

Instructional and motivational classroom discourse and their relationship with teacher autonomy and competence support—findings from teacher professional development

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Abstract The present study investigates whether productive classroom discourse in the form of instructional and motivational classroom discourse (Turner et al., *Journal of Educational Psychology* 94: 88–106, 2002) provides a supportive social context for students that fosters the fulfilment of the basic psychological needs of autonomy and competence (Meyer and Turner, *Educational Psychologist* 37(1): 17–25, 2002; Ryan and Deci, *Contemporary Educational Psychology* 25(1): 54–67, 2000). In order to explore this, we studied the ways in which a teacher professional development programme (Dialogic Video Cycle; Gröschner et al. 2015) might affect the quality of teachers’ instructional and motivational discourse. The programme provided video-based professional development on productive classroom discourse for an entire school year. During the same period of time, we explored changes in students’ perceptions of autonomy and competence support and possible implications for students’ intrinsic learning motivation. The study followed a two-group field-experiment design; 10 STEM classes participated ($N=226$ students). The intervention group (IG) was compared to a control group (CG), which participated in traditional professional development on classroom

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discourse (IG: $n_{\text{Students}}=136$, $n_{\text{Teachers}}=6$; CG: $n_{\text{Students}}=90$, $n_{\text{Teachers}}=4$). The results show significant group differences in the development of instructional and motivational discourse throughout the school year, resulting in significant benefits for the IG. Furthermore, the students experienced their teachers as more autonomy- and competence-supportive throughout the year, leading to increased experiences of self-determination and intrinsic learning motivation. The results are discussed in the light of recent research and theory.

Keywords Teacher professional development · Video study · Autonomy support · Classroom discourse · Self-processes model · Self-determination theory

Introduction

Educational research in the constructivist tradition proposes that knowledge cannot simply be transferred, but that students have to (re-)construct it individually during learning processes (Wells 2009). This necessitates classroom environments in which all students have the possibility to engage and to be supported in their engagement by motivational scaffolds, e.g. student-centred, meaningful interactions (Turner et al. 2002). Current research could demonstrate that students profit from meaningful teacher-student interactions, not only in the form of learning gains, better conceptual understanding and achievement (Lipowsky et al. 2007) but also in the form of more active engagement (Seidel and Prenzel 2006) and increased interest in the subject (Kiemer et al. 2015; Turner et al. 2002). In order to provide an explanation for the processes involved, we draw on aspects from Self-Determination theory (SDT) by suggesting that productive classroom discourse (van der Veen et al. 2015; Walshaw and Anthony 2008) offers students a social context in which they can feel autonomous and competent (Reeve et al. 1999; Reeve 2006, 2009; Reeve and Jang 2006; Turner and Patrick 2004). Therefore, “[w]hen teacher-student interactions go well, teachers function both as a guide to structure students’ learning opportunities as well as a support system to nurture students’ interest [...]” (Reeve 2006, p. 225).

The present study supposes that productive classroom discourse in the form of instructionally and motivationally supportive classroom discourse (Turner et al. 2002) provides a supportive social context for students (characterised by shared responsibility over the learning process and shared control over the thinking processes; see Stefanou et al. 2004) that fosters the fulfilment of the basic psychological needs of autonomy and competence (Ryan and Deci 2000). Thus, we investigate the capability of a newly developed teacher professional development (TPD) programme—the Dialogic Video Cycle (Gröschner et al. 2015)—to foster ways of teacher autonomy support and competence support during classroom discourse. We further investigate the effects of increased autonomy and competence support on students’ experience of self-determination and intrinsic learning motivation over the course of a school year.

Productive classroom discourse as a social context for allowing teachers to promote self-determination

This study investigates the extent to which a newly developed TPD programme—the Dialogic Video Cycle (Gröschner et al. 2015)—positively affects teachers’ practices as well as students’ experiences of autonomy and competence support. Thus, this study sheds light on

the benefits of video-based TPD in comparison to more common practices of professional development in the German context (Richter et al. 2011), as well as on the importance of meaningful classroom discourse for students' intrinsic learning motivation.

Social context—a prerequisite for motivated learning processes

The Self-Processes model (Appleton et al. 2008) provides a comprehensive framework that links the social context, the individual, their actions and their educational outcomes (Fig. 1). The framework integrates research on motivation (in the form of SDT), teacher and teaching effectiveness research and student engagement, and highlights the importance of the social context as a precursor for student motivation and desirable learning outcomes. Based on the Self-Processes model, supportive social contexts foster students' fulfilment of basic psychological needs and increase the quality of students' learning motivation (Ryan and Deci 2000). Such motivation is seen as a prerequisite for student engagement (Furtak and Kunter 2012).

In our view, teacher-student interactions in classroom discourse constitute a central element of the social context of classrooms (Meyer and Turner 2002). Hence, after delineating the basic tenets of SDT, we turn to describing common features of classroom discourse and their implications for student learning and motivation.

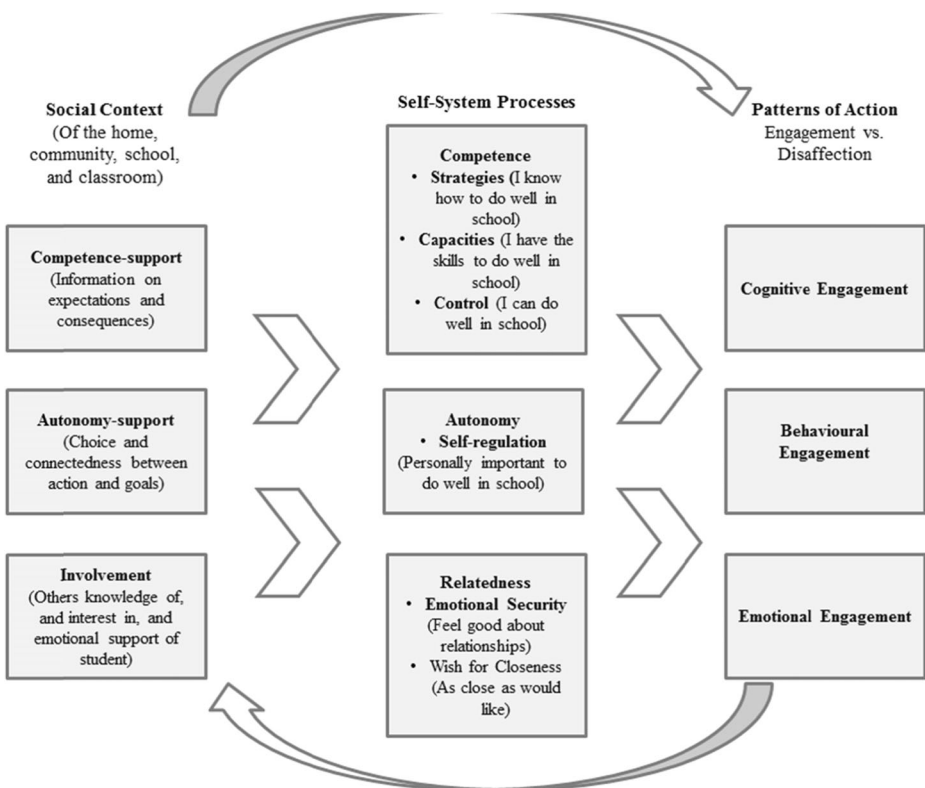


Fig. 1 Self-Processes model applied to educational settings. Note: Adapted from Connell and Wellborn (1991, p. 54); Appleton et al. (2008)

