

## **The Connected Classroom – Using Video Conferencing Technology to Enhance Teacher Training**

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### **ABSTRACT**

Bridging the gap between theory and practice in a meaningful way is one of the major challenges facing teacher training today. This problem could be solved in several ways, but this paper examines the potential of video-based learning to engage trainee teachers in school–university partnerships using video conferencing technology. Often utilized in other educational contexts, video conferencing enables audio-visual exchanges between universities and schools via Internet with the advantage of involving a broad variety of stakeholders simultaneously. Drawing on theoretical insights, trainee teachers develop lesson materials and ideas they can then watch practising teachers realise in a live classroom setting. Afterwards they have the opportunity for discussions with teachers and pupils. Live streaming affords trainee teachers the benefits of observing actual classroom situations in real time, actively engaging them in real school problems and potentially broadening their perspective through deeper learning about teachers’ and pupils’ views and ideas. In a qualitative interview study, trainee teachers who took part in a video conference were asked to evaluate their work with the conferencing system. The study showed that students criticized the technical equipment. However, they were mainly positive in their assessment of this technology emphasizing the usefulness of joint exchanges and reflections, contextualized observations, and their own active engagement. Future research should include quantitative studies to expand the attitude survey.

### **KEY-WORDS**

Theory and practice, teacher education, school-university partnerships, video-based learning, mathematics education

### **INTRODUCTION**

Teacher education in Germany includes two major phases: Academic studies at universities or universities of education followed by an obligatory one to two year (depending on the state regulations) practical pedagogic training. This preparatory service (second phase) takes place in

teacher training institutes (Studienseminare) and training schools. However, trainee teachers have various opportunities to combine theoretical knowledge and practical experiences already during their academic studies. Practical skills are strengthened, for example, during placements in schools, professionally oriented studies or projects in cooperation with schools (Brühwiler et al., 2012). However, there is significant disparity between trainees' experiences in schools: as Zeichner and Bier note, "clinical education for teachers that exists today [...] is highly varied in its characteristics and quality" (2012, p.155). Duration, continuity, structural integration in the degree programme, thematic orientation and support from lecturers and teachers are just a few aspects which can vary greatly in this regard. The heterogeneity of how university and practical learning are integrated reveals a degree of uncertainty as to how theory and practice can be linked in a manner optimally conducive to learning. This represents a structural problem in teacher training: the link between school and university, that is to say, between theory and practice, is not well understood. A key difficulty is that trainee teachers often ignore the importance and advantages of theoretical knowledge and demand practical experience in schools (Gordon, 2007; Makrinus, 2013). However, practical experience with no opportunity for trainee teachers to step back from practice, and without high-quality mentoring, is incapable of creating the space or distance for reflective learning and the professional development of trainee teachers (Bengtsson, 1993; Korthagen & Kessels, 1999; Zeichner & Bier, 2012).

One possibility for promoting a link between theory and practice in teacher training was developed and tested at the Leuphana University Lüneburg through the concept of "The Connected Classroom". As part of a school-university partnership in October 2013, the Future Centre of Teacher Education<sup>1</sup> of the Leuphana University Lüneburg and the Jesteburg secondary school installed a video conferencing system for the joint education and further training of current and prospective teachers and lecturers. The system was utilized as a communication tool between school and university, allowing audio-visual exchanges between the parties via the Internet. Use of video conferencing technology in this manner enables trainee teachers to jointly observe lessons and communicate with teachers and pupils over greater distances.

The purpose of this article is to show how video conferencing can be used to connect theory and practice – school and university. Our research is based on two fundamental questions:

1. How do trainee teachers evaluate working with the video conferencing system in terms of the seminar content?
2. What differences do trainee teachers identify in comparison to learning using classroom videos?

In order to answer these questions, we first discuss the link between theory and practice in teacher training. Current concepts involving video conferencing systems for schools and universities are then described. Finally we introduce the "Connected Classroom" model and examine trainee teachers' experiences and opinions of this concept

## THEORY AND PRACTICE IN TEACHER TRAINING

The relationship between theory and practice has long been part of discussions regarding the improvement of teacher training (e.g. Broekkamp & van Hout-Wolters, 2007; Gordon 2007; Korthagen & Kessels, 2001). Yet it is a problem that has to be solved: “What seems obvious to the teacher educator is not so to the student teacher. [...] What to us seems evident and easy to understand does not get through to the student [...] Apparently, there is an unbridgeable gap between our words and the student’s experiences.” (Korthagen & Kessel 2001, p.22). A continually growing number of voices demand more practice in teacher training in order to bridge this gap (Hedtke, 2003; Oelker, 1999). There are well-known negative aspects to practical training, including a conformist and conservative influence on the students or insufficiently deep-rooted practical reflections (Oonk, 2009). Nevertheless, it seems that the demand to increase the practical component in teacher training programmes is largely uncontroversial (Oelkers, 1999). Furthermore, this is the case even though the term “practice” is fuzzy and insufficiently defined. For example, Oonk (2009) views practice as a “professional situation” – a situation in which a profession is practiced. However, it seems that professional situations might just as well include case studies and reflection on classroom videos or even lesson planning, as well as job shadowing and simulations, and empirical classroom research (Hedtke, 2003).

