

Development approach to an action-oriented video-based measuring tool for professional competence in vocational teacher education

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This paper has not been published before, and all data was collect according to ethical clearances.

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1. Abstract

This paper represents a theoretical approach, aspects of its development, and the practical implementation for an innovative mode of assessing professional teacher competence in vocational teacher education.

University teacher training for vocational education almost exclusively builds up content and pedagogical knowledge, but this is only one facet of professional vocational teacher competence. University graduates often indicate during their transition to professional practice that they do not feel sufficiently prepared for the concrete, complex demands of teaching (Saas, Kuhn, & Zlatkin-Troitschanskaia, 2020). It can be assumed that this gap could be bridged by the targeted development of action-oriented competences. As a prerequisite for such a development, an instrument for the assessment of professional competence that is able to explicitly separate action-based (AC) from reflective competence (RC) (Lindmeier, 2011) facets may be needed. This instrument is probably needed to validate the existence of this gap, since the statement is based only on subjective estimations by students. Presumably this is related to the quality of teaching, which is proven to be effectively influenced in particular by focusing on depth structures (Lipowsky, 2015; Oser & Patry, 1990).

Video vignettes represent an instrument for the assessment of action-oriented competence facets in theoretical teacher training – at an early stage of training – that can otherwise only be observed in real lessons. Such an instrument does not yet exist for technical vocational disciplines. For this purpose, real-life lessons were videographed in a standardised way and divided into short (<2min.) sections in which specific quality criteria of the depth structure could be clearly identified and assigned either to the action-based or reflective competence facet. The basis for the development of these video vignettes is the Troitschanskaia model (Zlatkin-Troitschanskaia, Kuhn, Brückner, & Leighton, 2019), as a further development of Blömeke's PID model (Blömeke, Gustafsson, & Shavelson, 2015). For each video sequence, tasks are formulated that are aimed at mastering realistic teaching situations.

This work studies the suitability of the action-based model of professional competence, with regard to its objectivity and the operationalizability of the features for the development of video vignettes. To date, 21 video vignettes have been produced but show a large variance in the objectivity of evaluation ($\kappa_{RC} = .64$; $\kappa_{AC} = .47$).

In addition, the paper also examines how this tool can be integrated into an online environment for decentralised use in university teacher training.

2. Introduction

University education for the vocational teaching profession in Germany is intended to create the conditions for a successful transition to preparatory service (Saas et al., 2020). The aim is to develop the professional competence of future teachers. A frequent focus of empirical work is on professional knowledge as part of professional action or professional competence. However, the reduction of professional competence to just the knowledge facet (based on Shulman (1986) pedagogical knowledge (PK), technical knowledge (CK) and didactic knowledge (PCK)) seems to fall short. To solve practical problems in concrete teaching situations, prospective teachers feel unable to translate these knowledge components they have acquired during their studies into subsequent effective action. The national curriculum standards for teacher training at vocational schools (Kultusministerkonferenz [KMK], 2004) require that students be able to plan, implement and reflect on competence-enhancing (high-quality) teaching. These demands make it clear that the KMK assumes an understanding of professional competence that includes both knowledge elements and practical competences. However, this is not explicitly explained (Walker & Faath-Becker, 2019, p. 16). To date, university tutorials on teaching methodology for the vocational teaching profession have been focused almost exclusively on the planning of lessons (e.g., in the form of written elaborations on a fictitious teaching sequence). Until now, the students' competence to actually carry out lessons or to reflect on class interactions is being largely disregarded.

3. State of research and theoretical framework

The fields of action described and the resulting activity requirements give rise to three specific areas for examination: the professional competence of teachers, the quality of teaching and, on the technical part, video-based instruments to assess both aspects. The complexity of teaching is due, among other things, to the fact that personal, individual dispositions of both teachers and learners influence its course and, in particular, its effectiveness. This complexity has been modelled in the PID model by Blömeke et al. (2015) and competence structure model by Zlatkin-Troitschanskaia et al. (2019)) of both teachers and learners influence its course and, in particular, its effectiveness.

