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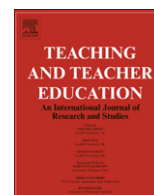
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Types and frequencies of feedback interventions in classroom interaction in secondary education

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HIGHLIGHTS

- ▶ We propose to distinguish between progress and discrepancy feedback.
- ▶ We propose a ratio of 3:1 on positive and negative feedback in teaching.
- ▶ Teachers in secondary education seldom provided the effective types of feedback.
- ▶ Frequency and types of feedback did not differ for experience or age.

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ABSTRACT

Contributing to the growing amount of literature on learning–enhancing feedback, this article attempts to distinguish between progress feedback and discrepancy feedback. Building on relevant literature drawn from psychology, we propose the use of a ratio of 3:1, positive:negative feedback. We analyzed contiguous 10 min blocks of classroom interactions from 78 teachers. Findings indicate that teachers seldom provide the types of feedback interventions identified as effective in enhancing learning in the course of typical classroom interactions. We examine potential explanations for this, discuss the consequences of this finding on teacher education and professional development, and offer several opportunities for future research.

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1. Introduction

In education research, feedback is generally seen as an important tool to enhance learning. For example, in his review of 196 studies of feedback in the classroom, Hattie (1999) described feedback as one of the most influential factors in learning, as powerful as the quality and quantity of instruction. Moreno (2004) regarded feedback as crucial to improving knowledge and skill acquisition (see also Black & Wiliam, 1998; Hattie & Timperley, 2007; Kluger & DeNisi, 1996; Shute, 2008). Keeping this in mind, certain conclusions regarding the application of feedback are alarming. First, Kluger and DeNisi (1996), in their review of 131 studies on the topic, found that about one-third of feedback interventions served to decrease learning. Hence, feedback has a powerful but variable influence on learning. Second, however rare research investigating the frequency of feedback in classroom interaction may be, the available research tells us that feedback in

the classroom is seldom given. In his inaugural lecture at the University of Auckland, delivered in 1999, Hattie stated that the incidence of feedback in a classroom is very low, at best measurable only in seconds per day. Pauli (2010) also found a low frequency of feedback interventions. She found that teachers often ask new questions or offer further explanation without explicitly reviewing the answer or statement of the student. If feedback was present, it was in most cases non-specific and had the form of praise: “good”; or, “that’s right”. Other, more specific examples of feedback interventions were less common. Bond, Smith, Baker, and Hattie (2000) carried out research on the certification system of the American National Board for Professional Teaching Standards. They found that the incidence of feedback was one of the discriminating variables differentiating between teachers who did and who did not receive verification as ‘accomplished’ teachers. The frequency of feedback, however, was very low in both groups. Like Pauli (2010), they found that the most common feedback was praise, for example, “Well done!” Owing to the importance of feedback in enhancing learning, it is particularly interesting to know which feedback interventions might enhance learning, and which are unlikely to do so. In addition, it is interesting which of the feedback interventions that are likely to enhance learning, are actually being

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used by teachers in interaction with their students in daily teaching practice, and how often. In the present study, we focus on the feedback teachers provide during the lessons they give in their regular day-to-day work. The main research question is:

“Which of the feedback interventions that, according to the relevant literature are likely to be either effective or ineffective in enhancing learning, are actually used by teachers in their interaction with students? And, how often are these feedback interventions employed?”

In order to answer this question, we will first define and describe the concept of ‘feedback’. Most existing descriptions of the concept available in the existing literature emphasize the discrepancy between a current level of performance of a given student on the one hand, and a goal or desired level of performance on the other. This relationship is what is described as ‘discrepancy-feedback’. Following the published research of Schunk and Swartz (1993), we propose that it may also be effective to compare a current level of performance with an earlier level of performance, a relationship defined as ‘progress-feedback’. Next, we will describe those features of feedback interventions that the literature has shown to probably enhance learning and those which apparently do not. The central part of the study presented here is an empirical examination of how 78 separate teachers actually employ those feedback interventions identified as enhancing learning. The article will close with a discussion of the results as they relate to the theories governing feedback and a description of the implications for the continuing education and professional development of educators.

2. Theoretical framework: feedback interventions that the literature describes as effective or not effective for enhancing learning

2.1. The concept of ‘feedback’

We have based the present section on the findings from three review studies on feedback: Kluger and DeNisi (1996), Hattie and Timperley (2007), and Shute (2008). We selected these three studies because of the large number of relevant studies each took into account, and because these studies serve as reference points for many other studies on feedback. The descriptions of feedback in these review articles were quite univocal, in that each considers feedback to be information regarding one’s performance or understanding, given by an agent—teacher, peer, computer, book, parent, self, experience—and, each considers the main purpose of feedback to be to reduce discrepancies between current understanding or performance and some desired level of performance or goal. This latter aspect of feedback is discussed in particular detail. Kluger and DeNisi (1996) described feedback intervention as creating a ‘feedback sign’, a positive or negative evaluation of one’s performance relative to a goal. In their model of feedback, Hattie and Timperley (2007) state that, “The main purpose of feedback is to reduce discrepancies between current understandings and performance and a goal” (p.86). Effective feedback should offer information about these discrepancies. Shute (2008) referred to several cognitive mechanisms through which feedback may be used by a learner, and stated that, “First it can signal a gap between a current level of performance and some desired level of performance or goal” (p.157). Based on these descriptions, we define feedback as, *information provided by the teacher concerning the performance or understanding of the student, with reference to a goal and aimed at improving learning.*

