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Enhancing authentic learning experiences in teacher education through 360-degree videos and theoretical lectures: reducing preservice teachers' anxiety

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ABSTRACT

Preservice teachers (PSTs) often experience professional anxiety when managing their classrooms. These feelings of anxiety can be reduced, and their feelings of self-efficacy increased by training PSTs' interpersonal competence. This study used authentic learning experiences combining theoretical lectures and 360-degree videos watched with virtual reality headsets, to train their interpersonal competence. Participants of this study were 141 first year PSTs of a teacher education institute in the Netherlands. Results showed that the video-lecture combination led to a reduced professional anxiety and increased self-efficacy. PSTs' self-perceptions of their own expected interpersonal behaviour indicated that PSTs thought they would be more in control in the actual classroom after the intervention. PSTs attributed these results to exemplary teacher behaviour shown in the 360-degree videos.

Introduction

Imagine standing in front of a classroom with approximately 25 to 30 adolescents. Some students are chatting with each other, some students are unmotivated to join the lesson, some students are waiting for you to start while other students are walking through the classroom. You have to attract their attention to start your lesson. However, you are just a beginning teacher – still a student yourself at a teacher education institute. You lack the experience and the tools (yet) to maintain order in the classroom. This is a difficult task and frightening for many preservice teachers (PSTs). Feelings of fear and anxiety are common for PSTs and are often related to classroom management issues (Murray-Harvey et al. 2000; Pillen, Beijaard, and den Brok 2013; Akmal et al. 2019). In this study, we define PSTs' stress manifested in feelings of fear and anxiety, as PSTs' *professional anxiety*.

PSTs' beliefs in their own capacities to influence student behaviour, also known as their *self-efficacy* (Friedman 2003), is an important coping resource to handle classroom management issues and can be increased by training PSTs in classroom management (McCarthy, Lineback, and Reiser 2015). However, when entering internship schools, PSTs

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feel ill-prepared for the difficult task of teaching, and especially for managing their classrooms (Keppell 2006; Korthagen 2010; McCarthy, Lineback, and Reiser 2015). PSTs often experience a gap between theory offered at the teacher education institute and educational practice, also referred to as the 'practice shock' (Keppell 2006; Korthagen 2010; Voss and Kunter 2019).

Exposing PSTs to real-world, complex problems and their solutions using realistic cases, creates authentic learning experiences which may help PSTs to bridge the gap between theory learned at the teacher education institute and educational practice, and smoothen the practice shock (Keppell 2006). Videos can be used to deliver these realistic cases (Herrington and Herrington 2006; Cho, Mansfield, and Claughton 2020). Furthermore, interpersonal competence, as part of classroom management, can be successfully developed using 360-degree videos in combination with theoretical lectures (Theelen, van den Beemt, and den Brok 2019). The current paper presents a mixed-method study about authentic learning experiences for PSTs using 360-degree videos in combination with theoretical lectures and evaluates if these authentic learning experiences lead to a reduction in PSTs' professional anxiety and increase in their self-efficacy.

Preservice teachers' feelings of stress and professional anxiety

Although PSTs perceive internships during teacher education as valuable learning experiences, many PSTs experience their school internship as particularly stressful (Murray-Harvey et al. 2000; MacDonald 1993; McCarthy, Lineback, and Reiser 2015). Sources of stress for PSTs appear to be twofold: *(1)* PSTs experience teacher stress in their role transition from student to intern at their internship school (MacDonald 1993; Pillen, Beijaard, and den Brok 2013; Voss and Kunter 2019) and *(2)* they are confronted with demanding situations within the class and school context in their internship (Alontaga and Durban 2013; Admiraal, Wubbels, and Korthagen 1996; Veenman 1984).

Stressful aspects in PSTs' role as an intern are related to role clarification, expectations, conformity, time, evaluation, assignments, peer discussions, and feedback (MacDonald 1993). Stressful aspects within the class and school context consist of dealing with intensive social relations, troublesome relationships with colleagues, fast decision making, time- and work pressure, constant change, unmotivated students, disruptive student behaviour, students' off and on task behaviour, classroom discipline, and classroom management issues (Harmsen et al. 2018; Alontaga and Durban 2013; Admiraal, Wubbels, and Korthagen 1996; Veenman 1984; Pillen, Beijaard, and den Brok 2013).

This teacher stress leads to negative emotions characterised by feelings such as professional anxiety and fear, which makes PSTs vulnerable for reduced well-being and even burnout (Chang 2009; McCarthy, Lineback, and Reiser 2015). According to Chang (2009), especially classroom management issues evoke PSTs' professional anxiety, and are therefore PSTs' most pressing concern (Pillen, Beijaard, and den Brok 2013).

Classroom management issues are not only a source of PSTs' professional anxiety, but also a consequence (Chang 2009; McCarthy, Lineback, and Reiser 2015). In other words, a PST who experiences anxiety, is potentially not capable to manage disruptive student behaviour in an effective way, which may lead to more disruptive behaviour and eventually higher levels of anxiety. Furthermore, PSTs experiencing anxiety are more likely to use negative classroom management techniques such as yelling at students, which

increases disruptive student behaviour (Sutton, Mudrey-Camino, and Knight 2009). Problematic for PSTs is that they cannot leave the classroom when they feel anxious. Instead, they instantly have to deal with the classroom management issues at hand (McCarthy, Lineback, and Reiser 2015).