3.1 Professional competence

Lindmeier (2011) proposes a model for professional competence that meets the requirement to include both knowledge and action-related competence facets (**Error! Reference source not found.**). (Lindmeier, 2011). The professional knowledge of teachers with the above-mentioned components, based on Shulman (1986), stands alongside action-oriented professional skills. Competences are thereby understood in the sense of Klieme and Hartig (2007) as requirement-specific achievement dispositions and thus understood more broadly than the knowledge components (Lindmeier, 2013). Lindmeier's examinations of these teacher cognitions are also reflected in the analytical part of the PID model from Blömeke et al. (2015).

The knowledge components (**Error! Reference source not found.**, left) comprise the basic pedagogical content knowledge (PCK) and the content knowledge (CK), which form the basis of professional action. The competence components (**Error! Reference source not found.**, right) are again divided into a component of reflective competence (RC) and a component of action-related competence (AC). In this model, action-related

competence components are thus formulated as a component of professional competence (Lindmeier, Heinze, & Reiss, 2013). "Reflective competence" (RC) refers to the ability to cope with pre- and post-instructive

requirement situations on the basis of subject-specific basic knowledge (Lindmeier, 2013, p. 10). These are complex skills that are needed to draw conclusions from the reflection on lessons held and to prepare future lessons. "Action-based competence" (AC) refers to the ability of a spontaneous teacher reaction based on professional knowledge in teaching situations

under time pressure (Lindmeier, 2013, p. 10). Spontaneous means that an activation of reflective processes is not possible (Lindmeier et al., 2013, p. 106). These two characteristics represent the central difference to reflective competence.

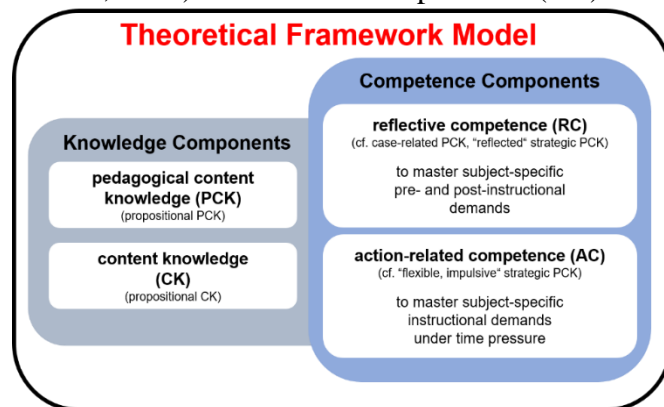


Figure 1: Competence structure model according to Lindmeier (2011)

Zlatkin-Troitschanskaia et al. (2019) draw on the Lindmeier model (2011) and distinguish between action-related and reflective competences. This holistic approach comprises two levels: a latent one with two areas (Figure , left: dispositions; centre: situation specific skills) and a manifest one (Figure , right: performance).

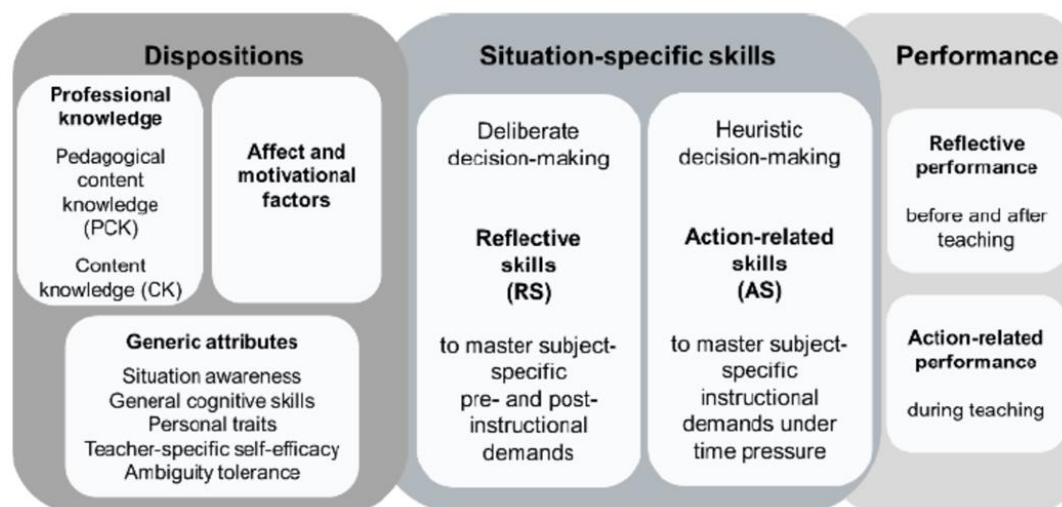


Figure 2: Competence structure model according to Zlatkin-Troitschanskaia, Kuhn, Brückner, and Leighton (2019)