2.2. Effective or ineffective feedback

Kluger and DeNisi (1996) performed a meta-analysis of 131 studies on feedback, the majority of which were not classroom-based. They found that, for the most part, feedback interventions improved performance, but over one-third of feedback interventions decreased performance. To explain this phenomenon, they suggested in their *Feedback Intervention Theory* that the effectiveness of feedback interventions decreases if the feedback draws attention closer to the self, and away from the task (p.254). They claimed that feedback lacking in specificity may be seen by students to be useless, while feedback that is too elaborate may cause a cognitive overload or may again direct the receiver’s attention away from the task. In addition, they found that both positive and negative feedback can enhance learning, provided the feedback contains enough information to allow the student to acknowledge what is right or wrong in their performance or understanding.

Hattie and Timperley (2007) proposed a model of feedback, derived from Hattie’s (1999) synthesis of over 500 meta-analyses. They distinguished four levels of feedback, each with a differential effect on learning. These levels are: (1) feedback on the task, (2) feedback about the processing of the task, (3) feedback about self-regulation, and (4) feedback about the self. Concurrent with Kluger and DeNisi (1996), they described feedback on the self as the least effective form of feedback. They also concluded that feedback on self-regulation and on the processing of the task served to enhance learning. Feedback on the task was effective in enhancing learning, provided the information is useful in improving either the use of strategies or self-regulation. Important in these levels of feedback was the amount of information, or the specificity, provided for in the feedback. Praise appeared to be ineffective in enhancing learning, and often had a detrimental effect on learning. Hattie and Timperley also noted that, when learners are committed to a goal, they are more likely to learn as a function of *positive* feedback, for example, “That is a thoughtful question!” When learners are forced to perform tasks, they are more likely to learn as a result of *negative* feedback, for example, “You have written this word incorrectly.” Hattie and Timperley, however, also warned researchers of the short-term effect of negative feedback interventions, making particular mention of the increased likelihood of task avoidance as a result of frequent negative feedback.

Shute (2008) completed a review of approximately 100 articles, conference proceedings, books and book chapters, all centered on feedback. She listed feedback interventions that seem either effective or ineffective in enhancing learning. She found that the feedback that is generally effective in enhancing learning is specific but not too elaborate, and is presented in manageable units. Furthermore, effective feedback focuses on the task. Feedback that is not effective in enhancing learning clearly lacks these same characteristics. In agreement with the two review articles previously discussed in this section, Shute described that feedback concerning the “self” and praise seem to be ineffective in enhancing learning.

3. A contribution to the discussion: a further theoretical analysis of concepts concerning feedback

In the previous section, we defined feedback effective in enhancing learning as being *specific*, in that it provides information about the learning goal with reference to the task, the processing of the task, or self-regulation, while not being overly elaborate. Feedback that is not effective in enhancing learning is either *non-specific* or takes the form of praise. Both positive and negative

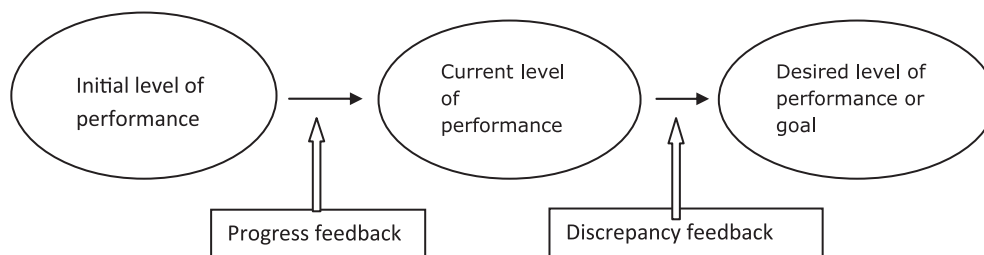


Fig. 1. Progress feedback and discrepancy feedback.

feedback can serve to enhance learning, as long as they provide specific information.

The concepts of specific, positive, and negative feedback are important in gaining an understanding of the type or types of feedback that enhance learning. Below, we will examine these concepts from other theoretical perspectives. In doing so, we aim to further the understanding of the effect of feedback in classroom interactions.

