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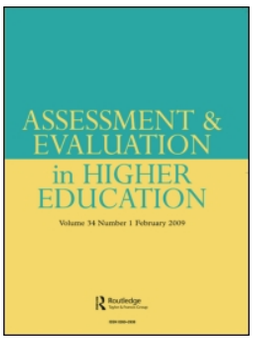

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Peer feedback on academic writing: undergraduate students' peer feedback role, peer feedback perceptions and essay performance

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ABSTRACT

Within the higher education context, peer feedback is frequently applied as an instructional method. Research on the learning mechanisms involved in the peer feedback process has covered aspects of both providing and receiving feedback. However, a direct comparison of the impact that providing and receiving peer feedback has on students' writing performance is still lacking. The current study compared the writing performance of undergraduate students ($N = 83$) who either provided or received anonymous written peer feedback in the context of an authentic academic writing task. In addition, we investigated whether students' peer feedback perceptions were related to the nature of the peer feedback they received and to writing performance. Results showed that both providing and receiving feedback led to similar improvements of writing performance. The presence of explanatory comments positively related both to how adequate students perceived the peer feedback to be, as well as to students' willingness to improve based upon it. However, no direct relation was found between these peer feedback perceptions and students' writing performance increase.

KEYWORDS

Peer feedback; academic writing; perceptions; performance

> The reader as evaluator imposes additional goals or criteria on the text… In a sense then, the process of evaluation simply turns up the power on the reading process: It enlarges the set of constraints that the mental representation one is building must meet and turns reading into testing. (Flower et al. 1986, 23)

Introduction

Peer feedback is frequently applied within the higher education context. As an instructional method, it can be beneficial to students' learning of domain-specific skills (van Zundert, Sluijsmans, and van Merriënboer 2010). With respect to the learning mechanisms involved in the peer feedback process, some prior studies have differentiated between providing and receiving peer feedback on academic writing (e.g. Cho and MacArthur 2011; Greenberg 2015; McConlogue 2015; Nicol, Thomson, and Breslin 2014). To our knowledge, however, a direct (quasi-)experimental comparison of the impact that providing versus receiving peer feedback has on students' learning gains is lacking. As a consequence, it remains an open question how these compare in terms of their relative impact on students' writing performance.

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The current study has two central aims. First, it compares the effects of providing versus receiving peer feedback on students' performance in the context of an authentic academic writing assignment. Second, to gain more insight into the peer feedback process, it investigates the relations between the nature of the received peer feedback, students' perceptions thereof, and their subsequent writing performance.

Providing versus receiving peer feedback

Providing peer feedback is considered beneficial to students' writing as it stimulates them to actively consider the task-specific processes and criteria. According to Flower et al. (1986), three specific processes come into play when a student reviews a text. First, there is problem detection. Second, there is problem diagnosis, which helps to improve writing when potential revision strategies are not obvious, i.e. do not involve relatively straightforward corrections or rewriting. Third, strategies for revision concern actions that follow problem detection and diagnosis. The act of providing peer feedback triggers students to engage in problem detection, and can stimulate them to engage in problem diagnosis and subsequently contemplate solutions and suggest revisions. As a result, students who provide peer feedback gain experience in problem detection, may become more aware of (types of) writing problems, and may discover different revision strategies (Patchan and Schunn 2015). These feedback processes include students taking different perspectives, comparing others' work to their own and the assimilation of new knowledge, which can be coherently referred to as reflective knowledge building (e.g. van Popta et al. 2017; Tsui and Ng 2000).

Two quantitative empirical studies have provided support for such learning-by-reviewing with academic writing (Cho and MacArthur 2011; Greenberg 2015). Cho and MacArthur (2011) found that students who reviewed three example papers performed better on a subsequent writing task compared to both students who only read these same example papers and to controls reading papers on an entirely different subject. Greenberg (2015) also found that students improved their research reports after providing peer feedback, and this improvement was evident across both simple and more complex sections of their reports. Yet, neither of these studies directly compared the impact of providing versus receiving peer feedback on students' final writing performance. To our knowledge, such a comparison has only been reported by Lundstrom and Baker (2009). They found that lower proficiency 'givers' outperformed lower proficiency students in a 'receiver' condition. In this particular study, however, students' experience of providing versus receiving (utilising) peer feedback was restricted to a controlled *training* intervention, without them actually providing or receiving peer feedback on each other's writing.

In summary, none of these studies directly compared the impact of providing versus receiving peer feedback in the context of an authentic writing task. As authentic writing tasks concern self-generated texts and may affect students' grades, students may be inclined and incentivized to provide peer feedback and respond to received feedback more seriously (McDowell 2012). Qualitative inquiries in authentic contexts indicate that students can perceive the benefits of providing peer feedback (Chen 2010), and that they may even consider this more beneficial to their learning than receiving feedback from peers (Ludemann and McMakin 2014; McConlogue 2015; Nicol, Thomson, and Breslin 2014). The current study's first central aim is to compare the impact that providing versus receiving peer feedback has on students' academic writing performance.