According to Zlatkin-Troitschanskaia et al. (2019), dispositions of teachers (Figure , left, dispositions) include knowledge components (cf. **Error! Reference source not found.**, left) as well as generic characteristics and motivational factors as a basis for all teaching. According to this model, the quality of this teaching action is manifested in the reflective or action-based performance (Figure , right) of the teachers. This requires situation-specific skills (Figure , centre): on the one hand, the (direct) reaction of prospective and experienced teachers to real instruction (i.e., AS) (Figure , action-related skills) and, on the other, the ability to prepare and follow-up instruction (i.e., RS) (Figure , reflective skills) in the specific discipline (Zlatkin-Troitschanskaia et al.,

2019). This model thus focuses on those situation-specific skills in which university graduates themselves do not feel adequately prepared.

3.2 Quality of teaching

Teaching action always raises the question of the quality of these actions – regardless of a distinction between reflective (RC) and action-related (AC) competences. The consideration of the understanding of competence-enhancing or quality teaching can create a possible approach here. Following Berliner (2005), quality teaching represents the synergy of good and effective teaching. According to Berliner (2005), good teaching is characterised by the fact that it follows normative principles and current standards of the field. A second evaluation criterion for teaching is its effectiveness (Berliner, 2005). Teaching is considered effective when it achieves the desired goals.

According to Kunter and Ewald (2016), it does not make sense to view and evaluate lessons superficially, but always to include interactions that are not easy to evaluate at first glance as well as the role of learners and teachers. A meaningful conceptual distinction in this context – dating back to Oser and Patry (1990) – is that between the visual and depth structures of teaching (Kunter & Ewald, 2016). The visual structures of teaching are the easily accessible features of teaching that refer to superordinate structures and settings (Kunter & Ewald, 2016, p. 13). The depth structures represent the levels of interaction between teachers and learners and their quality. The quality of the interaction between the learners and the way in which the learners deal with the subject matter is therefore at stake (Kunter & Ewald, 2016, p. 14), irrespective of the overarching organisation of the learning situation. In empirical studies on the quality of teaching, the depth structures of teaching in particular have proven to be significant (Hattie, 2009; Seidel & Shavelson, 2007) (Kunter & Ewald, 2016, p. 13). Compared to the depth structures of teaching, the visual structures have proven to be less relevant for the effect of teaching (Kunter & Ewald, 2016). Lipowsky (2015) also categorises the subject by citing as quality characteristics the structured nature of teaching, clarity and coherence of content, feedback, cooperative learning, practice, cognitive activation, supportive learning climate and inner differentiation.

3.3 Video-based tools for measuring professional competence

Basically, there are various conceivable ways of capturing action-related competences as part of the professionalisation of prospective teachers during their studies, like through practical phases (effectiveness discussed controversially; e.g., König, Rothland, & Schaper, 2018) or forms of teaching simulation, such as microteaching or role plays (effectiveness proven; e.g., Hattie, 2009, p. 112, $d=0.88$).

Video vignettes (didactically integrated video segments/sequences) are a diagnostic approach that can be easily integrated into studies due to technological progress or digitalisation. They are also suitable for acquiring professional competence through an authentic depiction of the teaching reality – especially in the area of university teacher training (Riegel, 2013, pp. 14–15). The fact that the use of video vignettes can promote the skills of (prospective) teachers is well documented (at a glance, e.g., Hatch, Shuttleworth, Jaffee, & Marri, 2016). In recent years, increasing numbers of video vignettes have been produced for the continuation or reflection of teaching in general education (Seidel & Thiel, 2017). No video vignettes are currently available for the industrial-technical part of vocational (teacher) education (Riegel, 2013) (Walker & Faath-Becker, 2019). Internationally, worth mentioning is the approach of Darling-Hammond (2010), who, for example, has students of the teaching profession or trainees

analyse the videography of their teaching attempt in order to reflect on their lesson planning as part of the "Performance Assessment for California Teachers (PACT)". The focus in this context is on effective teaching and includes the development of students' competences (Darling-Hammond, 2010, p. 44).