Preservice teachers' self-efficacy

Self-efficacy can be defined as teachers' beliefs that they can influence student behaviour and achievements (Friedman 2003). Self-efficacy can be an important coping resource for PSTs when dealing with professional anxiety (McCarthy, Lineback, and Reiser 2015). PSTs with a strong sense of self-efficacy are less vulnerable for experiencing professional anxiety when they are confronted with classroom management issues (Friedman 2003; Zee and Koomen 2016). Creating successful classroom management experiences helps PSTs gaining self-efficacy for classroom management (Brouwers and Tomic 2000; Marlow et al. 2015). Developing PSTs' classroom management competence could be an effective and important strategy to gain self-efficacy for classroom management and consequently reduce or even prevent PSTs' professional anxiety (McCarthy, Lineback, and Reiser 2015).

Practice shock

When confronted with classroom management issues, PSTs often experience a gap between the training they received at the teacher education institute about classroom management and the actual teaching practice. This gap between theory and practice is also known as the 'practice shock' (Keppell 2006; Korthagen 2010; Voss and Kunter 2019).

As Korthagen (2010) advocates, the practice shock is a well-known phenomenon for teacher education worldwide during the whole of the twentieth century. Lessons learned at the teacher education institute seem to be washed out when entering the educational practice (Veenman 1984; Korthagen 2010). Beginning teachers experience discrepancies between their personal preferences and teaching methods they feel forced into by their school practice (Brouwer and Korthagen 2005). Consequently, PSTs feel insufficiently prepared by teacher education institutes (Stokking et al. 2003).

Due to the complexity of classrooms, it is difficult for teacher education institutes to prepare PSTs for the educational practice (Korthagen 2010). In general, teacher education institutes are guided by generalised, theoretical principles and skills, instead of genuine practices of professionals at authentic contexts (Herrington and Herrington 2006).

Authentic learning experiences

Providing PSTs with authentic learning experiences at teacher education institutes, possibly bridges the gap between teacher education institutes and educational practice (Keppell 2006). 'Authentic learning typically focuses on real-world, complex problems and their solutions, using role-playing exercises, problem-based activities, case studies, and participation in virtual communities of practice' (Lombardi and Oblinger 2007, 2).

Videos can deliver authentic cases with realistic complex problems and real-world relevance (Herrington and Herrington 2006; Cho, Mansfield, and Claughton 2020). Videos expose PSTs to classroom events in which expert teachers function in real-world contexts.

This way, PSTs are given models to observe and are enabled to explore different perspectives on teaching (Herrington and Herrington 2006).

360-degree videos

In the current study, 360-degree videos are used, because previous studies showed that 360-degree videos in teacher education can be used to develop classroom management (Theelen, van den Beemt, and den Brok 2019; Theelen et al. 2020). With 360-degree videos one can view situations all around the viewpoint, which is also known as a spherical view. This spherical view makes it possible for viewers to drag the video up, down, left, right, and to decide themselves where to focus attention to (Reyna 2018). For classroom videos, this entails that PSTs can view classroom interactions from both a teacher and student perspective. Using YouTube as an online platform, 360-degree videos can be watched with a virtual reality-headset (Figure 1), disconnecting viewers from their surroundings (Aguayo, Cochrane, and Narayan 2017; Olmos et al. 2018; Olmos-Raya et al. 2018). This way, 360-degree videos provide viewers with a sense of presence and immersion within a realistic and authentic situation that cannot be realised with traditional 2D videos (Reyna 2018; Martín-Gutiérrez et al. 2016; Yoh 2001).

Although sometimes frustrated by technical hindrances, 360-degree videos are slowly finding their way into education (Aguayo, Cochrane, and Narayan 2017). In education, 360-degree videos can be used to show learners complex scenarios (Reyna 2018). In the context of teacher education, only a few exploratory studies and projects have been conducted on the use of 360-degree videos (e.g., Roche and Gal-Petitfaux 2017; Loewus 2017; Pea et al. 2004; Theelen, van den Beemt, and den Brok 2019). For example, in the study of Roche and Gal-Petitfaux (2017) PSTs watched 360-degree videos that helped them to understand classroom events during physical education lessons.


Figure 1. VR-headset.

Preservice teachers' interpersonal competence

Because PSTs' professional anxiety concerns classroom management issues the most, the 360-degree videos in the current study covered classroom management issues. Classroom management can be conceptualised in terms of the teacher-student relationship, PSTs manage their classrooms by all the actions they undertake to create a positive learning environment via teacher-student relationships, the so-called PSTs' *interpersonal competence* (Wubbels et al. 2015; Stough and Montague 2015). Positive teacher-student relationships are associated with higher levels of self-efficacy (Mashburn et al. 2006; Van der Want, Beijaard, and den Brok 2019), are important for PSTs' well-being (Wubbels et al. 2006), and contribute to PSTs' job satisfaction (Chang 2009). Positive teacher-student relationships are also positively correlated with better student achievement and attitudes (Den Brok, Brekelmans, and Wubbels 2004).

