Review

Understanding feedback: A learning theory perspective

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ABSTRACT

This article aims to review literature on feedback to teachers. Because research has hardly focused on feedback among teachers, the review's scope also includes feedback in classrooms. The review proposes that the effectiveness of feedback and feedback processes depend on the learning theory adhered to. Findings show that regardless of the learning theory effective feedback is goal- or task-directed, specific, and neutral. In addition, four rules of thumb were formulated that reflect what a majority of learning theories suggested as effective for learning. Finally, some feedback characteristics were considered effective from only one learning theory. The article shows that feedback processes are complicated and many variables influence and mediate the processes. Most reviewed studies did not investigate the whole feedback processes, and therefore, we suggest that future research is needed to further understand feedback.

Contents

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1. Introduction

Feedback has long been recognized as an effective tool for student learning (Hattie & Timperley, 2007; Mory, 2003; Shute, 2008). However, as Scheeler, Ruhl, and McAfee (2004) pointed out few studies have focused on effective feedback to teachers. In this article, we focus on feedback literature in order to provide insights into the effectiveness of feedback. More specifically, we aim to review research on feedback to teachers.

In this article, we propose that the characteristics of effective feedback and feedback processes are related to a specific learning theory from which learners, either students or teachers, are facilitated. For instance, in behaviourism, feedback can be positive or negative, depending on whether teachers want to reinforce and encourage student behaviour or not. Or in meta cognitivism, feedback can be directed at the "learning to learn" processes, such that learners can develop themselves as self-regulated learners. As a consequence of these differences, characteristics of effective feedback and feedback processes are expected to differ among learning theories.

In order to test this proposition and to provide insights into feedback among teachers, a systematic literature review (Petticrew & Roberts, 2006) was conducted. Research questions were formulated as follows:

1. To what extent does a learning theory influence characteristics of considered effective feedback?
2. To what extent does a learning theory influence feedback processes in pupil and student learning?
3. To what extent does a learning theory influence feedback processes in (student) teacher and adult learning?

This article first explains how the systematic literature review was conducted: the search process (Section 2.1) and data-analysis (Section 2.2) are addressed and the learning theories are described (Section 2.3). Next, the findings regarding the research questions are presented (Sections 3.1 and 3.2). Subsequently, the article discusses the findings and describes limitations, implications for practice, and implications for future research (Section 4).

2. Method

To our knowledge, only one review was previously published that focused on performance feedback given to teachers. Scheeler et al. (2004) aimed to determine which attributes of performance feedback given to teachers are effective. They found only 10 articles that matched their criteria, published between 1970 and 2000. They concluded that "(a) feedback is better than no feedback, (b) immediate feedback is better than delayed feedback, and (c) feedback that is immediate, specific, positive, and corrective holds the most promise for bringing about lasting change in teaching behaviour" (p. 68). This review updates their findings.

This section first addresses the search and selection process (Section 2.1) and then elaborates on the data-analysis (Section 2.2). Finally, five learning theories and their implications for feedback processes are described (Section 2.3).

2.1. Search and selection process

ERIC, PsychInfo, and Dissertation Abstracts were explored using search terms based on Scheeler et al.'s (2004) review. These (e.g., corrective feedback and peer coaching) and other search terms (e.g., professional development) were used.

Based on Scheeler et al.'s (2004) findings, in this review, we expected to find only a few publications that specifically examined feedback between teachers. Therefore, from the start, the scope of the review was expanded to research on feedback to students. The search covered literature from January 2000 up to and including June 2012. Some older seminal publications were also included. These were found by means of snowballing (Cordingley, Bell, Thomason, & Firth, 2005; Petticrew & Roberts, 2006), that is, literature cited in the already included articles was examined and included if it met our criteria.

In ERIC, an initial 630 articles were found and in PsychInfo, 757 articles, including 13 dissertations, were retrieved. The selection process encompassed two steps. In the first step, the title and abstract, as depicted by the databases, were judged on the following criteria for inclusion: (a) the article had to be peer reviewed, (b) the article had to report on an empirical or review study, (c) the sample should be in primary, secondary, tertiary, or teacher education or teacher professional development programs, and (d) feedback should be a subject of the study.

In the second step, the selected articles' research goals and questions, methods, results, and conclusions were summarized. Using the summaries and the four criteria, it was decided whether the article would be included in the review.

Moreover, additional criteria for inclusion were: (e) a clear point of view on learning, needed to determine the learning theory, (f) when the focus of an article was mainly on coaching, supervision, and so forth, the article was included if it reported on feedback characteristics and/or processes, and (g) when an article did not elaborate on feedback processes but it did on feedback characteristics it was included because it contributes to the first research question. Finally, 60 articles were selected.

2.2. Data-analysis

Five learning theories were distinguished to perform the data-analysis (Boekaerts & Simons, 1995): behaviourism, cognitivism, social cultural theory, meta-cognitivism, and social constructivism. These learning theories were chosen because they represent a chronological development of the theoretical notions on learning. Second, each following learning theory contrasts the former. Third, in the evolution of these learning theories, the black box became more 'white' and then it was opened. As a consequence, the learning processes each learning theory describes becomes more complex and more variables interfere. We do not aim to argue which learning theory is 'better' than the others, however, each of these describe learning processes in which feedback plays a significant part (Hattie, 2009).

The data-analysis consisted of five steps. First, a description of each learning theory was established (see Section 2.3). These descriptions were used to determine the learning theory from which each article reasoned. For each reviewed article, the authors' definition of learning and the intervention that they implemented was compared with these descriptions. Based on this comparison, the learning theory from which each article reasoned was set. One article appeared to hold two learning perspectives and was therefore assigned to both learning theories.

Ten articles were based on behaviourism: Werts, Wolery, Holcombe, and Gast (1995), Scheeler and Lee (2002), Ferreira, Moore, and Mellish (2007), Goodman, Brady, Duffy, Scott, and Pollard (2008), Rodriguez, Loman, and Horner (2009), Auld, Belfiore, and Scheeler (2010), Scheeler, Congdon, and Stansbery (2010), Duchaine, Jolivette, and Fredrick (2011), Ochieng' Ong'ondo and Borg (2011), and Scheeler, McKinnon, and Stout (2012).

Ten articles were based on cognitivism: Kluger and DeNisi (1996), Ashwell (2000), Hyland (2001), Ferreira et al. (2007), Shute (2008), Morra and Asis (2009), Baker and Bricker (2010), Murphy (2010), Nassaji (2011), and Van Beuningen, de Jong, and Kuiken (2012).