Social context from the perspective of research on self-determination

Self-Determination Theory (SDT) postulates three basic psychological needs as the basis of human motivation and activity—autonomy, competence and social relatedness (Deci and Ryan 1985; Ryan and Deci 2000). Autonomy is conceptualised as an inner motivational resource (Deci et al. 1991; Reeve et al. 1999) and is characterised by self-perception as the source of one's own behaviour, so that an individual's behaviour becomes the outer sign of their personality, values and beliefs (Ryan and Deci 2000, 2002). Competence perceptions are based on the notion of being able and effective in the face of challenging tasks. This means “feeling effective in one's ongoing interactions with the social environment and experiencing opportunities to exercise and express one's capacities” (Ryan and Deci 2002, p. 7). Within this framework, the social context is not separate from the basic psychological needs.

Autonomy and competence support are framed as aspects of the social context that foster the fulfilment of these basic psychological needs in students (Appleton et al. 2008; Reeve 2009; Reeve et al. 1999). Autonomy support is seen as the psychological freedom given to students to determine their own behaviours (Assor et al. 2002). Teachers are autonomy-supportive if they give “their charges as much choice as possible within the situation. The idea is to help [students] to connect their sense of self to the activity, so they can do it with a sense of ownership and volition, rather than feeling controlled and coerced by external forces” (Ciani et al. 2010, p. 90). Competence support refers to the communication of teacher expectations, information about the (success of the) ongoing learning process and support for achieving the desired learning outcomes (Jang et al. 2010; Skinner and Belmont 1993). Teachers provide competence support (aka *structure*) by communicating expectations and by providing guidance, optimal challenges and feedback (Reeve 2006; Vansteenkiste et al. 2012).

Recent studies have shown that both autonomy support and structure are important prerequisites for student self-determination (Assor and Kaplan 2001; Hospel and Galand 2016; Jang et al. 2010; Sierens et al. 2009; Vansteenkiste et al. 2012). SDT not only suggests that autonomy and competence support are prerequisites for students' self-determination and intrinsic learning motivation, but that the beneficial relations mainly depend on the way the competence support is realised in the classroom (Reeve et al. 2004).

When [competence support] is communicated in a context of respect for the learners' perspective, when instructors rely on non-controlling language to communicate expectations and provide a meaningful rationale when introducing limits students are more likely to follow the [competence support] with a greater sense of psychological freedom. (Sierens et al. 2009, p. 59)

Key here appears to be to allow for volitional functioning in students (Soenens et al. 2007), which is achieved through autonomy-supportive teacher actions. Numerous studies have shown the benefits of fostering volitional functioning; e.g. deep-level learning, positive affect, achievement and behavioural persistence (e.g. Buff et al. 2011). In turn, for the present study, we want to make the argument that a structured environment characterised by competence support is equally important in order for autonomy support to take full effect. Only in an environment that provides clear expectations, rights and responsibilities, as well as support mechanisms like constructive feedback, will students be willing to exercise their full (cognitive) autonomy. Research on parenting styles (e.g. Baumrind 1991; Schneewind 1995; Walker 2008) has long pursued this line of reasoning (see also Walshaw and Anthony 2008 for a similar argument in terms of productive classroom talk).

Furthermore, research has shown that the quality of teacher-student interactions plays a role in fostering desirable affective-motivational learning outcomes in students (Kaplan and Assor 2012; Meyer and Turner 2002; Turner et al. 2002). With this study, we aim to connect these two strands of research by arguing that the function fulfilled by productive classroom discourse is an autonomy- and competence supportive one, and that this is what produces positive motivational learning outcomes in students.

Some efforts have been undertaken to support teachers in their facilitation of basic psychological need support (e.g. Aelterman et al. 2014; Cheon and Reeve 2015; Tessier et al. 2008). However, to our knowledge, no such endeavours have so far been attempted in the context of classroom discourse with the aim of providing students with more meaningful discourse as a motivational scaffold. With the professional development programme implemented in this study, we addressed this gap in research. Given the predominance of narrowly focused classroom discourse in today's classrooms, supporting teachers to change their discourse behaviour is a palpable method of classroom reform.

Classroom discourse as a social context and its implications for promoting students' learning outcomes

Classroom discourse has often been found to have a strong focus on the teacher that follows a pre-structured design (Mehan 1979; Lemke 1990). Teacher-student interactions are most often tightly focused short exchanges that serve less the purpose of fostering the students' understanding than that of covering the content (Fischler 1994; Jurik et al. 2013). They are strongly asymmetrical, with the teacher as initiator and controller of the interactions, while student-to-student interactions are scarce and mostly perceived as a didactical variation (Howe 2009). This dominance of the teacher is reflected in closed questions, single-word student answers and very few student questions (Mercer and Howe 2012; Seidel and Prenzel 2006). The discourse lacks a *dialogic* stance (Lotman 1988); instead, it is structured as a sequence of teacher questions that support reproduction (Reznitskaya 2012). Research shows that this kind of instructional practice has negative effects on students' deep-level learning and conceptual understanding (Alexander 2008; Mercer 2010; Reznitskaya 2012), as well as their learning motivation (Seidel et al. 2003b).

Notwithstanding these findings, classroom discourse can be facilitated in a high-quality way and provide meaningful learning opportunities that promote positive learning outcomes in students (Elbers and Streefland 2000; Lipowsky et al. 2007; Mercer and Littleton 2007; Walshaw and Anthony 2008). Furthermore, such classroom discourse is associated with positive outcomes in student affect and interest development (Kiemer et al. 2015; Turner et al. 2002).

Descriptions of productive classroom discourse vary, but they share important core features. Alexander (2008) described productive classroom discourse as *collective, reciprocal, supportive, cumulative* and *purposeful*. Further important aspects include the opportunity for students to express their own ideas and hypotheses, hear other points of view, argue, reason and receive feedback from their teachers, which engages them in a process of "thinking aloud" (Dawes 2004; Myhill et al. 2005). Productive classroom discourse is not based on a simple prescriptive model but it does involve people providing arguments based on validity and not power claims (Alexander 2005). Hence, in productive classroom discourse, the students' voices are clearly audible and they share control over the learning process, which brings with it ownership and responsibility.