> Research question 1: To what extent do students who provide peer feedback improve their writing compared to students who receive peer feedback?

Students providing peer feedback are expected to improve their writing at least as much as students receiving peer feedback. If this expectation is confirmed, this would support the learning-by-reviewing rationale. In contrast, if students receiving peer feedback outperform those providing it, this would indicate that the learning mechanisms involved in the act of providing peer feedback are not as strong as those involved in receiving and utilising peer feedback (e.g. receiving information on the gap between current performance and goal performance; Hattie and Timperley 2007; Nicol and Macfarlane-Dick 2006).

Student perceptions of received peer feedback

The second central aim of the current study is to investigate the relation between the nature of the received peer feedback and students' perceptions thereof, and the relation between these perceptions and subsequent writing performance.

The nature of the peer feedback message

The current study focused on task-level peer feedback, adopting the operationalization proposed by van den Berg, Admiraal, and Pilot (2006). This operationalization differentiates between the aspects of the text on which the feedback focuses (including *content*, *structure* and *style*) and the functions of the feedback (including *analysis*, *evaluation*, *explanation* and *revision*). There were three reasons for adopting this operationalization. First, the four feedback functions by van den Berg, Admiraal, and Pilot (2006) are largely consistent with the different feedback functions and components described in prior review studies. For example, evaluations, explanations and suggestions for revision mirror a conceptual resemblance with 'correcting' and 'guiding' (Narciss 2008), and relate to the questions of how a student is doing in relation to the standard and how to proceed towards that goal (Hattie and Timperley 2007). Second, we considered the inclusion of van den Berg, Admiraal, and Pilot's (2006) feedback aspects content, structure and style as a valuable addition to the feedback functions, as we expected these feedback aspects to be relatively salient to students. For example, we expected that students will differentiate between the value of relatively superficial peer feedback on writing style or grammar versus more content or structure related peer feedback. Third, the operationalization of feedback aspects closely aligned with the criteria of the essay assignment that was the subject in this study.

Student perceptions of peer feedback aspects and functions

The relation between the nature of the peer feedback and subsequent writing performance is likely to be mediated by students' perceptions of the received peer feedback (Strijbos, Narciss, and Dünnebier 2010). However, empirical inquiries into students' perceptions tend to focus on students' general experience of the peer feedback process (e.g. Mostert and Snowball 2013). This study contributes to the existing literature by investigating the relations between the nature of the received peer feedback, students' perceptions thereof, and subsequent writing performance. To this end, we used the feedback-perception questionnaire developed by Strijbos, Narciss, and Dünnebier (2010). This questionnaire measures students' perceptions regarding the adequacy of the received peer feedback and their willingness to improve based upon it. In particular, we wish to assess the extent to which peer feedback on particular aspects of the text (content, structure or style) and with particular functions (analytical, evaluative, explanatory or suggesting revisions) relates to students' perceptions of adequacy and their willingness to improve.

Regarding the peer feedback aspects, comments on content and structure are more likely to go beyond straightforward corrections or rewriting than comments on style, and, therefore, are expected to stimulate more substantial revisions. Prior research indicates that complex revisions predict subsequent writing quality (Cho and MacArthur 2010). If students can recognise the different peer feedback aspects and, at least to some extent, differentially value the potential contributions of these aspects in making substantial revisions, then it seems plausible to expect that peer feedback on content and structure will be perceived as more adequate than peer feedback on style.

Regarding the peer feedback functions, these – implicitly or explicitly – indicate discrepancies between students' current performance and the performance goal of the task (analysis, evaluation), provide suggestions on how to advance towards that goal (revision), and provide explanatory information on either the gap between current and goal performance or the suggested revision (explanation) (Hattie and Timperley 2007; Lizzio and Wilson 2008). As a result, we expect these peer feedback functions to positively relate to students' perceptions of adequacy and their willingness to improve.

Research question 2: To what extent do students perceive peer feedback on aspects of content and structure as adequate compared to peer feedback on aspects of style?

Research question 3: To what extent are perceived peer feedback adequacy and students' willingness to improve related to the degree in which the peer feedback is analytical, evaluative, explanatory or suggesting revisions?

