Exploring the Composition Process of Peer Feedback

Maryam Alqassab, LMU Munich, Department of Psychology, maryam.alqassab@psy.lmu.de
Jan-Willem Strijbos, LMU Munich, Department of Psychology
jan-willem.strijbos@psy.lmu.de
Stefan Ufer, LMU Munich, Mathematics Institute, ufer@math.lmu.de

Abstract: This paper presents a study that explores the composition process of peer feedback. It adopts an interactional framework for feedback that takes into account feedback sender's and recipient's factors. Participants were pre-service mathematics teachers (N = 47) enrolled in a course about feedback and assessment. Quantitative content analysis was used to analyze students' reflections after being involved in a peer feedback provision activity on a geometry construction task. Students' reflections illustrated that the composition process is not purely cognitive, and can also involve self-reflection and self-evaluation activities as well as peer-related activities. Some examples of self- and peer-related activities during peer feedback composition are reported, followed by a discussion of implications for using peer feedback as a learning activity.

Keywords: Peer feedback, assessment for learning, feedback training, mathematics

Introduction

The role of students in classrooms has changed in the last decades with a strong emphasis on empowering students and actively involving them in assessment activities. Peer- and self-assessment are now common practices in which students evaluate quantitatively or qualitatively the correctness and the quality of their peer's or their own performance. The purposes of involving students in such assessment activities can vary, but they are normally meant to improve students' performance, evaluation and analytical skills, or both (Topping, 2003). Peer feedback (PF), which is regarded as the qualitative component of peer-assessment, is used as an instructional tool in many fields. Since the value of feedback is in the information that can be used to improve learning, most of the PF research focuses either on the quality of the feedback message or its application. Only recently some studies started to explore the learning gains of students who provide PF. In an experimental study Cho and MacArthur (2011) showed that, compared to the control group, the quality of students' written scientific reports improved significantly after involving them in providing PF. They hypothesized that while providing PF, students might engage in problem solving processes through which they reflect on and improve their own learning. While their study illustrated the learning gains resulting from providing PF, it purely focused on the outcomes of the act of providing PF. To date, little is known about the process resulting in the provided PF, i.e. the composition process of PF, and the cognitive, social and affective processes involved in that process. A survey by Nicol, Thomson and Breslin (2014) highlighted some cognitive processes that could be part of the PF composition activity, such as critical evaluation, reflection on one's own work, and comparing one's own work with peers' work. However, composing PF is not just about reflection on one's own work as students are expected to produce a feedback message to be delivered to their peers. It can be hypothesized, therefore, that multiple self-related and peer-related cognitive, metacognitive and affective processes take place simultaneously during the composition of a PF message. Further, involving students in PF provision cannot guarantee that they will automatically engage in self-reflection and problem solving activities. For instance, PF can be cognitively demanding, especially for students who have insufficient knowledge about the topic at hand. These students might spend most of the PF activity trying to understand the peer's solution. This is supported by Van Zundert, Sluijsmans, Könings and Van Merriënboer (2012) who showed that providing PF, when combined with insufficient domain-knowledge, was detrimental to the PF provider's performance; especially when the task was complex.

Many prominent feedback frameworks focus on the type, function and/or purpose of feedback (e.g., Kluger & DeNisi, 1996; Hattie & Timplerley, 2007), partly because most of the feedback research focuses on teacher's feedback which is used to help students improve their learning. However, when it comes to PF different interrelated processes and moderators can shape students' learning. Strijbos and Müller (2014) proposed a conceptual framework of feedback which incorporates the composition, provision, reception and processing of feedback as interactive processes taking into account the context and the personal and interpersonal factors of the feedback provider and the receiver. Particularly interesting is the composition process, which is mostly ignored by PF research or regarded identical to the provided PF message. According to Strijbos and Müller (2014) the composition process is influenced by the context (e.g., learning environment, the task), the providers' personal factors (e.g., empathy) and their personal representations of the feedback recipient (e.g., vulnerability to negative feedback). Although the feedback message can act as a good indicator of what the feedback provider knows or does not know, it does not provide any information about how the provider went about creating that feedback message. Moreover, instructional guidance during PF training tends to focus on the PF message (e.g., marking rubrics) rather than scaffolding students' learning from the PF activity (e.g., self-reflection support). In sum, these observations signify a need to explore the cognitive, metacognitive and affective processes students engage in during the composition of PF.

Research questions

This paper addresses the following research questions: (1) Which processes (cognitive, metacognitive, and affective) are reported by students while composing PF on a geometry construction task?, and (2) To what extent does the PF composition process reflect a self-orientation versus a peer-orientation?

Method

Participants and design

The participants were forty-seven pre-service mathematics teachers enrolled for a teaching degree for middle school. They had a mean age of 22.7 years (*SD* = 2.57, age range: 19-29) and seventy percent were female. We conducted an intervention study as a part of a mathematics teacher education course about feedback and assessment. Participation in the PF activities was mandatory as part of course requirements, but inclusion in the study was voluntary (informed consent).