Seventeen articles reasoned from social cultural theory: Brinko (1993), Chi (1996), Oliver (2000), Chi, Siler, Jeong, Yamauchi, and Hausmann (2001), Tuzi (2001), Ovando (2005), Chin (2006), Tang and Chow (2007), De Kleijn, Mainhard, Meijer, and Brekelmans (2009), Yeh and Lo (2009), Peterson (2009), Ackan and Tatar (2010), Espasa and Meneses (2010), Pokomy and Pickford (2010), McLaren, DeLeeuw, and Mayer (2011), Orsmond and Merry (2011), and Tang and Harrison (2011).

Three articles were based on meta-cognitivism: Sadler (1989), Nicol and McFarlane-Dick (2006), and Timperley and Parr (2007).

Twenty-one articles reasoned from social constructivism: Licklider (1995), Black and Wiliam (1998), Tillema and Smith (2000), MacDonald (2001), Manouchehri (2002), Mory (2003), Schelfhout, Dochy, and Janssens (2004), Gibbs and Simpson (2004), Yang and Liu (2004), Weaver (2006), Hattie and Timperley (2007), Brandt (2008), Segers, Gijbels, and Thurlings (2008), Landry, Anthony, Swank, and Monseque-Bailey (2009), Fund (2010), Gielen, Peeters, Dochy, Onghena, and Struyven (2010), Kretlow and Bartholomew (2010), Li, Liu, and Steckelberg (2010), Martens, de Brabander, Rozendaal, Boekaerts, and Van der Leeden (2010), Colasante (2011), and Van der Kleij, Eggen, Timmers, and Veldkamp (2012).

In the second step of the data-analysis, all mentioned characteristics of feedback in the reviewed articles were listed separately for each learning theory. This list was then clustered into five categories using a bottom-up approach. As a consequence, the five categories were: feedback characteristics, task-related characteristics, timing, affective and emotional characteristics, and effects on learners. These findings are presented in Section 3.1.

Third, based on Boekaerts and Simons (1995), Mory (2003), and Scheeler et al. (2004), models of feedback processes were built for each learning theory. A learning theory "comprises a set of constructs linking observed changes in performance with what is thought to bring about those changes" (Driscoll, 2000, p. 11). Driscoll further explains that learning theories have three basic components: the inputs, the means, and the results. In other words, each learning theory explains which mechanisms lead to certain learning outcomes. Consequently, each learning theory envisions another feedback process (see Section 2.3). The feedback models capture the essence of feedback processes: receivers (i.e., the learners), providers (e.g., teachers, peers), feedback itself, the receivers' stage before and after feedback is given, and the outcomes (Boekaerts & Simons, 1995; Mory, 2003; Scheeler et al., 2004). The created feedback models (see Figs. 1–4) were filled with findings from the reviewed articles. Both identified and proven relations were included. For the sake of readability the figures only show the relations between receivers, providers, feedback, and learning outcomes and do not show the findings of the reviewed articles. The findings are presented in Section 3.2.

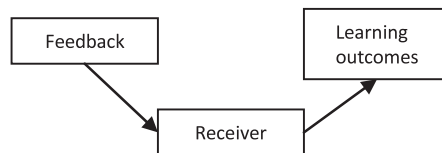**Fig. 1.** The feedback model for behaviourism.

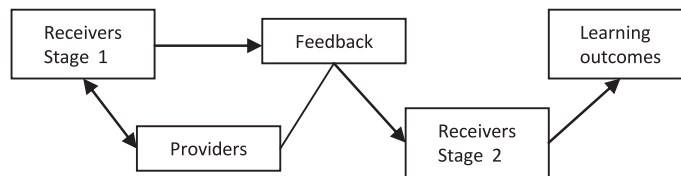Fig. 2. The feedback model for cognitivism.

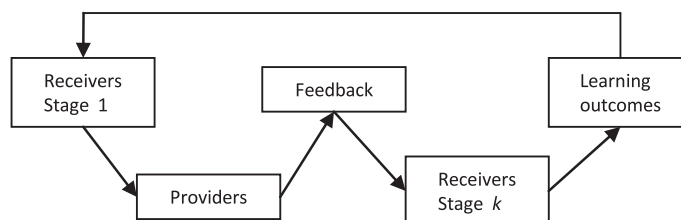Fig. 3. The feedback model for social cultural theory.

Fig. 4. The feedback model for meta cognitivism and social constructivism.

Fourth, all models were examined. This examination distinguished (a) whether authors only proposed what feedback processes are like, (b) whether they investigated perceptions, and (c) whether they statistically tested (parts of the) feedback models. In other words, this method makes a distinction between identified (i.e., processes might be like this) and proven (i.e., based on the results of the study, processes are like this) feedback processes and can hopefully make more profound claims of effective feedback and feedback processes in all five learning theories. The findings are presented in Section 3.2.

Finally, those articles that did focus on teachers, student teachers and/or adult learners were studied. The models were used in order to draw conclusions on what effective feedback among teachers is like. These results are separately presented in Section 3.2.

2.3. Descriptions of learning theories

Behaviourism focuses on visible behaviour of students, which can be manipulated by means of stimuli such as praise and punishment (Atkinson, Atkinson, & Hilgard, 1983; Skinner, 1968). Teachers guide students through the curriculum in small steps. Students are requested to reproduce what the teachers have told them. This indicates that feedback processes in behaviourism are straightforward and linear: feedback is given, and consequently, an outcome occurs (see Fig. 1).

Cognitivism stresses human information processing (Newell & Simon, 1972; Shuell, 1986). Teachers structure the curriculum and guide students through the curriculum as students actively process, decode, and use the curriculum. The students learn relationships between objects. This indicates that feedback processes start with giving feedback, which is then processed by the learners, finalizing in outcomes (see Fig. 2). Similar to behaviourism, the learning process is linear.

Social cultural theory highlights human intentions and possibilities and how these can be developed (Vygotsky, 1978). Dialogue between teachers and students is fundamental to this learning theory. Discussing teachers' actions supports students to proceed through zones of proximal development. This indicates that feedback processes start with learners at a certain stage. Feedback is given to guide learners to the next stage (i.e., zone of proximal development), in which outcomes are achieved (see Fig. 3). Similar to behaviourism and cognitivism, the learning processes are linear.