Peer feedback perceptions and writing performance

Students' perceptions may mediate between the received peer feedback and subsequent performance (e.g. van der Pol et al. 2008; Strijbos, Narciss, and Dünnebier 2010). It clearly is important to understand how such peer feedback perceptions relate to students' subsequent writing performance in authentic learning contexts. It is to be expected that students' perceptions of adequacy and their willingness to improve based upon the received peer feedback positively relate to their subsequent writing performance. However, empirical evidence for such perceptions/performance relations is mixed. van der Pol et al. (2008) found that students were more inclined to use peer feedback for revising their work when they regarded the peer feedback as important. In contrast, Strijbos, Narciss, and Dünnebier (2010) did not find a relation between students' peer feedback perceptions and revision efficiency (including error detection, error diagnosis and correctly suggested revisions) in a controlled experimental setting. In the context of a more authentic online peer assessment task, Kaufman and Schunn (2011) also found no relation between student perceptions and the frequency of revisions made. Focusing on students' writing *performance* instead of revision, the current study investigates the relation between peer feedback perceptions and writing performance within an authentic academic writing assignment.

Research question 4: For students receiving peer feedback, to what extent do perceived adequacy and willingness to improve relate to their subsequent writing performance increase?

A positive relation between, on the one hand, perceived peer feedback adequacy and/or students' willingness to improve, and, on the other hand, students' subsequent writing performance would support the findings by van der Pol et al. (2008). Moreover, if peer feedback in relation to certain aspects of the text or serving a particular function relates to these peer feedback perceptions (research questions two and three), this would shed light on *how* the nature of peer feedback influences students' writing performance. In contrast, if students' peer feedback perceptions do not relate to their subsequent writing performance, that would be in line with prior studies by Strijbos, Narciss, and Dünnebier (2010) and Kaufman and Schunn (2011). This would suggest alternative pathways through which the reception of peer feedback may influence subsequent writing performance, such as through inducing reflection (cf. Kaufman and Schunn 2011). See Figure 1 for an overview of the research questions.

Method

Participants and procedure

Participants were students of a research-intensive university in The Netherlands who participated in an introductory course on education and child development studies. Of the 136 students majoring in Education and Child Studies, 91 students fully participated by providing informed consent and filling in both pre-test and post-test questionnaires. Out of these 91 students, data for 8 students were removed

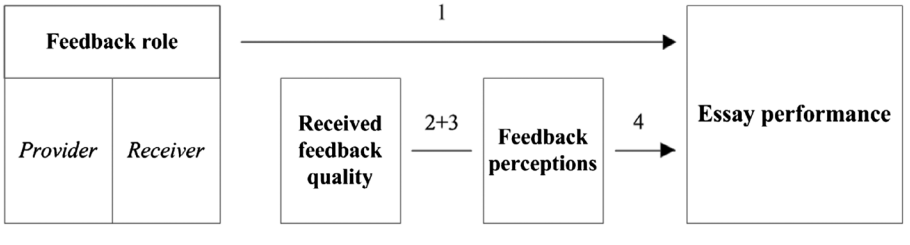

Figure 1. Graphical representation of research questions.

after the peer feedback phase because they did not adhere to their assigned role of either provider or receiver, resulting in a final sample of 83 students. Their mean age was 19.46 years ($SD = 1.83$), with 77 students (93%) being female, which was not uncommon for this and prior cohorts. In eight weekly lectures, the course covered topics from two different fields: family pedagogy and educational sciences. Between weeks 3 and 6 students were required to write and submit a draft essay on one of these two topics. The peer feedback phase took place in week 7, after which students were given the opportunity to revise their drafts and submit a final version of their essay during the 8th and final week.

Experimental manipulation

Within the virtual learning environment (Turnitin) and within each of the two essay topics, the researcher matched students with a similar ability peer based on their performance on a comparable essay assignment from a preceding course. Students were assigned the role of either feedback provider or receiver. The online peer feedback was provided and received anonymously to control for the potential effects of (perceived) status differences between students (e.g. Strijbos, Narciss, and Dünnebier 2010). Among the included students, 46 students were assigned the role of feedback provider, whereas 37 were assigned the role of feedback receiver. For ethical considerations, these roles were reversed in a subsequent course.

Peer feedback guidelines, assignment criteria and grading

In the first week of the course students were informed about the course structure, essay assignment and peer feedback process. It was mandatory for students to submit a draft essay, to provide serious peer feedback, and to submit a final version of their essay within the pre-set deadlines. The essay was to be about one of two preassigned topics, within the fields family pedagogy or educational sciences, with two scientific articles being provided for each topic. Students had at least one prior experience with peer feedback through the same virtual learning environment. Verbal instructions during the meeting in week 1 therefore focused on how to provide constructive feedback and on the assignment criteria. These instructions were made available online.