A commonly used approach to describe and understand teacher-student relationships is the dynamic systems approach (Watzlawick, Beavin, and Jackson 1967; Wubbels and Brekelmans 2005; Wubbels et al. 2015). Within this approach classes are seen as social systems in which teachers and students continuously interact, in both a verbal and non-verbal way (Wubbels and Brekelmans 2005). These interactions between teachers and students consist of a content and a relational aspect. Teachers' non-verbal behaviour plays an important part in the relational aspect of communicating content from a students' perspective (Wubbels et al. 2006).

Teacher-student interactions are reciprocal, which means that teacher and students affect each other mutually (Horowitz and Strack 2011). This mutual interaction can be described through two independent dimensions that together form a circumplex structure: agency, the level of influence teacher and students have, and communion, the warmth of the teacher-student relationship (Horowitz and Strack 2011). Both are visualised in the Teacher Interpersonal Circle (TIC) (Figure 2) (Pennings et al. 2018). Underlying the two dimensions are eight types of teacher behaviour that can be distinguished:
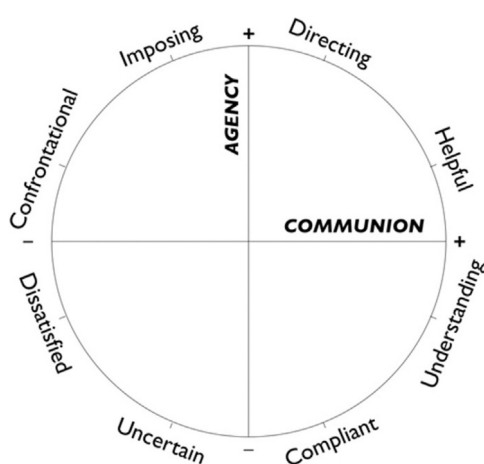
Figure 2. Teacher Interpersonal Circle (Pennings et al. 2018).

directing, helpful, understanding, compliant, dissatisfied, uncertain, imposing, and confrontational (Den Brok and van Tartwijk 2015). The TIC visualises, for example, that directing teacher behaviour is characterised by high levels of teacher influence on the agency dimension in combination with a warm teacher-student relationship on the communion dimension. This is also the case for helpful teacher behaviour, although for this type the communion dimension dominates (Wubbels and Brekelmans 2005). Teacher behaviour that scores high on both communion and agency is related to positive teacher-student relationships (Wubbels et al. 2006).

Aim and research questions

This study aimed to decrease PSTs' professional anxiety and increase PSTs' self-efficacy by developing their interpersonal behaviour through exposing them to authentic learning experiences using 360-degree videos in combination with theoretical lectures (The video-lecture combination will be explained in section 2.) Previous studies indicated a relation between PSTs' professional anxiety and self-efficacy, suggesting that PSTs' with high feelings of self-efficacy were less vulnerable for professional anxiety (e.g., McCarthy, Lineback, and Reiser 2015; Friedman 2003). In the present study we investigated the concepts 'professional anxiety' and 'self-efficacy' separately. Although we assume a relation between the two concepts and in the interpretation of the results of this study, we will take the presumed relation between professional anxiety and self-efficacy into account. This leads to the first two research questions:

(1) *What is the effect of authentic learning experiences within teacher education (video-lecture combination) focusing on teachers' interpersonal behaviour on PSTs' professional anxiety?*
(2) *What is the effect of authentic learning experiences within teacher education (video-lecture combination focusing on teachers' interpersonal behaviour on PSTs' self-efficacy?*

Previous research has also shown the relation between classroom management, including PSTs' interpersonal behaviour, and PSTs' professional anxiety and self-efficacy (e.g., Chang 2009; Brouwers and Tomic 2000). PSTs' poor interpersonal behaviour can lead to higher professional anxiety and self-efficacy can be gained by successful experiences managing a classroom. Because PSTs in the present study were not yet involved in real-life internships, PSTs' self-perceptions towards their own anticipated interpersonal behaviour were investigated. This leads to the third research question:

(1) *What is the effect of authentic learning experiences within teacher education (video-lecture combination) on PSTs' self-perception of their (anticipated) interpersonal behaviour?*

Because (preservice) teachers differ in their sense of self-efficacy (Friedman 2003) and cope differently with feelings of anxiety (Sutton, Mudrey-Camino, and Knight 2009), this study also investigates if different clusters of PSTs can be distinguished regarding PSTs' self-efficacy and professional anxiety. We assumed to find four clusters of PSTs differing in

their professional anxiety and self-efficacy when looking at the start of the intervention (see Table 1).

After establishing the clusters, we were also interested to see whether PSTs from various clusters developed their professional anxiety, self-efficacy, and self-perceived interpersonal behaviour differently. This leads to the last two research questions:

(1) *Which meaningful clusters can be distinguished among PSTs concerning their professional anxiety and self-efficacy before the start of the intervention?*
(2) *In what way do the various clusters concerning PSTs' professional anxiety and self-efficacy before the intervention differ from each other in their development of professional anxiety, self-efficacy, and self-perceived interpersonal behaviour after authentic learning experiences (video-lecture combination)?*

Design authentic learning experiences: video-lecture combination

To create authentic learning experiences within the teacher education institute, theory lectures in a regular teacher education setting were combined with watching 360-degree videos in three two-hour sessions. The aim of the 360-degree videos was exposing PSTs to model behaviour of expert teachers providing PSTs opportunities to observe real-world classroom situations from different perspectives.

