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Promoting effective teacher-feedback: from theory to practice through a multiple component trajectory for professional development

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This study describes an evaluation of a theory-based trajectory for professional development called FeTiP (Feedback-Theory into Practice) that aims to have an observable effect on teacher classroom behavior. FeTiP is a multicomponent trajectory for professional development and combines several types of interventions. Its goal is to help teachers expand their feedback behavior in the classroom to provide more, and more effective (i.e. learning-enhancing), feedback. We first describe the foundation of FeTiP, with a central focus on how classroom behavior can be influenced by a multicomponent trajectory of professional development, as this is often a major aim in initiatives for the professional development of teachers but is the most difficult to establish. We describe the effects of FeTiP on the feedback behavior of teachers and attempt to explain why these effects occurred.

Keywords: professional development; feedback; teacher change; video-coaching

1. Introduction

There are many initiatives and trajectories available for the professional development of teachers, but empirical research about their outcomes is scarce, specifically regarding the effects on teachers' classroom behavior. Most studies show effects that are determined by the teachers' self-evaluations. This study describes an evaluation of a theory-based trajectory for professional development called FeTiP (Feedback-Theory into Practice) that aims to have an observable effect on teacher classroom behavior. FeTiP combines several types of interventions, and its goal is to help teachers to expand their feedback behavior in the classroom to provide more, and more effective (i.e. learning-enhancing), feedback. We describe the effects of FeTiP on the feedback behavior of teachers and attempt to explain why these effects occurred. Before doing so, we first describe the foundation of FeTiP, with a central focus on how classroom behavior can be influenced by a multicomponent trajectory of professional development, as this is often a major aim in initiatives for the professional development of teachers but is the most difficult to establish.

1.1. Problem formulation

Traditionally, the professional development of teachers has involved attending courses, workshops, training or conferences and reading professional journals. These

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activities for professional development are not all successful. Kwakman (2003) underlined in her theoretical framework on teacher professional development that these traditional professional development activities fall short of helping teachers change their classroom behavior. Guskey (2002) described in his model the ineffectiveness of many trajectories for professional teacher development and the lack of transfer ability of these professional development activities to teacher practices in the classroom. He stated instead that teachers would benefit from programs for professional development that offer 'specific, concrete and practical ideas, that directly relate to the day-to-day operation of their classrooms' (p. 382). Buczynski and Hansen (2010) studied the results of a summer course of 118 elementary school teachers. While some teachers reported that they transferred their knowledge and skills to their classrooms, others reported obstacles in implementing them because of, for instance, time restraints, lack of resources, or classroom management issues. Most of the studies on professional development activities reported one single type of intervention for professional development. Taking another stance, Borko (2004) provided an overview of strategies and directions for extending our knowledge on the professional development of experienced teachers. She stated that we need studies that go beyond researching single type interventions and that we need to study trajectories for professional development in their full complexity, in real-life situations.

1.2. Goal of this study

In this study, we endeavor to add to the traditional ways for the professional development of experienced teachers and search for ways that would help teachers to transfer theory into actual behavior in the classroom that would go beyond a single type intervention. We aimed to do this by performing a series of interventions and combining interventions at different levels of the school organization.

The content focus of our trajectory for professional development is feedback. Providing feedback is an influential teacher intervention for promoting student learning (Hattie, 1999; Kluger & DeNisi, 1996). However, learning-enhancing feedback in the classroom seems to be rather rare (Hattie, 1999; Pauli, 2010; Voerman, Meijer, Korthagen, & Simons, 2012). In this study, we designed and carried out a trajectory that aimed to help teachers to further develop their skills in providing the more learning-enhancing types of feedback and to do so more frequently.

To reach this goal, we developed FeTiP, a trajectory that combines five components: (a) providing theory, (b) demonstration, (c) practice, (d) feedback, and (e) coaching. The five components of FeTiP were shaped into interventions inside and outside the classroom, and these were aimed at three 'levels' of the organization: the individual level, the collegial support group level, and the whole team level. Providing learning-enhancing feedback not only required the content and skill to be learned. FeTiP also contains a variety of feedback interventions as a means to enhance teacher learning and to stimulate teachers to bridge the gap between theories about providing feedback effectively and their practice. Because the involvement of school administration is an important condition for effective trajectories (Fullan, 2009; Hargreaves & Fullan, 2012), during FeTiP, we consulted with the management to monitor the way the trajectory was carried out.

Our research question was as follows: To what degree do teachers change their feedback behavior after FeTiP?

2. Theoretical framework

2.1. Feedback

In the literature, there has been some consensus about the goal of feedback. Among other things, feedback should close the gap between a current level of understanding or performance and a goal (Hattie & Timperley, 2007; Kluger & DeNisi, 1996) and should provide the information necessary to close this gap (Duijnhouwer, 2010; Hattie & Timperley, 2007; Kluger & DeNisi, 1996; Shute, 2008). To describe the concept of 'feedback,' we will follow Duijnhouwer's definition (2010) of 'information provided by an external agent regarding some aspect(s) of the learner's task performance, intended to modify the learners' cognition, motivation and/or behavior for the purpose of improving performance' (p. 16).