Meta cognitivism emphasizes students learn to learn (Brown, 1987; Garner, 1987). Self-regulated learning (Boekaerts, Pintrich, & Zeidner, 2000) fits into this learning theory. Teachers guide learners in their (self-regulated) learning processes, such as planning and monitoring, and the learners are responsible for their own learning. This indicates that the feedback process starts with learners at a beginning stage. Then, teachers give feedback and the learners flow through to another stage. As the process is continuous, a loop takes learners back to yet another beginning stage (see Fig. 4). In contrast to the former learning theories, the learning processes are cyclic.

Social constructivism focuses on how learners are actively engaged in constructing their knowledge (Jonassen, 1991; Paris & Byrne, 1989; VanderBilt Cognition and Technology Group, 1990). Prior knowledge is the starting point for learning.

Table 1
Overview of feedback characteristics.

Characteristic	Behaviourism	Cognitivism	Social cultural theory	Meta cognitivism	Social constructivism
Corrective; GAS; PAS	x	x			
KCR feedback		x	x		x
Elaborative feedback before KCR		x	x		x
Direct or indirect corrective feedback		x			
Interactional feedback		x			
Identifying and correcting errors			x		
Explaining misunderstandings			x		
Specific	x	x	x		x
Clear		x			
Concrete			x		
Consistent			x		
Descriptive					x
Directive	x		x		
Explicit or implicit		x			
Polite or direct			x		
Positive or negative		x			
Positive	x		x		x
Unbiased, objective		x			
Neutral		x			x
Non judgmental, non hurtful					x
Non evaluative					x
Balanced between positive and negative			x		x
Balanced with grade			x		x
Based on actual data					x
Summative and formative			x		x
Formative			x		
Accurate, irrefutable			x		x
Relevant, meaningful			x		x
Justifying marks			x		
Justification					x
Instructional (Parallel, expansive, novel)	x				
Performance feedback	x				
Form and content		x			
Product and process		x			
Leaving control to learner				x	
Sufficient					x
Constructive					x
Challenging					x
Consequence of performance					x

Learning occurs by studying multiple examples and by de-contextualization of the heuristics. Teachers guide this process. Peers are involved in the learning processes and students collaborate. This indicates that the feedback process starts with learners at a beginning stage. Multiple peers and teachers give feedback. Then, because the learning is continuous, learners move to another stage, which becomes a new beginning stage (see Fig. 4). Similar to meta cognitivism, the learning processes are cyclic.

3. Findings

3.1. Characteristics of effective feedback and learning theories

   Characteristics of feedback fell into five clusters (see also Section 2.2). These clusters are the characteristics that describe feedback (Section 3.1.1), task-related characteristics (Section 3.1.2), timing (Section 3.1.3), affective and emotional characteristics (Section 3.1.4), and effects on learners (Section 3.1.5). The following sections compare and contrast the descriptions provided in the reviewed articles.

3.1.1. Feedback characteristics
   Table 1 lists all mentioned feedback characteristics, which are addressed in this section. From a behaviouristic and cognitive point of view, corrective feedback is suggested to be effective (Goodman et al., 2008; Scheeler et al., 2012; Van Beuningen et al., 2012). Ferreira et al. (2007) distinguished two forms of corrective feedback: the *Giving Answers Strategy* (GAS) and the *Prompting Answers Strategy* (PAS). In the GAS strategy, teachers provide the correct answer; in the PAS strategy, teachers support and evoke learners to provide the correct answer. In addition, several articles from cognitivism (Murphy, 2010; Nassaji, 2011), social cultural theory (Espasa & Meneses, 2010), and social constructivism (Van der Kleij et al., 2012) made a distinction between Knowledge of Correct Response (KCR) only or elaborated feedback before KCR. In KCR, the learners are acknowledged that their answers are correct or not, whereas elaborative feedback supports the learners to attempt

self-correction and provides hints. Nassaji (2011) used different terms: he calls the former recasts and the latter elicitations. Similarly, Van Beuningen et al. (2012) made the distinction of direct and indirect corrective feedback: directive feedback indicates an error has been made and provides the correct answer; indirect feedback only indicates that an error has been made. Finally, Nassaji (2011) explained interactional feedback as "feedback that learners receive on their erroneous or inappropriate utterances during interaction" (p. 18) in the context of language learning. From social cultural theory, feedback can help to identify and correct errors and can explain misunderstandings (Orsmond & Merry, 2011).

Articles from behaviourism (e.g., Auld et al., 2010; Goodman et al., 2008), cognitivism (e.g., Shute, 2008), social cultural theory (Ackan & Tatar, 2010; Brinko, 1993; Yeh & Lo, 2009) and social constructivism (Colasante, 2011; Gielen et al., 2010) indicated that feedback should be specific and clear. Others used different terms: feedback should be concrete (Brinko, 1993) consistent (Brinko, 1993; Ovando, 2005; from social cultural theory), and descriptive (Fund, 2010; Kretlow & Bartholomew, 2010; from social constructivism).

From a behaviouristic (Ochieng' Ong'ondo and Borg, 2011) and social cultural theory (Ackan & Tatar, 2010) perspective, feedback can be directive. However, Ackan and Tatar (2010) suggested that directive feedback is not appropriate and they argued that it should elicit student teachers' reflection. Others made a distinction between explicit or implicit feedback (Baker & Bricker, 2010; from cognitivism) and between polite or direct feedback (McLaren et al., 2011; from social cultural theory).

From cognitivism (Baker & Bricker, 2010) it is suggested that feedback can either be positive or negative. From behaviourism (Rodriguez et al., 2009; Scheeler et al., 2012), social cultural theory (Orsmond & Merry, 2011), and social constructivism (Martens et al., 2010), feedback should be positive. On the other hand, Shute (2008) suggested giving neutral, unbiased, and objective feedback. Providing neutral feedback was also suggested by Fund (2010) and Martens et al. (2010), who reasoned from social constructivism. Others used terms like non judgmental and non hurtful (Fund, 2010) and non evaluative (Kretlow & Bartholomew, 2010), both from social constructivism. Moreover, from both social cultural theory and social constructivism, feedback should be balanced between positive and negative remarks (Brinko, 1993; Gielen et al., 2010; Weaver, 2006), should be balanced with the grade (Pokomy & Pickford, 2010; Weaver, 2006), and based on actual data (Li et al., 2010).

In addition, reasoning from social cultural theory and social constructivism, feedback can be formative or summative (Brinko, 1993; Espasa & Meneses, 2010; Martens et al., 2010; Pokomy & Pickford, 2010). Furthermore, these learning theories both suggested that feedback should be accurate and irrefutable (Brinko, 1993; Gielen et al., 2010) and feedback should be relevant and meaningful (Ackan & Tatar, 2010; Brinko, 1993; Martens et al., 2010; Ovando, 2005).