Existing research in this field focuses primarily on studies of school teaching practice (e.g. various contributions in Hascher & Neuweg, 2012), school-university partnerships (e.g. Callahan & Martin, 2007; Miller Rigelman & Ruben, 2012; Snow-Gerono, 2004), research-based teacher training or action research (e.g. Burns, 2011; Cooper & Cowie, 2009; Cutrim Schmid & Hegelheimer, 2014; Seberová, 2010), as well as classroom videos (e.g. Borko, Jacobs, Eiteljorg, & Pittman, 2008; Kleinknecht & Schneider, 2013; Seidel, Blomberg & Renkl, 2013). Many studies have indicated that for trainee teachers, interaction with practising teachers and pupils, as well as the opportunity to gradually discover and grow into the actual spheres of school and teaching activity, have positive effects – improved development of specialized knowledge, increased effectiveness in teaching the subject content, as well as an increase in the sense of belonging to the school as an institution and a group of teachers (Cochran-Smith & Lytle, 1992; Jimenez-Silva & Olson, 2006; Sutherland, Scanlon, & Sperrings, 2005; Tsui & Law, 2007).

Formats that provide trainee teachers with a conducive framework for participation, as well as reflection possibilities and a gradual skill development have been assessed as particularly effective (Grossmann, Wineburg, & Woolworth, 2001). Trainee teachers should be mentored and supported intensively as they pass through the phases of engagement, imagination and alignment on their journey from novices to expert teachers. West and Staub’s (2003) Content-Focused Coaching is a good example of such an approach. Trainee teachers should explore practical aspects of their profession in the form of situated learning (using real contexts with authentic tasks and in a community of practitioners) in the context of a Community of Practice (Wenger, 1998; Wenger & Lave, 2001). According to Zeichner’s (2010) third spaces in teacher education, trainee teachers should be engaged in actual teacher challenges while collaborating with teachers and generating new knowledge (Zeichner, 2010). However, research in this area of teacher education is still “fairly limited” (Zeichner, 2010, p. 95).

Classroom videos are an often used and frequently discussed resource to improve the integration of theory and practice in teacher training (Pauli et al., 2014; Seidel, Blomberg, & Renkl, 2013). Here, reflection on and analysis of recorded classes constitutes a means to expand prospective trainee teachers' didactic and methodological repertoires, to build on and develop their abilities to analyse teaching and learning processes, and to generally shape their reflective, systematized knowledge (Borko et al., 2008; Fischer & Schratz, 2005; Janík & Seidel, 2009; Petko, Prasse, & Reusser, 2007; Sherin, 2004). Embedding classroom videos in teacher training in universities thus provides an opportunity to link theoretical and direct practice-related content, and contributes to the establishment of a constructive, research-based culture of reflection and sustained development of teaching and learning processes (Krammer et al., 2008). Nevertheless, classroom videos also have their limits, as only a "facet of reality" is portrayed in a single video. The use of videos can be complemented by providing accompanying material alongside the recorded lessons, but what is observed cannot be reflected upon together with teachers and pupils (Krammer & Reusser, 2005).

## VIDEO CONFERENCING IN EDUCATIONAL CONTEXTS

A related but fundamentally different approach is to use video conferences to connect theory and practice in teacher education. Video conferencing systems allow a live exchange between different locations (e.g. a classroom and a seminar room). This technology enables the participating parties to see and to talk to each other. Video conferencing technology has been used in educational institutions for some time now. Current possible uses include the following:

- *Collaboration between classes:* Video conferencing allows collaborations between classes from different school levels, interdisciplinary cooperations with other classes and contact with schools abroad. For example, the differences between the respective schools can be discussed, or foreign languages can be practised (Arnold, Cayle, & Griffith, 2002). Content-related projects across national borders are also possible (e.g. European Schoolnet).
- *Bringing experts into the school/university:* Instead of Experts being physically present at the school or university Experts can be brought into lessons/seminars via video conferences. These experts can take pupils or students on virtual field trips or the link between schools and universities can be encouraged by allowing academics to talk to pupils about their respective research fields (Arnold, Cayle, & Griffith, 2002; Anderson & Rourke, 2005; Hung & Tan, 2004; Ivey, 1999).
- *Distance learning:* Students and pupils learn via video conferencing systems and need not be physically present at the university/school. Video conferencing has the advantage that students' access to the programme of study is facilitated in cases when the students would otherwise be unable to participate due to personal circumstances (Gillies, 2008). Furthermore, they can be installed in schools when children are absent due to illness (Weiss, Whiteley, Treviranus, & Fels, 2001). In remote areas video conferencing can be used for decentralized teaching so that pupils can also participate in subjects that are not offered at their own schools (School of Distance Learning, n.d.).