Each session started with a theoretical lecture about interpersonal teacher behaviour, which gave PSTs a perspective to watch the 360-degree videos. Theory included the systems approach to communication (Watzlawick, Beavin, and Jackson 1967; Wubbels et al. 2006), the TIC (Wubbels et al. 2006; Den Brok and van Tartwijk 2015; Pennings et al. 2018), and teachers' verbal and non-verbal behaviour (Van Tartwijk 1993) with increasing complexity in succeeding sessions. After each theoretical instruction, all PSTs watched 360-degree videos and were encouraged to observe systematically by doing assignments while watching the video (e.g., What do you notice about the teacher's non-verbal behaviour? How does the teacher in the video correct the disruptive student?) The sessions ended with PSTs discussing their interpretations of observed classroom events together with their fellow PSTs in the classroom setting. These discussions gave PSTs the opportunity to learn from their peers' interpretations (Star and Strickland 2008), to analyse classroom interactions (Sherin and van Es 2005), and to reflect and reason about teacher and student behaviour (Santagata and Guarino 2011).

Using their mobile phones in a virtual reality-headset playing 360-degree YouTube videos, PSTs watched a total of fifteen 360-degree videos of ten experienced secondary education teachers. All videos contained one or more classroom events that are considered important for the teacher-student relationship: (1) the beginning of a lesson, (2) a moment of instruction, (3) stimulating students to work, (4) disruptive behaviour, (5)

Table 1. Assumed clusters of PSTs regarding professional anxiety and self-efficacy at the start of the intervention.

	Cluster			
	1	*2*	*3*	*4*
professional anxiety	high	low	high	low
self-efficacy	high	low	low	high

comments of students, (6) insufficient students' performances, (7) questions or feedback from students, and (8) the transition between two different phases of the lesson (e.g., from instruction to work independently on the teaching materials) (Admiraal 1994; Admiraal, Wubbels, and Korthagen 1996; Wubbels et al. 2006). Video length averaged three minutes and 8 seconds with extremes of 47 seconds and four minutes and 48 seconds.

Methods

Participants

Participants in this study were first year PSTs of a teacher education programme in the Netherlands (N = 141; 81♀) with little or no teaching experience. This teacher education program prepares PSTs for the secondary education context. This study followed the research guidelines for social scientific studies from the Association of Universities in The Netherlands (2018). Participants took part voluntarily and gave their informed consent.

Questionnaires

To gather insight in PSTs' experiences with the video-lecture combination, data from a questionnaire with 69 statements about professional anxiety, self-efficacy, and self-perceptions of interpersonal teacher behaviour were analysed. Table 2 gives an overview of the questionnaires, with a sample item for each scale and its internal consistency. All scales had a good internal consistency. Items were measured using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). High scores imply positive experiences with the video-lecture combination for the self-efficacy scale. For the Teacher Anxiety Scale, high scores mean a high level of anxiety, which implies a negative experience. Because participants of this study had little or no teaching experience, they could only score their self-perceptions regarding their anticipated interpersonal behaviour on the Questionnaire on Teacher Interaction (Van Tartwijk et al. 2014), for instance from the perspective of the kind of teacher they think they thought they would be in the future.

Table 2. Questionnaires.

Questionnaire	Theoretical concept	Sample item	Number of items	α pre-test	α post-test
Student Teacher Anxiety Scale (Morton et al. 1997)	Teacher anxiety	I am anxious about possible problems in the class with individual disruptive children.	26	.94	.96
Teacher Self-Efficacy Scale – the classroom context (Friedman and Kass 2002)	Self-efficacy within the classroom context	I see myself as an interesting and motivating teacher.	19	.87	.87
Questionnaire on Teacher Interaction (Van Tartwijk et al. 2014)	Interpersonal behaviour	I think that as a teacher I will have a pleasant atmosphere in the classroom	24	Dimensions: influence:.68 proximity:.85	Dimensions: influence:.64 proximity:.76

Interviews

To gather more insight in PSTs' experiences with the video-lecture combination, semi-structured individual interviews were conducted after the video-lecture combination (n = 12; 7♀). Interviewees were selected with convenience sampling resulting in five PSTs from cluster 1 and seven PSTs from cluster 2 (see results cluster analysis section 4.3). This number of participants met the minimal requirement for theoretical saturation (Guest, Bunce, and Johnson 2006). The interviews were audio recorded and consisted of six questions about professional anxiety and self-efficacy (See Appendix A). A sample question is *'Did the video-lecture combination influence your professional anxiety? How?'* The interviews did not gather information about PSTs' self-perceived interpersonal behaviour.

Data-analysis

This study used a mixed-methods design with a pre-test, an intervention (the video-lecture combination), and a post-test. Data from the questionnaires were both gathered at the pre- and post-test. The interviews were conducted after the intervention, at the post-test. Results of the questionnaires for PSTs' professional anxiety, self-efficacy, and interpersonal teacher behaviour at the pre- and post-test were compared using a paired samples t-test and analysed with IBM SPSS Statistics 22.