In his review study, Hattie (1999) stated that the frequency of feedback influences learning. However, he also indicated that teachers do not seem to provide much feedback. An earlier study from Voerman et al. (2012) also showed that teachers do not provide much learning-enhancing feedback. The frequency of learning-enhancing feedback did not differ based on teaching experience, gender, or age. Apparently, teachers do not learn to provide more learning-enhancing feedback as they grow older or become more experienced in teaching.

Moreover, not all feedback is effective at enhancing the learning of the feedback recipient. There is evidence that in order to enhance learning, feedback should be specific and goal related (Alder, 2007; Black & William, 1998; Duijnhouwer, 2010; Hattie & Timperley, 2007; Kluger & DeNisi, 1996; Shute, 2008). In addition, providing more positive feedback than negative feedback appears to enhance learning. In their study of 60 management teams, Losada and Heaphy (2004) analyzed the verbal communication of these teams. They found that high performing teams showed high ratios of positive to negative feedback. They developed a positivity ratio, with optimal (between 3 and 11) and less optimal (below 3 and above 11) ratios of positive and negative feedback. Although the exactness of the ratio has recently been discussed (Brown, Sokal, & Friedman, 2013), there is no doubt that 'a higher positivity ratio is ordinarily more desirable than a lower one' (Brown et al., 2013, p. 31). Based on the review of many studies on positivity and negativity, Fredrickson (2013) concluded that when it comes to positivity ratios, within limits, higher is better. Following this, in classrooms, higher ratios of positive to negative feedback might be helpful toward enhancing learning. Non-specific feedback such as 'well done' is not learning-enhancing (Hattie & Timperley, 2007), and neither is feedback on the self, although feedback on character strengths seems to be learning-enhancing (Park & Peterson, 2009; Voerman, Meijer, Korthagen, & Simons, 2014). Hence, we need to help teachers to provide more specific feedback that is more often positive than negative.

2.2. Intervening in experienced teacher learning

As we mentioned in our problem formulation, recent research has suggested that it is difficult to intervene in the learning outcomes of experienced teachers such that they are able to transfer theory into behavior in the classroom. As one cause of this difficulty, Korthagen (2010) pointed at the complexity of teaching, where the teacher has to integrate many elements such as the curriculum, the context, and the reaction of individual students as well as the students as a group toward instruction. This

complexity was also emphasized by Hammerness, Darling-Hammond, and Bransford (2005), who described how teachers have to meet a large variety of cognitive and social goals in their classrooms. They stated that 'teachers … need not only understand, but also do a wide variety of things, most of them simultaneously' (p. 359). Another cause of the difficulty for teachers to change their behavior might be the need for prompt and concrete answers to situations in the classroom that they experience on a moment-to-moment basis (Korthagen, 2010). Because of the enormous amount of decisions-in-action with not much time to think, teachers depend strongly on the routines they have developed and such routines cannot easily be changed (Eraut, 2004). In conclusion, given the complexity of teaching and the need for prompt reactions to situations, it is not surprising that teachers find it hard to translate theory into their daily practices. Hence, it is important that a trajectory for professional development takes into account the complexity of teaching and the demand for direct responses.

2.2.1. A combination of theory, demonstration, practice, coaching in a collegial support group, and feedback

Joyce and Showers (2002) stated that, in order to be successful, a professional development trajectory should contain four learning components, namely theory, demonstration, practice, and coaching. They showed that the gradual addition of information, demonstration, and practice does not seem to have a notable effect on transfer into teacher behavior in the classroom. However, they found a dramatic increase in the transfer of skills into the classroom when coaching in collegial support groups was added to these training elements.

An additional important component is based on the insights on learning-enhancing feedback that were developed since the 1990s, as described in the section on feedback. These made us to view feedback as a valuable and maybe even an indispensable component in a trajectory for professional development. The value of feedback is supported by Gabelica, Van den Bossche, Segers, and Gijselaers (2012), who conducted a review of 59 studies on the effect of the feedback provided to teachers in higher education and stressed the importance of feedback for teacher learning. Borko (2004) also claimed that feedback given to teachers about the way they teach in their classroom is a necessary aspect of trajectories for professional development. In parallel with feedback to students, we hypothesize that learning-enhancing feedback for teachers should be specific, goal related and provide more positive than negative feedback (Hattie & Timperley, 2007; Losada & Heaphy, 2004; Shute, 2008).

2.2.2. Aiming toward a whole department, including school administration

Aside from the five components of a trajectory for professional development that were described earlier (theory, demonstration, practice, coaching in collegial support groups, and feedback), there are additional factors that are influential in the effectiveness of the professional development in schools. Firstly, an important factor in teacher learning was described by Fullan (2009) from the viewpoint of organizational change. He underlined the importance of a professional development program for a department as a whole, in order to develop a shared understanding of the nature of effective practice. In a report on teacher development in the United States and

abroad, Darling-Hammond, Chung-Wei, Andree, Richardson, and Orphanos (2009) stated that professional development tends to be more effective when it is an integral part of school policy. They also indicated that professional development activities have little impact if the new practices are not supported or reinforced. As a further reason for a professional development program to involve a whole department, Fullan (2009) stated that when only a few teachers implement an effective new skill in their classroom, there is not much effect on student learning. He further emphasized that 'teachers' ongoing interaction and experience with one another build the trust and knowledge that they are collectively responsible and good at their work' (p. 47). Fullan described this interaction as 'sharing.' By sharing, teachers 'externalize' and contribute to the learning of their team or organization in a process that Simons and Ruijters (2004) described as an important aspect of teacher professional development. Meirink, Imants, Meijer, and Verloop (2010) refined the concept of sharing in their comparative case study. They showed that learning frequently occurred in teams that started from (1) shared problem identification, (2) shared ideas for alternative teaching methods, and (3) discussions of their experiments with these alternative methods.