Turner and colleagues (2002) reported on the relationship between teachers' discourse and students' affect and achievement behaviours. In their study, they differentiated between

supportive instructional discourse and supportive motivational discourse. Instructional discourse is defined as discourse practices that transfer the responsibility of the learning process to students. It is characterised by the support of strategic thinking and autonomous learning and holds students accountable for understanding. Motivational discourse has a focus on learning and is achieved by challenging students, viewing errors as constructive and supporting persistence (Turner et al. 2002). The categories of Turner et al. are solely derived from theory; their relationships to students' perceptions of autonomy and competence have not been empirically investigated thus far.

In this study, we addressed this gap in research. We implemented a video-based professional development programme—The Dialogic Video Cycle (DVC)—with the aim of addressing and fostering multiple elements of Turner et al. (2002) conceptualisation and investigating their connection with students' perceptions of autonomy and competence support, as well as their intrinsic learning motivation.

Supporting teachers in facilitating productive classroom discourse—Teacher Professional Development

Within the last 10 years, educational research has pointed out a number of components that are considered effective for teacher learning in professional development programmes (e.g. Timperley et al. 2007; Desimone 2009; van Veen et al. 2012; Wilson 2013). Here, effective means the “perceived relevance and usefulness of the programme with respect to teachers' daily work” (van Veen et al. 2012, p. 12), as well as the empirical finding that sustained learning took place during the TPD and furthermore showed positive effects on student learning outcomes (Fishman et al. 2003; Guskey 2002). The following central features are generally referred to in the literature (Desimone 2009): *content focus*, *active learning*, *collective participation*, *duration* and *coherence*.

Even more recently, successful TPD programmes began using videos of teachers' classrooms as a tool for reflection (e.g. Borko et al. 2008; Santagata 2009; Sherin and van Es 2009). Video encourages teachers to see their teaching from a new perspective and to feel accountable for changing their practices (Tripp and Rich 2012). In comparison with other (text-based) formats, video was found to be a more effective tool in terms of the transfer and the application of theory into practice (Moreno and Valdez 2007).

Besides effective components and pedagogic variations, research on (teacher) professional development also investigated the circumstances under which changes to teachers' practice are actually implemented into their everyday practice and what obstacles there might be to teacher learning (Clarke and Hollingsworth 2002). Firstly, it has been argued that the success of professional development depends on trainees' attitudes towards the programme (Vermunt and Endedijk 2011). Moreover, from research on training transfer, it is known that the motivation for transfer is essential for changes in practice to occur (Gegenfurtner et al. 2009). Other research has also shown that changes in teacher learning are more likely if teachers recognise improvement in their students' learning as a result of their new practices (Guskey 2002; Opfer et al. 2011).

A professional development programme on productive classroom discourse—the Dialogic Video Cycle

Teachers in this study participated in the DVC. The programme targets generic aspects of classroom discourse as part of general pedagogical knowledge (Gröschner et al. 2015).

Specifically, it implements productive classroom discourse in the form of two main activities: *clarifying discourse rights and actively engaging students* and *scaffolding student ideas and providing feedback* (Walshaw and Anthony 2008). By helping teachers to implement both activities in the classroom, the DVC aims to change the perspective of teachers towards student ideas and their role in the co-construction of meaning (Borko et al. 2008).

Each cycle includes three teacher workshops and one videotaping of a lesson (Fig. 2). In the first workshop, teachers receive theoretical input on productive classroom discourse. Together with the facilitator, and in collaborative practice, teachers think about how to enrich existing lesson plans in order to spark instances of high-quality discourse. They jointly reflect upon their instructional practices, their uptake of student ideas, methods for student activation, etc. Approximately 1 to 2 weeks later, teachers are videotaped while teaching the revised lesson plan. In the subsequent workshops, teachers watch selected clips of their own practice, engage in extensive video-based discussions and jointly reflect upon their experiences (see Gröschner et al. 2015 for a more detailed description). The focus of workshop 2 is on *activity 1 (clarifying discourse rights and responsibilities)*; in workshop 3, the focus is on *activity 2 (scaffolding student ideas)*. The programme sees teachers as reflective practitioners (Schön 1983) and uses video to situate their professional development within a realistic context. In their community of learners, teachers have the opportunity for professional experimentation, as well as reflection and enactment (Clarke and Hollingsworth 2002).

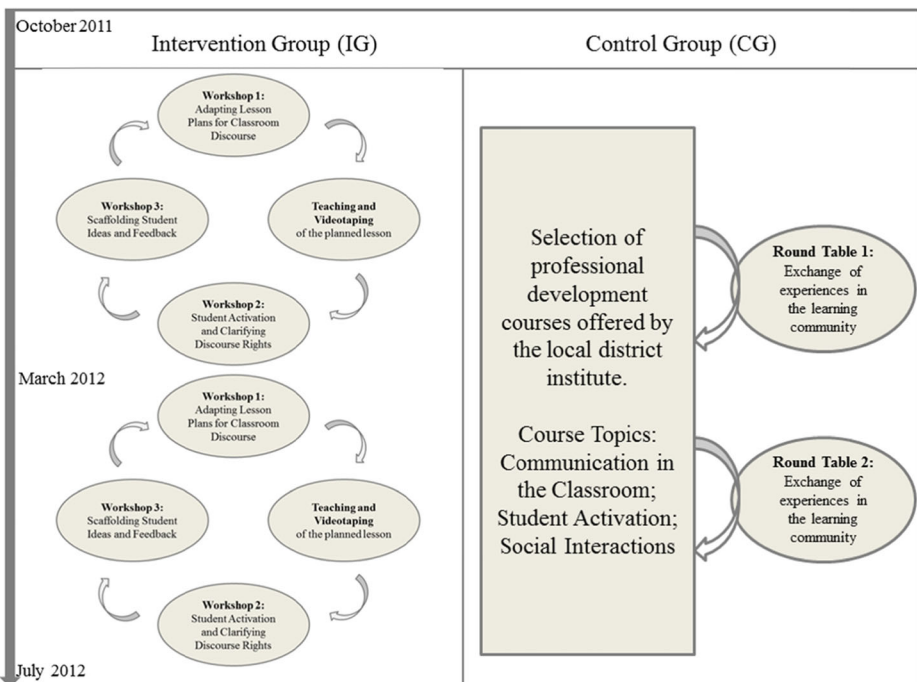


Fig. 2 Treatment conditions in DVC as intervention (left) and the traditional programme as control group (right)

Research questions

In our study, we draw on assumptions stemming from SDT (Ryan and Deci 2000) and research on productive classroom discourse (e.g. Mercer and Howe 2012; Mercer and Dawes 2014; Wegerif 2008) to explain why productive classroom discourse should promote student intrinsic learning motivation. By using this approach, we investigate the extent to which changes in the quality of classroom discourse due to participation in the DVC are linked to the discourse being more supportive, both instructionally and motivationally. It is assumed that this less controlling and more supportive social context will positively affect students' perception of autonomy support and competence support. Specifically, the following research questions were addressed, and the following conjectures were derived based on theory and previous findings:

1. To what extent does the facilitation of classroom discourse by teachers become more instructionally and motivationally supportive in the IG in comparison to the CG?