From social cultural theory, it is suggested that it should justify marks (Orsmond & Merry, 2011) and from social constructivism, feedback should hold justifications (Gielen et al., 2010).

Finally, several learning theories described feedback characteristics that no other learning theory does. For instance, from a behaviouristic point of view, feedback should be instructional (Werts et al., 1995), which can vary between parallel, expansive or novel. Parallel instructive feedback repeats the instruction given before. Expansive instructional feedback extends the previous instruction. Novel instructional feedback is unrelated to the previous instruction and might origin in another domain. Other articles from behaviourism suggested providing performance feedback. Auld et al. (2010) described performance feedback as monitoring behaviour. Duchaine et al. (2011) investigated written performance feedback that was handed over to the teachers. This feedback included how many Behaviour-Specific Praise Statements (BSPS) the teachers gave their students as well as some examples. Likewise, in Rodriguez et al.'s (2009) study, teachers received performance feedback, that described teachers' implementation of First Step to Success, a program used in Kindergarten to prepare children for school. From cognitivism, feedback can vary between form and content feedback (Ashwell, 2000) and between process and product feedback (Hyland, 2001). From meta cognitivism, feedback should leave the control with the learners (Nicol & McFarlane-Dick, 2006; Sadler, 1989), which aligns with this learning theory, where learners are supposed to direct their own learning. Articles reasoning from social constructivism suggested that feedback should be sufficient (Gibbs & Simpson, 2004; Tillema & Smith, 2000), constructive (Colasante, 2011; Li et al., 2010; Weaver, 2006), and challenging (Fund, 2010). Finally, feedback is a consequence of performance (Hattie & Timperley, 2007).

Table 2
Overview of task-related characteristics.

Task-related characteristics	Behaviourism	Cognitivism	Social cultural theory	Meta cognitivism	Social constructivism
Focused on/related to task	x	x	x	x	x
Related to goals			x	x	x
Focused on behaviour			x		
Depended on task		x			
Contain info about progress	x				x
Where to next			x		x
Targeted at appropriate level (task, process, regulation)					x
Related to learner's beliefs/perceptions of their performance					x
Provide high-quality info about learner's learning				x	

Table 3
Overview of timing.

Timing	Behaviourism	Cognitivism	Social cultural theory	Meta cognitivism	Social constructivism
Immediately	x				x
Timely	x				
In appropriate time frame		x			
As soon as possible			x		
When learners remember their actions/when still relevant					x
Frequent			x		x
Ongoing			x		

3.1.2. Task-related characteristics

Table 2 shows the task-related characteristics. It is suggested that feedback should be task- or goal-related (Black & Wiliam, 1998; Brinko, 1993; Ochieng' Ong'ondo and Borg, 2011; Sadler, 1989; Shute, 2008). Brinko (1993), reasoning from the social cultural theory, proposed that feedback should be directed at behaviour rather than on the receiver. Shute (2008), reasoning from cognitivism, indicated that the extent of feedback's effectiveness depends on the task.

Moreover, feedback should contain information about progress or the next step, as Rodriguez et al. (2009) from behaviourism, Espasa and Meneses (2010) and Orsmond and Merry (2011) from social cultural theory, and Hattie and Timperley (2007), Gibbs and Simpson (2004), and Li et al. (2010) suggested from social constructivism. Espasa and Meneses (2010) specified information on progress as hints on how to improve and Orsmond and Merry (2011) as suggesting further study.

Articles with a social constructivistic view also indicated that feedback should be directed at the appropriate level (Hattie & Timperley, 2007) and that feedback should relate to learners' beliefs and perceptions of their performance (Hattie & Timperley, 2007; Tillema & Smith, 2000). This reflects the ongoing learning and feedback processes in these learning theories.

Finally, articles from a meta cognitivistic approach implied that feedback should provide information about learners' learning processes (Nicol & McFarlane-Dick, 2006), reflecting the learning to learn view.

3.1.3. Timing

As Table 3 shows, from a behaviouristic perspective (Goodman et al., 2008; Rodriguez et al., 2009; Scheeler et al., 2010, 2012; Scheeler & Lee, 2002), feedback should be given immediately and/or timely (Auld et al., 2010). In addition, Van der Kleij et al. (2012; from social constructivism) described that feedback can be provided immediate or delayed.

Others are slightly vaguer in their formulations. For instance, with a cognitive point of view, Shute (2008) indicated that feedback should be timed in an appropriate time frame and, from social cultural theory, Brinko (1993) suggested to give feedback as soon as possible. Authors that used social constructivism as a starting point implied that when providers are timing feedback, they should consider that learners should still remember their actions so that feedback is relevant to them (Mory, 2003). This reflects the ongoing learning and feedback processes of these learning theories.

Furthermore, articles from social cultural theory (Brinko, 1993) and social constructivism (Black & Wiliam, 1998; Gielen et al., 2010) argued that feedback should be given frequently. In addition, feedback should be ongoing, as Pokomy and Pickford (2010) from social cultural theory suggested.

3.1.4. Affective and emotional characteristics

From all learning theories it is suggested that feedback receivers should have an opportunity to respond to feedback and engage in a dialogue with providers, and in addition, feedback should be given in a context of collaboration (Table 4; e.g., Auld et al., 2010; Brinko, 1993; Hyland, 2001; Landry et al., 2009; Licklider, 1995; Manouchehri, 2002; Nicol & McFarlane-Dick, 2006; Ochieng' Ong'ondo and Borg, 2011; Pokomy & Pickford, 2010).

Articles based on cognitivism and social cultural theory suggested to take the receivers into account, for instance, by being encouraging (Ackan & Tatar, 2010; Hyland, 2001; Kluger & DeNisi, 1996) and by being attentive to the receivers' locus of control and self-esteem (Brinko, 1993). In addition, feedback should be supportive, according to authors from a cognitivistic (Hyland, 2001) and social constructivism (Li et al., 2010) point of view. From social constructivism, feedback should be respectful and honest (Li et al., 2010) and should encourage positive motivational beliefs (Martens et al., 2010). From social cultural theory, a proper atmosphere that builds empathy is needed (Ackan & Tatar, 2010) and feedback providers should sustain a good relationship with the receivers (Pokomy & Pickford, 2010).