- *Teacher-to-teacher*: The video conferencing system can be used as a learning and coaching tool for teachers and trainee teachers. They can consult other schools, participate in training courses or observe other teachers in action (Arnold, Cayle, & Griffith, 2002).

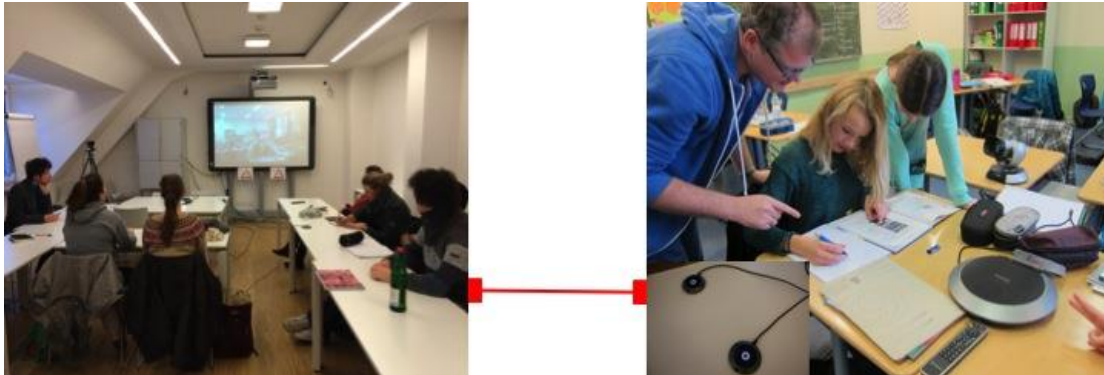
Findings on the application of video conferencing in teacher training are generally positive. Video conferencing fosters communication and collaboration (Hu & Wong 2006; Johnson et al. 2006, Kent & Simpson 2010) and trainee teachers can jointly dissect the newly acquired knowledge (Hu & Wong 2006). Kent and Simpson (2010) conclude that video conferencing is a “powerful tool” to give students confidence in innovative teaching practices. Further, they propose the application of video conferencing to facilitate the linkage of theory and practice in teacher education (Kent & Simpson 2010). However, trainee teachers require direct feedback if actively teaching via video conferencing (Johnson et al. 2006). Two other issues are critical to warrant successful learning through video conferencing: An impeccable video and audio transmission (Johnson et al. 2006; Romeo et al. 2012; Clarke 2015), as well as proper training for the users of the technology (Johnson et al. 2006; Lundgren 2012).

Though video-conferences resemble the use of classroom videos in teacher education to some extent, crucial differences remain (e.g. communication between trainee teachers, pupils, and teachers or live transmission). Further research is needed in terms of connecting video conferencing to collaborations in teacher education. Despite research on video conferencing in teacher education, little is known about the effects of this medium on trainee teacher’s professional development so far.

## **THE CONCEPT OF “THE CONNECTED CLASSROOM”**

The Leuphana University Lüneburg uses video conferencing to link schools and universities for a better integration of theory and practice within the learning process. Thus, students, lecturers, teachers, and pupils are able to learn together but do not need to travel.

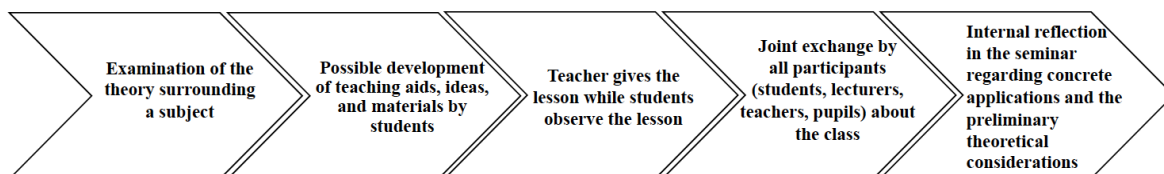
Working with video conferencing systems allows contextualized learning on the basis of concrete teaching situations possible for current and trainee teachers and lecturers. Schools and universities can digitally communicate with each other in real time. To do this, several technical components are required at each location. A functioning Internet connection is needed, along with video conferencing devices, as well as cameras and microphones. As can be seen in Figure 1, the microphones (the large device on the table in the picture on the right, and the small satellite microphones) can be flexibly distributed over tables, enabling far-reaching audio. The microphones can also be muted as required. The seminar participants can thus hear the sound in the classroom without disturbing the class when they discuss their observations. Speakers are required in both rooms to hear the sound.