As a second factor in teacher learning from the organizational change point of view, Fullan (2009) described the commitment of the school administration not only to support the concept but also to provide practical support (i.e. time and possibilities to practice) in the implementation of new skills. This commitment is underlined by Adey (2006), who stated that the role of the school administration is crucial for professional development, since administrators are a great influence on the culture of a school and participation in professional development activities. A committed school administration can develop a culture of mutual support and learning, where teachers provide each other with support and feedback, as do the administrators (Eraut, 2007). We might conclude that an effective trajectory for professional development takes place within a school, with involvement and support from the management and teachers in goals and methods.

2.2.3. Interventions aiming at the individual level, the collegial support group level and the department as a whole and carried out inside and outside the classroom

In this study, the components of a trajectory for professional development, i.e. theory, demonstration, practice, feedback, and coaching, were operationalized into interventions as part of the trajectory for professional development. Through an analysis of the literature on effective interventions, we found two features of interventions that, in our opinion, are important for developing a trajectory for professional development. The first feature is that interventions can be aimed at different levels of the school organization. We have already described two levels that are important. The whole department level, as Fullan described, and the collegial support group level, as Joyce and Showers (2002) discussed, are essential. Adey (2006) described a third level, intervening at the individual level as a key level of professional development. We will elaborate on this level below by describing in more detail the combination of interventions of FeTiP.

A second feature of interventions is that they can be carried out inside the classroom, or outside. Recent studies have stressed the combination of learning settings for teachers inside and outside the classroom as effective for professional development (Hodkinson & Hodkinson, 2005; Tynjälä, 2008). Support for the view that

intervening in teachers' own classrooms can be effective might be found in the concept of 'approximation of practice,' as described by Grossman et al. (2009). They view approximation of practice as one of the key concepts for teacher education, as characterized by opportunities to engage in practices that are more or less proximal to the practices of a profession. Approximation of practice provides opportunities for 'deliberate practice,' especially for practices that are highly challenging. Deliberate practice is defined as prolonged engagement in practice that is especially designed and intended to improve individual performance (Bronkhorst, Meijer, Koster, & Vermunt, 2011). Approximation of practice, as in intervening in the individual teachers' classrooms, might be an effective tool for addressing the complexity of teaching and the need for immediate decisions, and as such might help teachers to translate theory into practice.

In summary, we hypothesize that an effective trajectory for professional development consists of (a) a combination of components, i.e. theory, demonstrations, opportunities to practice, feedback, and coaching in collegial support groups; (b) interventions aiming at the individual level, the collegial support group level and the department as a whole, and carried out inside and outside the classroom; and (c) involvement and support of the school administration.

2.2.4. *Operationalizing components into interventions*

There have been some recent studies on interventions that seem promising for helping teachers to change their behavior in the classroom. Firstly, at the collegial support group level, *video-coaching under the guidance of a trained coach* has appeared to be effective. Fukkink, Trienekens, and Kramer (2011) showed a positive effect of this kind of video-coaching, as reported by the teachers. A recent research project conducted by Thurlings (2012) on four groups of three teachers using their video recordings for feedback showed that collegial teacher feedback was effective when performed under the guidance of a process supervisor. The supervisor acted as a chairman, modeled coaching behaviors, and provided feedback on the teachers' coaching behaviors. In this way, teachers learned how to provide feedback to each other. In his review on the use of video in the professional development of teachers, Brouwer (2009) showed that they reported changes to their teaching with the help of video-coaching that was supervised by a video-coach. The video-coach supports learning by directing the attention of the teachers and by stimulating reflection by asking open-ended questions, with both colleagues and coach providing feedback. In their study on the influence of video analysis on teacher change, Tripp and Rich (2012) showed that teachers can reflect on their behavior with the help of video recordings and that this helps them to see their teaching from a new perspective as well as to monitor their progress. Hennessy and Deaney (2009) state that video recordings help teachers capturing and revisiting classroom activity and describe video as a powerful tool for critical reflection and knowledge construction by practicing and trainee teachers.

Secondly, at the individual level, a successful intervention is one that offers *a type of in-class support*, as Adey (2006) denoted, for instance: 'Coaching in teachers' own classrooms is a sine qua non of effective professional development' (p. 54). A possibility for coaching in the classroom is modeling. Korthagen, Loughran, and Lunenberg (2005) stated that teacher educators teach about teaching and during that process, they model teaching. Lunenberg, Korthagen, and Swennen

(2007) emphasized that the way teacher educators model teaching serves as an important factor in shaping teacher behavior. We might hypothesize a correspondence between teacher education and professional development in this respect. As teacher educators, trainers teach teachers about teaching, while teaching. We might conjecture that modeling is an important factor in professional development trajectories as well.