3.1.5. Effects on learners

Table 5 shows that the reviewed articles on behaviourism did not consider any effects on learners. A very specific effect on learners is that feedback should lead to the repair of faults (Nassaji, 2011). More generally, others, also reasoning from cognitivism indicated that feedback should be focused on improvement (Hyland, 2001; Kluger & DeNisi, 1996).

Table 4
Overview of affective and emotional characteristics.

Affective/emotional	Behaviourism	Cognitivism	Social cultural theory	Meta cognitivism	Social constructivism
Giving opportunity to respond, dialogue/context of collaboration	x	x	x	x	x
Encouraging		x	x		
Sensitive to receiver's locus of control			x		
Self-esteem			x		
Supporting		x			x
Respectful/honest					x
Encourages positive motivational beliefs					x
Proper atmosphere, building empathy			x		
Good relationship with feedback provider			x		

Table 5
Overview of effects on learners.

Effect on learners	Behaviourism	Cognitivism	Social cultural theory	Meta cognitivism	Social constructivism
Repair of faults		x			
Focused on improvement		x			
Supporting learner in getting clear idea of what standard aimed for is			x	x	
Supporting learner in comparing their performance with standard			x	x	
Supporting learner to engage in action to close gap			x	x	x
Acted upon					x
Creating cognitive dissonance			x		
Obtain further information			x		
Engaging students in thinking			x		x

From social cultural theory, meta cognitivism, and social constructivism, it is important that feedback supports learners to become familiar with the standard aimed for, to know the gap between their actual and the desired performance, and then to close this gap (Gibbs & Simpson, 2004; Nicol & McFarlane-Dick, 2006; Pokomy & Pickford, 2010; Sadler, 1989). This reflects the learning to learn ideas from meta cognitivism. In other words, from a social constructivistic view, it is important that feedback should be acted upon (Gibbs & Simpson, 2004; Segers et al., 2008).

Articles from the social cultural theory are more specific as they suggested that feedback should create cognitive dissonance (Brinko, 1993) and that feedback should invite to obtain further information needed to accomplish a task (Espasa & Meneses, 2010). Moreover, feedback should engage students in thinking, as Orsmond and Merry (2011) from a social cultural point of view and Fund (2010) from a social constructivistic point of view suggested. Fund (2010) explicitly indicated that students should be engaged in thinking of alternative strategies to learn from journal writing.

3.2. Feedback processes and learning theories

Section 3.1 attended to the first research question (see Section 1) and addressed all mentioned characteristics of feedback that were considered effective. The second research question focuses on those feedback characteristics that were studied in relation to the feedback process as a whole and is addressed in this section (Section 3.2), which further examines the models. Here, a distinction is made between effective feedback to students and/or pupils and effective feedback to teachers, student teachers and/or adult learners.

3.2.1. Behaviourism

Of the 10 reviewed articles, two focused on students and pupils and eight focused on (student) teachers. The former are addressed first; the latter second.

Examination of model: students and pupils. Werts et al. (1995) illustrated mixed results on the three types of instructional feedback; it is unclear which type is the most effective. Ferreira et al. (2007) investigated two approaches to corrective feedback in language education: the GAS strategy (i.e., Giving Answers Strategy) in which teachers provide the correct answer, and the PAS strategy (i.e., Prompting Answers Strategy) in which teachers support and evoke learners to provide the correct answer. Their findings showed that GAS was applied more often than PAS; however, PAS was shown to improve student performances in the classroom significantly.

Examination of model: (student) teachers and adult learners. Four articles from a behaviouristic point of view investigated feedback via bug-in-the-ear technology and its effects on (student) teachers' teaching behaviours (Goodman et al., 2008;

Scheeler et al., 2010, 2012; Scheeler & Lee, 2002). All of them concluded that immediate feedback is effective, and, in addition, Goodman et al. (2008) and Scheeler et al. (2010) advised that feedback should be specific and corrective. An overwhelming majority of these (student) teachers showed 90–100% of the desired behaviour in short term and in the 2010 study, Scheeler et al.'s participants showed their desired behaviour in the long term as well as in other situations in 75–100% of the cases.

Three others examined the effect of performance feedback on (student) teachers' teaching behaviours (Auld et al., 2010; Duchaine et al., 2011; Rodriguez et al., 2009). In these studies, performance feedback revealed the number of desired teachers' behaviours to the (student) teachers. Most of this feedback was provided immediately. Each study drew the same conclusion: the performance feedback led to an increase of the desired teaching behaviour. In Auld et al.'s (2010) and Rodriguez et al.'s (2009) studies, the students also showed an increase of their desired behaviour (e.g., less interrupting in Rodriguez et al.).

These seven studies show similar results: immediate and corrective feedback leads to the implementation of desired teacher behaviour. Some studies showed positive long term effects and a few showed positive effects on the students. However, the sample in each of these studies was pretty small: it ranged from three to seven participants.

Ochieng' Ong'ondo and Borg (2011) used a completely different approach and interviewed student teachers, their co-teachers, and mentors (i.e., teacher educators) in Kenya about their experiences with feedback in the student teachers' internships. We could not use this data in the feedback model, because it reviewed perceptions of feedback and did not connect it to learning outcomes. To sum up their findings, student teachers perceived feedback to be focused on general pedagogy instead of teaching English. In addition, feedback was perceived as evaluative, corrective, and direct and lacked opportunities for reflection. These interview findings were confirmed by observations of written feedback provided to the student teachers.

3.2.2. Cognitivism

Of the 10 reviewed articles, eight focused on students, one focused on adult learners, and one was not included in this part of the review, because it did not examine relations of the feedback model.

Examination of model: students and pupils. Both Baker and Bricker (2010) and Van Beuningen et al. (2012) studied the effect of direct and indirect corrective feedback in the context of language learning; Baker and Bricker (2010) also distinguished hedging feedback. Baker and Bricker (2010) showed that learners were fast but not accurate in improving errors when they received indirect or hedging feedback and that learners were slow but accurate in improving errors when they received direct feedback. Van Beuningen et al. (2012) showed that direct and indirect feedback led to fewer errors than self-correction or additional practice time. In addition, they found that direct feedback was more appropriate for correcting grammar errors and that indirect feedback was more appropriate for correcting non-grammar errors. These findings differ, however, a major difference between the studies was that in Baker and Bricker's the participants were university students, whereas in Van Beuningen et al.'s the participants were secondary vocation education students. Another difference was that in Van Beuningen et al.'s study only second language learners (L2) participated and that in Baker and Bricker's study both L2 and native learners participated, yet most outcomes were similar for both groups, except that L2 learners were slowest in recognizing hedging feedback.

