Investigating differentiated instruction in a text-learning strategy intervention with mind maps

Abstract

Students need effective strategies for text-based learning to deal with the emergent information flow in our current society. Prior research has shown the beneficial effect of mind maps to support learners in this text-based learning. However, not all learners are alike in their need for instruction in this respect, making differentiated instruction required. Therefore, this study examines the occurrence of differentiated instruction in a text-learning strategy intervention with mind maps in fifth and sixth grade classes. A quasi-experimental pretest-posttest design was set up, with one experimental and one control condition. 187 students from 9 different elementary classes participated. Data were collected by means of a self-report questionnaire, trace methodology, and class observations. The results show that students' characteristics such as learning disability and home language are related to their text-learning strategy use in the experimental condition. Furthermore, the results indicate that the degree of differentiated instruction is positively related to the quality of students' traces and some (meta)cognitive strategies they use. Based on these findings, implications, limitations, and suggestions for future research are discussed.

Extended summary

Theoretical background

Text-learning strategies (i.e., strategies to acquire knowledge from text) are essential to cope with the emergent 21st century information flow. Initiating students in these strategies becomes increasingly important in late elementary education, where the focus shifts from 'learning to read' to 'read to learn' (Hall-Kenyon & Black, 2010). However, previous studies revealed that the use of text-learning strategies (TLS) in this target group is limited (Tielemans et al., 2016). The use of mind maps (i.e., colorful graphical text summaries; Buzan, 2005) has already proven to be effective in supporting elementary students in this respect (e.g., Author et al., 2016). However, not all learners take advantage of the same instruction, since student characteristics (e.g. home language or learning disabilities) appear to be related to the effectiveness of instruction and learning (Veenman, 2011). To provide the necessary learning opportunities to all students, the literature refers to differentiated instruction (DI) as promising (Struyven et al., 2015).

Little or no research has been devoted, however, to the occurrence of DI in general and DI related to the students' 'learning disability' and 'home language' in particular in mind map interventions. The aim of this study is, therefore, to explore (a) the occurrence of DI during a mind map intervention (RQ1), b) the relationship between the degree of DI and the evolution in students' TLS (RQ2), and (c) the relationship between student characteristics, DI, and the students' evolution in TLS (RQ3). In the present study, DI is conceptualized based on the threefold inner class differentiation teacher model (Struyven et al., 2015).

Method

Participants. A total of 186 Flemish late elementary school students from 9 classes participated. Their average age was 11.46 years (*SD*=0.648). 7.5% had a learning disability (i.e. dyslexia) and 15.1% spoke another language at home than the instructional language.

Instruments and procedure. A quasi-experimental pretest-posttest design was applied, including an experimental (mind map intervention; Author et al., 2014) and a control condition (traditional curriculum). The intervention included 10 lessons wherein TLS were stimulated by using mind maps. During the intervention, class observations of teachers' DI, were executed in both conditions. Each teacher was at least observed once. To allow posterior in-depth analysis, the observed lessons were videotaped from two different perspectives. Observations were transcribed and systematically coded based on a pre-established coding scheme (table 1; based on Struyven et al., 2015).

Concerning the pre- and posttest, students received a learning task to study an informative text. TLS use was assessed by the task-specific self-report 'Text-Learning Strategies Inventory' (table 2; Author et al., 2014) and a trace analysis of students' study materials by means of a scoring rubric (Author et al., 2014).

Data-analysis. In view of RQ1, descriptive analyses were performed on the class observations. To answer RQ2, one-way repeated measures ANOVA was conducted based on the 'degree of differentiation' (low, medium, high) derived from the descriptive analyses. To answer RQ3, both observational data as ANOVA results were used.

Results and discussion

RQ1. Differentiation according to instruction was frequently observed in both conditions, differentiation according to the curriculum and students' learning profile was scarcely observed. Differentiation according to student characteristics was mostly observed for students with dyslexia. Counterintuitive, foreign-speaking students usually received less speaking time than Dutch-speaking students.

RQ2. Regardless of the research condition, in classes with an average level of differentiation, students evolved to more traces on the informative text ($F(1,164)=9.631$, $p<.001$) and the scratch paper ($F(1,164)=3.388$, $p=.036$) from pre- to posttest and reported more 'self-evaluation' ($F(1,164)=3.216$, $p=.041$) than students in class with a low level of differentiation. Interestingly, students in classes with a low differentiation level report significantly more 'linking with prior knowledge' than students in high differentiation classes ($F(1,164)=3.306$, $p=.039$). This could be due to the fact that 'linking with prior knowledge' activities might be fostered in whole-class activities across classes. In sum, these results indicate that the differentiation degree is positively related to some important TLS.