There are several ways in which the modeling of feedback behavior can take place. Trainer-coaches might model feedback behavior during training and coaching, as teacher educators do. However, there is another way to model feedback behavior, namely *modeling feedback behavior in the teachers' own classroom,* where teachers can observe the modeling of the trainer-coach and practice directly afterward by copying the trainer-coach. Approximation of practice as modeling feedback behavior in teachers' own classrooms might provide teachers with the opportunity to deliberately practice the skills they want to learn. In this way, teachers might learn how to provide learning-enhancing feedback.

Another example of an intervention at the individual level in the classroom is *synchronous coaching*. In this type of coaching, direct interventions are provided to the teacher by the trainer-coach. The trainer-coach uses a microphone to provide keywords to the teacher, who wears an earplug. Keywords are discussed in a coaching session beforehand and are used to prompt the teacher during the synchronous coaching session. In his experimental study on 40 student-teachers, Hooreman, Kommers, and Jochems (2008) showed that the knowledge of student-teachers in the synchronous condition about quality of teaching progressed more than in a more traditional type of coaching, where a lesson was observed and feedback was provided afterward. In a study by Vuijk and Robbers (2012), synchronous coaching was combined with individual video-coaching. Interviews with the 15 participating teachers showed that they all felt more competent after the intervention. Teachers also highly valued synchronous coaching combined with video-coaching for their professional development. Complementary to the modeling of feedback, through synchronous coaching, teachers might learn of opportunities in the classroom for providing learning-enhancing feedback.

In an earlier study (Voerman et al., 2012), we analyzed the video recordings of 78 teachers on the frequency of feedback. We found in this study that the total frequency of feedback and the frequency of learning-enhancing feedback did not differ based on the teachers' gender, age, or experience. This result surprised us since we had expected that older, more experienced, and female teachers would provide more and better feedback than male and younger, less experienced teachers. Perhaps incidental factors were involved in the previous study, preventing the expected correlations from showing up. Hence, we decided to investigate whether gender, age, and experience perhaps do influence the increase of the frequency of learning-enhancing feedback in a trajectory for professional development.

Research studies on interventions that seem promising for helping teachers to change their classroom behavior have reported results from teachers' self-evaluation or reflections. In FeTiP, we are interested in actual changed behavior in the classroom; hence, we have refined our research question into more specific feedback behavior of the teachers based on these theoretical views. Our question was as follows:

To what degree do teachers change their feedback behavior after following FeTiP?

We added the following sub-questions:

(1) To what degree do teachers change (a) the frequency of feedback, (b) the frequency of specific feedback, and (c) the ratio of positive and negative feedback after following FeTiP, as observed in their classroom behavior?
(2) To what extent do the answers for (a), (b), and (c) differ according to the gender, age, and/or experience of the teachers?

3. Designing FeTiP

3.1. Management involvement

In preparing FeTiP, several meetings took place between two trainer-coaches and the school administrators of the participating school department. The school administrators assured that they would provide the necessary support of time and means. In the same period, the school administration had two meetings with the whole department of teachers to discuss whether the subject, i.e. providing feedback, was sufficiently interesting for their participation. They also discussed the various elements of FeTiP, especially the unfamiliar ways of professional development as modeling in the classroom, synchronous coaching, and supervised video-coaching. In an additional meeting with the whole department, the trainer-coaches demonstrated the design of FeTiP. Teachers were explicitly asked whether they were willing to participate in both FeTiP and the accompanying study.

The whole department and the school administrators all participated in the interventions that were part of FeTiP. In addition, trainer-coaches and school administrators had five meetings during FeTiP to discuss its alignment with the needs of the department. Based on these discussions, one explicit intervention was added at the request of the school administration, namely a session involving each individual teacher with both a school administrator and a trainer-coach. In these sessions, the trainer-coaches provided feedback to each teacher on his or her feedback behavior in the classroom, based on quantitative and qualitative analyses of the video recordings of the teachers halfway through the trajectory. Little (2006) has mentioned that the systematic use of data for learning by teachers might be very effective feedback, but feedback based on data on teacher behavior does not very often occur in schools (cf. Hattie & Timperley, 2007). Hence, the feedback conversation was included in FeTiP. Of course, this is also an example of the commitment of the school administration to the design of the trajectory. Fullan (2009) and Adey (2006) described this commitment as essential for trajectories for professional development. The feedback the trainer-coaches provided to the individual teachers also served as a model to the school administrators on how to provide learning-enhancing feedback to the teachers.

3.2. Interventions included in FeTiP

In our study, we searched for interventions that covered five components, i.e. (1) theory, (2) demonstration, (3) practice, (4) feedback, and (5) coaching. We also aimed to address three levels, i.e. the whole department level, the collegial support group level, and the individual level. Moreover, we searched for interventions that were carried out both outside and inside the classroom. Of all the possibilities to

shape the components into interventions, we chose interventions that seemed to do most justice to the complexity of teaching that teachers experience in their classroom and that specifically aimed to translate the theory into actual behavior in the classroom. In selecting these interventions, we based ourselves on our search of promising new interventions.