In order to enrich learning outcomes, feedback should be directed at the task (Ashwell, 2000; Kluger & DeNisi, 1996) and be specific, detailed, and clear (Shute, 2008). Furthermore, feedback should help learners to close the gap between their actual and the desired outcomes. This finding from the reviews by Kluger and DeNisi (1996) and Shute (2008) probably explains that combined form and content feedback was the best condition for students to improve their writing skills (Ashwell, 2000), that the way in which feedback is communicated (i.e., on-tape or written) did not matter (Morra & Asis, 2009), that elaborated feedback before KCR (Knowledge of Correct Response) with the opportunity to revise leads to better learning outcomes in language learning that KCR only (Murphy, 2010), that both direct and indirect corrective feedback leads to less errors than self-correction or additional practice time (Van Beuningen et al., 2012), that direct feedback led to more accuracy in improving errors than indirect or hedging feedback (Baker & Bricker, 2010), and that the PAS strategy was significantly better in improving students' language skills than the GAS strategy (Ferreira et al., 2007).

Examination of model: (student) teachers and adult learners. Nassaji (2011) is the only one who focused on adult learners in second language learning in the cognitive perspective. Similar to Van Beuningen et al. (2012) and Baker and Bricker (2010), he made a distinction between feedback that corrects an error (recasts) and feedback that encourages to self-repair an error (elicitations). Both recasts and elicitations led to improvements in the short term, however, the effects of recasts reduced over time. Only when the recasts were repeated several time, the effect remained positive. This shows that learners need to be actively involved in improving their errors.

3.2.3. Social cultural theory

Even though 17 articles that reasoned from social cultural theory were reviewed, nine of these were included in the model. The other eight articles did not describe or investigate relations that could be included in the model (Chi, 1996; Chi et al., 2001; Chin, 2006; Oliver, 2000; Ovando, 2005; Peterson, 2009; Tang & Harrison, 2011; Tuzi, 2001). Five of the nine included articles focused on students; four focused on (student) teachers.

Examination of model: students and pupils. Most reviewed articles did not provide results on what feedback should be like in order to enhance learning outcomes; they touched upon the subject, but did not investigate (parts of) the process. A few

articles illustrated that focussing on a specific issue that learners can improve, for instance by giving form and content feedback, is an appropriate approach (De Kleijn et al., 2009; Yeh & Lo, 2009).

One study examined the effects of polite versus direct tutoring by a web-based tutor (McLaren et al., 2011). The findings showed that polite tutoring only had a positive effect on students that made many errors, and these effects were only shown in the short term. There were no differences in outcomes between the groups, or between high- and low-performing students.

Two studies investigated perceptions of feedback. Orsmond and Merry (2011) interviewed biology students, who argued that feedback would be most helpful for learning if it corrects errors, provides guidance and insights into what their tutor wants, and adds meaning. Pokomy and Pickford (2010) interviewed first and final year university students and compared their perceptions. First year students preferred summative feedback, while last year students preferred formative feedback. Last year students thought useful feedback provides insights into what their teachers ask for (cf. Orsmond & Merry, 2011) such that they can compare their own and the desired behaviour. Both groups indicated that dialogue and relations with the providers are important.

Examination of model: (student) teachers and adult learners. From social cultural theory, Brinko (1993) focused on faculty staff, Tang and Chow (2007) on student teachers, Espasa and Meneses (2010) on adult learners, and Ackan and Tatar (2010) interviewed student teachers, their co-teachers, and their mentors (i.e., teacher educators). Ackan and Tatar (2010) did not focus on feedback processes, Tang and Chow (2007) revealed different types of feedback, and Brinko (1993) provided several recommendations on feedback processes. However, none of the authors empirically tested this. Brinko (1993) concluded that timely and specific feedback is effective. Espasa and Meneses (2010) concluded that formative feedback supports learning processes and that it leads to general satisfaction with the course.

Brinko (1993), in a review on effective feedback for faculty staff, provided insights into what effective feedback is like. Feedback should be mediated by a consultant and given by multiple sources that are of the same or lower status than receivers and receivers should also give feedback to themselves. Feedback should be perceived as credible and well-intentioned. In addition, feedback should be accurate, contain concrete and specific information, be directed at the task, descriptive, and create cognitive dissonance. Concerning receivers, Brinko (1993) recommended to take into account their locus of control and self-esteem, negative feedback should be sandwiched between positive remarks, feedback should reduce uncertainty, be relevant and meaningful, focused on the goals, frequently given, and receivers should welcome feedback.

3.2.4. Meta cognitivism

Two of the articles focused on student learning; one focused on teacher professional development.

Examination of model: students and pupils. Sadler (1989) and Nicol and McFarlane-Dick (2006) agreed that learners should become familiar with the gap between their actual and desired outcomes and should be capable of closing this gap. The feedback provided should allow for this, however, the articles do not elaborate how and what kind of feedback should be provided.

Examination of model: (student) teachers and adult learners. Timperley and Parr (2007) focused on teacher professional development. They reported on a large scale professional development program, however, they did not elaborated on results of coded feedback episodes.

3.2.5. Social constructivism

One article was not included in the model, because it did not propose or prove what feedback should be like (Schelfhout et al., 2004). Fourteen articles focused on student learning and six focused on (student) teachers.

Examination of model: students and pupils. Five reviewed articles examined students' perceptions of the learning environment and feedback (Brandt, 2008; MacDonald, 2001; Segers et al., 2008; Tillema & Smith, 2000; Weaver, 2006). Two of them found significant results. Tillema and Smith (2000) studied how students used feedback on the development of their portfolios. They showed that perceptions of feedback significantly influenced perceived outcomes. Segers et al. (2008) investigated how perceptions of the learning environment and feedback influenced approaches to learning. Their findings showed that more positive perceptions of quantity and quality of feedback increased their deep approaches to learning, and in addition, that intentions to do something with the received feedback increased their deep approaches of learning.

Fund (2010) argued, based on an in-depth analysis of two participants, that feedback reinforces reflection. This feedback should be reinforcing, challenging, thorough and sincere, radiate faith, and have a friendly nature.