Material

Student reflections were collected during the intervention study in which pre-service mathematics teachers were trained to provide PF (based on Hattie and Timperley's (2007) model) on a geometry construction task. Students received an evaluation rubric for geometry construction, a worked example, and feedback prompts. After PF provision, the students were asked to reflect on PF provision and the PF composition process guided by the following prompts (this paper only focuses on prompts 2 and 3):

(1) What did you learn about geometry construction from providing feedback?
(2) What did you consider/ focus on while composing feedback on the solution of your peer?
(3) Please write down other things you thought about while giving feedback.

Analysis

Quantitative content analysis was used to analyze the reflections, because it is a systematic technique for text analysis. A coding system is the main instrument for analysis and the interpretation of data is theory guided (Mayring, 2014). Before coding the reflections, they were segmented based on Strijbos, Martens, Prins and Jochems' (2006) procedure using the smallest meaningful segment as the unit of analysis. Two independent coders segmented 7 out of 47 reflections (15%) reaching an agreement level of 81% lower bound and 88% upper bound. One of the coders segmented the remaining reflections. A coding scheme was developed using the segmented reflections and guided by the research questions. Two independent coders coded 15% of the reflections reaching an acceptable level of inter-rater reliability on the main categories (Krippendorff's α = .78). One of the coders coded the remaining reflections. A total of 222 segments from 47 students were analyzed.

Findings

Peer feedback composition processes

Three main categories emerged from the data namely cognitive, metacognitive and affective, with specific sub-categories for each main category (see Table 1). The cognitive category involves all statements about actions or thoughts about the PF message (e.g., structure and accuracy) and the composition of PF (e.g., evaluation of solution) at the cognitive level. The metacognitive category is about monitoring and regulation thoughts or actions about the provider's own learning or PF. The affective category refers to attempts to motivate or preserve the feelings of the peer by avoiding negative comments or emphasizing positive aspects. Most of students' reflections were at the cognitive level (76%), followed by the metacognitive (15%) and the affective (9%) level. At the cognitive level students focused mostly on the structure and accuracy of the PF message (32.5%) followed by the evaluation of the peer's solution (23.5%), which is not surprising given the instructional support (i.e., feedback prompts, evaluation rubric and worked example). At the metacognitive level, students focused mostly on monitoring and evaluating their PF message (53%), self-reflection (31.3%) and PF provision self-efficacy (15.6%).

Table 1: Categories of the PF composition processes with definitions and examples

Main category	Sub-category	Definition	Examples
Cognitive	Structure and accuracy	Related to the structure and clarity of the PF message	"I tried to write my feedback in a clear and understandable way"
	Procedural and conditional	Related to the process of composing the PF message	"How to give feedback when the answer is correct?"
	Evaluation of solution	Related to error detection and evaluation of peer performance	"Identifying mistakes"
	Self-reference evaluation	Evaluating the solution relative to one's own solution or thoughts	"I compared the solution to how I would do it"
	Comprehensibility of solution	Related to clarity of and trying to understand the peer solution	"Can I understand all the described steps?"
	Inferring peer's knowledge	Inferring what the peer knows or was thinking about	"Trying to see if the student had a basic level of knowledge"
	Higher cognitive processing	Thinking of alternative solutions, and going beyond correctness of the peer solution	"I tried to find another way to solve the task"
	Improvement purpose	To help peer improve their solution	"Make peer's solution work with changes"
	Questioning solution	Making peers think about their solution	"I asked questions to see if he knew what he was doing"
	Being critical	Related to being critical and objective when providing PF	"How to be objective"
Metacognitive	Self-reflection	Referring to one's own ability to solve the task	"Would I solve it the same way?"
	Self-efficacy	Related to perceived difficulty of providing PF	"Difficult to find mistakes"
	Monitoring and self-evaluation	Monitoring of the PF provision process	"Is my feedback as good that the same or another task can be solved without any problems?"
Affective	Motivating and praising	Related to motivating the peer, avoiding negativity or emphasizing correct parts of the peer solution.	"Encouraging by emphasizing the correct"

Me and my peer: Two overarching themes

Within the cognitive, metacognitive and affective main categories, we identified self-related (me) and peer-related (my peer) aspects. Examples of the peer-related actions/thoughts at the subcategory level include: comprehensibility of solution (cognitive), inferring peer's knowledge (cognitive) and motivating and praising (affective). Examples of the sender's self-related actions/thoughts were: self-reference evaluation (cognitive), higher cognitive processing (cognitive), being critical (cognitive), reflection on one's own ability to solve the task or to provide PF (metacognitive) and monitoring the PF composition process (metacognitive). Figure 1 shows the proportions of self-related (me) and peer-related (my peer) statements at the main category level (i.e., cognitive, metacognitive and affective). Peer-related statements are very prominent in the cognitive and affective categories. This might be because students are concerned with how to compose feedback to their peer, how it should appear to their peer and how to evaluate the solution by their peer.