We chose the following interventions to shape the components of FeTiP:

(1) Two training sessions
Two training sessions were provided for the whole department on the theory of how to provide learning-enhancing feedback, with demonstrations and opportunities to practice outside the classroom, during the meeting. The theory was about learning-enhancing feedback, as described in the theoretical framework. In these training sessions, teachers also practiced providing learning-enhancing feedback. In both training sessions, we strived to utilize approximation of practice. In the first session, the teachers taught each other in small groups, using the theory on learning-enhancing feedback. Afterward, the teachers provided feedback for each other regarding the feedback they provided while teaching. In the second session, students participated. During the training, one teacher would teach one student, while another teacher would observe. Afterward, both the observing teacher and the student provided feedback to the teaching teacher.

(2) Modeling in the classroom
The trainer-coaches went into the classroom to model feedback to students for the teachers. Teachers indicated in advance the type of feedback they wanted to observe in their own classroom. During one lesson, a trainer would model the feedback for about 10 min, while the teacher observed the trainers' actions. The teachers were asked beforehand to choose one or two of the observed feedback interventions that they would like to use themselves. After 10 min, the trainer videotaped the teacher who practiced providing feedback. Box 1 shows an example of modeling and the subsequent feedback provided by a teacher for a student.

Box 1.

Modeling and subsequent feedback of a teacher for a student.

[The trainer would for instance model:]

'I can see that you're really making an effort. You have already done most of the assignment.

And you've done it all by yourself.'

[Afterwards, you would then hear the teacher providing the following feedback:]'
I want to give you a compliment, because you are so independent. You first try for yourself and if you really do not know, then you ask questions, well done!'

(3) Synchronous coaching
During one lesson, the teacher wore an earpiece during teaching while the trainer-coach prompted with keywords. Teachers indicated in advance the feedback interventions that they wanted to provide more often. Based on the teachers' choices, a maximum of three keywords were chosen (e.g. 'feedback' or 'positive'. Box 2 shows an example of a keyword and the teacher's reaction.

Box 2.

Example of a keyword and the teacher's reaction after hearing the keyword.

[Teacher has told three students to sit quietly and do their work, because they were being noisy and distracted, about five minutes before the keyword.]

Trainer-coach provides keyword:

'*feedback'*

[Teacher approaches the students and points at each student respectively]:

'Now you're working. You are practicing, you are practicing, and you are practicing. Good job!'

(4) Supervised video – coaching in collegial support groups
After both explicit modeling in the classroom and synchronous coaching, teachers reflected on their behavior and provided and received feedback from each other on their feedback during supervised video-coaching in collegial support groups of four or five teachers. The teachers watched their own classroom video recordings in advance and selected two fragments: one fragment in which they were quite satisfied with the way they provided feedback and one fragment in which they felt they needed to act differently. These fragments were watched and discussed during video-coaching. Special attention was given to the effect of feedback that the teachers provided on their students. Teachers were asked to provide specific feedback to each other and to relate their observations to the theory provided in the training sessions. They were also asked to be aware to provide more positive than negative feedback.

(5) Feedback session
The teachers received individual feedback on their feedback behavior in a feedback session of 20 min. This feedback was provided both orally and in a written report. The trainer-coach and a school administrator participated in this feedback session. The feedback that the teachers received was based on the analysis of video recordings halfway through FeTiP. During the session,

teachers received a report on the frequency of feedback they had provided in a lesson, the specificity of their feedback, and the ratio of positive to negative feedback. During this session, the trainer-coach provided specific feedback to the teachers based on an analysis of the feedback behavior of the teachers in the classroom.

Table 1 shows an example of the feedback report a teacher received. The table illustrates the feedback frequencies of the teacher in absolute numbers and the mean frequency of the feedback the whole department provided.

To summarize, Table 2 shows the interventions of FeTiP in the first row, while the components are described in chronological order over seven months in the second row. The columns show whether these interventions were outside or inside the classroom and whether they were aimed at individual teachers, the collegial support group level, or the department as a whole.

4. Research method

The study we conducted was an effect study with a repeated measurement design, in which we performed a pre-test and a post-test. Both the pre-test and post-test consisted of analyzing a video recording of one lesson of each teacher. The pre-test took place before the start of FeTiP. Seven months later, a week after FeTiP had ended, we performed the post-test. The video recordings of both the pre-test and post-test were analyzed according to the model described in Section 4.3.

4.1. Participants

This study was conducted in a school department of lower vocational education at a school in the southern part of the Netherlands. FeTiP took place in one school year, from November until June. The department consisted of 29 teachers. Two of the teachers also participated in the school administration. The school administration consisted of three members, i.e. the two participating teachers and a school principal. Not all participating teachers were part of our sample. Two teachers fell ill at the beginning of the school year, and one teacher fell ill during the year. Some teachers did not attend all meetings or activities because they worked part time or because they were temporarily unable to attend. In the final analysis, we only

Table 1. Feedback frequencies of an individual teacher and mean frequencies of the whole department.

Types of feedback	Elly (Total)	Mean of your department
Total feedback	20	12.5
Specific feedback	16	6.9
Non-specific feedback	4	16.2
Positive feedback	19	10.7
Specific positive feedback	15	5.5
Non-specific positive feedback	4	5.3
Negative feedback	1	1.9
Specific negative feedback	1	1.4
Non-specific negative feedback	0	.5
Ratio of positive–negative feedback	19	5.9

Table 2. Chronological summary of FeTiP in components and interventions.