Conjecture 1: We conjecture that teachers in the IG will show more instructionally and motivationally supportive classroom discourse over the course of the intervention compared to the CG.

2. Changes in the students' perceptions of autonomy support and competence support in a changing social context (IG):

- a. To what extent do the students' perceptions of autonomy support increase during the intervention (IG)?
- b. To what extent do the students' perceptions of competence support increase during the intervention (IG)?
- c. Are changes in the students' perceptions of autonomy and competence support predictive of the students' experience of self-determination in the classroom as well as positive changes in their intrinsic learning motivation?

Conjecture 2: We expect that the IG students' perceptions of autonomy support will change positively (conjecture 2a) during the intervention, as well as these students' perceptions of competence support (conjecture 2b). These positive changes will in turn predict the students' experience of self-determination and intrinsic learning motivation (conjecture 2c).

Method

Design

The DVC was implemented as a year-long TPD programme (two cycles, 22 TPD hours). In the context of German TPD conditions, the teachers chose which form of TPD they wanted to participate in—video-based or traditional. They did not know which group served as the intervention and which as the control condition. This avoided having the teachers feel reluctant to participate in the video-based TPD programme or doubt the effectiveness of watching themselves (Fishman et al. 2003). The fidelity of the implementation was investigated in a separate study and tested positively (Gröschner et al. 2015). Central components of effective TPD (content focus, duration, coherence, collective participation and exchange, active learning

and reflection, lesson planning, video-based reflection) were judged as present by two independent raters. The raters independently watched video footage of the TPD workshops and scored each workshop for each component on a three-point Likert scale (“0” = “not observable”, “1” = “partially observable”, “2” = “clearly observable”). Spearman’s ρ was used as a measure of agreement. The rater agreement varied between $\rho = .80$ (active learning) and $\rho = 1.0$ (coherence) over the different components. Differences between the IG and the CG were present in the form of more *active learning*, *video-based reflection* and *transfer to practice* in the IG (for a fuller description see Gröschner et al. 2015). Data was collected at multiple measurement points: in the IG at the beginning of the year (Tpre), once per semester (T2, T3) and at the end of the year (Tpost); in the CG, at the beginning of the year (Tpre) and at the end of the year (Tpost). Students reported on their perceptions via questionnaire directly after class, while the teachers’ facilitation of classroom discourse was videotaped and coded later. Ethics approval was obtained by the Secretary of Education and Research in the federal state of Bavaria.

Dialogic Video Cycle (IG) The IG teachers participated in two iterations of the DVC (Fig. 2). Each cycle included three workshops and one lesson videotaping. In workshop 1, the teachers focused on revising a lesson plan by considering elements of productive classroom discourse and communication strategies. Workshop 2 focused on *activity 1* delineated in Walshaw and Anthony (2008): *student activation*, while *activity 2: scaffolding of students’ ideas* was the focus of workshop 3 (see Gröschner et al. 2015).

Advanced Traditional Programme (CG) The CG teachers chose a set of workshops pre-selected by the research team, which focused on classroom discourse and were offered by the local TPD institute (Fig. 2). They met twice in round tables with the same facilitator as of the IG to share their TPD experiences. They were encouraged to share how they had experienced the central aspects of productive classroom discourse during their TPD and how they would apply their experience to teaching. This was done to afford them the opportunity for collaborative practice and exchange. The central difference in comparison to the IG was the lack of video-based reflection and thus the intensive engagement with their own practice (for a fuller description, see Gröschner et al. 2015).

Sample

The participants were 10 teachers and their 226 students (47.8% girls) in 10 science and mathematics classrooms from German middle- or high-track schools. The students’ mean age was 15.67 years ($SD = .98$); they were in 9th grade.

The teachers chose whether they wanted to participate in the video-based TPD programme (IG) or the programme with a set of workshops (CG). Six teachers opted for the intervention (DVC), and four chose the traditional TPD programme. The two groups did not differ in age ($M = 38.3$, $SD = 5.56$, $U(6:4) = 7.5$, $z = .97$, $p = .33$), teaching experience ($M = 5.65$, $SD = 2.93$, $U(6:4) = 6.0$, $z = 1.30$, $p = .20$) or gender, $\chi^2_{\text{gender}}(df = 1) = .08$, $p = .79$. They did not differ in their TPD motivation (“I want to learn more about communication in the classroom”, $M_{IG} = 3.51$, $SD = .47$; $M_{CG} = 3.81$, $SD = .38$; $U(6:4) = 7.0$, $z = 1.14$, $p = .25$) for the respective TPD programme. Given their teachers’ choices, there were 136 students in the IG and 90 students in the CG.

Instruments

Student questionnaire

All items on students' perceptions were answered on a four-point Likert scale ranging from "0" = "fully disagree" to "3" = "fully agree". The instruments had been used in prior national studies with large samples (e.g. in the context of TIMSS, Kunter 2005; in the context of PISA, Ramm et al. 2006).

Perceptions of autonomy support The students' perceived autonomy support was assessed with three items ("During the lesson, I felt like my teacher gave us enough time to work independently."; Kunter 2005). Internal consistency was good and ranged from $\alpha = .70$ to $.85$.

Perceptions of competence support The perceived competence support provided by the teacher (i.e. structure) was assessed with seven items ("During the lesson, I could get help if I got stuck"; Seidel et al. 2003a). Internal consistency varied from $\alpha = .71$ to $.83$, providing good reliability scores.

Experiences of self-determination The students' self-determination was assessed with five items ("During the lesson I could allot my time freely."; Kunter 2005). With a Cronbach's alpha of $\alpha = .67$ – $.72$, the scale showed acceptable reliability.

Video analysis: rating of classroom discourse events

Using the software Videograph (Rimmele 2004), 32 videotapes were analysed (IG, 24; CG, 8). The analysis was restricted to classroom discourse during whole-class discussions. A high-inference coding rubric was developed (Pehmer et al. 2014) on the basis of a previous large-scale video study in physics instruction. The item development and coding of the data followed protocols used in prior research (Seidel et al. 2003a).

The analyses employed event-sampling: we used talk format as the unit of analysis (whole-class discussion vs. seatwork; $\kappa = 1.0$), which was coded independently by two coders. Each unit of analysis was then rated on all items (Appendix Table 5), which were averaged for that lesson to receive an aggregate score for each item. All ratings were assessed on a four-point Likert scale ("0" = "not applicable", "3" = "fully applicable"). Systematic training preceded the independent raters' coding of the videos. At first, six raters coded 30% of the data corpus independently to establish inter-rater reliability (intra-class correlations, ICC = $.85$). The remaining 70% of video footage were then coded independently by the two raters with the highest agreement in the first pre-coding (ICC = $.92$).