3.1. Specific feedback: discrepancy and progress feedback

Several studies have described the nature of specific feedback, or provided suggestions meant to assist in making feedback interventions more specific. Shute (2008) described specific feedback as information pertaining to the accuracy of particular responses or behaviors. Hattie and Timperley (2007) stressed the need for teachers to provide more evaluative information in their feedback as a means of providing specific feedback. Other authors have acknowledged this as well. For instance, Sadler (1989) stated that the teacher must possess a concept of quality appropriate to the task and be able to judge the work of the student in relation to that concept. Based on a case study, Parr and Limbrick (2009) identified the impact of the explicitness of teachers' feedback on the way in which the students met goals as a hallmark of effective teaching.

As mentioned above, an important aim of feedback is the reduction of discrepancies between a current level of performance or understanding and a goal. To be specific, feedback should provide information about this discrepancy. According to both Shute (2008) and Hattie and Timperley (2007), specific feedback can be used to clarify goals and reduce or remove uncertainty in relation to how well learners are performing a task. Feedback should also be about what needs to be accomplished to attain a desired level of performance, a type of specific feedback we have labeled as *discrepancy feedback*. This is one way of using goals to provide effective feedback.

In addition to this perspective, it would also be useful to consider specific, goal-related feedback from another angle: the possibility of providing feedback on the *progress* students have made toward meeting goals. For example, Schunk and Swartz (1993) studied the influence of what they called *progress feedback* on writing achievement. They found that children who received feedback on the difference between an initial level of performance and their actual level learned strategies better and more quickly than students who received only information about the overall goal of the task. Progress feedback also had a notable impact on maintenance and generalization. This conclusion is repeated in Schunk and Ertmer (1999), where the authors demonstrate that feedback on progress, when given relative to one's initial performance, enhances both learning and motivation. This serves, also, as a way to compare one's performance to a desired level or goal, while allowing emphasis to be placed on what has already been achieved. As a result, in goal-related feedback it seems appropriate to make

a distinction between progress feedback—which emphasizes what has already been achieved—and discrepancy feedback—which emphasizes what is yet to be achieved. Both progress feedback and discrepancy feedback allow teachers to be specific in the type of feedback they provide to their students. The use of both types of feedback in combination is shown in Fig. 1.

3.2. Positive and negative feedback interventions: a ratio

Kluger and DeNisi (1996) found that both positive and negative feedback can enhance learning. In our understanding of positive and negative feedback we will follow Losada (1999), who described positive feedback as showing support, encouragement, or appreciation, and negative feedback as showing disapproval, or even sarcasm. Table 1 provides examples of both positive and negative feedback.

The influence of both positive and negative feedback on learning is also underlined by Hattie and Timperley (2007), who, along with Kluger and DeNisi (1996) and Shute (2008), however have cautioned against the overuse of negative feedback, owing to the threat such an approach poses to the self-esteem and self-efficacy of the learner. In second language acquisition, the effectiveness of negative feedback has been heavily debated (e.g. van Beuningen, 2011; Kim, 2004; el Tatawy, 2002). Negative feedback has been found to have little impact on language learning, or to be potentially harmful to learning and the motivation to learn (Kim, 2004). Other research, however, has shown that negative feedback can be effective. In van Beuningen (2011), negative feedback was found to have a positive effect on learners' ability to write linguistically accurate texts. This relates, also, to the variability of the impact of

Table 1
Feedback interventions and examples^a.

Feedback intervention	Example
Non-specific positive feedback	Good job! All right! (examples from Pauli, 2010)
Specific positive feedback	"Well done, you have shown the way you arrived at the solution." "You're learning to do the steps! ", and, "You're doing well, because you followed the steps in order". (Schunk & Swartz, 1993) "Last week you didn't know that many words, this week you know them all!" (<i>progress feedback</i>) "You've got some direct speech here, direct speech using thoughts. Excellent." (Parr & Limbrick, 2009)
Non-specific negative feedback	"That's incorrect." "That doesn't sound right."
Specific negative feedback	"Your answer is too long. In your exam your answer needs to be short." (<i>discrepancy feedback</i>) "You do not know the conjugations of the irregular verbs. This is really necessary to get a good mark in your test." (<i>discrepancy feedback</i>)

^a The examples come from multiple studies conducted on the use of feedback by teachers, including our own study.

feedback. In their study on teacher feedback and achievement in physical education, Silverman, Tyson, and Krampitz (1992) found that positive feedback was associated with increased student learning.

Positive and negative feedback do not have equal impact on learning. Baumeister and Cairns (1992) examined the manner in which an individual processes and remembers positive and negative feedback. They found that negative feedback elicited clear defensive responses, ranging from avoidance in elaborating on the feedback to negative thoughts. They also found that the highest memory scores in the experiment were achieved if positive feedback was mixed with small amounts of negative feedback. There were no similarly high scores achieved by tempering generally negative feedback with small amounts of positive feedback. As an explanation for this phenomenon, Baumeister, Bratslavsky, Finkenauer, and Vohs (2001) have suggested that, when feedback is generally positive, people let their defenses down, whereupon small bits of negative feedback penetrate exceptionally well. According to the same authors, negative feedback has a greater impact on memory and self-esteem than does positive feedback, a conclusion which supports the findings of Kluger and DeNisi (1996), that negative feedback can have a greater impact on self-efficacy than positive feedback. The impact of negative feedback is not only on self-esteem or self-efficacy; Goodman, Hendrickx, and Wood (2004) found that increasing specific negative feedback served to reduce both exploration and explorational strategies.

