Can teachers use gaze displays to provide adaptive reading comprehension instruction?

Carolien A. N. Knoop-van Campen

Radboud University, the Netherlands, carolien.knoop-vancampen@ru.nl

Ellen Kok

Utrecht University, the Netherlands, e.m.kok@uu.nl

Halszka M. Jarodzka

Open Universiteit, the Netherlands, halszka.jarodzka@ou.nl

Tamara van Gog

Utrecht University, the Netherlands, t.vangog@uu.nl

Teaching reading comprehension can be challenging, as reading is mainly a covert process and teachers often have to rely on reading comprehension scores to provide feedback to students. Teachers might be better able to tailor their reading instruction to the needs of individual students if they would know whether students use efficient reading comprehension strategies. Eye-tracking might provide this kind of insight. Students' reading strategies can be recorded using eye-tracking technology, and visualized in 'gaze displays'. Earlier, we found that teachers can indeed infer students' reading strategies from gaze displays. However, it is as yet unclear if they would also be able to use gaze displays in deciding on adaptive follow-up actions, like providing additional instruction. Therefore, the aim of this study was to experimentally investigate whether teachers make more accurate instructional decisions when presented with gaze displays (process), reading comprehension scores (outcome), or both (RQ1) and what type of instruction they would provide (RQ2). Teachers will be shown a text with the student's reading behavior (gaze display superimposed on the text of an efficient/inefficient reading strategy), the student's reading comprehension score (pass/fail), or both, for 16 (fictitious) students. They will be asked to indicate whether they would offer this student extra help/instruction, and if so, what type of instruction (e.g., explanation, modelling). If gaze displays support teachers' instructional decisions, we would expect them to be more inclined to offer instruction when there is a mismatch between the intended and displayed strategy, especially when the reading comprehension score is low.

Additional Keywords and Phrases: reading comprehension; eye tracking; teachers; reading instruction

1 RATIONAL

Reading comprehension is a crucial skill for academic success. Teaching reading comprehension can be challenging for teachers as reading is mainly a covert process and teachers can often rely only on reading comprehension scores (outcome measures) to provide feedback. Generally, teachers cannot monitor the process, i.e., how students read the material and whether they did so efficiently (e.g., applied the correct reading strategy).

Reading comprehension strategies can be divided into two overarching types: selective and intensive reading [1,2]. The selective strategy is used when a learner is looking for certain information without having to understand the whole text [3]. This is for example a useful strategy if a learner needs to answer a question about part of the text. An intensive strategy is used when the entire text needs to be read, for example for making a summary of the text or when studying [2]. Tailoring the strategy to the reading question is important for effective and efficient studying.

For teachers to incorporate information on the performed strategy in their instruction and, thereby improve their ability to provide adaptive instruction to individual students, they need to know which strategy students used. Eye-tracking might provide an innovative tool to visualize those covert reading strategy processes, as it allows for recording students' eye movements during reading and then constructing gaze displays that show teachers visualizations of students' eye movements overlaid on the text. Such displays have the potential to provide teachers with insights into the reading strategy used by a student, and as such, into the efficiency of the reading process. This knowledge may support teachers in subsequently optimizing their reading instruction.

In a recent study, it was found that teachers were able (to a certain extent) to distinguish specific reading comprehension strategies from students' gaze displays [4]. However, subsequently they differentiated little in their intended actions based on these gaze displays. In addition, teachers often indicated that they needed more information, especially student's reading comprehension score, before they were able to take action (such as providing additional instruction).

This raises the question to what extent teachers use students' process information (gaze displays) and outcome information (reading comprehension performance) when deciding on their pedagogical actions (whether or not to provide additional instruction). Therefore, the aim of this study was to experimentally investigate whether teachers make more accurate instructional decisions when presented with gaze displays (process), reading comprehension scores (outcome), or both (RQ1) and what type of instruction they would provide (RQ2).

2 METHOD

In Spring of 2022, 120 teachers from primary and secondary education will fill in an online questionnaire, presented in Qualtrics, in which they are presented with information on 16 students who made reading comprehension assignments. Half of these assignments require an intensive reading strategy (i.e., required reading the entire text to make a summary), and the other half elicit a selective reading strategy (i.e., required searching for specific information in the text) (see Figure 1).