3.4 An action-oriented model of professional competence

If one takes up the critical feedback mentioned at the beginning, this must be manifested in a model of professional competence as the basis for the development of video vignettes. Here, both the idea and understanding of professional competence (Blömeke et al., 2015; Lindmeier, 2011; Zlatkin-Troitschanskaia et al., 2019) of future teachers and the central aspect of teaching quality (Berliner, 2005; Kunter & Ewald, 2016; Lipowsky, 2015; Oser & Patry, 1990) must be taken into account.

On the basis of the above considerations, the approach of Lindmeier (2011) on subject-specific competences (competence structure model, **Error! Reference source not found.**) required for the preparation and follow-up of teaching (Lindmeier et al., 2013, p. 105), is an essential part of this theoretical framework. Accordingly, in line with the first objective, the question was which idea or understanding is the basis of the professional competence of future teachers. On the basis of the models presented, a model of teachers' professional competence was to be selected whose components

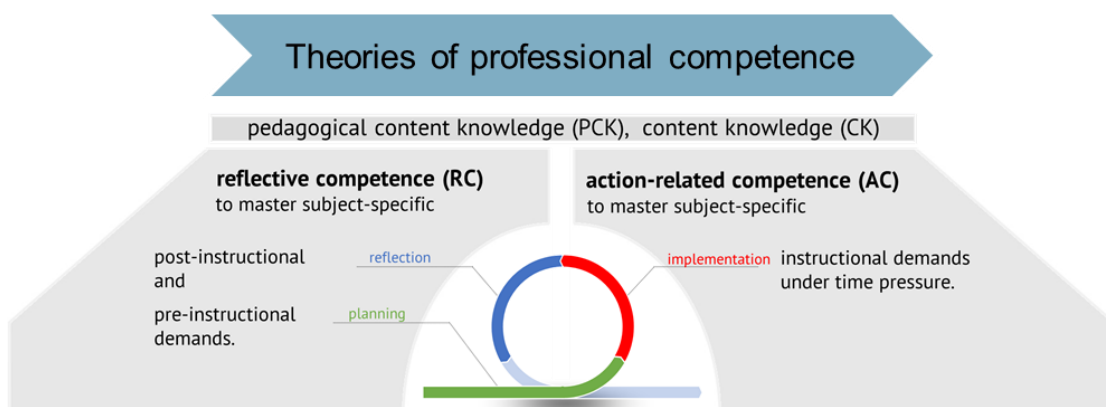


Figure 3: Action-oriented model of professional competence of Walker and Faath-Becker (2019) based on Zlatkin-Troitschanskaia, Kuhn, Brückner und Leighton (2019), Blömeke, Gustafsson und Shavelson (2015), and Lindmeier (2011)

reflect both the above-mentioned arguments regarding the training situation and the practical situation, as well as the requirements of the KMK. The action-oriented model shown in Figure **Error! Reference source not found.** is based on the work of Zlatkin-Troitschanskaia et al. (2019), Blömeke et al. (2015) and Lindmeier (2011). The elements of the PCK and CK (Figure , top centre) are summarised according to Lindmeier (2011) under basic knowledge (**Error! Reference source not found.**, left), while below they can be distinguished between two fields of competence. In the model by Zlatkin-Troitschanskaia et al. (2019), these competence components can be found under situation-specific skills. The ability to act under time pressure and make teaching decisions can be related to the delivery of instruction under the concept of action-based competence (Figure , right). For our model, action-based competence is defined as follows: Action-based competence refers to the ability of a teacher to react spontaneously and adequately based on professional knowledge (Lindmeier, 2013) and taking into account the dimensions of teaching (Lipowsky, 2015, pp. 77–94) in teaching situations under time pressure. Spontaneous means that an activation of reflective processes is not possible. With the other two phases, planning and reflection (Figure ,