Other studies examined the relation between feedback and learning outcomes. Gielen et al. (2010) concluded that justification feedback (i.e., an argumentation of, for instance, strengths) reinforces learning outcomes for low performing students. Li et al. (2010) found a significant relationship between the quality of feedback (i.e., identification of central issues and constructive comments) and the quality of students' projects if controlled for students' initial projects. Martens et al. (2010) revealed that positive feedback positively affects motivation and feelings of competence, autonomy, and relatedness, yet positive feedback did not relate to the final grades. Van der Kleij et al. (2012) investigated the effects of Knowledge of Correct Response (KCR) and elaborated feedback (EF) in immediate and delayed conditions. There were no differences between the groups' performances, however, students preferred EF above KCR and immediate above delayed feedback and thought that this was most helpful for their learning.

Other reviewed articles were reviews of literature (Black & Wiliam, 1998; Gibbs & Simpson, 2004; Hattie & Timperley, 2007; Mory, 2003). The conditions that support formative assessment described by Gibbs and Simpson (2004) were

confirmed by Segers et al. (2008); however, Gielen et al. (2010), who implemented a reply form for students to explain how they used the feedback (one of these conditions) showed that this form did not affect performance. Mory (2003) explicitly elaborated on effective feedback from a constructivist point of view. Effective feedback guides learners towards internal reality, facilitates knowledge construction, helping to build symbols, and is given in the context of human experience; gives general, mental construction 'tool kits', and the meaning within feedback message is determined by internal understanding.

Examination of model: (student) teachers and adult learners. From social constructivism, Licklider (1995) and Landry et al. (2009) focused on teachers, Colasante (2011), Manouchehri (2002) and Brandt (2008) on student teachers, Yang and Liu (2004) on teachers and student teachers, and Kretlow and Bartholomew (2010) reviewed studies on coaching programs for teachers. Manouchehri (2002) concluded that feedback is part of peer coaching and professional development and Yang and Liu (2004), Brandt (2008), and Colasante (2011) investigated perceptions.

One reviewed article, out of 21, actually investigated the relation between feedback processes and learning outcomes. Landry et al. (2009) conducted a large scale project on professional development for teachers in the context of writing education. They used a two-by-two framework: teachers either received mentoring or none; and received simple or extended feedback on the progress of their students. In addition, a control group was used. Their study showed that teachers who received mentoring and extended feedback significantly improved the task at hand, namely writing teacher strategies and that their students achieved better learning outcomes. The mentoring consisted of classroom visits, evaluating the classroom environment using the Teacher Behaviour Rating Scale, and follow-up mentoring sessions. However, it was unclear what exactly happened during the mentoring sessions.

Licklider (1995) investigated perceptions of peer feedback among eleven teachers and short term effects of the peer feedback on classroom instruction. Her findings showed positive short term effects in the classroom; however, it was unclear whether these effects are significant. In addition, teachers reported that they learned more from practicing instruction and giving feedback than from receiving feedback.

Landry et al.'s (2009) and Licklider's (1995) findings align with Kretlow and Bartholomew's (2010) review study on coaching programs for teachers. They concluded that coaching in which feedback is incorporated leads to the improvement of teaching.

Yang and Liu (2004) investigated perceptions of (student) teachers participating in an online environment in which they discussed their experiences. Similarly, Colasante (2011) examined student teachers' perceptions of feedback using an annotation tool. Their findings indicated that the participants were positive about the online environment and the received feedback. In addition, participants from Yang and Liu's (2004) study found that they received too much positive feedback.

4. Conclusions and discussion

The aim of this article was to review feedback to teachers. Three research questions were addressed. These research questions were formulated as follows: (a) To what extent does a learning theory influence characteristics of considered effective feedback? (b) To what extent does a learning theory influence feedback processes in pupil and student learning? and (c) To what extent does a learning theory influence feedback processes in (student) teacher and adult learning?

The general conclusions and recommendations described here are build upon the reviewed articles. Only when a majority of authors recommended a specific characteristic for effective feedback, this characteristic was recorded into this conclusions and recommendations section. So, suggestions from only one study were not incorporated. In addition, findings from other review studies were given more weight. Moreover, if certain characteristics are not reported as being effective from a certain learning theory, this does not suggest that this characteristic is not effective, yet, it was not shown to be effective in the articles we reviewed.

Findings from the *first* research question suggest that there are differences between the learning theories and that several characteristics are considered effective only from one learning theory. For instance, from meta cognitivism, it is important to leave the control with the learners; and from social constructivism, it is important to give constructive feedback. Yet, similarities were also found. Independent of a learning theory effective feedback is task- or goal-directed, specific, and neutral. In addition, characteristics of the learners should be taken into account and the learners should be supported and respected. Furthermore, there seem to be four rules of thumb, which reflect the majority of what is believed to be effective in three to four learning theories. First, feedback receivers should have an opportunity to engage in dialogue with feedback providers, except for behaviourism. Second, in behaviourism and cognitivism feedback should elaborate on errors that have been made: an indication of whether learners made a mistake or not is not enough. This finding was also found for social cultural theory and social constructivism that suggested that justification is needed. Third, feedback should contribute to further improve learning, except for behaviourism. Fourth, timing of feedback should be immediate, according to behaviourism which contrasts the other learning theories, which mainly suggested that feedback should be given frequently, as soon as possible, and when it is still relevant for the learners.

Regarding the *second* research question, the examined feedback models mainly reflect the learning processes as they are postulated from all learning theories. Except for behaviourism, which has the most straightforward feedback process, no articles investigated the whole learning processes. The feedback processes in all other learning theories are more complex, which makes it more complicated to examine the whole process. In contrast to the first research question, this research

question distinguishes identified feedback from proven feedback. Based on the examination of the models, it can be concluded that feedback processes for students and pupils are more effective if feedback is:

- corrective in such a way that learners are guided to provide the right answer (extracted from behaviourism),
- focused on the task, specific, detailed, clear, corrective in such a way that learners are guided to give the right answer, and helping learners to close the gap between their actual and the desired performance (extracted from cognitivism),
- specific, providing insights into the desired behaviour, and provided in a dialogue in which good relations exist between receivers and providers (extracted from social cultural theory),
- helping to become familiar with the gap between an actual and desired performance and to close the gap (extracted from meta cognitivism),
- task and/or goal-directed, focused on the learning process, specific, in time and frequent, positive, unbiased, non judging, constructive, holds elaborations and/or justifications, and encouraging dialogue (extracted from social constructivism).

Findings from the *third* research question show that effective feedback to (student) teachers is:

- immediate, specific, and corrective (extracted from behaviourism),
- elaborative, actively engages learners in correcting their errors (extracted from cognitivism),
- timely, specific, formative, accurate, concrete, specific, focused on the task and/or goal, descriptive, frequently, and creating cognitive dissonance (extracted from social cultural theory),
- provided in the context of coaching and/or peer coaching, constructive, not only positive (extracted from social constructivism).