Based on the difference in impact, both Losada and Heaphy (2004) and Frederickson and Losada (2005) posited that, to overcome the impact of negative feedback, experiences of positivity may need to outnumber experiences of negativity—in other words, experiences of positive feedback need to outnumber experiences of negative feedback. Based on their research into management teams, Losada and Heaphy (2004) developed a ratio at which positive and negative feedback should occur in order for people to develop and learn. Higher performance in, for instance, management teams occurs if the ratio of positivity to negativity is higher than 3:1—that is, if there are three instances of positive feedback for each instance of negative feedback. These authors also found, however, that in order for the feedback to be effective, this ratio should not exceed 11:1. They made no distinction between feedback levels, or between specific and non-specific types of feedback.

The question remains whether we can directly apply these findings to teaching, and more specifically, to teacher feedback. There is a general paucity of research on this issue. Classroom interaction may possess different features as compared with the interactions that occur within business management teams. More importantly, the impact of a teacher's feedback, whether said feedback is positive or negative, on a student may be determined, for example, by the degree to which the feedback either confirms or contradicts the student's own appraisal of his or her performance. If a student believes they have performed a task well, negative feedback may be perceived as confrontational and limit the potential for further learning, whereas negative feedback that confirms his own estimation may have another effect, in limiting the students motivation to learn. In sum, we believe that the issue of what constitutes an appropriate ratio of positive to negative feedback is a complicated matter, too complicated to be reduced to a simple number derived from a mathematical analysis. Still, Losada and Heaphy's ratio may give some indication of an appropriate balance. It also provides an interesting avenue for further analysis of feedback intervention in a classroom setting. We have used this ratio in our analysis of the feedback offered by the teachers included in the current study.

In our theoretical analysis, we identified several types of feedback intervention that might enhance learning. We made distinctions between specific and non-specific feedback, and noted that specific feedback can be either progress feedback or discrepancy feedback. We have also distinguished between positive and negative feedback. Combining these features produces the feedback interventions shown above, in Table 1.

4. The empirical study

4.1. Refining the research question

To answer our central research question, we have formulated the following related questions, based on the above theoretical analysis:

1. What is the frequency of teachers' feedback interventions and other interventions (i.e., questions, brief instructions) during classroom interaction?
2. How many teachers provide each of the feedback intervention types during classroom interactions? How often do they do so?
3. What is the ratio of positive feedback to negative feedback (both specific and non-specific) that teachers provide?
4. How many teachers provide progress feedback and discrepancy feedback? And how often?
5. Do the answers to questions 1, 2, 3, and 4 differ based on school type (ranging from vocational education to pre-university level), school subject, grade level, gender, age, and experience?

4.2. Design

4.2.1. Research participants

78 teachers from eight different secondary education schools in the Netherlands were involved in this study. The participating schools varied from very traditional to highly innovative in their educational approach, and ranged from vocational education to pre-university level. The schools were as diverse as possible in terms of both geography and demography. Table 2 lists the types of schools included in the study, the grade levels taught by the subject teachers, and the gender, age, and experience of the teachers included in the study. We sought the permission and cooperation of all teachers prior to the onset of research. We explained our research by e-mail and, regarding the issue of confidentiality, ensured all parties that the recordings would not be used for any other goal, nor would they be made public at any time. Participating teachers were filmed during a lesson of their choice. They were aware that we were carrying out a study into their communication with their students, but did not know that we were explicitly observing their feedback. We also made sure that no names of

Table 2
Characteristics of the participating teachers.

Characteristic	Division	Number
Type of school	Lower vocational education	26
	Higher levels of secondary education	52
Subject	Language teachers	25
	Science and math teachers	25
	Other subjects	28
Grade level	Teachers of lower grades	41
	Teachers of higher grades	37
Gender	Male	37
	Female	41
Age	Ranging from 19 to 59, with a mean of 37.1	
Experience	Ranging from 1 to 40 years, with a mean of 11.61	

teachers or schools appear in our data. All teachers received a copy of their recording and had the opportunity to refuse their cooperation after reviewing the tape. Two teachers did withdraw their consent after doing so, and their respective data and recordings were removed from the sample.