Final essays were graded by the teaching staff on a scale of 1 (lowest) to 10 (highest), with overall grades being the weighted sum of the following criteria: content (30%), structure (20%), writing style (20%), referencing (20%), and presentation and spelling (10%). Based on the same criteria, an experienced research assistant graded the draft essays, the grades for which were not communicated to students. For the purpose of this study, the elements of writing style, referencing and presentation were aggregated into a single style variable (weighing 50% in the calculation of final grades). Both the teaching staff and research assistant were unaware of students' assigned feedback role. To ascertain the comparability of grades as indicators of essay quality, inter-rater agreement between the grades of the research assistant and the teaching staff was calculated based on nine (> 10%) random draft essays. Inter-rater agreement was high ($r(9) = 0.84$, $p = 0.005$) and absolute grades were similar ($t(8) = 0.57$, $p = 0.584$).

Measures and instruments

Peer feedback perceptions

Students' peer feedback perceptions were measured post-test, that is, directly after the deadline for the revised final essays. An adapted and translated version (Agricola et al. 2016) of the feedback perception questionnaire by Strijbos, Narciss, and Dünnebier (2010) was used, with a Likert-scale ranging from 1 ('totally disagree') to 5 ('totally agree'). The subscales for perceived adequacy (9 items, $\alpha = 0.92$, $N = 37$) and willingness to improve (3 items, $\alpha = 0.87$, $N = 37$) both proved reliable.

The nature of peer feedback

The nature of peer feedback was operationalized based on van den Berg, Admiraal, and Pilot (2006), distinguishing between aspects and functions. Regarding the peer feedback *aspects*, content referred to elements such as the argumentation within the text or the clarity or use of information and concepts. The structure aspect referred to issues concerning the internal consistency of the essay (e.g. between the problem statement and the discussion), and the style aspect referred to issues including grammar, language use, and referencing. Regarding the feedback *functions*, peer feedback segments were coded as analysis when they concerned the reader's understanding of the text. Analytical comments were often phrased as questions such as 'What did you mean by…?' Peer feedback segments were coded as evaluation when they reflected a quality statement, including comments such as 'Well-structured paragraph' or 'This sentence is very hard to read'. Segments were coded as revision when they either directly or indirectly suggested revisions. These could include comments such as 'Rephrase your main question to incorporate…' or 'See the APA manual for correct in-text referencing'. Finally, feedback segments were coded as explanation when they provided arguments supporting either evaluative comments or suggestions for revision. For example, explanatory peer feedback could follow up suggestions for revisions such as 'Rephrase your main question to incorporate…' with '*because right now it does not align with your conclusion*', or follow up evaluative comments such as 'This sentence is very hard to read' with '*it is too long and there are multiple spelling and grammar issues*'.

Coding procedure. Following the two-step procedure used by Huisman et al. (2017), feedback segments were first coded as an aspect of content, structure or style, after which each aspect-coded segment was assigned one or more feedback functions. Hence, a feedback segment was attributed only one feedback aspect, which could include multiple functions. Feedback segments were independently coded by the first author and a trained research assistant, with initial agreement indices for the separate peer feedback aspects and functions ranging between $k = 0.73$ and $k = 0.87$ (see Table 1). Disagreements were resolved through consultation between the coders.

Analyses

Research question 1: peer feedback role and writing performance

To compare the impact of providing versus receiving peer feedback on students' overall writing performance increase (final grade minus draft grade), an independent t-test was conducted to compare overall performance increase between feedback providers and feedback receivers (feedback role). Subsequently, a multivariate analysis of variance (MANOVA) was conducted to more specifically investigate the relation between students' feedback role (independent variable) and students' performance increase on the assignment criteria content, structure and style (dependent variables). All standardised mean differences and standardised gains reported in this study were corrected for sample size (Hedges' *g*, see Borenstein et al. 2009).

Table 1. Inter-rater agreement for peer feedback coding.

		Inter-rater agreement		95% CI
	Code	Kappa	SE_{kappa}	
Feedback aspect	Content	0.80	0.026	0.75 ≤ 0.85
	Structure	0.77	0.047	0.68 ≤ 0.86
	Style	0.87	0.019	0.83 ≤ 0.91
Feedback function	Analysis	0.73	0.048	0.64 ≤ 0.82
	Evaluation	0.76	0.027	0.70 ≤ 0.81
	Explanation	0.75	0.027	0.70 ≤ 0.80
	Revision	0.87	0.021	0.83 ≤ 0.92

Notes: $N = 711$ feedback segments (multiple feedback functions per feedback aspect possible).

Research question 2: student perceptions in relation to peer feedback aspects

To assess the extent to which content or structure-related peer feedback contributed to students' perceptions of adequacy in comparison to peer feedback on style, a multiple regression analysis was conducted. The independent variables were feedback comments on content, structure and style, with the dependent variable being perceived adequacy. Using the statistical software R (v3.4.1, R Core team 2017), the 'relaimpo' package (Groemping 2006) was applied to compare the relative contribution of the independent variables. This procedure compares two independent variables with respect to the proportions (percentages) of the total explained variance (R^2) that each account for in explaining the dependent variable. In particular, it assesses the differences between these relative contributions and provides bootstrapped confidence intervals (here set at $\alpha = 0.05$) to test whether this interval includes zero. For the current research question, two specific comparisons were made: one comparing the relative contributions of content and style in predicting perceived adequacy and one comparing the relative contributions of structure and style in predicting perceived adequacy.