left), the competence facet of reflective competence is linked. This is understood to mean coping with pre-instructional (planning) and post-instructional (reflection) teaching requirements (Lindmeier, 2011). Reflective competence is the ability to cope with pre- and post-instructional situations (Lindmeier, 2011) on the basis of subject-specific basic knowledge (Lindmeier et al., 2013, p. 106) and taking into account the dimensions of teaching quality (Lipowsky, 2015, pp. 77–94). These are complex skills that are needed to draw conclusions from the reflection of lessons held and to plan lessons (Lindmeier, 2011, pp. 106–107). Pre-instructional reflective competence refers to the ability to reflect the didactic design of instruction on the basis of subject-specific basic knowledge and the characteristics of teaching quality. Post-instructional reflective competence is defined as the ability to reflect on learners' learning processes and products, the quality of interaction between teachers and learners and their (re-)actions, and the methodological and organisational design of teaching based on the characteristics of teaching quality through class observation.

The second goal of the work – what is meant by competence-enhancing or quality instruction – is covered by the presentation of Berliner (2005). Following this idea, instruction is of high quality if it is good (by adhering to normative principles) and effective (by achieving the required competence goals). The distinction between visual and depth structure in class observation is important here. Above all, the characteristics of the depth structure proved to be characteristics of effective teaching and are operationalised by corresponding quality characteristics. In addition to class leadership, cognitive activation and constructive, Lipowsky (2015) emphasises, among other things, structured teaching, clarity and coherence of content, cognitive activation and informative feedback as quality characteristics (Lipowsky, 2015, p. 95). (Kunter & Ewald, 2016)

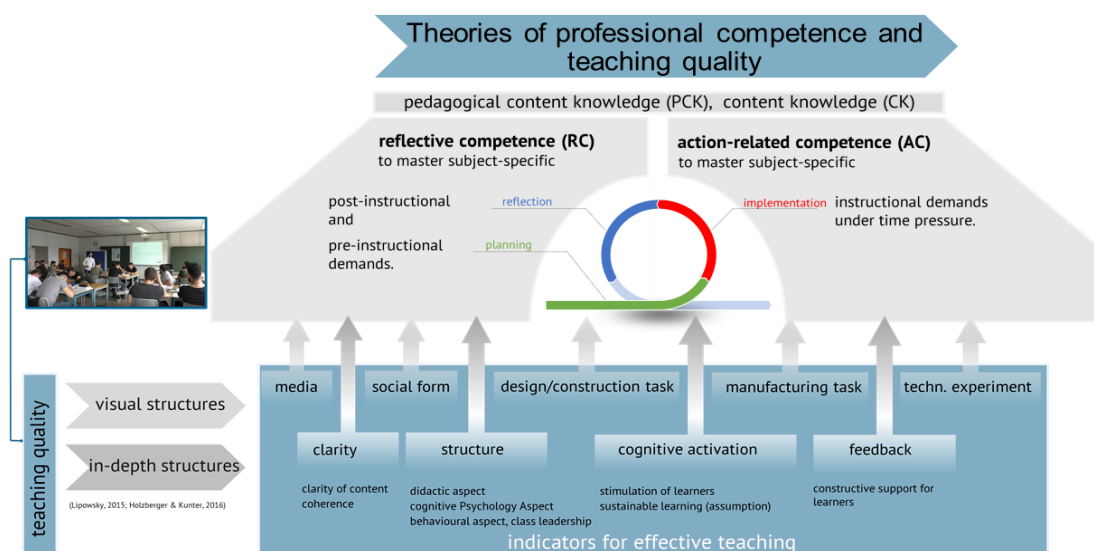


Figure 4: Action-oriented model of professional competence (Figure), combined with characteristics of teaching quality (Walker & Faath-Becker, 2019; translated from German into English)