4.2.2. Observation instrument

We conducted a pilot study to develop an observation instrument, to be derived from the framework described in the above section reviewing current theory and the relevant literature on the topic. The instrument consists of the following categories:

1. *Non-specific positive feedback*: non-specific positive utterances, such as: “Well done!” and, “Great!”
2. *Non-specific negative feedback*: non-specific utterances, such as: “Wrong!” and, “Not quite!”
3. *Specific positive feedback*: positive feedback containing specific information about the performance or level of understanding of the student.
 - 3a. *discrepancy feedback*: positive feedback comparing the performance or level of understanding of the student with some predefined goal or desired level of achievement.
 - 3b. *progress feedback*: positive feedback comparing the performance or level of understanding of the student with their earlier performance or level of understanding.
 - 3c. *otherwise*: other specific positive feedback.
4. *Specific negative feedback*: negative feedback containing specific information about the performance or level of understanding of the student.
 - 4a. *discrepancy feedback*: negative feedback comparing the performance or level of understanding of the student with some predefined goal or desired level of achievement.
 - 4b. *progress feedback*: negative feedback comparing the performance or level of understanding of the student with their earlier performance or level of understanding.
 - 4c. *otherwise*: other specific negative feedback.
5. *Other interventions*: i.e., questions, brief instructions.

While pilot-testing the observation instrument, we made several decisions as to how to evaluate the teacher feedback interventions. In our decision making regarding specificity, we asked: do the students know exactly what they have done right or wrong? If we could answer this question positively, we scored the feedback as specific. We recorded feedback as specific however small the specificity of the feedback. For instance, the intervention, “Well done, you have 28 good answers,” was scored as specific. Another example was the exclamation, “Geburtstag, yes!” This was provided as feedback to a correct answer from a student in translating “birthday” from Dutch into German. By this same criterion, (does the student know what is right or wrong) questions were not

regarded as feedback; questions might, however, help shift students’ focus toward goals.

We decided to use the intonation as well as the surrounding context (e.g. task and content of the comment) of the teacher in interpreting the feedback as positive or negative. We did not use the facial expression of the teacher. In evaluating the intonation, we observed whether it was possible to perceive either positive or negative emotions on the part of the teacher, such as joy, praise, irony, anger or cynicism. Some examples of intonation used to interpret the feedback include the following:

- An ironic remark, such as: “This is going smoothly!” When delivered to students who were not making progress, this was observed to be non-specific negative feedback. The students knew their work was not going smoothly, but gained no information that would help them improve from the feedback.
- An enthusiastic exclamation, such as the student’s name. When delivered to a student who had shown keen insight, such remarks were scored as positive non-specific feedback.
- A cynical and angry remark, such as: “You really do your best, don’t you!” When spoken curtly by the teacher to a student who had already received feedback on his non-working attitude. Due to the tone of voice, and the specific nature of the comment—the student is made to know they are not working hard enough—we were able to positively answer the question, “Does the student know what they have done wrong?” Hence we scored this feedback as negative and specific.

Furthermore, we chose to count feedback that was immediately repeated in a different manner or tone as being a continuation of the earlier feedback intervention.

As can be seen in the examples in Table 3, utterances from teachers were short sentences, or exclamations. Each teacher’s interventions were scored as feedback or other interventions. Utterances of the teacher that were not related to the learning of the students were not regarded as an intervention and ignored in the observation (for example, beautiful weather today!) Because we decided only to score teachers in interaction with their students there were no long explanations by the teacher. The utterances that we coded mostly consisted of one or two sentences.

We encountered a limited number of situations—fewer than 10—in which it was unclear as to how to score a feedback intervention. Examples include:

Situation 1:

A student is staring out the window instead of working on the assignment. The teacher approaches and says: “You’re looking sleepy.” Because of the teacher’s angry tone of voice, this intervention was scored as an instance of negative feedback; it

Table 3
Sample scoring form of one teacher.

Feedback	Positive		Negative		Other interventions (tally)
	Non specific	Specific	Non-specific	Specific	
All right, that's nice	x				27
Marvelous, that's how you make it more interesting and exciting		x			
Your work is very neat		x			
You've done a fantastic job!	x				
Ah, you've taken this into account, well done!		x			

was also scored as non-specific, because there was no information provided on the student's level of performance or understanding.

Situation 2:

A group of students is working together on an assignment. Their teacher follows their conversation and says: "Ah, you want to develop trucks that are good for both animals and the environment." Because of his positive tone of voice and the content of the comment, this instance of feedback was scored as both positive and specific.

As can be seen in these examples, tone of voice and clarity of information were two of the key criteria mostly used in evaluating the nature of individual feedback interventions.

Two observers received training in the use of the observation instrument. After completing the training, the observers separately scored 10 min of video, consisting of three different teachers. The observers were placed in separate rooms while performing the scoring, so as to avoid unintentional social effects on their respective interpretations. A procedure was established based on the following set of instructions:

1. Write down the feedback interventions of the teacher verbatim (put the tape on hold while writing, if necessary). Do not distinguish between feedback addressed to an individual student, a group of students or the entire class.
2. Tally all other interventions of the teacher.
3. Score the logged feedback, using the feedback categories listed on the observation schedule.
4. Categorize the specific feedback as either progress feedback or discrepancy feedback.