Research question 3: student perceptions in relation to peer feedback functions

Research question three assessed the extent to which analytical, evaluative or explanatory peer feedback comments or peers' suggestions for revisions were related to two components of students' peer feedback perceptions: perceived adequacy and willing to improve. Two separate multiple regression analyses were conducted to facilitate an exploration into the relative contribution of the independent variables (analogous to research question 2). Independent variables were the received feedback functions analysis, evaluation, explanation and revision. Dependent variables were either perceived adequacy or willingness to improve.

Research question 4: peer feedback perceptions and students' writing performance

To explore the relation between students' perceptions of the peer feedback they received and their subsequent increase in writing performance, a multiple regression analysis was conducted. Independent variables were students' willingness to improve and the perceived adequacy of the received peer feedback, the dependent variable was students' performance increase.

Results

Feedback role and writing performance

Overall writing performance between drafts ($M = 6.56$, $SD = 1.38$) and final essays ($M = 6.99$, $SD = 0.99$) improved significantly ($t(82) = 2.62$, $p = 0.010$, $g = 0.35$; see Table 2). Confirming our expectations, students providing peer feedback ($N = 46$, $M = 0.45$, $SD = 1.43$) improved their essays to a similar degree

Table 2. Draft and final essay performance by feedback role.

Feedback role	Assignment criterion	Draft essay		Final essay		Performance increase	
		Mean	SD	Mean	SD	Mean	SD
Provider ($N = 46$)	Total weighted grade	6.55	1.27	7.00	0.85	0.45	1.43
	Content	6.22	1.59	6.27	1.26	0.05	1.85
	Structure	6.20	1.75	6.68	1.39	0.49	1.90
	Style	6.89	1.36	7.56	0.94	0.67	1.53
Receiver ($N = 37$)	Total weighted grade	6.56	1.52	6.98	1.16	0.42	1.61
	Content	6.46	1.52	6.31	1.53	−0.15	2.04
	Structure	6.27	1.81	6.82	1.67	0.55	2.40
	Style	6.75	1.72	7.45	1.32	0.70	1.62
Total group ($N = 83$)	Total weighted grade	6.56	1.38	6.99	0.99	0.43	1.51
	Content	6.33	1.55	6.29	1.38	−0.04	1.93
	Structure	6.23	1.76	6.75	1.51	0.52	2.03
	Style	6.83	1.52	7.51	1.12	0.68	1.56

Notes: Grades range from 1 (lowest) to 10 (highest).

as students receiving peer feedback ($N = 37$, $M = 0.42$, $SD = 1.61$; $t(81) = 0.09$, $p = 0.928$, $g = 0.02$). In addition, the performance increase for feedback providers and receivers was similar on the separate assignment criteria content, structure and style ($V = 0.01$, $F(3, 79) = 0.18$, $p = 0.912$, $\eta_p^2 = 0.01$). In summary, students generally improved from draft to final essay, and peer feedback providers and receivers similarly improved their writing performance after the feedback phase across all aspects of the assignment.

Student perceptions in relation to peer feedback aspects

Peer feedback was generally provided on aspects of style (62.4%) or content (26.9%), whereas peer feedback on essay structure (8.9%) did not occur frequently (see Table 3). Taken together, peer feedback on aspects of content, structure and style explained 21.6% of the total variance in students' perceived peer feedback adequacy ($F(3,33) = 3.04$, $p = 0.043$). Separately however, peer feedback on content ($\beta = 0.29$, $p = 0.100$, $R^2_{content} = 0.11$), structure ($\beta = 0.19$, $p = 0.277$, $R^2_{structure} = 0.07$), or style ($\beta = 0.12$, $p = 0.471$, $R^2_{style} = 0.04$) did not significantly predict the extent to which students perceived the peer feedback as adequate. Peer feedback on content and style (relative contribution difference = 0.04, [−0.15, 0.27]) and peer feedback on structure and style (relative contribution difference = 0.03, [−0.14, 0.20]) contributed similarly in explaining students' perceptions of adequacy (see Figure 2). In summary, all peer feedback comments on aspects of content, structure and style combined significantly explained 21.6% of the variance in students' peer feedback perceptions, and their relative contribution in explaining perceived adequacy was similar.