Based on the models mentioned above and the idea of quality teaching, the action-oriented competence facets are now combined with the quality criteria of teaching (Figure). The characteristics of the depth structure in particular are seen as indicators of quality teaching, which can be related to the expression of the reflective and action-based competence facets as part of the professional competence of the (prospective) teachers. These exemplarily listed characteristics of the depth structure (Figure , below,

in the middle) are operationalised for a more detailed examination of the assessment of action-related professional competences in interaction with teaching quality in video vignettes. For this purpose, the respective feature definitions are related to concrete teaching situations in which actions can be observed and reflected upon or which can provide occasions for the active continuation of a teaching action. As an example of the characteristics of teaching quality, the feedback characteristic is considered in more detail here. First, a definition of feedback/constructive support is given on the basis of the above-mentioned literature: This dimension focuses on supporting learners with comprehension problems and creating a learning environment in which the interaction between teachers and learners is characterised by respect and appreciation (Kunter & Ewald, 2016, p. 16).

3.5 Development of a video-based instrument for the assessment of professional competence: video vignettes

In a first step, real lessons in the industrial-technical field of vocational training are recorded by means of standardised videography (Seidel & Thiel, 2017). For this purpose, student and teacher perspectives are each captured with a fixed camera as well as selectively interesting scenes with a moving camera, and separate microphones are used for teacher and learner. The evaluation objectivity of the criteria for capturing professional competence in this context is determined after the next step: The video recordings are then divided by trained observers into sections in which specific characteristics of teaching quality and the requirements of the RC and AC can be identified (Figure , centre) (Walker & Faath-Becker, 2019). From these video sequences video vignettes can be produced in the last step.

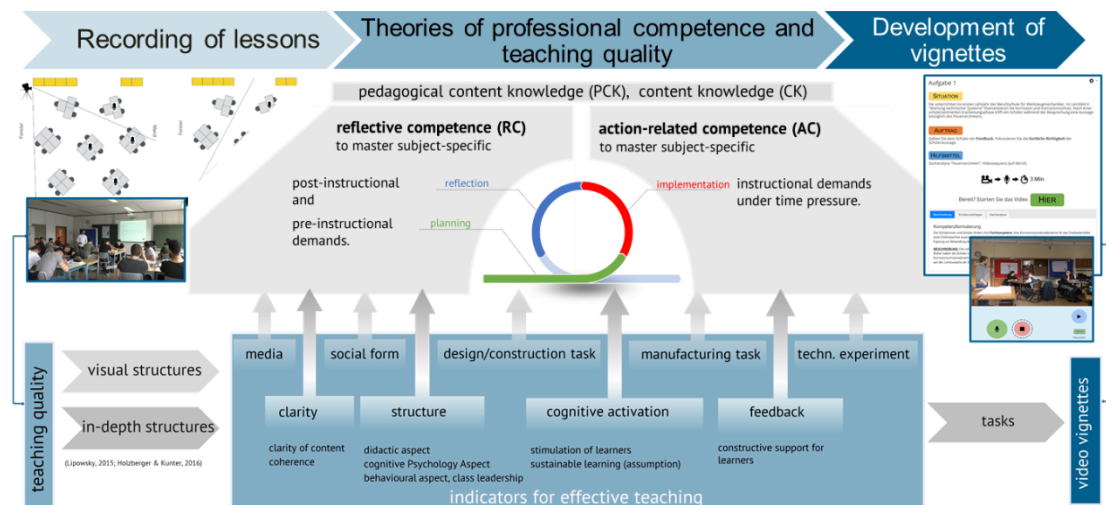


Figure 5: Overview of the development of video vignettes (Walker & Faath-Becker, 2019; translated from German into English)

So far, 21 vignettes have been identified from the recorded lessons and assigned to the two competence areas RC (13) and AC (8). For the above-mentioned characteristic "feedback", the corresponding definition was used as a basis and a targeted search was made in the video material for passages in which the designated actions could be observed either in terms of reflective or action-based competence. Thus, for example, the support of learners with comprehension problems is expressed in the fact that the teacher shows a corresponding reaction (AC) to a pupil's question by either answering directly, reflecting the question back to the class, putting the answer to the question back and referring to another process, or leaving the question as is without clarifying it.

