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The Potential of Video Vignettes to Promote Diagnostic Skills of Prospective Teachers at Vocational Schools

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Abstract

The ability to evaluate teaching situations effectively is a critical component of vocational school teachers' professional competencies, particularly in diagnosing students' learning difficulties and potential in heterogeneous classrooms. Inclusive diagnostics serve as the foundation for adaptive teaching and individualized support, highlighting the importance of fostering these competencies in teacher education. To meet these demands and provide practice-oriented training, video-based teaching and learning formats are gaining increasing importance. In this context, video vignettes have been identified as promising tools for bridging the gap between teacher education and professional practice. In this context, we developed video vignettes to enhance student teachers' professional vision and inclusive diagnostic competencies. In our exploratory study, we analyzed both (1) the current state and (2) the development of student teachers' professional vision regarding inclusive diagnostics through their engagement with video vignettes in teacher training. The findings indicate that while prospective vocational school teachers find the description of the scenarios depicted manageable, providing well-reasoned justifications for their decisions presents greater difficulty but shows improvement with continued engagement. Furthermore, measurable changes both in competencies and in self-efficacy related to cognitive, linguistic, and behavioral aspects, are observed over the course of vignette-based interventions. These results highlight the efficacy of video vignettes as a pedagogical instrument in advancing professional vision and inclusive diagnostic skills within the framework of teacher education programs.

Keywords Video vignettes · Teacher education · Professional vision · Pedagogical diagnostics · Competence development · Inclusion

Extended author information available on the last page of the article

Heterogeneity and Inclusive Education at Vocational Schools

Vocational education and training (VET) systems around the world serve a highly diverse student population. This heterogeneity is reflected in various dimensions, including students' educational backgrounds (Eiríksdóttir & Rosvall, 2019; Pasura, 2015; Smith & Yasukawa, 2017), linguistic and cognitive abilities (Itkonen et al., 2015; Konstantinidou et al., 2023; Smith & Yasukawa, 2017), and demographic factors such as age and gender (Eiríksdóttir & Rosvall, 2019; Pasura, 2015). Cultural and social influences further contribute to the diversity found within VET classrooms (Eiríksdóttir & Rosvall, 2019; Fine-Davis & Faas, 2018; Smith & Yasukawa, 2017). Additionally, VET systems can serve as an important pillar for the inclusion of vulnerable groups, such as students with special educational needs (Scharnhorst & Kammermann, 2020). Although VET teachers often value learner diversity (Smith & Yasukawa, 2017), it can also present significant challenges (Itkonen et al., 2015). Teachers are increasingly required to adopt flexible and responsive teaching strategies to address the diverse needs of their students (Nakar & Bagnall, 2024). These challenges can be particularly complex for novice vocational school teachers (Kärkkäinen & Tarnanen, 2022).

Although VET in Germany, particularly the dual vocational training system, has always been characterized by a heterogeneous student population (Vonken et al., 2022), this heterogeneity has increased in recent years (German Federal Ministry of Education and Research, 2024) and is expected to continue growing (Burda-Zoyke & Joost, 2023). For instance, the proportion of students with limited or no language proficiency in VET has risen, particularly in preparatory training programs, a trend partly attributed to refugee migration (Authoring Group, National Report on Education, 2024; German Federal Ministry of Education and Research, 2024). Moreover, the German VET system encompasses various school types (Authoring Group, National Report on Education, 2024; Hippach-Schneider et al., 2007).

In this context, our study examines prospective teachers at German vocational schools who face specific challenges in heterogeneous classrooms demanding inclusive education. This requires adaptive teaching supported by pedagogical diagnostics to assess students' strengths and weaknesses and provide tailored support (Lindmeier & Lütje-Klose, 2015; Sherin et al., 2008). While diagnostics are central to teaching professionalism (Klug et al., 2012), teachers often lack skills to effectively manage heterogeneity, support students, and conduct inclusive diagnostics (Biederbeck & Rothland, 2017).

Addressing these gaps is essential in teacher training, as highlighted by Buchner et al. (2021), who identify insufficient emphasis on inclusion-related topics, such as individualized learning, as a barrier to fully inclusive education. Promoting diagnostic competencies and teaching skills, especially student support (see Praetorius et al., 2018, 2020), is therefore a critical priority for fostering inclusivity in VET. Therefore, it is important to enable (student) teachers to deal with heterogeneity. It is assumed that factors such as teachers' self-efficacy and their attitude towards inclusion influence inclusive teaching practice (Wray et al., 2022).

In addition to self-efficacy, professional vision—the selective perception and interpretation of classroom events by teachers (Van Es & Sherin, 2002)—is linked

to higher teaching quality and enhanced student learning outcomes (e.g., Kersting et al., 2012; Roth et al., 2011; Sherin & Van Es, 2009). As professional vision is domain- and context-specific (Holodynski & Meschede, 2022; Van Es & Sherin, 2002), teacher training must provide authentic, real-life learning opportunities. Video-based formats, particularly video vignettes, are recognized as effective tools for fostering professional competencies, especially professional vision, in teacher education (Gaudin & Chaliès, 2015). Video vignettes depict selected teaching situations in short video sequences, encouraging (prospective) teachers to reflect on and analyze them. This approach has proven successful in Germany's VET system, where video vignettes have been used to enhance professional vision, address heterogeneity, and promote diagnostic competencies (e.g., Enenkiel et al., 2022).