**Figure 1:** Observation of a school class via video conferencing

There is a camera at each location. The university can control the camera in the classroom remotely so that particular groups of pupils, the board or the teacher can be observed. Monitors are also required at each location to receive the camera images. In school and university contexts, projectors or digital whiteboards are suitable and will often have been installed together with speakers. The seminar in Figure 1 (left) is using a digital whiteboard to observe the school class (right). The video conferencing system is portable and can thus be used in different lecture rooms at the university or classrooms in the school. The video conferences are not recorded for reasons of data protection and in order to reduce the inhibition of the participating teachers.

A possible working procedure with the video conferencing system may include the following steps (Figure 2): After the theoretical examination of a subject, the trainee teachers help shaping the class' content in developing new lesson ideas. Afterwards they coach the teacher based on their ideas who realizes these ideas in his class while the students watch via video conference (Figure 1). However, they do not interfere with the classroom activities. The joint reflection phase at the end involving all the participants (trainee teachers, lecturers, teachers and pupils) is one of the core elements of the video conference. The groups participating can ask questions, talk about the class from their own perspectives and provide feedback for all participants. A second reflection phase taking place only in the university seminar concludes the online session.



**Figure 2:** Possible procedure for working with video conferencing systems

The use of the video conferencing system has the following objectives:

1. *Building up trainee teachers' actionable knowledge:* Actionable knowledge is generated through the interaction between the implicit knowledge of teachers and the acquired theoretical educational-, background-, explanatory- and foundational-knowledge (Neuweg, 2011). This theoretical knowledge should apply not only as a "guide" for practice. Trainee teachers should rather learn to ask questions, to systematically observe classroom activities and to reflect on and recognize theoretical knowledge as a model that helps to understand reality (Neuweg, 2011).

2. *Understanding through the broadening of perspectives:* Through exchange between trainee teachers, lecturers, teachers and pupils various stakeholder perspectives are included into the reflection process. Limits of one's own observations can thus be overcome (Dlugosch & Werning, 2002; Vescio, Ross, & Adams 2008) and potential solutions to central issues include multiple stakeholder perspectives.
3. *Professional development of teachers and lecturer expertise:* The video conferencing system offers new opportunities for coaching and counselling to the teachers involved and can help them to optimize their own teaching. The teachers reflect on their classes together with trainee teachers and pupils and are introduced to the latest theoretical and empirical findings. In addition, the university lecturers have the opportunity to implement and evaluate theoretical knowledge in actual school settings.
4. *School development:* Through the video conferencing system rural schools can become involved in an innovation process.

### **WORKING WITH VIDEO CONFERENCING SYSTEMS BASED ON THE EXAMPLE OF THE SEMINAR "EVALUATION AND FEEDBACK IN MATHEMATICS CLASSES"**

Numerous studies have shown the instructional significance of feedback in mathematics and other subjects, and also identified a number of criteria for learning-conducive feedback (inter alia Bangert-Drowns, Kulik, Kulik, & Morgan, 1991; Hattie & Timperley 2007; Kluger & DeNisi 1996; Shute 2008). But these studies have also demonstrated that even experienced teachers have relatively little theoretical knowledge in this field (Besser, Leiss, & Klieme, in press). In light of this, the seminar subject "Evaluation and Feedback in Mathematics Classes" was chosen. There is a wealth of theoretical and empirical findings on this, which has so far only sporadically been applied in actual classrooms. Therefore, the subject is of importance both for the trainee teachers, as well as the practising teachers at the school.

The flowchart below for the 13 seminar sessions includes a total of three online sessions in which the seminar was linked to the school. Working with the video conferencing system it became apparent that both the content and organizational preparation of and reflection on such online sessions require a significant time commitment.

Session	Seminar form	Learning block	Content
1.			Organizational aspects and vision
2.	- School visit and meet-and-greet -		
3.	Theory reception	Design of written feedback	Criteria for learning-conducive written feedback

4.	Material development		Development of a feedback tool (formative assessment)
5.	Data evaluation		Application and evaluation of the developed tools
6.	VIDEO CONFERENCE		Return of the materials to the pupils
7.	Theory and material session	Design of class feedback situations on the example of classwork	Development of a situation for feedback on classwork
8.	Practice session		Teacher training regarding feedback on classwork
9.	VIDEO CONFERENCE		Analysis of the redesigned hour for the feedback on classwork
10.	Theory reception	Design of oral feedback as part of an autonomy-oriented learning environment	Individual feedback during the class
11.	Material development		Development of a learning environment for observing feedback “on the fly”
12.	VIDEO CONFERENCE		Observing teacher feedback in the learning environment
13.			Evaluation of and reflection on the seminar content/the seminars

**Table 1:** Flowchart of the seminar “Evaluation and Feedback in Mathematics Classes”

The cooperation in this seminar was a collaboration between a university seminar group and a fifth-year class at the school. Furthermore, an educational cooperation was implemented between teachers and university lecturers to discuss the current developments and upcoming objectives in the class or the seminars.