No clear recommendations were provided from meta cognitivism.

Because we used the same method for analysing feedback processes in student learning and teacher learning, we can compare the findings of research questions 2 and 3. Regarding behaviourism, feedback should be corrective to any learner. For teachers, it was argued that it should be immediate and specific. Concerning cognitivism, feedback should be elaborative about errors and it should encourage learners to actively engage in correcting these errors. For students, feedback should be focused on the task, specific, detailed, and clear. Regarding social cultural theory, feedback should be specific for any learner. All other characteristics that are considered effective differ for students and teachers. Concerning meta cognitivism, results lack for feedback to teachers; students should receive feedback that supports them in getting a clear idea of the gap between their performance and the desired performance and to close this gap. Regarding social constructivism, feedback should be constructive and task/and goal-related. For teachers, this feedback should be provided in a (peer) coaching context. Similarly, for students, feedback should encourage dialogue. These findings show that feedback generally does not differ for teachers compared to students. Similar kinds of feedback characteristics are considered and shown effective. Only in social cultural theory, the majority of characteristics differ between the groups.

Notwithstanding the general conclusions and rules of thumb, findings also show that different and sometimes contrasting characteristics of feedback are considered effective within one perspective. For instance, in behaviourism, Goodman et al. (2008) suggested that telling somebody what to do leads to the desired outcomes. On the other hand, Ferreira et al. (2007) concluded that supporting and evoking somebody to provide the right answer is more effective than telling them what to do. As a consequence, not all contrasting empirical findings can be explained by the learning theory. In addition, the number of reviewed articles differs between the learning theories and between those that focused on students and those that focused on teachers. Furthermore, the task that participants in each study perform can have an influence: learning a language differs from implementing teacher strategies. However, our findings are supported by Tang and Harrison's (2011). They revealed three different types of tutors: traditional-autonomous-global (TAG), student-centred (SC), and traditional-local (TL). Each of these types of tutors held different beliefs about what kind of feedback would be most effective. TAG tutors thought that grading was the most helpful kind of feedback to students and that any additional feedback would not benefit their students. SC tutors believed that feedback is more than a grade and that it supports student in improving their learning. TL tutors did not believe that feedback would support learners in improving future assignments and gave very specific, detailed feedback.

Some general rules of thumb were found; however, some guidelines are established that origin in only one learning theory. For instance, only from behaviourism, feedback should be timed immediately. This finding might be explained as follows. Behaviourism is the only learning theory that focuses on changing behaviour; others address the development of knowledge. This may have led to the established guidelines for timing and might explain the mixed results that are reported in feedback research (see for instance Mory, 2003 on timing of feedback).

In this review, we have used learning theories as a way to determine what effective feedback among teachers is. The five learning theories provide a chronological perspective of the development of concepts of learning. We do not aim to determine which learning theory is 'better' than the others. We believe that teachers and researchers should become aware of the differences between the learning theories and choose the appropriate feedback mechanism for what they intend to learn their students and consequently implement a certain research context or teaching behaviours.

This article shows that feedback processes are complicated. Guidelines for giving effective feedback depend on many aspects: the learners, the tasks at hand, the providers, the feedback message, the context in which feedback is given, and the interaction between these aspects.

4.1. Limitations

There are some limitations to this article. First, while some authors explicitly mentioned their learning perspectives, others were less clear from which learning theory they reasoned. In addition, one article combined two learning theory perspectives and was assigned to both learning theories. Second, the learning theories themselves differ in clarity. The learning processes in behaviourism are obvious; however, learning processes in social constructivism are much more complicated and meanings of several characteristics are not always clear. Consequently, few articles examined the feedback process as a whole. Third, the number of reviewed articles differs between the learning theories and between those that focused on students and those that focused on (student) teachers within one learning theory. Finally, some characteristics of feedback lacked clear descriptions in the articles. These limitations influence the comparison of the studies' findings and the established guidelines.

4.2. Practical implications

A practical implication for the professional development of teachers is that mentoring and peer coaching programs need to be implemented in schools. These kinds of programs are shown to reinforce teacher professional development. Within these programs, feedback is provided. When teachers are given feedback in mentoring or peer coaching programs, feedback should be specific, clear, and unbiased. In addition, teachers should have the opportunity to engage in dialogue and should be respected and supported. The feedback should support them to further improve their learning processes and feedback should be given frequently. It should be avoided that teachers only receive positive feedback: they need constructive feedback that supports them in their learning processes. These kinds of guidelines can also be used by teacher educators when providing feedback to student teachers during, for instance, their field experience.

Furthermore, teachers could benefit from these kinds of experiences and use these guidelines in their classrooms when giving feedback to their students. This feedback should be task- or goal-related, specific and clear, and unbiased. In addition, teachers should take the learners characteristics into account and use the four rules of thumb. As such, the students can benefit from effective feedback that supports them to achieve better learning outcomes.

When feedback is provided on errors, it is important that this feedback elaborates, explains, and justifies the errors and that it encourages the learners to actively engage in repairing.

4.3. Future research

Feedback processes are complicated and many aspects interact with each other. Future research should acknowledge this complexity and try to comprehend it. Studies need to focus on larger parts of feedback processes such that these processes can be understood. To achieve this, different research methods might be needed. Many studies included in this review examined perceptions of feedback or manipulated feedback characteristics to reveal its effectiveness. Future research can explore feedback processes for instance by means of observation. In an empirical study, we have pilot tested our observational instrument and shown that effectiveness of feedback depends on patterns of feedback instead on one dimensional characteristics (Thurlings, Vermeulen, Kreijns, Bastiaens, & Stijnen, 2012).

For future research, we recommend to define, describe, and operationalize terms such as 'sufficient' and 'constructive' in a more precisely manner. This allows researchers and practitioners to better understand the meaning of these terms and from there on use them, either in empirical or review studies as well as in classrooms and teacher professional development.

Several suggestions for future research for the different learning theories are: (a) to use larger samples in the bug-in-ear and performance feedback studies (behaviourism); (b) studies that examine the effects of direct and indirect feedback, because these results were inconclusive (cognitivism); (c) empirical studies that focus on feedback in social cultural theory learning environments for teachers; (d) empirical studies on feedback in meta-cognitivism, both for students and teachers; and (e) studies that explore feedback processes in (peer) coaching settings for teachers.

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