at the upper secondary vocational programme “construction work”. The interviews lasted about 1h, and were audio-recorded, transcribed verbatim, and analysed using a phenomenographic approach (see Marton & Booth, 1997). In this study, the explored phenomenon could be described in terms of ‘appropriate vocational mathematics knowing’.

## Preliminary results

The analysis resulted in an outcome space, consisting of six categories of description, which shows that ‘appropriate vocational mathematics knowledge’ could be seen as:

* A tool to be used, without necessarily understanding the mathematical rationale behind it. The interviewees express this view by giving examples of sets of numbers or procedures to be learned by heart, and tables to be read in a correct manner.
* A vocational skill, to be learned and used in a specific context. Here the vocational task is in the foreground. Mathematical concepts are learned and understood in specific ways related to specific contexts and are not expected to be generalized. Explaining slope: ”They usually work with 6 m long pipes, and then 1m parts, so we have made it easy for them” (C3).
* A set of vocationally relevant mathematical concepts, to be understood and applied. Teachers express this view by stating that students need to “grasp the meaning”, and “think a step further and understand why it is like that” (C2), and by summarizing vocational mathematics knowledge in terms of a set of relevant concepts.
* Application per se. Here transfer is in the foreground. Teachers express this view by stating that students understanding significantly improves when they see that mathematics in the classroom and mathematics in vocational practice is “the same mathematics”. For example: “You must help them to see that connection. And then they say: “Aha! It’s the same mathematics! (….) Then, they really understand “(C4).
* A field of knowledge beyond general mathematics. In this category, various aspects of vocational -and mathematical knowledge are simultaneously in the foreground. Teachers express this view by exemplifying that vocational mathematical tasks require both a high level of general mathematical knowledge, and vocation specific knowledge as well as knowing how to integrate these different aspects.
* Another way of seeing. Teachers convey this view by referring to an increased level, or depth, of mathematical knowledge, as “another eye” and further on “you can see things in a different way, basically, that is what knowledge really is about” (CM5).

## References

Bakker, A. (2014). Characterising and developing vocational mathematical knowledge. *Educational Studies in Mathematics, 86(2)*, 151–156.

FitzSimons, G. E., & Björklund Boistrup, L. (2017). In the workplace mathematics does not announce itself: towards overcoming the hiatus between mathematics education and work. *Educational Studies in Mathematics, 95(3)*, 329–349.

Hoyles, C., Noss, R., Kent, P., & Bakker, A. (2010). *The need for techno-mathematical literacies.* Routledge.

Marton, F., & Booth, S. (1997). *Learning and awareness.* Mahwah, N.J: Erlbaum.

Muhrman, K. (2016). *Inget klöver utan matematik.* Doctoral thesis*.* Linköping University, Faculty of Educational Sciences.