Instructional discourse A total of ten rating items were used to assess the teachers' facilitation of instructional classroom discourse (a full list of rating items can be found in Appendix Table 5). The rating items focused on aspects such as negotiating meaning ("The teacher provides students with strategies to reach their learning goals.") or transferring responsibility ("Students work independently/autonomously. They take initiative in the learning process."). The internal consistency was satisfactory ($\alpha = .86$ – $.93$).

Motivational discourse The scale of motivational discourse was comprised of seven rating items and assessed the teachers' focus on learning ("The teacher allows for errors and used them constructively."), their use of positive emotions ("The teacher shows high regard of student contributions.") and peer support and collaboration ("Students are encouraged to actively shape the classroom discourse."). The reliability of the scale ranged from $\alpha = .79$ to .89.

Analyses

Changes in instructional and motivational classroom discourse due to the intervention

We used the video data of both IG and CG in these analyses. To investigate whether the teachers' facilitation of instructional and motivational classroom discourse changed differentially between the groups, pre/post comparisons were made using non-parametric analyses of variance (Brunner et al. 2002). The analyses were run using the software package nparLD (Noguchi et al. 2012) in R (R Core Team 2013).

Change in students' perception of autonomy support and competence support

To answer research question 2, we used questionnaire data from four measurement points in the IG. We acknowledge that the present data is nested, both as measurement points in students and as students in classrooms, and thus a three-level multi-level model is required to optimally represent the data. The ICC are given in Table 1 and mostly show—with the exception of Tpre and T2—limited amounts of between-variance ($ICC \leq .10$; see Lee 2000 for details on the appropriateness of MLM in such cases). Schoppek (2015) reports results from simulation studies showing that, in samples with five units on level 2 (here the classes), multilevel models arrive at less robust regression weights and residual variances. Furthermore, the author points to restrictions in the power of such analyses (see also McNeish and Stapleton 2016). Given the restrictions in sample size in the present study ($n = 6$ teachers with $n = 136$ students in the IG) and the small amounts of between-variance ($Var_{\text{between}} = .01-.11$), we refrain from multilevel modelling. Instead, using the software Mplus (Muthén and Muthén 2010), we applied latent growth curve (LGC) models to model changes across time. Time scores were fixed and the variance of the slope was fixed to zero; therefore, the estimated models represent random intercept models.

In answer to research question 2c, we calculated the relative change (Δ -scores between Tpost and Tpre) in the students' perceptions of autonomy support, competence support and

Table 1 Intra-class correlations for autonomy support, competence support and self-determination (Tpre, T2, T3, Tpost)

	Tpre	T2	T3	Tpost
Autonomy support	.25	.14	.09	.08
Competence support	.21	.12	.13	.08
Self-determination	.22	.05	.04	.07

experiences of self-determination and intrinsic learning motivation. These scores were submitted to a path analysis modelling the direct effects of $\Delta_{\text{autonomy support}}$ and $\Delta_{\text{competence support}}$ on $\Delta_{\text{self-determination}}$, and of $\Delta_{\text{self-determination}}$ on $\Delta_{\text{intrinsic motivation}}$. Also, we estimated indirect effects in the model (Fig. 2). The ICCs of the change scores show that only limited amounts ($\text{ICC} \leq .10$) of the variance are attributable to the class level ($\text{ICC } \Delta_{\text{autonomy support}} = .06$, $\text{ICC } \Delta_{\text{competence support}} = .02$, $\text{ICC } \Delta_{\text{self-determination}} = .02$); hence, multilevel modelling is not appropriate in this case (Lee 2000).

Results

Changes in the quality of teachers' facilitation of classroom discourse due to the intervention

Descriptive statistics of instructional and motivational discourse in the IG and CG are shown in Table 2. The findings indicate an increase in instructional and motivational discourse in the IG, while in the CG instructional discourse decreases throughout the year and the quality of motivational discourse stays level.

The results of the non-parametric analyses of variance (Brunner et al. 2002) indicate time-related differences in instructional discourse in the groups. However, the interaction between time and treatment did not reach statistical significance ($F(1)=2.92$, $p=.09$). The relative treatment effect (RTE) of the IG increased though ($\text{RTE}_{\text{Tpre}} = .48$, $\text{RTE}_{\text{Tpost}} = .73$), while during the same period of time there was a small decrease in the CG ($\text{RTE}_{\text{Tpre}} = .36$, $\text{RTE}_{\text{Tpost}} = .33$). These results can be interpreted as follows: the probability that a randomly chosen observation from the whole sample (at Tpre) shows a smaller score on instructional discourse than a randomly chosen observation from the IG is 48% (Noguchi et al. 2012). At Tpost, this probability rises to 73% in the IG; consequently, the teachers in the IG outperform the teachers in the CG on instructional discourse on most occasions. The same analysis for motivational discourse produced a significant main effect for time ($F(1)=4.00$, $p=.05$) and treatment ($F(2)=3.93$, $p=.05$). Furthermore, the interaction between time and treatment was significant ($F(1)=5.98$, $p=.01$). Similarly to instructional discourse, the relative treatment effect on motivational discourse increased in the IG ($\text{RTE}_{\text{Tpre}} = .50$, $\text{RTE}_{\text{Tpost}} = .75$), while it decreased slightly in the CG ($\text{RTE}_{\text{Tpre}} = .33$, $\text{RTE}_{\text{Tpost}} = .31$). In terms of effect sizes (using pooled standard deviations), the results show $d=1.04$

Table 2 Descriptive statistics (mean values and standard deviations) for instructional and motivational discourse in the intervention and control group

		Tpre		T2		T3		Tpost	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
IG	Instructional discourse	1.43	.53	1.81	.61	1.76	.51	1.88	.45
	Motivational discourse	1.26	.78	1.42	.59	1.68	.59	1.82	.46
CG	Instructional discourse	1.21	.68	–	–	–	–	1.02	.59
	Motivational discourse	.80	.66	–	–	–	–	.80	.58

for the group comparison of instructional discourse between pre- and post-test and $d = .73$ for motivational discourse (Morris 2008).

Changes in students' perceptions of autonomy support and competence support within a changing social context

Descriptive statistics of the students' perceptions of autonomy and competence support (Table 3) show that the IG students perceived the teachers' autonomy and competence support as rather high (theoretical maximum is 3). Inspecting the mean values shows an increase on the scales from Tpre to T2, followed by a decrease (T2 to T3) and a levelling out at Tpost.

Overall, the LGC models show adequate fit (values greater than .90 for the CFI and TLI are considered adequate fit, whereas values smaller than .08 are needed for the RMSEA; Morin et al. 2016), especially given that the sample size is small for such analyses and that fit indices are sensitive to small samples (Wu et al. 2009). However, limitations are found in the RMSEA of competence support ($RMSEA_{\text{competence support}} = .10$), leading us to proceed tentatively when interpreting the result.

