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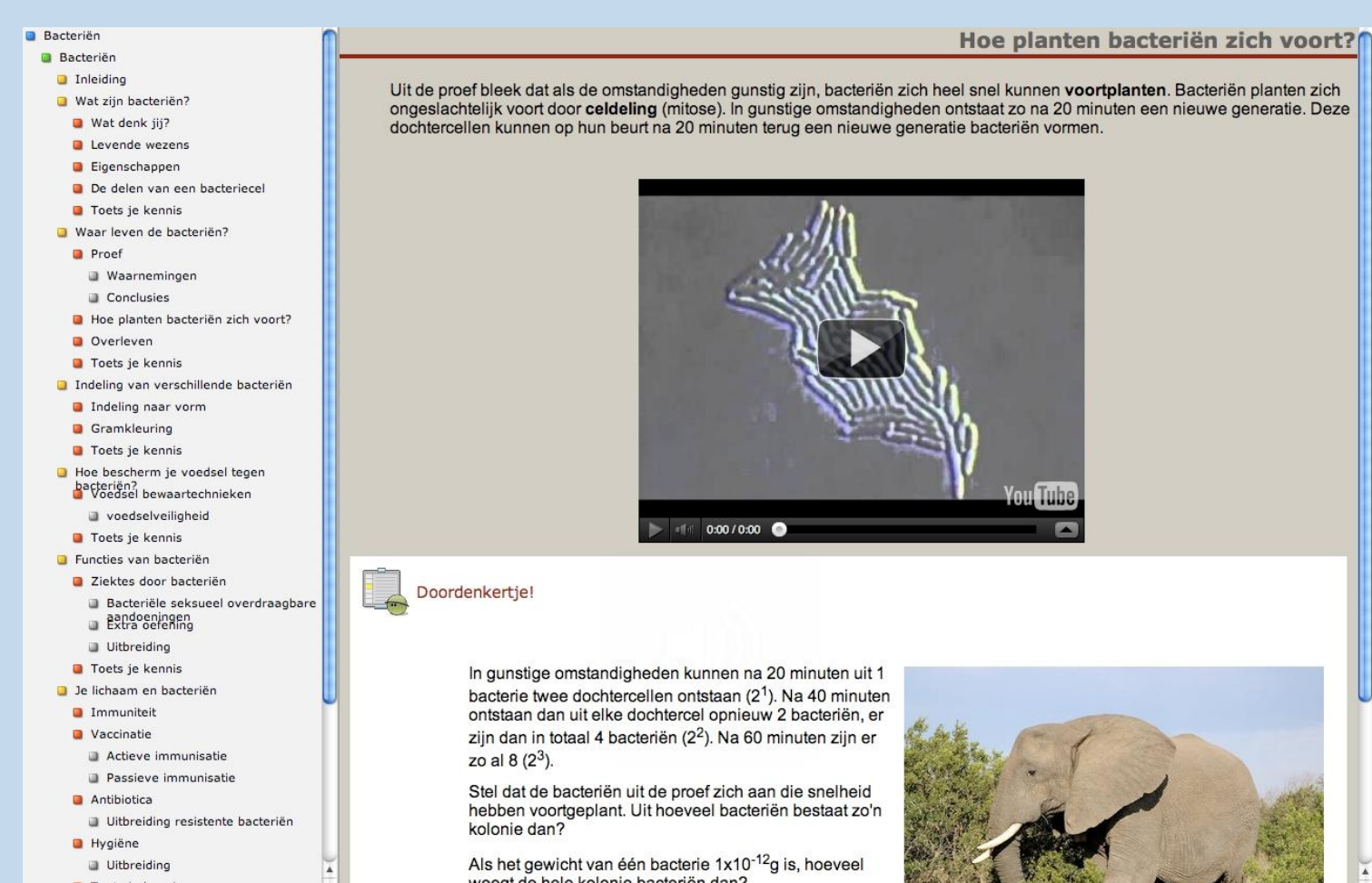
# The impact of group setting and visual representations on secondary school students' learning outcomes

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## Introduction

Technology-enhanced learning objects (see figure below) have the potential to play an important role in the way educators will serve their learners in the future. However, research on the impact, effectiveness, and usefulness of learning objects is scarce, particularly in secondary education (Kay & Knaack, 2008)<sup>1</sup>.



## Objective

With this research, which is part of a larger design-based research (Wang & Hannafin, 2005)<sup>2</sup>, we want to fill in this gap and concentrate on the impact of the organization (group setting) and the creation (representation) of learning objects on learning outcomes.

## Methods

We studied the impact of an individual versus a collaborative group setting on learning outcomes. Simultaneously, we examined the impact of visual representations in learning objects.

Knowledge tests were offered to all secondary school students (N = 511) on 3 different moments (pre-post-retention).

(1) Kay, R. H. & Knaack, L. (2008). A formative analysis of individual differences in the effectiveness of learning objects in secondary school. *Computers & Education*, 51, 1304–1320.

Two different learning objects covering the bacteria subject were created and used during 4 lessons within a blended learning environment.

## Results

	Visual representations	
	Reduced	Amplified
Group setting	M (SD)	M (SD)
Individual	1.11 (3.48)	2.47 (2.70)
Collaborative	1.06 (2.57)	.11 (2.81)

Note. The learning outcomes were calculated as the difference between the post-test and the pre-test (descriptive statistics dependent variable). M = Mean; SD = Standard deviation.

In a two-way analysis of variance, the main effect due to group setting was significant ( $p = .001$ ), whereas the main effect of representation guiding ( $p > .05$ ) was not significant. The interaction between these the main effects was found to be significant ( $p = .001$ ).

## Conclusions

The best result was obtained by students who were offered an amplified representation in an individual setting. The same amplified learning object in a collaborative setting affected students' learning in a negative way.

Follow-up research will focus on:

- › the role of the teacher ( qualitative data),
- › detailed group composition of the students (e.g. same-sex vs. mixed-sex groups),
- › student behavior at the computer (screencasts and video taping).

(2) Wang, F. & Hannafin, M. J. (2005). Design-based research and technology-enhanced learning environments. *Educational Technology Research and Development*, 53, 5–23.