Student perceptions in relation to peer feedback functions

Overall, peer feedback functions predominantly concerned (suggestions for) revisions (52.0%), evaluations (19.2%) or explanations thereof (24.2%). Taken together, these peer feedback functions explained 34.3% of the variance in students' perceived adequacy ($F(4,32) = 4.18$, $p = 0.008$) and 34.0% of the variance in students' willingness to improve ($F(4,32) = 4.11$, $p = 0.008$). Regarding the extent to which students perceived the peer feedback as adequate (research question 3), we only found a significant positive relation with explanatory peer feedback ($\beta = 0.69$, $p = 0.004$, $\eta_p^2 = 0.45$). This relative contribution of explanatory peer feedback was significantly higher than that of analytical peer feedback (relative contribution difference = 0.22, [0.03, 0.38]) and that of peers' suggestions for revisions (relative contribution difference = 0.19, [0.04, 0.35]) in explaining perceived peer feedback adequacy. Regarding the extent to which students were willing to improve their writing based on the received peer feedback, we again found explanatory peer feedback to be the only significant predictor ($\beta = 0.57$, $p = 0.016$, $\eta_p^2 = 0.37$). Moreover, the relative contribution of explanatory peer feedback was again significantly higher than that of analytical peer feedback (relative contribution difference = 0.18, [0.02, 0.41]) and that of peers' suggestions for improvement (relative contribution difference = 0.16, [0.05, 0.38]). In predicting both perceived adequacy and willingness to improve, the relative contributions of evaluative peer feedback did not differ from any of the other three feedback functions.

In summary, peer feedback in the form of analytical, evaluative and explanatory comments and suggestions for revision taken together explained over a third of the variance in both students' perceived

Table 3. Received peer feedback aspects and functions.

		Function				
		Analysis	Evaluation	Explanation	Revision	Total
Aspect	Content	46	88	59	81	274
	Structure	1	35	27	27	90
	Style	0	72	160	421	653
Total		47	195	246	529	1017

Notes: $N = 37$ receivers; 1017 segments (97.60%) coded as an Aspect with ≥ 1Function(s); 25 segments (2.40%) coded as Not Applicable and neglected in analyses.

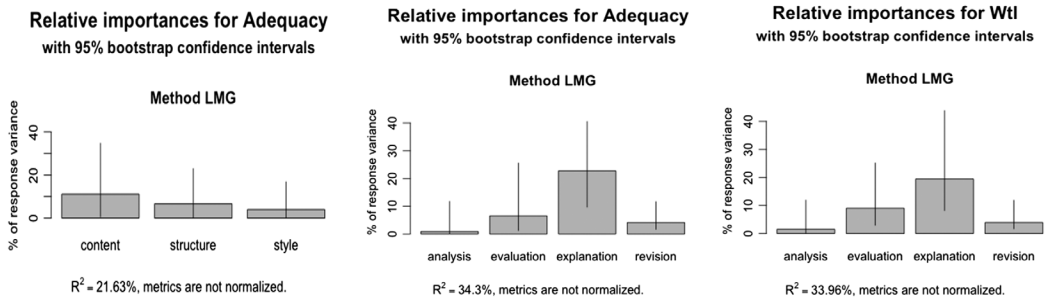

Figure 2. Relative importance of peer feedback aspects and functions in predicting perceived adequacy and willingness to improve (Wtl).

peer feedback adequacy and their willingness to improve. However, a closer look revealed that only explanatory peer feedback comments significantly predict these peer feedback perceptions. In predicting these perceptions of adequacy and willingness to improve, explanatory peer feedback was more important than analytical peer feedback comments and suggestions for revisions.

Peer feedback perceptions and students' writing performance

We investigated the extent to which students' perceived peer feedback adequacy and their willingness to improve related to their writing performance increase (research question 4). Neither perceived peer feedback adequacy ($\beta = 0.17$, $p = 0.617$, $\eta_p^2 = 0.085$) nor students' willingness to improve based upon the received peer feedback ($\beta = -0.45$, $p = 0.088$, $\eta_p^2 = -0.295$) significantly related to students' subsequent increase in writing performance.

Conclusion and discussion

The current study had two central aims: (1) to compare the impact of providing versus receiving peer feedback on students' performance on an authentic academic writing assignment, and (2) to explore the relations between the nature of the received peer feedback, students' perceptions thereof and their subsequent writing performance. In the following sections, we discuss the main outcomes with regards to these central aims and the corresponding research questions.