In order to overcome some of the learners’ reservations regarding online-based communication, the trainee teachers visited the pupils in the school at the beginning of the semester.

The subsequent seminar sessions, consisted of learning blocks (see flowchart) that were always conceptually structured in the same way (Theory-Material-Practice-Reflection). Therefore, the following exemplarily describes the first block:

*1. Subject block: Designing written feedback as part of formative assessment.*

The objective was for the trainee teachers to build up actionable teaching knowledge for everyday working life and for them to be able to give pupils written feedback conducive to their learning. To this end, the trainee teachers initially dealt with both the general pedagogical literature on feedback as well as the application of formative assessments in mathematics instruction (third session + homework<sup>2</sup>). In the fourth session, a diagnostic test to support the learning process was developed by students, as were elements of relevant feedback. The trainee teachers evaluated the diagnostics test in the fifth session after the



pupils worked on it in their mathematics class. The students each provided their individual written feedback. In the sixth session, the diagnostic tests were returned to the pupils by the teacher. The students observed this situation with the help of the video conferencing system. Together with the teacher, pupils and lecturer they discussed and reflected on the advantages and disadvantages of possible changes to the didactic tools, as well as the lesson itself. In the end, they discussed their findings in their seminar.

This seminar, as well as previous ones, was evaluated to validate the effects of the video-conferencing concept. These evaluations provide further insights on the views of trainee teacher's collaborations within a community of practice via video conferencing.

## IMPLEMENTATION OF THE ACCEPTANCE SURVEY

Based on the question "How do trainee teachers evaluate working with the video conferencing system?" two university seminars were evaluated.

The seminar groups consisted of 39 students (35 women / 4 men) from the Leuphana University Lüneburg who were trainee teachers in primary school, lower secondary school and middle secondary school education. All trainee teachers who worked with the video conferencing system in the seminar for the school subject of mathematics (N = 21) participated in the evaluation. The second evaluated seminar took place in the school subject of English. Of the 22 trainee teachers, only 18 were interviewed. The trainee teachers were in the second (N = 1), fourth (N = 20), sixth (N = 17) and eighth (N = 1) semester at the time of the interviews.

The trainee teachers were interviewed using guided interviews. The interviews took place at the end of the semester, as soon as the work with the video conferencing system was completed. The findings presented here are from the 2014 summer term. The length of the interviews varied from 17 minutes to around 55 minutes. The interviews were transcribed and inductively coded and evaluated according to the qualitative content analysis (Mayring 2014). To address the questions "How do trainee teachers evaluate working with the video conferencing system in terms of the seminar content?" and "What differences do trainee teachers identify in comparison to learning with classroom videos?", further statements are based on selected questions from the guided interviews.

Main subject	Questions
Concept of the video conferencing system	<ul style="list-style-type: none"> <li>• What do you think about the concept of the video conferencing system</li> <li>• What did you think about the video conferences?</li> <li>• What did you like about the video conferences?</li> <li>• What didn't you like about the video conferences?</li> </ul>
Advantages of the concept	<ul style="list-style-type: none"> <li>• What advantages does video conferencing offer trainee teachers?</li> </ul>
Video conferences and classroom videos	<ul style="list-style-type: none"> <li>• What is the difference between a video conference and classroom videos?</li> </ul>

- |  |   |
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|  | <ul style="list-style-type: none"> <li>• Which one do you think is better – video conferences or classroom videos?</li> </ul> |
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**Table 2:** Guided interview questions