Cohens' Kappa, calculated to determine inter-rater agreement, was 0.82. This led us to conclude that the categories contained within the observation instrument were sufficiently clearly defined.

4.2.3. Procedure and analysis

We videotaped 78 teachers in secondary education as they delivered their regular lessons, which varied in duration from 45 to 70 min. During a portion of these lessons, teachers interacted with their students, either as a group or individually. For each teacher, we selected one fragment of ten contiguous minutes in which there was interaction between teacher and students, to maximize the incidence of feedback interventions available to be evaluated. With the aid of the observation instrument developed in the pilot study, we thus scored 78 fragments of 10 min each.

In the analysis, descriptive statistics such as means and percentages of the feedback and other interventions were calculated. Next we performed a Multivariate Analysis of Variance (MANOVA), using the feedback categories as dependent variables and school subject, grade level, school type and gender as independent variables. We used these results to test for the existence of a relationship between these variables and the feedback categories. We performed Analyses of Variance (ANOVAs) to test for the existence of relationships between age and experience on the part of the teacher's on the one hand and the feedback categories on the other. In addition, we employed a Chi-Square test to examine the relationship between the different feedback interventions the teachers used. We looked, in particular, to see for instance whether teachers who provided specific positive feedback also provided specific negative feedback.

Table 4

Mean frequencies and standard deviations of feedback and other interventions.

Interventions	Mean frequency	SD ^a
Feedback interventions	6.64	4.44
Other interventions	33.13	6.24
Total	39.77	5.34

^a Standard deviation.

5. Results

5.1. What is the frequency of teachers' feedback interventions and other interventions (e.g. questions, brief instructions) on the part of teachers during normal classroom interactions?

Table 4 shows the mean frequency of the feedback and other interventions (e.g. questions, brief instructions), based on the analysis of each teacher in their analyzed 10 min fragment. As Table 4 shows, the average number of interventions contained within a typical 10 min lesson fragment is approximately 40, of which seven are classified as feedback interventions and 33 are labeled with the generic "other" interventions.

5.2. How many teachers provide each of the feedback intervention types during classroom interactions? How often do they do so?

Table 5 shows the percentage of teachers who provide each of the types of feedback interventions we have distinguished.

Table 5 shows that 85.9% of teachers included in the study provided non-specific positive feedback once or more, with a mean of 3.57 times per teacher. Non-specific negative feedback was given by 48.7% of teachers, with a mean of 1.71 times per teacher. 35.9% of teachers provided specific positive feedback once or more, with a mean of 2.24; approximately 60% of teachers provided specific negative feedback once or more, with a mean of 2.98. We performed a Chi-Square test to illustrate any relationships between the teachers' use of the various types of feedback, but there were no statistically significant relationships to be identified. This means that those teachers who provided specific positive feedback were not necessarily the same teachers who provided specific negative feedback.

5.3. What is the ratio of positive feedback to negative feedback (both specific and non-specific) that teachers provide?

Table 6 shows that 56.4% of teachers had a positive–negative ratio below the prescribed benchmark of 3:1. Conversely, 43.6% of

Table 5

Percentage of teachers providing each of the four types of feedback within a 10 min block of classroom interaction, and mean frequencies and standard deviations of each of the four types of feedback intervention.

Feedback intervention	Number and percentage of teachers performing the various feedback interventions N = 78		Mean	SD	n
	Not found	Performed by one or more teachers			
Non-specific positive feedback	11 (14.1%)	67 (85.9%)	3.57	2.2	67
Specific positive feedback	50 (64.1%)	28 (35.9%)	2.24	1.8	28
Non-specific negative feedback	40 (51.3%)	38 (48.7%)	1.71	1.3	38
Specific negative feedback	31 (39.7%)	46 (60.3%)	2.98	2.2	46

Table 6
Ratio at which teachers provided positive and negative feedback interventions.

Positive/negative ratio	Percentage (n = 78)
Ratio between 3:1 and 11:1	36 (43.6%)
Ratio less than 3:1	42 (56.4%)

teachers had a positive–negative ratio equal to or higher than 3:1. There were no ratios which exceeded 11:1.

5.4. How many teachers provided progress feedback and discrepancy feedback in classroom interactions? And how often?

Table 7 summarizes the results concerning progress feedback and discrepancy feedback. Not all specific feedback could be categorized as progress or discrepancy feedback, because the feedback lacked the explicit comparison with a former performance or a goal. Progress feedback was given by 6.4% of the teachers, and 41.0% of the teachers provided discrepancy feedback. Again a chi square test showed no statistically significant relations between the cells. Hence, the teachers who provided progress feedback were not necessarily the same as the teachers who provided discrepancy feedback. We also examined the nature of progress and discrepancy feedback. Interestingly, discrepancy feedback was always negative specific feedback, whereas in all cases progress feedback was positive specific feedback.

5.5. Do the answers to questions 1, 2, 3, and 4 differ based on school type (ranging from lower vocational education to pre-university level), school subject, grade level, gender, age, and experience?