Regarding the qualitative data retrieved from the interviews, the sensitising concepts (Charmaz 2006) professional anxiety, self-efficacy, interpersonal teacher behaviour, and 360-degree videos were derived from the theoretical background. These four concepts were used to categorise the interviewees' answers in an analysis matrix. Three sub-categories were distinguished for the category interpersonal teacher behaviour: teachers' verbal behaviour, teachers' non-verbal behaviour, and interpersonal teacher styles. Concerning the reliability of the qualitative analysis, the second author validated the categorisation of the first author by discussing and evaluating the categorisation. For example, if the interviewees' statements concerned feelings of confidence to create positive teacher-student relationships, they were categorised as self-efficacy. The qualitative part of this study was relatively small and there were no points of debate when categorising the statements.

To obtain a deeper understanding about PSTs' professional anxiety and self-efficacy at the pre-test, a hierarchical cluster analysis on the cases was conducted using IBM SPSS Statistics 22, identifying different clusters of PSTs regarding PSTs' professional anxiety and self-efficacy in our dataset. The hierarchical cluster analysis was chosen above discriminant or assignment methods because no classification was known a-priori (Everitt 1995). The hierarchical cluster analysis starts with treating all cases as a cluster on its own. Then clusters are merged based on similarity using Euclidean Distance (geometric distance between two cases) (Field 2017). Because this process is hierarchical, final clusters will depend on the cases that are used as a starting point (Field 2017). For this reason, we repeated the cluster analysis several times with different cases as starting point. Ward's method was used to include cases into clusters in such a way that the variance within clusters were minimised. To determine if PSTs from different clusters developed their interpersonal behaviour differently, analysis of variances (one-way ANOVAs) were

conducted. For this analysis, the cluster-solution was used as an independent variable, the pre-and post-test of the two dimensions agency and communion and the eight sectors of teacher behaviour of the TIC were used as dependent variables.

To determine if the two clusters differed by background variables, an analysis of variance (one-way ANOVA) was conducted. The background variables included teaching domain, age, gender, previous education, previous teaching experience, and the device used for watching the videos (e.g., mobile phone, tablet, laptop). The one-way ANOVA revealed that the clusters did not differ in terms of background variables.

Results

Preservice teachers' professional anxiety and self-efficacy

For research questions 1 and 2, this study examined the effect of authentic learning experiences using 360-degree videos in combination with theoretical lectures on PSTs' professional anxiety and self-efficacy. Table 3 shows negative and statistically significant differences for PSTs' professional anxiety, and positive and statistically significant differences for PSTs' self-efficacy between the pre-and post-test, with small effect sizes (Cohen 1988). This indicates that the video-lecture combination contributed to PSTs experiencing a slightly reduced anxiety and gain in their self-efficacy.

The qualitative data revealed that all twelve interviewees agreed that the video-lecture combination was useful to reduce PSTs' professional anxiety. This was because of the exemplary behaviour of experienced teachers in the videos they observed. This made PSTs familiar with the actual teaching practice. As one PST quoted: *'You learn what behaviour you can display in different situations.'* Another PST stated: *'I learned on which aspects in the classroom I have to focus when teaching.'* Furthermore, two PSTs reported that they paid more attention to the non-verbal behaviour of the experienced teachers. This made them more conscious about their own non-verbal behaviour. Finally, one PST reported: *'I have learned that you do not have to be strict to be in control in the classroom.'* This was an important lesson for her.

Although all interviewees experienced the authentic learning experiences using a video-lecture combination as a useful method to reduce PSTs' professional anxiety, only seven PSTs reported that the video-lecture combination reduced their own professional anxiety. This was because three of them did not experienced anxiety at all before the intervention. The other two stated that they still experience some anxiety and they hoped their anxiety would be reduced after their actual internships at the internship schools.

After the video-lecture combination, ten interviewees were convinced about their own ability to create positive teacher-student relationships. These ten PSTs attributed their

Table 3. Mean score and standard deviations on PSTs' professional anxiety and self-efficacy.

	pre-test		post-test				
	M	SD	M	SD	t(df)	d	p
professional anxiety (n = 141)	3.11	0.61	2.92	0.70	3.951(140)	0.3	< 0.01
self-efficacy (n = 141)	3.77	0.38	3.86	0.36	−2.595(140)	0.2	< 0.05

1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree

feelings of self-efficacy to the video-lecture combination. Two PSTs still felt somewhat insecure about their own interpersonal behaviour.

Self-perceived interpersonal competence

For research question 3, this study examined the effect of authentic learning experiences using 360-degree videos in combination with theoretical lectures on PSTs' self-perceptions of their anticipated interpersonal behaviour. First, PSTs' self-perceptions on the two dimensions of the TIC (agency and communion) were examined. Second, we took a closer look at PSTs' self-perceptions on the eight sectors of teacher behaviour of the TIC. Table 4 shows positive and statistically significant differences for PSTs' self-perceptions regarding the communion dimensions between the pre- and post-test, with a small effect size (Cohen 1988). No statistically significant differences were found for the agency dimension. These data suggest that after the authentic learning experiences, PSTs perceived themselves as teachers with higher levels of communion, which means they think they would have a more warm, positive relationship with their students.

Table 5 shows a positive and statistically significant difference for PSTs' self-perceptions regarding directing teacher behaviour, and negative and statistically significant differences for imposing teacher behaviour between the pre- and post-test, with small effect sizes (Cohen 1988). No statistically significant differences were found for helpful, understanding, compliant, uncertain, dissatisfied, and confrontational types of teacher behaviour. This is in line with the positive difference on the communion dimension, because imposing teacher behaviour entails less communion than directing teacher behaviour.