Feedback role and writing performance

Students in this study either provided or received anonymous written peer feedback in the context of an authentic academic writing assignment. As expected, feedback providers and receivers were found to improve to a similar extent from draft to final essay, both in terms of their overall grades and in terms of the separate assignment criteria relating to content, structure and style. These results suggest that the learning mechanisms involved in the act of providing peer feedback (e.g. triggering problem detection, stimulating problem diagnosis and revision strategies; Flower et al. 1986; Patchan and Schunn 2015), and those involved in receiving peer feedback (e.g. receiving information on the discrepancies between current performance, goal performance, and how to close this gap; Hattie and Timperley 2007; Nicol and Macfarlane-Dick 2006), have a similar impact on students' subsequent writing performance. This finding corroborates those of prior studies reporting the positive effects providing peer feedback on students' own writing performance (e.g. Cho and MacArthur 2011; Greenberg 2015). This study also corroborates the survey data of Nicol, Thomson, and Breslin (2014), who reported on students' *perceptions* of the benefits of providing versus receiving peer feedback. Specifically, similar proportions of students reported to have modified their initial writing assignment as a result of providing peer feedback versus

receiving it. In addition to exploring the relation between the specific nature of the peer feedback and students' perceptions thereof, the current study builds on Nicol, Thomson, and Breslin's (2014) findings by investigating how students' feedback role impacts their actual writing *performance*.

We know of only one prior study that related students' feedback role to their writing performance (Lundstrom and Baker 2009). This study reported higher writing performance for students who were trained in providing peer feedback, particularly for relatively low performing students. Contextual differences may explain the different findings of this study and ours. In particular, Lundstrom and Baker's (2009) peer feedback intervention was restricted to a training phase, and as such related less directly to the measured writing assignments, potentially limiting students' engagement. The current study was conducted within an authentic writing assignment and incorporated both a carrot (grade) and a stick (mandatory participation) to incentivize students' engagement. Given these differences, it may not be surprising that the feedback providers in the Lundstrom and Baker study outperformed the feedback receivers; the 'providing' training may have sufficiently activated learning mechanisms such as problem detection, diagnosis and the contemplation of strategies for revision (Flower et al. 1986; Patchan and Schunn 2015), whereas the 'receiving' training may not have been perceived as sufficiently relevant to the students' own writing assignment and performance. In the current study, students' task-engagement and these learning mechanisms are stimulated to more similar degrees for peer feedback providers and receivers.

Research on the training of students *before* the peer feedback phase and research conducting interventions during the peer feedback process both have their merits, and may even be complementary. In both cases, however, the authenticity of the learning context may be crucial in determining the practical value of the research findings. In order to more confidently pin down the effects that providing and receiving peer feedback have on students' own subsequent performance, we would therefore like to make a case for further empirical research in authentic writing contexts, ideally including a control or comparison group.

Student perceptions and the nature of peer feedback comments

The current study adopted van den Berg, Admiraal, and Pilot's (2006) operationalization of the nature of peer feedback, which distinguishes between the aspects of the text to which the peer feedback refers (content, structure, style) and the function of the peer feedback (analysis, evaluation, explanation, suggestion for revision). We expected that students would perceive peer feedback on essay content and structure as more adequate compared to peer feedback on style. Contrary to our expectation, students perceived peer feedback on aspects of content, structure and style as equally adequate. An explanation could be that aspects of style weighted 50% in calculating students' final grades. Students may have perceived peer feedback on style as relatively important as a result of the 'backwash effect' (Biggs 1996), meaning that the assessment criteria could have driven students' perceptions of what is adequate peer feedback and performance. Hence, future research applying differently weighted assignment criteria may clarify to what extent perceptions of peer feedback adequacy are driven by such characteristics of the task.

Given that the feedback functions can provide information on the discrepancies between current performance, goal performance and how to close this gap (e.g. Hattie and Timperley 2007), we expected that each feedback function could contribute to students' perceptions of peer feedback adequacy and their willingness to improve based upon it. However, only explanatory peer feedback positively related to these peer feedback perceptions. In particular, explanatory peer feedback comments were relatively important in comparison to analytical peer feedback and peer feedback containing suggestions for revision. These findings are largely aligned with those of Strijbos, Narciss, and Dünnebier (2010), who found that elaborate and specific peer feedback can be perceived as more adequate in comparison to concise and general peer feedback, and with Bolzer, Strijbos, and Fischer (2015), whose findings suggest that justifications influence mindful cognitive processing. They also resonate with the findings

of Lizzio and Wilson (2008), who reported a relation between explanatory ('justifying') peer feedback comments and perceptions of fairness.

Knowing what students perceive as adequate peer feedback and what drives these perceptions can be applied in the training of students in the peer feedback process (see, e.g. Gielen, Dochy, and Onghena 2011; Sluijsmans 2002). Contingent on the extent to which the assessment criteria may have driven students' perceptions of peer feedback adequacy, the current findings indicate that the role of explanations should be emphasised when training students for the peer feedback process.

Peer feedback perceptions and students' writing performance

In addition to investigating the effects of providing versus receiving peer feedback, this study explored the extent to which students' perceptions of the received peer feedback related to an increase in their subsequent writing performance. We found that students' perceived adequacy of the peer feedback and their willingness to improve based upon it were unrelated to their writing performance increase. Apparently, these perceptions do not mediate between the nature of the peer feedback and subsequent writing performance.