We performed MANOVAs, using the feedback categories as dependent variables and school subject, grade level, school type, and gender as independent variables. No statistically significant relationships were identified in the scores on the feedback categories.

To further analyze the influence of age, we organized the teachers included in the study into the following age groups: (1) under 28; (2) 28–37; (3) 38–47; and, (4) 48 years or older. For experience, we used the following groups: (1) less than 3 years of experience; (2) 3–7 years; (3) 8–18 years; and, (4) more than 18 years of experience. ANOVAs performed with age and experience as independent variables showed no statistically significant differences. We therefore conclude that neither the frequency of feedback, nor the feedback intervention type, nor the positive:negative ratio differ dependent upon school type, school subject, grade level, gender, age, or experience.

Table 7
Number, percentage, mean and standard deviation of teachers providing progress feedback and discrepancy feedback interventions during normal classroom interactions.

Specific feedback intervention	Number and percentage of teachers performing progress feedback and discrepancy feedback interventions N = 78		m (SD)	SD	n
	Not found	≥1			
Progress feedback	73 (93.6%)	5 (6.4%)	1.40	0.55	5
Discrepancy feedback	46 (59.0%)	32(41.0%)	1.94	1.11	32

6. Conclusions and discussion

Based on an analysis of the literature concerning feedback, combined with new perspectives based on other insights, we have studied the feedback interventions of 78 Dutch secondary-school teachers. We have found that these teachers performed, on average, seven feedback interventions in a typical 10 min block of normal classroom interaction. This comprised less than 20% of all observed interventions. We also found that the feedback interventions offered were mostly non-specific. About half of the teachers did not provide any specific feedback, whether positive or negative. This is consistent with findings published by Hattie (1999) and Pauli (2010), who have also shown that the occurrence of feedback is low and that most feedback interventions are non-specific. We find these outcomes to be alarming, because feedback in general, and specific feedback in particular, is one of the most important tools available to have to positively influence their students' learning (Hattie, 1999).

Concerning the ratio to which the teachers provided positive and negative feedback (be it specific or non-specific), we found that about 44% of the teachers did not produce a ratio in the appropriate range indicated by Losada and Heaphy (2004). Research in the area of organizations (e.g. Stacey, 1996) also emphasizes the importance of the interplay between positive and negative feedback for the capacity of an organization to perform. As far as we know, no research has been conducted into the effect that the ratio between positive and negative feedback in the classroom has on the enhancement of student learning. In this study there is some support for the 3:1 ratio, although there is need for more evidence to be convincing. We suggest more research in this area, because of the importance for student learning.

In their examination of feedback among team members in a business setting, Losada and Heaphy (2004) did not distinguish between specific and non-specific feedback, or between feedback levels. We would suggest further research into whether the frequent use of specific feedback influences the ratio in classrooms. Research on the feedback levels teachers employ—namely: (1) the task; (2) the processing of the task; (3) self-regulation; and, (4) feedback about the self—also carries great potential as an avenue for further research. A second such avenue would be an examination of the influence of the effectiveness of these respective levels of feedback on the ratio of positive to negative feedback.

In the discussion of whether questions constitute a type of feedback, different perspectives have contributed to different views. In the present study we chose to evaluate feedback mainly from the perspective of the provider of said feedback—in this case, on the part of the teachers. The recipient of the feedback—the student—can, however, regard questions as feedback. For instance, were a teacher to ask several questions without providing any feedback concerning the accuracy of a student's answer, this can be regarded as a form of feedback, as an attempt to lead the student to the correct conclusion. Feedback recipients might come to the conclusion that the teacher does not approve of their performance, and thus regard the persistent questioning as a form of feedback.

Another research question dealt with the relative occurrences of progress feedback and discrepancy feedback. A closer look at the incidences of each shows that approximately 41% of the teachers included in this study provided some form of discrepancy feedback. Progress feedback, on the other hand, was offered by only 7% of teachers. There were more teachers who provided discrepancy feedback more often than progress feedback. Teachers seem to place greater emphasis on what has *not yet* been learned or understood, rather than on what has already been achieved. Interestingly, we found that progress feedback, when it did occur,

always took the form of specific positive feedback, while discrepancy feedback was always conveyed as specific negative feedback. It is, however, difficult to draw conclusions about this phenomenon, as the frequencies of both types of feedback were so low as to be statistically insignificant. This finding is consistent, however, with the examples of progress feedback Schunk and Swartz (1993) illustrated; those examples were all positive, as well.

The reason for this low frequency could, firstly, be attributed to the way in which we evaluated the feedback interventions. We decided to classify individual events as progress feedback only if there was an explicit reference to a former level of performance or understanding. In classifying discrepancy feedback, our criterion was the reference to a particular goal, however small or far-fetched. Secondly, we hypothesize that, in order to provide these two types of feedback interventions, teachers must first be aware of the educational goals of each student. Many authors, such as Sadler (1989), have stated that, while teachers do possess conceptions of goals and quality, these remain largely tacit. An explanation for the difference in frequency between progress feedback and discrepancy feedback may be attributable to the fact that, in order to provide progress feedback, understanding and awareness of the goals are more important in providing progress feedback than in providing discrepancy feedback. Teachers might see what is lacking in a student's current level of performance without being consciously aware of the actual goal of a given assignment.