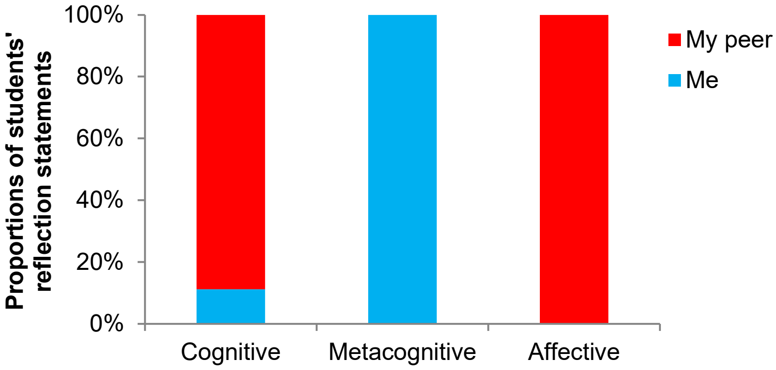

Figure 1. Cognitive, metacognitive and affective self- (me) and peer-related (my peer) statements.

Conclusions and implications

Our results show that the PF composition process involves multiple self- and peer related activities which are not necessarily evident in the PF message. They also show that students can engage in critical evaluation and self-reflection during PF composition as suggested by Nicol et al. (2014). Nonetheless, students appear to focus more on the structure of the PF message (at least in this study). One of the limitations of this study is that students' self-reports were used to explore a complex process like the PF composition. Therefore, the reported activities are by no means regarded as the only experienced activities. Rather, they provide a glimpse of possible cognitive, metacognitive and affective activities of the PF composition process. The findings of this study have several implications for educators who use PF as a learning activity. First, we should pay attention to the PF training and support materials we provide to the students, which are based mostly on the PF message. We cannot expect learning to take place through self-reflection during PF composition if we do not train and scaffold such self-reflection. Second, as suggested by Strijbos and Müller's (2014) interactional framework, representations of peers' characteristics or expected reactions (i.e., affective) seem to be activated during the PF composition activity. One direction for future research is to investigate the effects of affective aspects of a PF message on the learning of the PF sender and recipient. Additionally, the PF sender could receive instructional support about how to balance one's representation of the peer recipient, regulating personal learning, and the impact of such support on the composition of a meaningful and useful PF message.

References

Cho, Y. H., & MacArthur, C. (2011). Learning by reviewing. *Journal of Educational Psychology*, *103*(1), 73-84. doi: 0.1037/a0021950

Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of Educational Research*, *77*(1), 81-112. doi: 10.3102/003465430298487

Kluger, A. N., & Denisi, A. (1996). The effects of feedback interventions on performance: A historical review, a meta-analysis and a preliminary feedback intervention theory. *Psychological Bulletin*, *119*(2), 254-284.

Mayring, P. (2014). *Qualitative content analysis: Theoretical foundation, basic procedures and software solution*. Retrieved from: http://nbn-resolving.de/urn:nbn:de:0168-ssoar-395173

Nicol, D., Thomson, A., & Breslin, C. (2014). Rethinking feedback practices in higher education: A peer review perspective. *Assessment & Evaluation in Higher Education*, *39*(1), 102-122.

Strijbos, J. W., Martens, R., L., Prins, F. J., & Jochems, W. M. G. (2006). Content analysis: What are they talking about? *Computers & Education*, *46*(1), 29-48. doi:10.1016/j.compedu.2005.04.002

Strijbos, J. W., & Müller, A. (2014). Personale Faktoren im Feedbackprozess. In H. Ditton & A. Müller (Eds.), *Feedback und Rückmeldungen: Theoretische Grundlagen, empirische Befunde, praktische Anwendungsfelder* [Feedback and evaluation: Theoretical foundations, empirical findings, practical implementation] (pp. 87-134). Münster, Germany: Waxmann.

Topping, K. (2003). Self- and peer assessment in school and university: Reliability, validity and utility. In M. Segers, F. Dochy & E. Cascallar (Eds.), *Optimising new modes of assessment: In search of qualities and standards* (pp. 55-87). Dordrecht, the Netherlands: Kluwer Academic.

Van Zundert, M. J., Sluijsmans, D. M. A., Könings, K. D., & Van Merriënboer, J. J. G. (2012). The differential effects of task complexity on domain-specific and peer assessment skills. *Educational Psychology: An International Journal of Experimental Educational Psychology*, *32*(1), 127-145. doi: 10.1080/01443410.2011.626122