Interventions		Training November/ December 2010	Explicit modeling in the classroom January 2011	Feedback conversation on frequency and quality of feedback interventions February 2011	Supervised video-coaching #1 March 2011	Synchronous coaching April 2011	Supervised video-coaching #2 June 2011
Components		Theory, demonstration, practice, feedback	Demonstration, practice	Feedback, demonstration, theory	Coaching, feedback, practice, demonstration, theory	Practice	Coaching, feedback, practice, demonstration, theory
Outside the classroom	*Department*	x		x			
	Collegial support group				x		x
	Individual			x			
Inside the classroom	*Individual*		x			x	

included data from 23 teachers who missed no more than one FeTiP intervention. Two administrators were included among these 23 teachers. Although the school principal attended as much FeTiP as he could, he was not a part of our sample because he missed more than one intervention. Of all the teachers, 12 were male and 11 were female. Their age varied from 22 to 63 years, with a mean of 41.3 and a standard deviation of 13.2. Their experience varied from 1 to 38 years with a mean of 15.8 and a standard deviation of 12.9.

There were two trainer-coaches who performed all of the interventions. In the training sessions that involved the whole department, the trainer-coaches worked together. In the other interventions, the trainer-coaches worked separately with a small group of teachers or with teachers individually. Both trainer-coaches were experienced and well trained in the interventions they performed.

4.2. Instruments

The teachers were videotaped before and after FeTiP during one lesson of 50 min. From these lessons and for each teacher, we selected one fragment of ten contiguous minutes of both pre-test and post-test recordings in which there was interaction between the teacher and students to maximize the incidence of feedback interventions available for evaluation. The first analysis was quantitative: We counted the frequency of feedback. Then, we conducted a qualitative analysis using the observation scheme that Voerman et al. (2012) developed in an earlier study. The elements of the observation instrument were as follows:

- *Non-specific positive feedback*: non-specific positive utterances, such as 'Well done!' and 'Great!'
- *Non-specific negative feedback*: non-specific utterances, such as 'Wrong!' and 'Not quite!'
- *Specific positive feedback*: positive feedback containing specific information about the student's performance or level of understanding. 'I can see that Peter and John are already applying the schedule, well done!'
- *Specific negative feedback*: negative feedback containing specific information about the student's performance or level of understanding. 'I'm missing something here. You have to add step 1 to the description, not only steps 2 and 3.'

The inter-rater reliability (Cohens' Kappa) was 0.82. Using this scheme, we categorized the feedback interventions as positive and negative, and specific and non-specific. We also calculated the ratio of positive to negative feedback.

4.3. Analysis

In the analysis, descriptive statistics of the feedback such as means and percentages were calculated. To answer our research question of the degree to which teachers changed their feedback behavior, being (a) the frequencies of feedback, (b) specific feedback, and (c) the ratio of positive to negative feedback after FeTiP, we conducted a paired samples *t*-test. We applied the paired samples *t*-test to the frequency of all feedback, positive and negative feedback, specific feedback, and the ratio of positive and negative feedback to establish whether the pre-test and post-test of the participating teachers differed significantly.

To answer the question, to what extent does the change of feedback behavior differ according to the gender, age, and/or experience of the teachers, we first explored whether the feedback behavior of teachers at the pre-test could be explained with the teacher characteristics gender, age, and years of teaching experience. We performed regression analyses with the dependent variables being the pre-test scores frequency of feedback, specific feedback, and the ratio of positive and negative feedback and the independent variables being gender, age, and teaching experience. Second, we explored whether we could explain the teachers' feedback behavior at the post-test with the pre-test measures and the teacher characteristics. We performed a second series of regression analyses, with the dependent variables being the post-test scores for frequency of feedback, specific feedback, and the ratio of positive and negative feedback and the independent variables being the pre-test scores for the frequency of feedback, specific feedback, and the ratio of positive and negative feedback, and the teacher characteristics gender, age, and experience.

5. Results

Regarding the research question of the degree to which the teachers changed (a) the frequency of feedback, (b) the frequency of specific feedback, and (c) the ratio of positive to negative feedback after FeTiP, our results (Table 3) show that the frequency of all feedback interventions significantly increased from 11.0 (SD 6.4) in the pre-test to 18.6 (SD 6.3) in the post-test. Teachers also provided significantly more specific feedback in the post-test, with a mean of 13.4 (SD 5.8); in the pre-test, the mean was 6.5 (SD 5.3). An example of specific positive specific feedback in the post-test was as follows: 'I can see that you used a mind-map. That's a real good way to handle this assignment.' An example of specific negative feedback in the post-test was as follows: 'I can see that you're making a scheme for your work. You are not specific enough in the way you are going to divide your work'.

The mean number of positive feedback interventions was 6.3 (SD 4.7) in the pre-test and 14.7 (SD 5.4) in the post-test. The mean of negative feedback did not differ significantly; in the pre-test, teachers provided negative feedback at a frequency of 4.7 (SD 3.3), and in the post-test, the frequency was 3.8 (SD 3.4). The mean ratio of positive and negative feedback rose from 1.7 (SD 1.6) to 6.3 (SD 4.7), which was also a significant difference.

Table 3. Mean and standard deviations of the feedback interventions during pre- and post-test ($N = 23$).