Preservice teachers' anxiety and self-efficacy clusters

Regarding research questions 4 and 5, this study examined if PSTs differed in their sense of self-efficacy and feelings of anxiety and whether PSTs from various clusters developed

Table 4. Mean score and standard deviations on the agency and communion dimension.

	pre-test		post-test				
	M	SD	M	SD	t(df)	d	p
agency (n = 141)	0.49	0.38	0.52	0.35	−.67(140)	0.1	.51
communion (n = 141)	0.75	0.47	0.85	0.43	−2.54(140)	0.2	.01*

* $p < 0.05$, Z-scores

Table 5. Mean score and standard deviations on the eight types of teacher behaviour.

	pre-test		post-test				
	M	SD	M	SD	t(df)	d	p
directing (n = 141)	0.70	0.33	0.74	0.11	−2.99(140)	0.3	.00*
helpful (n = 141)	0.80	0.14	0.81	0.11	−3.82(140)	0.0	.70
understanding (n = 141)	0.71	0.14	0.73	0.12	−1.46(140)	0.1	.15
compliant (n = 141)	0.42	0.16	0.42	0.18	0.29(140)	0.0	.78
uncertain (n = 141)	0.26	0.18	0.23	0.16	1.67(140)	0.1	.10
dissatisfied (n = 141)	0.23	0.17	0.23	0.17	0.00(140)	0.0	1.00
confrontational (n = 141)	0.37	0.15	0.36	0.15	0.72(140)	0.1	.47
imposing (n = 141)	0.43	0.15	0.39	0.16	2.22(140)	0.2	.03**

* $p < 0.01$, ** $p < 0.05$, Z-scores

their professional anxiety, self-efficacy, and self-perceived interpersonal behaviour differently. The cluster analysis resulted in two meaningful clusters of PSTs at the pre-test, differing in professional anxiety and self-efficacy (see Table 6). These results indicated that PSTs from cluster 1 scored both high on professional anxiety and self-efficacy at the pretest. PSTs from cluster 2 scored average on professional anxiety and high on self-efficacy at the pre-test. Because of the hierarchical process of cluster analysis (Field 2017), the cluster analysis was repeated several times with different cases as starting point. This led to comparable cluster solutions. Beside the two-cluster solution, various cluster solutions were explored. However, no other interpretable cluster solutions were found. Additional clustering led to new clusters containing only small numbers of student teachers (e.g., containing four PSTs), with otherwise minimal differences compared to the two-cluster solution.

The qualitative data revealed that all PSTs from cluster 1 indeed experienced high feelings of professional anxiety and self-efficacy at the same time. As one PST stated: *'Although my anxiety is reduced, I recognise feelings of anxiety. You do not know how the students are doing and how your lesson is going to be.'* Two PSTs reported that their feelings of anxiety were mostly related to classroom management issues; how to be in control during the lesson. Another PST mentioned he even had physical reactions regarding his anxiety: *'After every lesson, I could put on a new t-shirt because of my sweating.'* Concerning PSTs' self-efficacy of cluster 1, two of the five interviewees reported that they, contrary to the quantitative data, were a little bit insecure to teach. This insecurity was mainly about their own teaching skills. As one PST put it: *'It is mainly in teaching, I am concerned about that.'* With respect to PSTs from cluster 2, the qualitative data confirmed that all seven interviewees had average feelings of anxiety and experienced high self-efficacy. For example, one PST mentioned: *'I do not feel anxiety at all. [...] I have many good experiences in building relationships.'*

To determine how the two clusters influenced PSTs' professional anxiety, self-efficacy, and development of interpersonal behaviour after the authentic learning experiences using a video-lecture combination an analysis of variance (one-way ANOVA) was conducted. For professional anxiety, the one-way ANOVA revealed that PTSs from both clusters differed statistically significant at the post-test (F $(1,140) = 45.014$, p <.01). PSTs from both clusters experienced less anxiety after the video-lecture combination, for PSTs from cluster 1 the reduction of anxiety was the largest. A statistically significant difference was found between the two clusters for self-efficacy at the post-test ($F(1,140) = 8.743$, p < .01). PSTs from cluster 1 gained self-efficacy after the video-lecture combination, whereas self-efficacy of PSTs from cluster 2 stayed almost the same as at the pre-test. Noteworthy is that six of the seven interviewees from cluster 2 experienced that their self-efficacy positively changed after the

Table 6. Clusters and mean scores on professional anxiety and self-efficacy at the pre-test.

	cluster 1 (n = 69)		cluster 2 (n = 72)	
	M	SD	M	SD
professional anxiety pre-test	3.57	0.37	2.67	0.44
self-efficacy pre-test	3.60	0.37	3.95	0.31

n = 141; Cluster analysis: Ward's method, Squared Euclidian distances
1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree

intervention because of the exemplary behaviour they saw on the videos. For example, one PST stated: *'It did contribute to my feelings of being certain. You have more experience, that is always good.'*

Regarding PSTs' interpersonal behaviour, the two clusters differed statistically significant at the pre-test for the dimension agency ($F(1,140) = 8.023$, p < .01). PSTs from cluster 1 perceived themselves low on agency, PSTs from cluster 2 estimated their agency between average and high. At the post-test, no statistically significant differences between PSTs from the two clusters were found. Furthermore, PSTs from both clusters differed statistically significantly for two types of teacher behaviour: dissatisfied ($F(1,140) = 4.241$, p < .05) and imposing ($F(1,140) = 5.226$, p < .05). PSTs from cluster 1 perceived themselves after the video-lecture combination as less dissatisfied and more imposing. For PSTs from cluster 2 this was the other way around; more dissatisfied and less imposing.