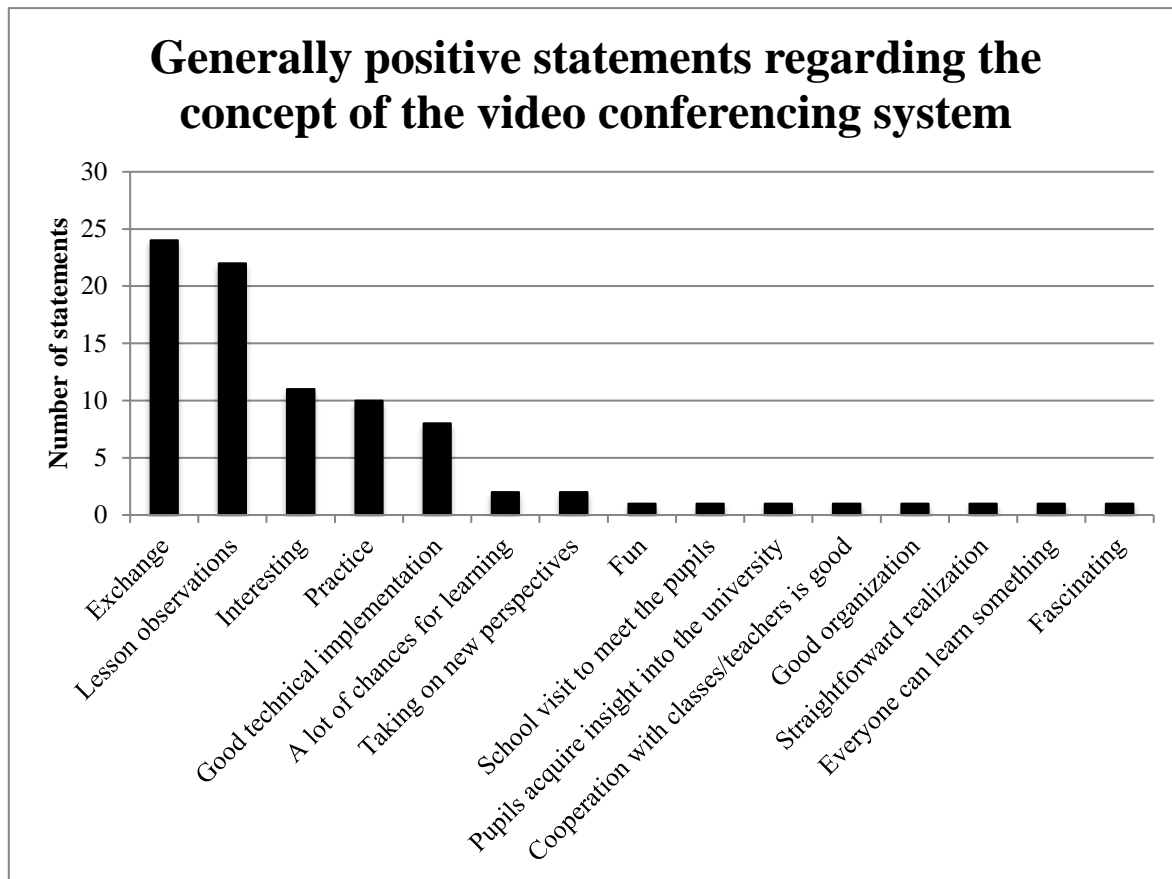
## RESULTS

In order to better understand how trainee teachers evaluate working with the video conferencing system, their views are structured according to the main topics presented.

### Concept of the video conferencing system

In response to the question “What do you think about the concept of the video conferencing system?”, 27 trainee teachers responded “Good” or “Very Good”. 7 of the trainee teachers stated that the concept is as a good idea, but not the actual implementation, and 2 students think the concept is “OK”.

The reasons given by the trainee teachers vary significantly. The following answers are more likely to be assigned to a negative area: 1 person each indicated that he could not relate to the pupils, that he thought there was too much “commotion” in the classroom or that he does not wish to participate in video conferences again; 2 persons doubted the advantages of video conferences or viewed them as insufficiently explicit; video conferences were unfamiliar to 3 trainee teachers and a further 3 hoped for better integration into the seminar; 13 persons mentioned the equipment as a problem because not all the action in the classroom could be observed using one camera only and the sound was not always up to scratch. However, 8 students were satisfied with the technical aspects. They pointed out that the option to turn off the sound in the seminar made internal communications possible.



**Figure 3:** Generally positive statements regarding the concept of the video conferencing system

In the sphere of generally positive statements, the key elements of video conferencing stood out. 22 trainee teachers highlighted learning through observations of a live classroom, while 24 emphasised the opportunity for exchange – here both the seminar-internal exchange and the subsequent reflection phase with the teachers and pupils were named – whereas 7 students hoped for more interaction. In the observation of real live teaching, it seems important, *“that one can generally peek inside the classroom and see how it actually runs”*. 3 students would have liked more observation tasks during the conference sessions. 8 students thought video conferences were boring, due to length:

*“We watched for an entire hour and I think perhaps it was too long [...] even as a student, one shuts off at some point”*

and teaching situations which had been observed:

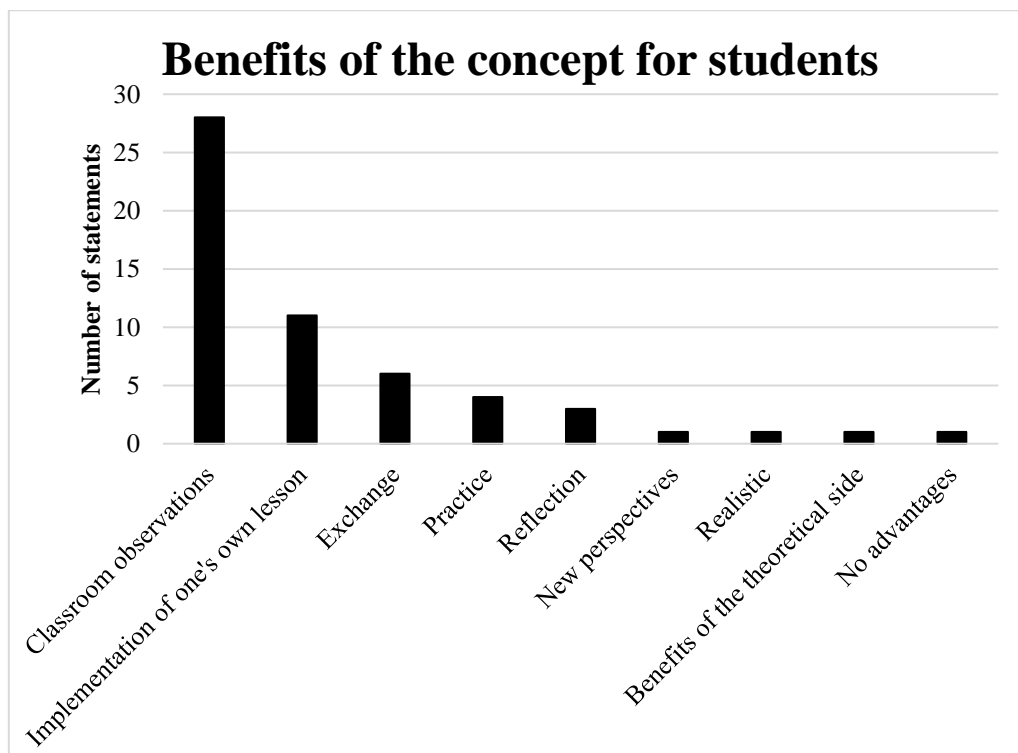
*“[...] at one point I frankly found it somewhat boring, because we were just sitting there while they were taking some kind of test.”*

However, 4 trainee teachers would like to have video conferences more regularly.

These responses demonstrate that excellent preparation for the video conferences seems to be crucial for meaningful acquisition of the seminar content. The teaching situations observed must be appropriate to the seminar content and include content-relevant aspects for the seminar. The involvement of all participants is a prerequisite so that joint reflection at the end of the sessions is meaningful for each participant's learning.

### Advantages of the concept

The trainee teachers viewed the classroom observations as an especially important advantage of the video conferences (Figure 4).



**Figure 4:** Benefits of the concept for students

Here, the trainee teachers mentioned various observation aspects that were important to them, such as classroom management, the conduct of teachers and pupils and teaching methods. In addition, 11 persons said that the monitoring of the implementation of their own lessons was important to them. For example, a trainee teacher answered:

*“Yes. Well, I thought it was pretty good to see this direct implementation. The fact that we had prepared the lesson [...] and then watched it implemented was really good. [...] yes and so you can really see that reality is not always a perfect construct, but can sometimes look quite different.”*

However, for many trainee teachers, the observations are not sufficient on their own. They are only useful if real teaching situations are shown, in which they are involved in the classroom activities themselves or in which an exchange takes place.

### **Differences between classroom videos and video conferences**

A total of 26 trainee teachers expressed their views on the question of whether they would rather watch classroom videos or participate in a video conference. 9 of these students reported that this depended on the aim; 2 persons preferred watching classroom videos, while 14 would rather participate in a video conference; and 1 trainee teacher viewed both options as equally good.

The trainee teachers' statements about the differences between video conferences and classroom videos can be divided into advantages and disadvantages of each media.

Trainee teachers particularly highlighted the advantages of video conferences. They saw them as more authentic than the classroom videos they had watched previously (13 persons). They highlighted mutual exchange (19 persons), their direct influence (8 persons) and the joint reflection sessions (5 persons). The immediacy of video conferences and the direct relationship they build with pupils and their teacher seemed to be important (7 persons). Some of the trainee teachers further indicated that one becomes more aware of errors, can empathize with teachers and cooperate with a school, that pupils quickly forget the camera and that one gets more from video conferences than from classroom videos (1 person).