A summary of the results of the LGC models for autonomy support and competence support across four measurement points is given in Table 4. Overall, the mean values of the latent intercepts of both variables were significant, indicating significant differences from zero for the latent estimates of autonomy support and competence support at Tpre. Also, the latent intercepts of both variables vary significantly across students; they perceive autonomy support and competence support significantly differently. The mean latent slopes indicate that small but significant positive changes occurred in the students' perception of autonomy support and competence support across the school year. The variations between students in the slope factor could not be estimated as the slope was fixed, leading to zero variation ($Var_{\text{slope}} = 0$). In the case of autonomy support, the latent growth factors (intercept and slope) explained between 33 and 40% of the variance between students ($R^2 = .33-.40, p < .01$). For competence support, it was between 42 and 54% ($R^2 = .42-.54, p < .01$). These results need to be reflected upon in the light of the sample and resulting model fit; we see them as positive and encouraging, but also only tentatively as first evidence of support for the relationship between changes in the students' social context and changes in their perception of autonomy and competence support.

In order to look more closely into the possible process involved, the results of path analyses are reported. In preparation for the path analysis, the correlational patterns were investigated.

The mean pre/post difference scores (Δ -scores) in the IG are positive, but rather small for all variables with the exception of experienced self-determination: $\Delta_{\text{autonomy support}} = .001$ ($SD = .66$), $\Delta_{\text{competence support}} = .07$ ($SD = .35$), $\Delta_{\text{self-determination}} = .23$ ($SD = .50$), $\Delta_{\text{intrinsic motivation}} = .07$ ($SD = .65$). The standard deviations here are somewhat larger than for the individual

Table 3 Descriptive statistics (mean values and standard deviations) for students' perceptions of autonomy support and competence support across the school year (Tpre, T2, T3, Tpost)

	Tpre		T2		T3		Tpost	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Autonomy support	2.19	.66	2.36	.64	2.16	.68	2.16	.72
Competence support	1.99	.49	2.15	.53	1.98	.56	2.03	.59

Table 4 Summary of the latent growth curve analyses for students' perceptions of autonomy support and competence support across the school year (Tpre, T2, T3, Tpost)

	Autonomy support	Competence support
Time score		
Tpre ^a	0	0
T2 ^b	1	1
T3	0	0
Tpost	1	1
<i>M</i>		
Intercept	2.16** (.05)	1.97** (.04)
Slope	.11* (.05)	.12** (.04)
<i>Var</i>		
Intercept	.16** (.04)	.14** (.02)
Slope ^c	0	0
<i>R</i> ²		
Tpre	.36** (.07)	.54** (.05)
T2	.39** (.08)	.43** (.06)
T3	.35** (.07)	.50** (.07)
Tpost	.32** (.08)	.41** (.06)

Standard errors given in brackets

***p* < .01; **p* < .05

^a Time scores 1 and 3 were fixed to 0

^b Time scores 2 and 4 were fixed to 1

^c Slope variance was fixed to 0

measurement points (see Table 2). Furthermore, we found a significant positive relationship between $\Delta_{\text{autonomy support}}$ and $\Delta_{\text{self-determination}}$ ($r = .44, p < .01$), $\Delta_{\text{autonomy support}}$ ($r = .50, p < .01$) and $\Delta_{\text{intrinsic motivation}}$ ($r = .47, p < .01$). The correlations between $\Delta_{\text{competence support}}$ and $\Delta_{\text{self-determination}}$ ($r = .41, p < .01$), as well as $\Delta_{\text{intrinsic motivation}}$ ($r = .38, p < .01$) were also significantly positive.

These findings are supported by the path analysis (Fig. 3). Overall, the model showed good fit (RMSEA = .06, CFI = .96, TLI = .96; Morin et al. 2016). The results tentatively indicate that the changed perceptions of autonomy and competence support serve as positive predictors for

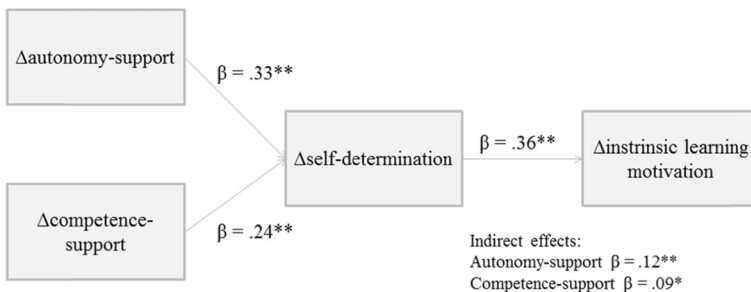


Fig. 3 Path analysis of pre/post difference scores (Δ -scores) for autonomy support, competence support, self-determination and intrinsic learning motivation with direct and indirect effects

changed experiences of self-determination and indirectly for intrinsic learning motivation from pre- to post-test. These predictors explain 25% of the variance associated with the changes in experienced self-determination ($R^2 = .25$, $p < .01$) and 13% of the variance associated with intrinsic learning motivation changes ($R^2 = .13$, $p < .05$).

Discussion

The present study aimed to integrate two research perspectives based on a common perspective of the role of the learner as responsible for and autonomous in the learning process (Furtak and Kunter 2012; Turner et al. 2002). In order to do so, we investigated the ways in which a year-long TPD programme (DVC; Gröschner et al. 2015) might affect the quality of teachers' instructional and motivational discourse. During the same period of time, we explored changes in their students' perceptions of autonomy and competence support and the possible implications for the students' intrinsic learning motivation.

Our analysis of the coded video material on the changes in teachers' discourse practices from pre-test (Tpre) and post-test (Tpost) of the study indicates systematic group differences in instructional and motivational discourse between IG and CG. Whereas the IG developed positively with respect to these measures, the quality of instructional and motivational discourse in the CG decreased (support for conjecture 1). These different trajectories in the groups led to large effects (Cohen 1992) in the pre-/post-test group comparisons in favour of the DVC. With a likelihood of more than 70%, the IG showed more supportive instructional and motivational discourse than the CG at Tpost (Noguchi et al. 2012). For the control group, the findings indicate that despite attending on average 22 h of TPD on classroom discourse that year, the teachers' instructional quality (i.e. facilitation of productive classroom discourse) decreased throughout the school year. Based on the Interconnected Model of Professional Growth (Clarke and Hollingsworth 2002), the teachers in the CG probably lacked opportunity for enactment and reflection, which was a central design element in the IG.