Considering the mixed findings in prior research, the current study's results do not provide a conclusive answer regarding the role of students' peer feedback perceptions in relation to their performance. On the one hand, Gielen et al. (2010) found that the presence of explanations ('justifications') in peer feedback could raise subsequent performance of assessees in secondary education. In that light, and as perceptions are likely to influence information processing (Pajares 1992), it may be considered somewhat surprising that students in the current study did perceive peer feedback as adequate when it included such explanatory comments, but that these perceptions – in turn – did not relate to their subsequent writing performance. On the other hand, the current study's findings are in line with prior research by Schunn and colleagues (e.g. Cho, Schunn, and Wilson 2006). These studies indicate that students' peer feedback perceptions are unrelated to revision behaviour, and that what students perceive to be helpful peer feedback may not always be linked to subsequent writing performance. Possibly, the peer feedback process may have induced students' reflection about their writing, which may act independently from how they perceive their fellow students' peer feedback (cf. Kaufman and Schunn 2011).

Alternatively, an explanation could be that perceptions of a single peer feedback experience do not weigh enough into affecting students' attitudes, beliefs and/or performance. If the influence of students' peer feedback perceptions indeed depends on their cumulative experience of multiple peer feedback occurrences over time (e.g. van Zundert, Sluijsmans, and van Merriënboer 2010), this would suggest a more longitudinal approach for investigating the relation between peer feedback perceptions and writing performance.

Limitations

The finding that peer feedback providers and receivers improve their writing to similar degrees suggests that the learning mechanisms involved in these different activities are similarly beneficial. Some caution is needed, however. Although we consider it plausible to regard the performance increase of providers and receivers as a result of the peer feedback phase (serious participation was both mandatory and incentivized), the authentic context of the current study made it practically and ethically unfeasible to incorporate a no-feedback control group. Hence, we can only refer to the *relative* writing performance increase of feedback providers versus receivers, and not to their absolute performance increase as compared to a true baseline measure. Clearly, future studies that are able to combine the inclusion of such a control group with an authentic context could provide meaningful information regarding the absolute effects of providing and receiving peer feedback on students' academic writing.

With respect to the nature of the peer feedback and students' perceptions thereof, the empirical findings in this study – as in most empirical studies – are inherently limited as they represent one

measure in time for one particular group of students. Although the participating students did have at least one prior experience with peer feedback on writing, a specific peer feedback training was not integrated in their curriculum. Therefore, and in addition to the potential backwash effect resulting from the weighting of the assignment criteria, this lack of training should be considered when comparing the nature of the reported peer feedback in this study with that reported in other studies.

Implications

The current study's findings are informative for higher education professionals who contemplate the design and implementation of peer feedback training within their course or curriculum. Specifically, in designing such peer feedback training, we believe that our findings regarding students' feedback role provide higher education professionals with a degree of flexibility. In addition, the importance of explanatory peer comments indicates what should be included in such a training for students.

We would argue for a more longitudinal approach (e.g. van Zundert, Sluijsmans, and van Merriënboer 2010), both for training students for the peer feedback process as for researching the relations between the nature of the peer feedback students produce, their perceptions thereof and subsequent learning outcomes. Within such a longitudinal context, the current study's findings suggest that students could confidently, at first, only be involved in the provision of peer feedback in order to avoid issues such as distrust in each other's quality as assessor (for example, by initially withholding the feedback provided by students' peers). After all, this study suggests that students' learning gains are similarly affected by providing peer feedback and receiving it. In addition, students may also *perceive* the act of providing peer feedback as the most beneficial part of the peer feedback process (cf. McConlogue 2015). When students gain experience and follow training, among others with respect to the importance of explanatory peer feedback, students may perceive the peer feedback as increasingly positive as a result of increasing peer feedback quality. Through such iterative experiences, a classroom culture can be developed in which peer feedback is accepted or even is the norm (see McConlogue 2015, for a similar rationale).

It should be mentioned here that we are currently conducting such a longitudinal inquiry with a large group of biopharmaceutical science students. Specifically, these students are followed during the first three semesters of their undergraduate programme with respect to their peer feedback quality and their perceptions thereof, and with respect to how these measures relate to their academic writing. In addition, students' more general attitudes towards peer feedback are investigated to gauge their support for peer feedback as an instructional method across this period of time. With the conception in mind that peer feedback is an important academic and professional skill in itself (Liu and Carless 2006; Nicol, Thomson, and Breslin 2014), which should be trained as such, we believe that such a longitudinal approach is a promising way to address and assess the development of students' peer feedback skills and their attitudes towards it.

Statement on open data

The anonymized data and analyses (syntaxes) are accessible via the following link: https://osf.io/awkd9

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Disclosure statement

No potential conflict of interest was reported by the authors.

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