Some said that the advantage of classroom videos is simply that a certain aspect can be observed (4 persons). However, this very point was also criticized by 2 trainee teachers. Another 2 students found the fact that you can watch classroom videos again and reflect on them to be positive; 1 person stated that classroom videos portray an "ideal example" of teaching, as the videos are better prepared and the teacher is less nervous, the camerawork is better and you have the ability to view the videos multiple times. 1 student criticized that this is not possible with video conferences. Also 1 person said the disadvantage of video conferences is that they are too long or boring and the trainee teachers are distracted in class, while 7 students said that a disadvantage of classroom videos is the fact that they do not believe the videos to be authentic or that classroom videos are only passively received. They lack the opportunities to get involved in the class and to communicate with teachers and pupils:

*"Yes. Well, as I said, you can interact with the teacher in video conferencing. You can talk to fellow students or the lecturer during the class and can actually reflect the entire time. And yes, these video sequences are often spliced together since [video conferencing; A/N] allows you to get up close with everything, including disruptions by pupils and so forth. You're in the middle of the action, while video sequences are often grouped under a particular topic with things cut out. I like the fact that you see the real situation."*

4 of the participants interviewed complained about the lack of context in classroom videos; 5 students said that they think classroom videos are outdated, and 1 student stated that they lack reflections and exchange. This comparison between classroom videos and video conferences demonstrates the specific advantages of video conferencing, namely that

learning is embedded into current contexts, in which exchange and direct, active influences are possible.

Though video-conferences resemble the use of classroom videos in teacher education, crucial differences remain. Working with our video-conferencing concept enables trainee teachers to jointly observe lessons and to communicate with teachers and pupils – before and after the lessons. Trainee teachers actively develop new teaching ideas and endeavour different concepts and methods. As the lessons are carried out by practising teachers, trainee teachers can reflect upon their ideas without the pressure to perform in a classroom. Furthermore, trainee teachers become part of a community of practice and solve actual challenges in collaboration with teachers, pupils and university lecturers. Such involvement and ownership may foster trainee teachers' actionable knowledge and support them to link theory and practice. To validate the effects of the video-conference concept, various seminars, including the one above, were evaluated by the trainee teachers.

## **CONCLUSION**

The goal of this article has been to demonstrate to what extent video conferences present a real opportunity to link theory and practice in teacher training – a statement also made by Kent & Simpson (2010) in their study about video conferencing in teacher education. In the theoretical chapter it has been shown that learning in real contexts and the exchange between trainee teachers and teachers in particular can be considered effective for the learning experience of the trainee teachers. This is where the concept of “The Connected Classroom” begins.

The video-conferencing concept enables trainee teachers to jointly observe lessons and to communicate together with teachers and pupils – before and after the lessons. Trainee teachers actively develop new teaching ideas and endeavour different concepts and methods. As the lessons are carried out by practising teachers, trainee teachers can reflect upon their ideas without the pressure to perform in a classroom. Furthermore, trainee teachers become part of a community of practice and solve actual challenges in collaboration with teachers, pupils and university lecturers. Such involvement and ownership can foster trainee teachers' actionable knowledge and support them to link theory and practice.

The study, in which the trainee teachers were meant to evaluate working with the video conferencing system, demonstrated that the trainee teachers recognized the advantages of video conferencing. They highlighted in particular the exchange between all parties, the lesson observations in real surroundings and the opportunity to implement one's own teaching ideas. However, it was also discovered that improvements need to be made. For example, the technical aspects have to function better and have to be adjusted in terms of what is observed and how the observation of tasks occurs. Other studies reach similar conclusions with respect to communication, collaboration and technical equipment despite differences in the use of video conferencing systems (e.g. Hu & Wong 2006; Johnson et al. 2006, Kent & Simpson 2010).

Classroom videos are a further tool to combine theory and practice and to promote the ability to reflect. As with classroom videos, lessons can also be observed via video conferencing. Although classroom videos have their specific advantages, video conferences enable a form of learning that goes beyond reflection. The study shows that trainee teachers often have greater regard for authentic classroom activities. They point out that they have a direct influence and can better understand the lesson – and thereby the seminar content – through their exchanges with teachers and pupils.

It must be noted that the use of the system and the planning of video conferences by the lecturers, the agreements between lecturers and teachers, and the behaviour of all parties, all have an impact on the implementation and evaluation of video conferences.

However, the study should only be used to identify positive and negative aspects of the video conferencing system, to improve the application of the concept. Thereby the survey nourishes a new concept to improve trainee teacher's actionable knowledge, professional development and collaborations with schools.

Suggestions for future research include the following. Based on the qualitative guided interviews already undertaken, further quantitative research could be developed to evaluate the system in terms of trainee teacher's professional development and third spaces in teacher education. It would be interesting to find out whether the professional vision (e.g. Goodwin, 1994; Stürmer, Könings, & Seidel 2014) of trainee teachers changes by working with the video conferencing system. It should also be determined what effects the video conferences have on practicing teachers' learning and lessons.

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