	Frequency in pre-test		Frequency in post-test			
Type of feedback	M	SD	M	SD	*t*	*p*
Feedback	11.0	6.4	18.6*	6.3	4.7	.0
Positive feedback	6.3	4.7	14.7*	5.4	4.6	.0
Negative feedback	4.7	3.3	3.8	3.4	4.7	.28
Specific feedback	6.5	5.3	13.4*	5.8	4.6	.0
Ratio of positive to negative feedback	1.7	1.6	6.3*	4.7	4.9	.0

*A paired samples *t*-test showed that the results of the teachers in the post-test condition differed significantly from the pre-test condition.

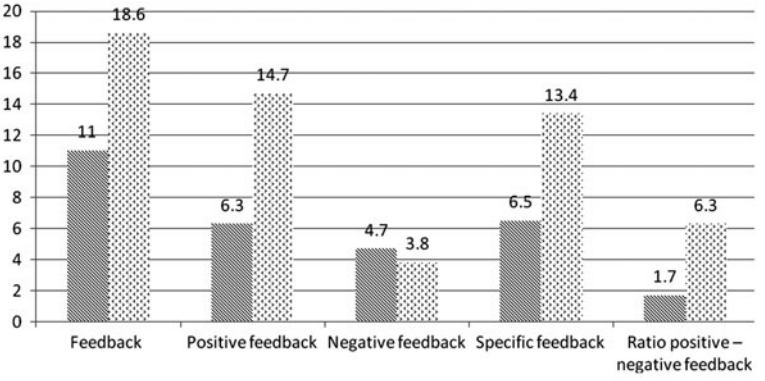

Figure 1. Pre-test and post-test results of the means of feedback, positive feedback, negative feedback, specific feedback, and the ratio of positive to negative feedback. Pre-test in hatched lines, post-test in dots.

Figure 1 shows the increase in the mean of total feedback, positive feedback, negative feedback, specific feedback, and ratio of feedback of the participating teachers during the pre-test and post-test.

The next research question was as follows: To what extent do the answers to questions (a), (b), and (c) differ for gender, age, and experience? First, we performed analyses to establish whether the results of the pre-test condition showed significant differences for these three variables. We found that they did not, as values of p varied from .25 to .96. Then, we performed regression analyses to determine the influence of gender, age, and experience on the progress made by the teachers from pre-test to post-test on the frequency of feedback, the frequency of specific feedback, and the ratio of positive to negative feedback. We found no significant differences, with values of p varying from .19 to .86. The progress of the teachers could not be explained by their age, gender, or experience.

In order to get information about the representativeness of our small experimental group, we compared the group of participating teachers to a group of 78 teachers whose feedback we analyzed in an earlier study (Voerman et al., 2012). Table 4 shows that the current group of participating teachers provided significantly more feedback during the pre-test than the comparison group of 78 teachers; the mean of

Table 4. Mean scores, standard deviations, and t-test for equality of means of the current group and the comparison group for the frequency of feedback, specific feedback and the ratio of positive to negative feedback.

	Comparison group ($N = 78$)		Current group ($N = 23$)		t-test for equality of means[a]		
	M	SD	M	SD	t	df	p
Frequency of feedback	6.6	4.4	11.0	6.4	3.11	99	.00
Frequency of specific feedback	2.2	1.8	6.5	5.3	4.71	99	.00
Ratio	2.4	2.7	1.7	1.6	−1.39	61.25	.17

[a]We used the t-test for unequal variances because of the significant difference between variances on Levenes' test for equality of variances.

the current group was 11.0 (SD 6.4), while the mean of the comparison group was 6.6 (SD 4.4). This was also the case for specific feedback, where teachers of the current group provided significantly more specific feedback than teachers in the comparison group during the pre-test. The mean of the current group was 6.5 (SD 5.3), and the mean of the comparison group was 2.2 (SD 1.8). No significant differences were found between the two groups for the ratio of positive to negative feedback.

6. Conclusion and discussion

We found that teachers did indeed change their classroom behavior. They showed significant progress in the frequency of the feedback they provided after following FeTiP. In the post-tests, they also provided significantly more specific feedback, and their ratio of positive and negative feedback increased. We found no differences for age, gender, or experience in the total frequency of feedback, specific feedback, and the ratio of positive and negative feedback at the pre-test condition. We also did not find differential effects of training with these objective variables as moderating factors.

We hypothesize from the results of our study that FeTiP is successful for helping teachers to expand their feedback behavior and to provide more learning-enhancing feedback and to do so more frequently. Our design was a repeated measurement design, in which we performed a pre-test and a post-test. A comparison of the pre-test of this group of teachers with the results we found with our earlier study with 78 teachers did not make this a true experimental design. It only showed that during the pre-test, our current teachers already performed significantly better than the group of teachers from our earlier study (Voerman et al., 2012). The fact that the video fragments used for measuring were part of the training for the group of teachers in this study and not for the comparison group is a weakness in this study.

However, although the in this study participating group already provided more as well as more specific feedback than the group of 78 teachers, there was considerable progress between the pre-test and the post-test. Hence, we have found that it *is* possible to influence teacher feedback behavior and to help teachers transfer theory into practice.