In his work on goal-relatedness, Martin (2006) introduced the notion of *personal bests*, described as personalized standards of excellence, as a means of goal-setting. According to Martin, students are most likely to reach their personal best performance in working toward goals that are specific, challenging, competitively self-centered, and focused on self-improvement. This notion provides researchers with at least two new perspectives on goal-related feedback. First, goal-related feedback need not be exclusively centered on the goals of the teacher, but can also center on the goals of the student. Second, if we employ this notion of personal best in evaluating feedback interventions, we can then propose the provision of feedback not only on progress or discrepancy in relation to the goals set by the teacher or school, but also as it relates to the goals set by the student.

Intervention frequencies, the various types of feedback interventions used, and the positive:negative ratio of feedback achieved did not differ for school type, school subject, grade level, or based on the gender of the teacher. Similarly, frequency, feedback type and positive:negative ratio did not differ based on the age or experience of the teacher. With respect to this latter finding, it seems that teachers do not learn to provide effective types of feedback in the appropriate ratio with age or experience. The question of why this is the case is of great interest, and we offer three hypotheses in this regard. The first hypothesis concerns the preexisting conceptions of teaching and learning possessed by teachers, and by teacher educators. It is possible that a considerable percentage of teachers at all levels, including secondary education, view teaching and learning in a fundamentally reproductive way, as demonstrated by Hamer and van Rossum (2010) in their review of teacher conceptions of learning. Teachers tend to focus on providing information, with the expectation that students will then accurately reproduce this knowledge. Relatively few teachers regard teaching as a process and try, for example, to engage students in thinking about how and why facts are as they are. We might hypothesize that teachers with a more reproduction-based conception of teaching and learning will opt for the more task-oriented feedback interventions, or provide more direction, as opposed to feedback. Hamer and van Rossum have warned against

the perpetuity of the traditional reproductive way of thinking which has taken root in teacher education. If teacher educators also possess a reproductive conception of teaching and learning, they may not be ideal role models in demonstrating the effectiveness of providing feedback to their students. The second hypothesis is that teachers as a consequence of the latter hypothesis, do not receive many good examples of or much instruction in how to provide effective specific feedback. As Russell, a teacher educator and researcher, puts it: "The image of 'teaching as telling' permeates every move we make as teachers, far more deeply than we would ever care to admit to others or ourselves" (1999, p. 222). Third, the low relative frequencies of what is considered effective feedback could be related to the assessment-driven culture of education in most current contexts. As a consequence, teachers might regard their feedback as being relatively less important, or might regard the outcomes of the assessments as being more valuable to the students.

We believe that the findings presented in this study can be generalized to Dutch teachers of various subjects in Dutch secondary education. A primary limitation of the current study is the absence of analogous information from other contexts; indeed, further research is needed to reveal whether these results also apply to other cultures and contexts. A second limitation is the fact that the vast majority of teachers included in this study were Dutch by birth. There is, however, a growing population of teachers in the Netherlands that are first- or second-generation immigrants. Their unique cultural backgrounds might influence the frequency and type of feedback they provide. Further research on progress feedback and discrepancy feedback would also be of interest, owing to the assumed impact each has on learning. The discipline in general would be helped by the conducting of additional research into how to best train teachers to provide those types of feedback which have been identified as having the greatest positive impact on learning and achievement among recipients.

It might be useful for teacher educators to take a close look at the way in which they provide feedback to their students, and to engineer situations in which they can provide feedback. They could also stimulate situations in which student teachers provide feedback to one another. In turn, teacher educators could then provide feedback on that feedback. The same holds true for the training of experienced teachers. As we may conclude from this study, an emphasis on the art of providing effective feedback seems to be a crucial factor in the continued professional development of teachers.

Finally, we would recommend teachers seek to provide feedback, especially the learning-enhancing types of feedback, more frequently. In doing so, they should attempt to provide more positive feedback than negative feedback. Moreover, the issue of feedback and its effectiveness seems to warrant increased attention from teacher educators. The findings of the present study indicate that teacher educators should not only make student teachers and experienced teachers more aware of the benefits and drawbacks of feedback interventions, but also suggest that it might be necessary to attempt to influence existing classroom habits and practices through extensive training. For this reason, we suggest that more research be carried out to allow the identification of effective approaches in initial teacher education and in in-service-training for experienced teachers, in order to promote the use of learning enhancing types of feedback. After all, feedback seems to be a fundamental ingredient of effective teaching, but until now this fact has not been reflected in the attention given to it, whether in initial teacher education or ongoing professional development, or in research into the actual behavior of teachers.

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