RQ3. Experimental condition foreign-language speaking students are significantly evolved towards more qualitative traces in the informative text from pre- to posttest as compared to control condition students ($F(1,163)=6.819$, $p=.010$). Experimental condition students with dyslexia reported to be significantly more engaged in 'linking with prior knowledge' ($F(1,162)=6.529$, $p=.012$). Furthermore, in the experimental condition a higher average differentiation level occurred compared to the control condition. Interestingly, combining the results of the self-report with the observational data, students' higher progress may be influenced by the effect of differentiation or, the mind map lessons themselves might promote differentiation opportunities.

Theoretical and educational significance

Implications. In sum, the results seem promising concerning the effectiveness of DI through a mind map intervention on (meta)cognitive strategy use, particularly for students with dyslexia and foreign language-speaking students. It is therefore recommended to explicitly teach TLS within a differentiated context, especially for these specific target groups.

Limitations and future research. First, to corroborate and further investigate these findings in-depth, larger sample sizes are needed in future research. Second, also long-term effects and other variables such as academic performance (Liu et al., 2014) could be included. Finally, data collection could be supplemented with other methods (e.g. think-aloud or eye tracking methodology).

References

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Table 2

Example items of the TLSI-subscales (Author et al., 2014).

	N_{items}	*Example item*
Cognitive strategy use		
Summarizing and schematizing	7	*I repeated the text with my summary or graphic organizer on my scratch paper*
Highlighting	1	*I marked the most important things*
Rereading	3	*To learn the text, I read the text a lot of times*
Paraphrasing	7	*I covered up the text information and tried to recall it*
Linking with prior knowledge	3	*Before learning, I thought about what I already knew*
Studying titles and pictures	3	*I looked at the titles to understand the text*
Metacognitive strategy use		
Planful approaching	3	*First, I read the whole text and then I started learning*
Monitoring	5	*While learning, I checked what I had already done and how much I still had to do*
Self-evaluation	5	*I managed to learn the text in a good way*

Table 1

Frequency distribution of the descriptive analyses from the observational data.

	Facilitating maximum learning for each student																											**Proactive, positive and planful approach**			
	Interests										Learning status										Learning profile							Routines tailored to flexible grouping			
	Identify interests			Promote interests						Build new interests	Differentiation according instruction				Differentiation according the curriculum						Differentiation according learning profile				Differentiation according preferences			Groups and grouping			Output = input
Code	**Speaking time**	**1**	**2**	**3**	**Independent work time**	**4**	**5**	**6**	**7**	**8**	**9**	**10a**	**10b**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**
Class																																
Z6A*	8'35"	2	1	1	33'28"	3	4	0	1	0	0	1	3	1	3	0	0	0	1	0	0	0	0	0	0	0	1	2	1	0	0	1
Z6B*	6'36"	2	0	1	26'32"	10	5	0	4	2	0	11	22	0	4	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	4
R5A	3'31"	2	0	0	15'35"	5	6	0	0	1	0	8	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0
R5B	8'32"	1	2	0	15'49"	2	1	0	0	1	0	6	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0
R6A	4'51"	1	1	0	15'19"	0	3	0	1	0	0	7	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	3
R6B	6'32"	4	1	3	16'03"	0	1	1	0	0	0	16	3	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
W6A*	4'08"	8	1	0	19'57"	4	3	0	2	1	0	11	10	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
W6B*	2'11"	2	0	0	29'11"	22	6	0	10	1	0	28	19	1	4	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	3
W6C*	12'25"	1	0	0	19'01"	27	2	2	2	1	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	1

* experimental condition.

Note. The coding scheme is based on the work of Struyven et al. (2015).

Note. The numbers in the table represent the following subcategories: 1) reflection time; 2) ask students their wishes; 3) empathy; 4) positive feedback; 5) hints; 6) offer points to work; 7) unconditionally encourage; 8) offer choices; 9) offer an explanation or a rationale; 10a) extended instruction on demand; 10b) extended instruction without demand; 11) deploy resources; 12) accelerated instruction; 13) memorizing; 14) understanding; 15) applying; 16) analyzing; 17) evaluating; 18) creating; 19) memorizer (little or no strategy use); 20) mental learner (dominant use of mental TLS); 21) information organizer (non-integrated strategy user); 22) integrated strategy user (strategic generative strategy user); 23) thinking preferences; 24) preferred work methods; 25) preferred media; 26) divergent work methods; 27) convergent work methods; 28) division of roles; 29) formative evaluation.