Working with teachers on classroom discourse—a very routine practice (Morton 2012)—is challenging because it requires overcoming old patterns. Even when learning takes place in TPD, the implementation of new practices into the classroom remains challenging for teachers (Buczynski and Hansen 2010). Our data shows this, as the positive linear developments in the IG across all four measurement points were not large, indicating that the teachers' implementations of discourse practices were not straightforward but rather showed individual patterns. As such, the DVC appears to be a scaffold (Wood et al. 1976) that helps teachers to improve their productive classroom discourse in practice, and also at individual starting points and with different paths (Stürmer et al. 2016). This can likely be explained by the careful design of the DVC in accordance with state-of-the-art research on effective professional development and its inclusion of aspects that in other, more traditional programmes often remain unconsidered (such as reflection of practice and transfer).

Investigations into the prerequisites of teachers' autonomy/competence support provide evidence that organisational and structural aspects in the form of experienced pressures (Reeve 2009), as well as individual differences in personality dispositions (Leroy et al. 2007), affect their adoption of an autonomy/competence-supportive

teaching style. Also, it could be shown that teachers' causality orientations (Su and Reeve 2011), as well as their beliefs (Reeve and Cheon 2016; Reeve et al. 2014), play an important role in how readily they incorporate new autonomy-supportive practices into their teaching. The teachers' beliefs about the ease of implementation of new practice are pivotal here. These aspects are likely to have contributed to the teachers' individual learning patterns, and consequently to differences in practice and practice change across the study. The fact that they were not considered represents a limitation of this study and we strongly encourage including them in future research (Gröschner et al 2016).

Similarly, research into professional development has shown that the transfer of new knowledge into teachers' classrooms is an individual process affected by various cognitive and motivational–affective aspects, as well as situational and organisational frameworks (Clarke and Hollingsworth 2002). These findings—like many others in TPD research (e.g. Furtak et al. 2016; Hetzner et al. 2012; Santangata 2009; Zhang et al. 2011)—demonstrate that prolonged interventions and continuous reflection are necessary for teachers to change their practice and make these changes sustainable, even if on the way towards those goals teachers might show their individual learning paths. Our finding suggests further support for Vesico et al. (2008), who argue for carefully designed TPD programmes based on TPD research (e.g. Desimone 2009) that produce favourable outcomes in teachers' practice and student learning. This carries implications for TPD providers; financial resources ought to be spent on comprehensive programmes that prove successful and not “single-shot” workshops that have been shown to be wanting (Fullan and Siegelbauer 1991; Lovitt and Clarke 1988).

Descriptive statistics from the student questionnaire data show initial increases in the students' perceptions of autonomy support and competence support (T2), followed by a return to the initial level. For both trajectories, LGC analyses show a significant slope factor, suggesting significant positive developments during the school year. Keeping in mind the restrictions of the specified model, this slope factor indicates a cubic trajectory across the school year if the nested data structure is at least partially modelled (time points in persons). Overall, these results support—at least in part—our conjectures. However, the question arises why student perceptions did not change more consistently, especially in the face of changed teacher practice as tentatively supported by the results of Research Question 1.

Looking at the teacher data, one possible explanation might be that the most substantial change in the teachers' facilitation of instructional discourse also occurred at T2. Possibly, all further improvements were not pronounced enough for the students to further increase their perceptions of autonomy and competence support. Furthermore, it could be argued that a socialisation process into this new classroom culture occurred over the course of the school year. The longer the study ran, the more students aligned their script of “doing school” (Jimenez-Aleixandre et al. 2000; Pope 2003) and consequently adjusted their threshold for increased autonomy and competence support. At the opposite spectrum of research into the social dimensions of motivation, new approaches looking at the interactions between the individual prerequisites of students and the classroom context (*person-in-context approaches*; e.g. Lemos 2001; Nolen et al. 2012; Vauras et al. 2001) show promising avenues for further research. For example, confronting students with video examples of their teachers' practices and inquiring about their interpretation of these practices would greatly help our understanding of what teaching needs to be like in

order to support the fulfilment of students' basic psychological needs and to be interpreted as such.

Also, this study focused on productive classroom discourse and documents positive results in this respect. It is not impossible that while becoming more supportive in this area, teachers became more controlling in other areas of support, such as communicating value and providing rationales or accepting students' expression of negative affect (Reeve 2006). To account for this possibility, future research ought to consider all forms of autonomy and competence support and control for them in the analyses. With regard to this possibility, it is worth noting that Behrmann and Souvignier (2015) were able to demonstrate effects of fit or misfit between teachers' instructional beliefs and the teaching practices they use for student achievement. Consequently, in this study, students whose teachers had beliefs (transmission vs. constructivist) that did not align with the teaching practice they engaged in during the intervention may not have perceived the learning environment as supportive. Including teacher beliefs in future investigations may therefore not only shed light on a further level of effective teacher learning during the intervention (Guseky 2002; Lipowsky and Rzejak 2015) but also help to understand the present findings in more detail.

Secondly, aptitude-treatment interactions between students' motivational orientation (intrinsic vs. extrinsic) and their perception of supportive learning environments have been reported. Even after controlling for students' academic self-concept, extrinsically motivated students reported more negative affect than intrinsically motivated students under autonomy-supportive conditions; for directive support, the reverse trend was discovered (Knollmann and Wild 2007). Possibly, due to their prior experiences in rather narrowly focused, controlled learning environments, students tend to hold extrinsic causality orientations and thus experience more supportive environments as more aversive than more controlling ones. Students might also perceive supportive discourse as less structured than their custom teacher-student interactions. However, structure is important in order for students to experience their learning environment positively (Sierens et al. 2009). Jungwirth (1993) documented that routines and rules can fulfil positive functions in the interaction process during instruction, as well as having negative effects on learning outcomes.

Along the same lines, prior research found that the interpretation of classroom events by well-informed researchers can be quite different from the interpretation of the same events by students (Urduan 2004). It is therefore possible that the changes in the teachers' discourse observed by the research team were not experienced as empowering by the students (Furtak and Kunter 2012). Struyven and Dochy (2008) also found great variation in students' likes and dislikes for more activating and less controlled learning environments. While lecture-style learning environments were commonly perceived as positive, extreme opinions (both negative and positive) prevailed for activating learning environments.

Similar to the pre/post-differences for autonomy support and competence support, the changes in the students' experiences of self-determination and intrinsic learning motivation were on average not large in the IG. However, these changes showed significant positive relationships with each other. In line with our conjecture and prior research (e.g. Hospel and Galand 2016; Jang et al. 2010; Sierens et al. 2009; Vansteenkiste et al. 2012), the changes in autonomy and competence support

(structure) were predictive of the changes in the students' experiences of self-determination, which in turn positively predicted the changes in intrinsic learning motivation (support for conjecture 2c). Furthermore, autonomy and competence support had indirect effects on intrinsic learning motivation via experienced self-determination. Consequently, the support perceived by students during classroom discussions fostered their learning motivation. These results underscore both research on SDT (Ryan and Deci 2002), as well as student engagement in classroom discourse (Schindler et al. 2015 [Paper E]). We can view them as providing further explanations for the positive effects of productive classroom discourse, not only based on social constructivism (Mercer 2010; Mercer and Howe 2012; Mercer and Dawes 2014; Wegerif 2008; Wegerif et al. 1999), but also based on motivational considerations. As this study was a first glance into the relationship between instructional and motivational classroom discourse and students' perceptions of autonomy/competence support, there remain open questions. In the future, we aim to take a look at the predictive power of classroom discourse for the experience of support during instruction and the ways in which it is affected by TPD.