So it is not yet a question of checking the quality of feedback given or evaluating it as positive or negative. Rather, sequences in the video material were selected for the mere occurrence of the feature and thus only perception – whether positive or negative – played a role. This characteristic is thus assessed purely from an observational and not a judgmental attitude. A suitable sequence can thus be selected both by the occurrence of the feature and the absence of an expected feature. The assessment and allocation of the observed actions to the features is carried out by two independent observers, in order to secure each of them against each other in a first step. The observations of both are examined with respect to the agreement in the assignment of the vignettes to the same characteristic of teaching quality regarding the associated competence area (AC or RC). Initial analyses of the objectivity of the evaluation show sufficient quality ($\kappa_{RC} = .64$; $\kappa_{AC} = .47$) with a simultaneous large variance between the vignettes (Walker & Faath-Becker, 2019, p. 18).

Finally, the vignettes are integrated into an online environment and enriched with additional materials. The following example shows the video vignette implemented on the online platform for action-based competence and the feedback feature. The introduction to the online environment is a brief description of the teaching situation (Figure , "situation" above). In addition, it is possible to view further planning documents for the lessons, such as essential information on the learning group, the classification in the curriculum and a reference to the subject content (Figure , left). Once the required information on the lessons has been obtained, the processing of the assignment can begin. In this example, a technically correct feedback on a pupil's answer is to be provided (Figure , above). Before the video is started, the editors of this action-based competence video vignette are informed that the editing must take place with an audio recording/voice output within a predefined period of time. After confirmation of the message, the video starts automatically and the editing time runs (Figure , right). Now it is possible to document one's own reaction orally, thereby providing technically correct feedback on the student's response within the given time. The recording is automatically saved (Walker & Faath-Becker, 2019, p. 18).

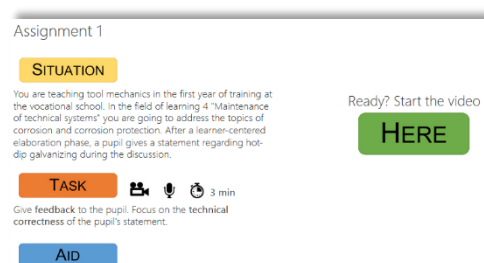


Figure 6: Start view of a video vignette in the online environment (Walker & Faath-Becker, 2019; translated from German into English)

4. Discussion and limitations

A video-based instrument for the assessment of "action-oriented" facets of professional competence was presented in the context of the article. This development took place on the theoretical basis of the models of Zlatkin-Troitschanskaia et al. (2019) and Lindmeier (2011), whereby the action-based competence facets focus in particular on the characteristics of competence-enhancing and quality teaching action. The generated video vignettes are based on real teaching. The video vignettes developed in this way (21 pieces) and the characteristics of quality teaching contained therein could be identified with satisfactory objectivity. The integration of the video vignettes into an online environment in which further information on the teaching situation (lesson plans, worksheets, specialist information, etc.) can be viewed completes the instrument.

To the authors' knowledge, the instrument presented here represents the first video-based instrument in the industrial-technical field of teacher training in Germany and Europe. The use of the instrument is not limited to diagnostic purposes: the identified video vignettes can be used to build up action-oriented competences within the framework of the studies or the second phase of teacher training. The focus on the characteristics of quality teaching obviously limits the meaningfulness of the instrument developed here, as only a part of the characteristics of quality teaching is depicted. The same applies to the construct of professional competence. Although, in comparison to other models of professional competence, "action-oriented" competence facets were integrated into the model, knowledge aspects remained only implicit in the instrument, that is, as a basis for teaching action. The video vignettes integrated into the instrument show real lessons, which have both negative and positive consequences. It should be positively emphasised that the teaching situations represented in the video vignettes depict authentic teaching in all its complexity. But this is also connected with the negative aspect. It is precisely this multidimensional nature of teaching that can lead to the fact that several characteristics of quality teaching of varying intensity occur in the video sequences and thus the construct to be captured is not exactly depicted (construct irrelevant variance (Downing & Haladyna, 2006; Haladyna & Rodriguez, 2013)). With the help of these online-based video vignettes, both the assessment as perspective and the development of professional competence can be authentically integrated into the teacher training course for vocational schools (Walker & Faath-Becker, 2019).

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