Teachers will be shown how the students have performed on the reading comprehension tasks by means of either: the reading behavior (gaze display), the reading comprehension score (pass or fail), or both. Gaze displays show either an intensive or a selective reading strategy. In Table 1 all conditions and stimuli-combinations are presented. Based on this information, teachers are asked to indicate what strategy is displayed (manipulation check), whether they would offer this student extra help/instruction (RQ1), and if so, what type of instruction (e.g., explanation, modelling) they would provide (RQ2).

3 HYPOTHESES

Specific main and interaction effects will be tested (RQ1), namely:

- To what extent are teachers more inclined to offer help/instruction when students have a low reading comprehension score versus a high reading comprehension score?
- To what extent are teachers more inclined to offer help/instruction when there is a mismatch between the expected and observed strategy versus a match between expected and observed strategy?
- To what extent does the latter depend on students' reading comprehend score? E.g., do teachers only provide help/instruction on mismatch strategy when the student also has a low reading comprehension score?

The type of instruction teachers want to provide (RQ2) will be presented and interpreted descriptively.

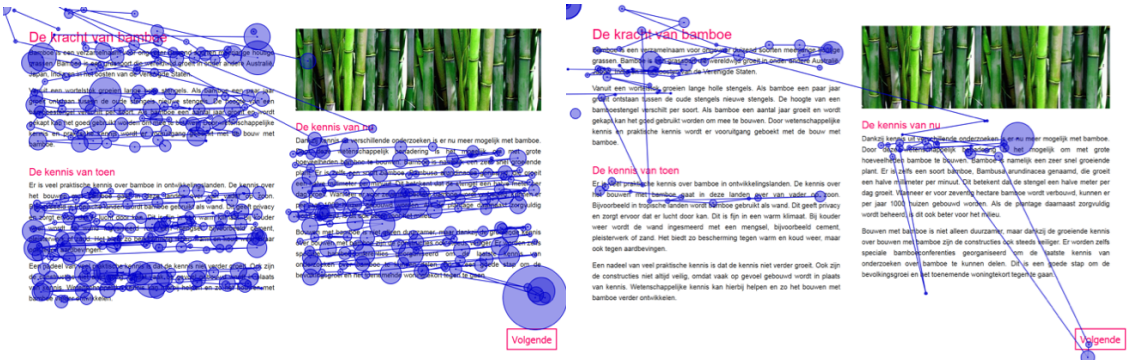

Figure 1: Example of the two reading strategies. Left - intensive reading strategy. Right – selective reading strategy

Table 1: Overview of stimuli and conditions

Nr	Assignment	Intented strategy	Displayed strategy	Reading comprehension score
A	Summary	Intensive	Intensive	Pass
B	Summary	Intensive	Intensive	Fail
C	Summary	Intensive	Selective	Pass
D	Summary	Intensive	Selective	Fail
E	Summary	Intensive	Intensive	x
F	Summary	Intensive	Selective	x
G	Summary	Intensive	x	Pass
H	Summary	Intensive	x	Fail
I	Search-and-find	Selective	Intensive	Pass
J	Search-and-find	Selective	Intensive	Fail
K	Search-and-find	Selective	Selective	Pass
L	Search-and-find	Selective	Selective	Fail
M	Search-and-find	Selective	Intensive	x
N	Search-and-find	Selective	Selective	x
O	Search-and-find	Selective	x	Pass
P	Search-and-find	Selective	x	Fail

REFERENCES

[1] P. Afflerbach, P. D. Pearson, & S. G. Paris, 2008. Clarifying differences between reading skills and reading strategies. *The Reading Teacher, 61*(5), 364-373. https://doi.org/https://doi.org/10.1598/RT.61.5.1

[2] F. Liu, 2010. Reading abilities and strategies: A short introduction. *International Education Studies, 3*(3), 153-157. https://doi.org/10.5539/ies.v3n3p153

[3] J. T. Guthrie, & P. Mosenthal, 1987. Literacy as multidimensional: Locating information and reading comprehension. *Educational Psychologist, 22*(3-4), 279-297. https://doi.org/10.1080/00461520.1987.9653053

[4] C. A. N. Knoop-van Campen, E. Kok, R. van Doornik, P. de Vries, M. Immink, H. Jarodzka, & T. van Gog (2021). How teachers interpret displays of students' gaze in reading comprehension assignments. *Frontline Learning Research, 9*(4), 116-140. https://doi.org/10.14786/flr.v9i4.881