The findings of this study have important implications for the design and conduct of professional development, and the possible linkage between professional development, productive classroom discourse and student learning motivation. Collaborative professional development following teaching cycles of planning, teaching and reflecting (Borko et al. 2008) and incorporating effective components of professional development (Desimone 2009; van Veen et al. 2012; Wilson 2013) can raise teacher effectiveness. Furthermore, the study provides tentative evidence for the mechanisms explaining the positive relationship between productive classroom discourse and students' development of motivation and interest (Kiemer et al. 2015 [Paper E]). The theoretical proximity between productive classroom discourse and aspects of SDT as delineated in the theoretical background could be supported by the findings of this study.

Conclusion

The present study provides a piece of empirical support for positive functions of the DVC as a TPD programme for teacher learning and changes in their teaching practice. The findings exploratively support the conjectures that participating teachers would start to change practice in the form of less teacher control and that these changes would be sustained. Furthermore, they add to the body of literature investigating the positive effects of productive classroom discourse on students' motivation to learn and engage in classrooms (Kiemer et al. 2015; Meyer and Turner 2002; Schindler et al. 2015 [Paper F]). These increases in productive classroom discourse practices were associated with increases in the students' intrinsic learning motivation. Furthermore, the students' perceptions of autonomy and competence support changed positively and served as helpful indicators for explaining the processes involved in how changes in teaching actions transfer into changes in the quality of student learning.

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Appendix

Table 5 Codes for instructional and motivational classroom discourse (unit of analysis is talk format, four-point Likert scale: 0 = “not applicable”, 1 = “partially not applicably”, 2 “partially applicable”, 3 = “fully applicable”)

Discourse type	Code in Turner et al. (2002)	Description	Rating item in Authors 2014
Instructional discourse	Negotiating meaning (supportive)	Adjusting instruction, simplifying, clarifying or elaborating; highlighting concepts or key features or contrasts; modelling what students should do—“thinking aloud” with students	The teacher identifies and responds to errors
			The teacher uses errors to provide students with hints for their individual learning process
			The teacher uses errors as opportunities for learning and adapts the lesson accordingly
Instructional discourse	Transferring responsibility (supportive)	Supporting strategic thinking and autonomous learning; holding students accountable for understanding	The teacher makes the learning goals/central topic of the lesson explicit
			The teacher provides students with strategies to reach their learning goals
			The teacher is transparent in her expectations of the students
Instructional discourse	No telling (supportive)	Not prescribing how students should think and act conceptually or emphasising completion and accuracy over learning	The teacher makes sure that all students have understood the expectations
			The teacher probes for reasons, evidence, warrants, etc. in student responses
Motivational discourse	Focusing on learning (supportive)	Focusing on the process of learning, challenging students, viewing errors	Students work independently/ autonomously. They take initiative in the learning process
			The teacher allows students to answer fully without interruption (even if an answer is erroneous)
Motivational discourse	Focusing on learning (supportive)	Focusing on the process of learning, challenging students, viewing errors	The teacher allows for errors and used them constructively

Table 5 (continued)

Discourse type	Code in Turner et al. (2002)	Description	Rating item in Authors 2014
		as constructive or supporting persistence	The teacher makes sure that all students have opportunity to contribute and be engaged
	Positive emotions (supportive)	Using enthusiasm or humour, or reducing anxiety; addressing emotional needs	The teacher poses cognitively demanding tasks The teacher includes cheerful comments into the discourse
	Peer support and collaboration (supportive)	Building collaboration, emphasising joint goals—shared responsibilities	The teacher shows high regard of student contributions The teacher shows high regard for students' independent/autonomous working Students are encouraged to actively shape the classroom discourse

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Current themes of research:

Classroom discourse. Teacher professional development. Student learning motivation

Most relevant publications in the field of Psychology of Education:

- Furtak, E.M., Kiemer, K., Swanson, R., DeLeon, V., Circi, R., Morrison, D., & Heredia, S. (2016). Developing teachers' attention and response to student thinking through long-term professional development: results of a longitudinal study. *Instructional Science*. doi: 10.1007/s11251-016-9371-3
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Current themes of research:

Classroom discourse and teacher-student interactions. Mentoring and video-based peer-coaching. Professional development and effective teacher learning

Most relevant publications in the field of Psychology of Education:

Gröschner, A., Seidel, T., Pehmer, A.-K. & Kiemer, K. (2014). Facilitating collaborative teacher learning: the role of “mindfulness” in video-based teacher professional development programs. *Gruppendynamik und Organisationsberatung*, 45(3), 273–290

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Current themes of research:

Classroom discourse. Teacher professional development. Teacher education. Teacher-student interaction

Most relevant publications in the field of Psychology of Education:

Furtak, E.M., Seidel, T., Iverson, H., Briggs, D. (2012). Experimental and quasi-experimental studies of inquiry-based science teaching: a meta-analysis. *Review of Educational Research*, 82(3), 300–329. doi: [10.3102/003465431245720](https://doi.org/10.3102/003465431245720)

Seidel, T., & Shavelson, J.R. (2007). Teaching effectiveness research in the past decade: role of theory and research design in disentangling meta-analysis results. *Review of Educational Research*, 77(4), 454–499

Seidel, T. & Stürmer, K., (2014). Modeling the structure of professional vision in pre-service teachers. *American Educational Research Journal*, 51(4), 739–771. doi: [10.3102/000283121453132](https://doi.org/10.3102/000283121453132)

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Current themes of research :

Professional competence of teachers. Teacher career development. Classroom instruction. Motivation at school

Most relevant publications in the field of Psychology of Education:

- Decristan, J., Klieme, E., Kunter, M., Hochweber, J., Büttner, G., Fauth, B., Hondrich, A. L., Rieser, S., Hertel, S., & Hardy, I. (2015). Embedded formative assessment and classroom process quality: how do they interact in promoting students' science understanding? *American Educational Research Journal*, 52(6), 1133–1159. doi:10.3102/0002831215596412doi:10.3102/0002831215596412
- Dicke, T., Parker, P. D., Holzberger, D., Kunina-Habennicht, O., Kunter, M., & Leutner, D. (2015). Beginning teachers' efficacy and emotional exhaustion: latent changes, reciprocity, and the influence of professional knowledge. *Contemporary Educational Psychology*, 41, 62–72. doi: 10.1016/j.cedpsych.2014.11.00
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