SUPPORTING STUDENT LEARNING IN SCIENTIFIC INQUIRY: THE POTENTIAL OF TEACHERS’ WRITTEN FEEDBACK

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The feedback that teachers give to students is a central aspect of formative assessment. This study focused on teachers’ written feedback. More specifically, on written feedback that is scaffolded by two different types of feedback templates: rubrics and more open-ended comment templates. The use of teachers’ written feedback in the classroom was explored by analysing respective cases from Germany (chemistry, lower and upper secondary school), Switzerland (integrated science, primary school; biology and physics, upper secondary school) and Denmark (integrated science, biology, and technology, lower and upper secondary school). All the cases took place in the context of scientific inquiry and the respective written feedback focused on investigation competences such as planning and conducting experiments. Based on the teachers’ written feedback and students’ artefacts, the extent to which the two types of feedback templates help teachers to provide feedback was analysed. Furthermore, data from teacher questionnaires with open items was used to examine the potential but also the difficulties teachers have in using written feedback. The results could help to shape means of support for an implementation of written feedback as part of formative assessment in science education but also to identify areas where further research on written feedback is needed.

Keywords: written feedback, formative assessment, scientific inquiry

INTRODUCTION

Feedback is an important part of formative assessment in science classrooms. There is, however, little research on how teachers provide feedback to their students – specifically, there is a lack of knowledge about the viability of the practice of giving written feedback in scientific inquiry. Therefore, it is difficult to provide suitable support to teachers to help them enhance their feedback practices. This study will therefore focus on the teacher perspective on written feedback. The results will, on the one hand, be used to discuss measures of support for an implementation of teachers’ written feedback in science education. On the other hand, the exploratory study will also allow for the deduction of further research questions.

Literature review

Feedback has the purpose of “reduc[ing] discrepancies between current understandings / performance and a desired goal” (Hattie & Timperley, 2007, p. 87). Effective feedback, i.e. feedback that is usable for students and supports learning, has to satisfy four criteria (Brookhart, 2008; Harks, Rakoczy, Hattie, Besser, & Klieme, 2014): (1) it is linked to predefined assessment criteria; (2) it includes a justification for a judgement; (3) it reassures motivational beliefs and aids recipients in adequate self-assessment and (4) it is provided timely, it is complete, it contains enough detail and is clearly formulated.

Feedback to students can be provided in written form. This includes both rubrics (e.g. Andrade, 2000) and open comments (e.g. Black, Harrison, Lee, Marshall, & Wiliam, 2003). Rubrics are reported to help clarifying teachers’ expectations (Andrade, 2005) whereas other authors found that they are useful for students but not for teachers (So & Lee, 2011; Bharuthram, 2015). Regarding the use of open comments, there seem to be two basic questions for the teachers, namely how to select what to comment on and how to avoid giving away part of the answer but to still provide useful guidance (Bruno & Santos, 2010).
Research questions

The aim of this study is to explore aspects of quality, benefits and challenges of written feedback from a teacher perspective. Research question 1 is: To what extent can rubrics and templates for open comments help teachers to provide effective written feedback? Research question 2 is: Which benefits and challenges do teachers see in using rubrics and open comments for written feedback?

METHODS

The sample included 19 trials of written feedback from different school levels and science subjects in three countries: 5 trials from Germany (chemistry, lower and upper secondary school), 4 trials from Switzerland (integrated science, primary school; biology and physics, upper secondary school) and 10 trials from Denmark (integrated science, biology, technology, lower and upper secondary school). All the trials took place in the context of scientific inquiry and the respective written feedback focused on investigation competences such as planning and conducting experiments.

Data collection and –analysis for research question 1

In order to explore to what extent rubrics can support teachers in the provision of written feedback, both the teachers’ feedback but also the initial and the revised student artefacts were analysed: The teachers’ written feedback was coded in terms of its focus on the learning goals; the justification of the judgements and in terms of the provision of guidance about concrete next steps. The student artefacts were coded for the students’ consideration of the feedback in their revised artefacts. The coding was conducted by two independent raters. Double-coding of a subsample resulted in a satisfactory Krippendorf’s Alpha in most of the cases whilst some items of the Danish implementations could not be coded reliably even after many iterations of coding, discussions among raters and recoding (details in the presentation).

Data collection and –analysis for research question 2

For research question 2 on the benefits and challenges of written feedback, the teachers were asked to fill out a self-reporting questionnaire. In there, they reflected on the strengths and weaknesses of written feedback in their daily teaching practice. The teachers’ answers were analysed using open coding and qualitative content analysis (Mayring, 1994).

RESULTS

Results on research question 1

Regarding the focus on learning goals in teachers’ written feedback, the teachers were generally able to refer to previously specified criteria in their feedback in the different countries of this study. The feedback was not detached from the learning goals.

Differences between the trials of the three countries were found in the justifications of the judgement: Whereas the German teachers in the study tended to justify their references to what the students had not yet achieved, the Swiss teachers generally provided few justifications. For the Danish trials, no analysis was possible (see methods part).

In the guidance about concrete next steps, the results from the three countries were similar: The teachers did provide specific guidance to their students about what should be done next.

A relation between the provision of guidance and the students’ consideration of the feedback was found in the German and in the Swiss trials: In Germany, an abstract way of formulating next steps led to students not using the feedback. In Switzerland, the use of the feedback seemed to depend on the time provided to engage with the feedback and the continuity of working on an artefact. In Denmark, no clear relation
between the specificity of the guidance and the students’ uptake of the feedback was found. Overall, the students’ use of the feedback seemed to depend strongly on the concrete context of the lesson or unit.

**Results on research question 2**

The benefits of written feedback as mentioned by the teachers included the transparency on the learning goals for both students and teachers. Further benefits for teachers were better insights into the students’ levels of performance, an opportunity to reflect on their own assessment practices and the easy combination of written feedback with summative assessment practices. For their students, teachers saw benefits in the potential of written feedback to enhance student learning and motivation as well as social interaction.

Regarding the challenges of written feedback, the teachers mentioned the time needed for planning formative assessment activities and for formulating feedback; the flaws in the teachers’ assessment literacy; but also the students’ insufficient use of the feedback.

**DISCUSSION AND CONCLUSIONS**

Overall, the results from the study confirm that written feedback can be used meaningfully for formative assessment in scientific inquiry. Tools, ideas and examples of good practice do support teachers; they are, however, not sufficient to enable teachers to provide effective feedback. The role of pre-and in-service professional development will be discussed in the presentation.

This was an exploratory study. As a next step, variables such as school level; subject; context and complexity of the task; student level of performance; and teachers’ experience with written feedback should be controlled or systematically varied. The differences between rubrics and templates for open comments should also be investigated in more detail in order to gain a better understanding of what feedback that supports student learning in scientific inquiry looks like. Furthermore, the study exclusively focussed on a teacher perspective. So the integration of the students’ opinion on written feedback but also its effect on student learning and student self-regulation is evident.

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**REFERENCES**


