Representational Competence in the case of fractions

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2nd Cohort

Theoretical Background

Representational competence: The ability to deal with given external representations (ER) and the ability to generate/construct ER together can be defined as representational competence (Cox 1999 and Kozma/Russell 2005). The focus of this study is on generating ER in the case of fractions to record results in self-regulated learning processes.

„Basic ideas“ of fractions: The concept of basic ideas builds the link between the world of mathematics and the individual world of the student. In the case of fractions this means to focus on semantical meanings of fractions and operations between them before dealing with mathematical syntax (vom Hofe 1998, 1996).

Prompts: “Prompts are short hints or questions presented to students in order to activate knowledge, strategies or skills” (Wirth 2009, p. 96), with the aim to promote self-regulated learning. In the presented intervention study feed-forward prompts were used to ask students to report their learning results in a proper way during self regulated learning.

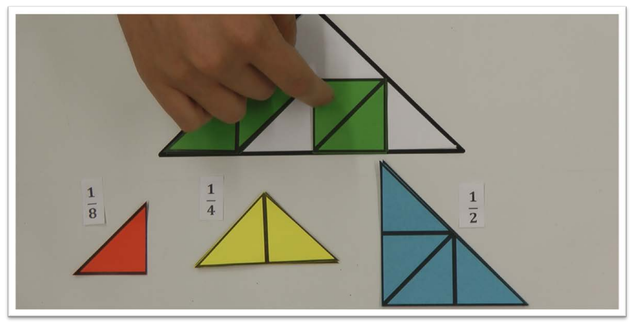

Fig. 1: Video-task screenshot

Research Design and Research Questions

Research Design

- Grade 6 students of German grammar schools (*N* = 182)
- Experimental group 1: self-regulated learning; prompts with high instruction-level (*N* = 79)
- Experimental group 2: self-regulated learning; prompts with low instruction-level (*N* = 62)
- Control group: teacher centered setting (*N* = 41)
- Intervention: three 90 minute units on basic ideas of fractions with the same content for each group
- Pre-, post- and follow-up-test on basic ideas of fractions (RM-ANOVA)
- Video-tasks to measure the representational competence (pre- and post- test, RM-ANOVA)

Research Questions

- Can students in self regulated learning processes in structured learning environments reach the same learning-success as students in a teacher centered setting?
- Does representational competence correlate with achievement on fractions?
- How does representational competence develop in the three different settings?
- Do prompts influence the achievement with regard to fractions or representational competence?

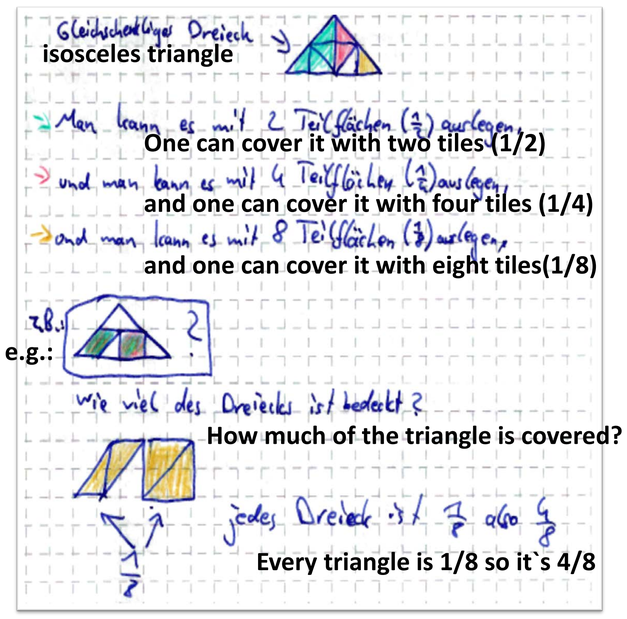

Fig. 2: Students representation of the video-task content

Results

Basic ideas of fractions:
Regarding our hypothesis, there are no significant differences between the three groups ($F(4,318) = 1.19$, $p > .05$). The results of the two experimental groups are as good as the control group at any measurement occasion. That means that students are able to work out basic ideas of fractions on their own.

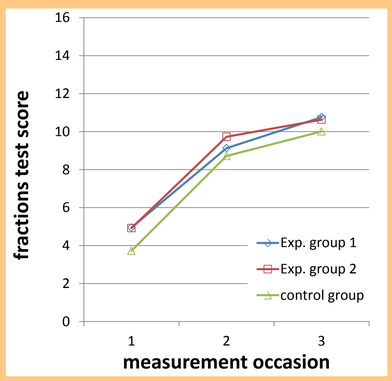

Fig. 3: fraction-test results

Representational competence:
There is a significant difference between the three groups ($F(2,180) = 3.82$, $p = .024$).
A Tukey’s HSD Post-hoc-test reveals a sig. difference between the exp. group 2 and the control group ($p = .019$). That means that self regulated learning students with prompts on a low instructional level develop sig. better regarding representational competence.

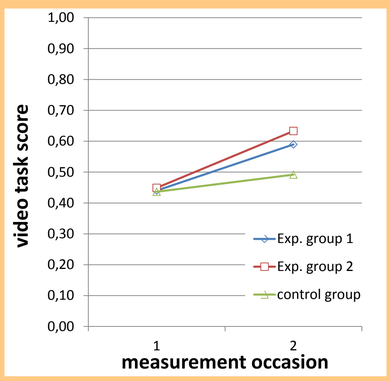

Fig. 4: video-task results

Correlation:
There are only low correlations (around $r = .3$, $p < .01$) between content knowledge and representational competence (RC) at both measurement occasions. This leads to the conclusion that content knowledge and RC are different constructs that are slightly dependent on each other (see also Nitz et al. 2012).

Conclusion

Practical implication:

By simply asking students to record their learning results through prompts, students develop representational competence. This leads to the conclusion that students need more self regulated learning time, especially considering that there will be no lack in content performance afterwards.

Question of further research:

Are there differences in the development of representational competence or content performance in self regulated learning environments, when comparing groups using given prompts with groups without prompts?

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Status of Work

current: assessment of the main research is finished; beginning of data-analysis and writing

start: April 2012

expected submission of PhD thesis: December 2014