We hypothesize that involving the school administration and collegial support are fundamental features of the trajectory that we carried out. In our theoretical framework, we already endeavored to clarify this assertion. Although we do not have qualitative data from our own study that might corroborate this assertion, other research underlines the crucial role of school administration and collegial support. We might find a further basis for this assumption in the work of Newman, King, and Youngs (2000). They state that key conditions for programs for effective professional development are a professional supportive community and leadership.

The effectiveness of combining interventions at different levels is also shown by Bickmore and Bickmore (2010). They found that new teachers who took part in a combination of interventions, such as one-to-one mentoring, observations of colleagues' teaching, and collaboration with other teachers in the school, exhibited improvements in their professional practice.

From our own data, we could not find clear clues for why this combination of interventions was effective in helping teachers to expand their feedback behavior in the classroom. However, we would like to propose a couple of hypotheses.

In the first place, *at the individual level*, teachers experienced the effect of learning-enhancing feedback themselves. As Boud, Cohen, and Walker (1993) stated, experience is the foundation of, and the stimulus for, learning. Teachers not only become aware of the effect of feedback on themselves, but also of the effect of their feedback on their students. Teachers become highly motivated when they see the effect of their actions on their students, as Van Eekelen, Vermunt, and Boshuizen (2006) found. The combination of experiencing the effect of feedback themselves and observing the effect on their students might be a powerful combination in teacher learning.

Secondly, *the involvement and participation of the school administration* in, for instance, the feedback conversations, helped the school administrators provide learning-enhancing feedback to the teachers in their role as leaders. Their feedback to the teachers may have significantly influenced the learning of the teachers. We hypothesize that through involving the whole department and management, we influenced the feedback culture in the department. In turn, this may not only have had an impact on the learning of the whole department, but also on the sustainability of the feedback behavior of the teachers in their classrooms. As Fullan (2009) argued, teacher change is not achieved by training one teacher or a small group of teachers. He stated that for teacher change to be persistent, interventions must include the whole department and the school administration. In line with this statement, we argue that the feedback culture in a school is essential for the sustainability of learning. London and Smither (2002) described feedback culture as the organization's support for feedback. According to these authors, a strong feedback culture is 'one where individuals continuously receive, solicit, and use formal and informal feedback to improve their job performance' (London & Smither, 2002, p. 84). In our study, teachers and school administration learned *at the collegial support group level* to provide effective feedback to their students, and to each other. This may have influenced the feedback culture of the department as a whole. Losada and Heaphy (2004) found that the quantity and quality of feedback significantly influenced the performance of teams. High ratios of positive versus negative feedback were a crucial factor in high performing teams, and low ratios were characteristic of low performing teams. This ratio of positive to negative feedback is linked to the creation of 'emotional spaces' (Losada & Heaphy, 2004, p. 744). These authors concluded that positive feedback generates expansive emotional spaces that open possibilities for learning. Negative feedback, however, creates restricted emotional spaces that close possibilities for learning. In this way, the feedback that the teachers received and provided in our study may have contributed to an expansive emotional space at the level of the whole department, and as a consequence, the teachers may have been able to learn better and to change their classroom behavior.In our theoretical framework, we argued that trajectories for professional development should take into account the complexity of teaching and the demand for direct responses. In FeTiP, we endeavored doing just that by designing interventions that were carried out in teachers' own classrooms, aiming to approximate practice as much as possible. The interventions of modeling and of synchronous coaching provided the teachers with an opportunity to practice in a real-life situation, with its complexity and demand for direct responses. On the basis of the data presented in this study, we cannot conclude whether these classroom interventions were more effective in helping the teachers in changing their classroom practices than the other interventions outside the classroom. We suggest more research that approximates practice as much as

possible. A possible pathway could be research that combines interventions inside and outside the classroom, with repeated measurements after each intervention. Currently, we are doing just this in researching the effectiveness of the various components of FeTiP. We think this is a necessary step before deciding how to move forward with professional development practices. There are several limitations to this study. First of all, the group of teachers was rather small, with 23 participants. Also, only one secondary school participated. This was a school for lower vocational education so that more research is needed for other types of education. We suggest further research in several ways. First, additional research should be done on FeTiP by gradually dismantling the trajectory so that we can find answers to questions such as whether or not it would be possible to reach the same results if we leave out one or more intervention. Also, the sequence of the interventions might be of influence on the results we have achieved, so we would like to suggest research on the influence of the sequence of the interventions. We would be interested in identifying whether all teachers benefited from all interventions or if there were differences between the teachers. Consequently, in developing effective professional development programs, future researchers might seek for differences in the way teachers change their feedback behavior in the classroom after the various interventions. Some teachers may, for instance, need help in discovering the importance of feedback, whereas others may only need to see how one can give feedback in large classrooms. A further suggestion would be for future researchers to carry out a trajectory for professional development and also to collect data on the influence of the school administration through interviews and questionnaires. A qualitative analysis of these data might underpin our hypotheses about the involvement of school administration and address the three levels of intervening. Alternatively, school trajectories could be compared to open programs. Further research into the sustainability of the results of FeTiP would also be of interest. In this study, we performed several interventions. In addition, although not often mentioned in intervention studies, the result of the intervention depends not only on the design and content of the intervention, but also on the quality and expertise of the trainer-coaches and on the opinion of the teachers regarding this quality and expertise. Research is needed on the competencies and behavior of trainer-coaches to motivate and captivate teachers and help them to change their behavior in the classroom.

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