Conclusion and discussion

The aim of the current study was to examine if PSTs' professional anxiety decreased and PSTs' self-efficacy increased by developing their interpersonal behaviour through exposing them to authentic learning experiences using 360-degree videos in combination with theoretical lectures. This study assumed a relation between PSTs' professional anxiety, self-efficacy, and PSTs' interpersonal behaviour based on previous research (e.g., McCarthy, Lineback, and Reiser 2015; Friedman 2003; Chang 2009; Brouwers and Tomic 2000). Less developed interpersonal behaviour could lead to professional anxiety, while positive classroom management and interpersonal behaviour experiences could lead to PSTs with higher feelings of self-efficacy. The authentic learning experiences, using a video-lecture combination, in this study were focused on teachers' interpersonal behaviour providing PSTs with exemplary interpersonal teacher behaviour. It was expected that if the authentic learning experiences contributed positively to a reduction in PSTs' anxiety, PSTs' self-efficacy would increase. Although PSTs professional anxiety, self-efficacy and self-perceived interpersonal behaviour were examined separately, conclusions drawn within this study should be seen in the light of the assumed connections between these concepts.

With respect to research questions 1 and 2, this study found that PSTs' professional anxiety decreased, and PSTs' self-efficacy increased statistically significantly after being exposed to authentic learning experiences using a video-lecture combination. Data from the interviews revealed that the reduction of PSTs' professional anxiety and their increased self-efficacy was mainly because of the exemplary behaviour of experienced teachers in the 360-degree videos. It helped PSTs becoming familiar with the actual teaching practice. The presumed relation between PSTs' professional anxiety and self-efficacy was confirmed in the current study and supported Brouwers and Tomic (2000), who found that successful classroom management experiences increase PSTs' self-efficacy. Consequently, higher self-efficacy leads to less anxiety (McCarthy, Lineback, and Reiser 2015).

Concerning research question 3 our results showed that PSTs perceived themselves as teachers with higher anticipated levels of communion after the authentic learning experiences using a video-lecture combination. Although the cluster analysis showed PSTs

differed in their perceived agency at the pre-test, no significant differences were found for the agency dimension between the pre- and post-test, implying that watching videos of experienced teachers was not useful to influence PSTs' self-perceived agency. The reason for this could be that the PSTs perceived themselves already relatively high on the agency dimension before the intervention. Regarding the eight sectors of teacher behaviour of the TIC, only positive differences were found on PSTs' self-perceptions for directing teacher behaviour, and negative differences for imposing teacher behaviour. This led to teacher behaviour that combines relatively high communion and agency. It is possible that PSTs perceived their own anticipated teacher behaviour as more directing and less imposing because they have learned within the video-lecture combination that students appreciate the class climate with this teacher behaviour (Wubbels et al. 2006). Previous research also showed that experienced teachers display behaviour that scores higher on the communion dimension than PSTs (Brekelmans, Wubbels, and van Tartwijk 2005). Because PSTs observed experienced teachers in the video-lecture combination, and the 360-degree videos of the current study contained exemplary teacher behaviour combining high levels of communion and agency, it is possible that PSTs perceived teacher behaviour characterised by combining high communion and agency on the TIC as ideal teacher behaviour.

The current study indicated that successful classroom management experiences could be accomplished within authentic learning experiences to simulate a realistic context using 360-degree videos and virtual reality-headsets. After the authentic learning experiences PSTs characterised their own interpersonal behaviour with higher dimensions of communion, meaning more directing and less imposing teacher behaviour. This implies that these experiences help PSTs to form self-perceived interpersonal behaviour that is in line with interpersonal teacher behaviour that students perceive as 'ideal'. The attention given to interpersonal teacher behaviour within the video-lecture combination also seemed to influence PSTs' professional anxiety and self-efficacy. PSTs became more confident with their own abilities to manage classrooms from an interpersonal perspective and felt less anxious. Because difficulties with classroom management issues are among the main reasons for PSTs to leave (teacher) education (Evertson and Weinstein 2006), it is important that teacher education institutes invest in classroom management competence including interpersonal behaviour. McCarthy, Lineback, and Reiser (2015) stress the importance of a preventive approach as used in the current study for teacher education institutes to prepare PSTs for stressful moments in the actual classroom and with this, prevent burnouts and dropout. In conclusion, authentic learning experiences using 360-degree videos containing experienced teachers showing interpersonal teacher behaviour within classroom events, combined with theoretical lectures about interpersonal behaviour are useful for teacher education institutes to prepare PSTs for the actual teaching practice. With this approach PSTs develop a better image of their own ideal interpersonal teacher behaviour. Even more important, PSTs experience less anxiety for the actual teaching practice and will enter this teaching practice with more self-efficacy.

Because of the differences between PSTs in their sense of self-efficacy (Friedman 2003) and feelings of anxiety (Sutton, Mudrey-Camino, and Knight 2009), this study also investigated if different clusters of PSTs could be distinguished regarding PSTs' self-efficacy and professional anxiety. Consequently, it was examined whether PSTs from different clusters differed in their professional anxiety, self-efficacy, and self-perceptions of their interpersonal

behaviour after the intervention. Regarding research questions 4 and 5, there were assumed to be four clusters of PSTs differing in their professional anxiety and self-efficacy at the pre-test (see Table 1). However, only two meaningful clusters of PSTs could be distinguished. PSTs from cluster 1 scored both high on professional anxiety and self-efficacy. This was quite a remarkable result for PSTs of cluster 1, because the literature suggests that in general PSTs with high feelings of professional anxiety, have a lower self-efficacy (e.g., Brouwers and Tomic 2000; McCarthy, Lineback, and Reiser 2015; Friedman 2003). This indicated that many first year PSTs, with little or no teaching experience, were feeling anxious when they think about managing a classroom. At the same time, they were also confident that they could handle classroom management issues. PSTs from cluster 2 scored average on professional anxiety and high on self-efficacy.

A closer look at the effect authentic learning experiences using a video-lecture combination had on these two clusters of PSTs' professional anxiety and self-efficacy, it was revealed that PSTs from both clusters experienced reduced anxiety. However, this reduction differed statistically significant between clusters, with the largest decrease for PSTs of cluster 1. Furthermore, PSTs from cluster 1 gained in their self-efficacy while the self-efficacy of PSTs from cluster 2 stayed almost the same. These results indicate, that PSTs from both clusters evolved to the normal pattern where self-efficacy is a counterpart of professional anxiety. In other words, the video-lecture combination enables PSTs to have a more realistic understanding and appraisal of themselves. Finally, it is noteworthy that PSTs from both clusters differed statistically significant on the dissatisfied and imposing teacher behaviour. After the authentic learning experiences PSTs from cluster 1 perceived themselves as less dissatisfied and more imposing, which was opposite to PSTs from cluster 2. Imposing teacher behaviour is characterised by teachers being in the lead and cooperative (Wubbels and Brekelmans 2005). That PSTs from cluster 1 scored perceived themselves as more dissatisfied is in line with their gain in self-efficacy. Having confidence in your own abilities to handle classroom management issues, makes teachers feeling more in control by taking the lead in their classroom. The reason why PSTs in cluster 2 perceived themselves as more dissatisfied and less imposing is less clear. These results indicate that PSTs in cluster 2 perceived themselves lower on agency. Before the video-lecture combination they perceived themselves relatively high on agency. Possibly, their self-perceptions became more realistic after the video-lecture combination. The cluster analysis provided interesting insights into the relation between PSTs' professional anxiety and self-efficacy for PSTs with no or little teaching experience. Almost half of the PSTs experienced anxiety before the intervention, but at the same time they had high self-efficacy and believed in their own abilities to influence student behaviour. For teacher education institutes it is valuable to know that PSTs' professional anxiety and self-efficacy evolved in a normal pattern because of the video-lecture combination. Furthermore, this study showed that authentic learning experiences are useful for all PSTs to reduce professional anxiety and increase self-efficacy, however PSTs with high levels of anxiety and self-efficacy profit the most from the video-lecture combination.

The current study did not include students' perceptions of PSTs' interpersonal behaviour. For this study PSTs' self-perceptions about their own expected teacher behaviour were used. The question is whether PSTs have an accurate perception of their own interpersonal behaviour, since they lack teaching experience and because students

have a different perception of teacher behaviour. Previous research (Brekelmans et al. 2011) has shown that teachers tend to overestimate their own behaviour on the communion and agency dimension. Further research could provide more insights in whether the video-lecture combination also influences PSTs' interpersonal competence as perceived by students in the classroom.

In conclusion, the current study investigated authentic learning experiences using a combination of theoretical lectures and 360-degree videos watched with a virtual reality-headset about expert interpersonal teacher behaviour in order to reduce PSTs' professional anxiety and increase their self-efficacy. This study showed that these experiences may be an asset for teacher education institutes to smoothen the transition from the teacher education institute to the actual teaching practice, decreasing the practice shock, by reducing PSTs' professional anxiety and increasing their self-efficacy with behalf of exemplary teacher behaviour. Furthermore, PSTs perceptions of their own interpersonal behaviour tended towards more to 'ideal' interpersonal teacher behaviour after the authentic learning experiences.

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a. No potential competing interest was reported by the authors.

b. Access to the database will be provided by the first author on request. Solicitations should contain information about the research aim and the type of analysis.

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Appendix A

Interview questions

Question	Topic
Did you feel anxiety for teaching in an actual classroom before you entered the video-lecture combination?	professional anxiety
Did the video-lecture combination influence your professional anxiety? How?	professional anxiety
Do you think the video-lecture combination is a useful method to decrease PSTs' professional anxiety?	professional anxiety
How sure are you about you own skills to create positive teacher-student relationships?	self-efficacy
Did the video-lecture combination influence your feelings about your own skills to create positive teacher-student relationships?	self-efficacy