Against this backdrop, we developed video vignettes specifically designed for vocational school settings, focusing on the domain of business and administration. Our exploratory study aims to foster a specific competence dimension: professional vision related to inclusive diagnostics. This topic has been insufficiently addressed in both research and practice concerning video vignettes, highlighting a pressing practical need and a significant research gap. Although there is growing interest in professional vision, the conditions necessary for successfully developing such skills remain underexplored and are described as a persistent research gap (Holodynski & Meschede, 2022). Based on these considerations, our research questions are as follows:

- (1) How can the professional vision of prospective vocational school teachers regarding inclusive diagnostics be characterized?
- (2) Can the use of video vignettes promote prospective teachers' self-efficacy and professional vision on inclusive diagnostics?

Theoretical Background

Inclusive Diagnostics and Professional Vision

Inclusive education requires adaptive teaching supported by a specific form of pedagogical diagnostics to address the diverse needs and potentials of all learners (Lindmeier & Lütje-Klose, 2015; Sherin et al., 2008). We call this inclusive diagnostics in a broad understanding (Burda-Zoyke et al., 2025). This construct refers to pedagogical diagnostics (Ingenkamp & Lissmann, 2008), inclusive diagnostics (Schäfer & Rittmeyer, 2015, 2021; Simon & Simon, 2014), and didactical diagnostics (Prengel, 2016).

(Inclusive) pedagogical diagnostic activities are a core responsibility of teachers (Edelenbos & Kubanek-German, 2004; Vogt & Rogalla, 2009). Broadly defined, pedagogical diagnostics describes a wide range of diagnostic activities through which the prerequisites for learning and teaching processes of individual learners and learners in a group or class are assessed, learning processes are analyzed, and learning outcomes are assessed in order to optimize individual learning by informed pedagogical decisions, such as individualized support (Aufschnaiter et al., 2015;

Ingenkamp & Lissmann, 2008; Schrader, 2013). This diagnostic function becomes particularly important in the context of inclusive education, where the focus lies on addressing the diverse needs and potentials of all learners.

Within this theoretical framework, we follow a broad understanding of inclusive diagnostics (Burda-Zoyke et al., 2025) as the process of gathering information on students' needs, potential, and resources to support their learning and development. Unlike narrower approaches focused solely on students with special needs, inclusive diagnostics applies to all learners and can be implemented at individual, group, or class levels. While the focus is on learning processes, prerequisites and outcomes may also be considered. Inclusive diagnostics gather data on students employing both quantitative and qualitative methods, with an emphasis on semi- or non-formal dialogical approaches co-constructed with students, integrating the individual, their environment, and interactions. In summary, inclusive diagnostics refers to diagnostic practices aimed at systematically assessing students' individual learning prerequisites, strengths, and potential barriers—particularly within diverse and heterogeneous classrooms. Rather than focusing on the identification of deficits for the purpose of selection or categorization, inclusive diagnostics embraces a resource-oriented and participation-centered approach, thereby informing inclusive teaching strategies and the design of adaptive learning environments.

Teachers require advanced professional competencies to manage these complex tasks, as research highlights the significant impact of teacher expertise on students' learning processes and outcomes (Hattie, 2008; Hill & Chin, 2018; Seidel & Shavelson, 2007).

Within VET research, various definitions of professional competencies of vocational teachers exist. A common understanding emphasizes that competencies are developmental and situated, meaning they can be learned and must be acquired within context (Antera, 2021). Diagnostic knowledge and skills are integral to teachers' pedagogical content knowledge (PCK, e.g., knowledge about common misconceptions of students) and pedagogical knowledge (PK, e.g., knowledge about developmental psychology and diagnostic methods) (Shulman, 1986). Furthermore, content knowledge (CK) is required to accurately identify and interpret subject-specific learning difficulties, particularly in performance-heterogeneous groups. In addition, inclusion-related beliefs play an important role in inclusive teaching including pedagogical diagnostics (Miesera, 2018). Teacher competence can be viewed as a continuum, ranging from dispositions (cognition, affect, and motivation) to performance, with intermediate steps in between called situation-specific skills or professional vision (Blömeke et al., 2015). These skills are crucial, as they are closely associated with teaching quality and student learning outcomes (e.g., Kersting et al., 2012; Roth et al., 2011; Sherin & Van Es, 2009).

Professional vision, in teaching, refers to the selective perception and knowledge-based interpretation of relevant classroom events (Goodwin, 1994; Van Es & Sherin, 2002). It comprises two interrelated components: noticing and reasoning. Noticing involves distinguishing relevant from irrelevant events in complex environments and focusing attention on the former. Reasoning entails categorizing these events using prior knowledge to reach valid conclusions (Seidel & Stürmer, 2014; Sherin et al., 2008; Van Es & Sherin, 2002). Some authors suggest a third component: generat-

ing alternative actions. This involves evaluating possible responses and making a well-founded decision on the appropriate course of action (e.g., Santagata & Guarino, 2011). To further specify the processes involved in professional vision, Barth (2017) developed a comprehensive six-stage model that expands upon the commonly identified components (Fig. 1). The first step is (1) the acquisition of professional knowledge. This is followed by (2) recognizing (noticing) and (3) assessing (reasoning), the two steps commonly included in existing models. In addition, Barth places particular emphasis on professional action, expressed through (4) the generation of alternative courses of action, (5) deciding on a course of action, and (6) its implementation. The author confirms her hypotheses that correlations exist among step 1 (Knowledge Acquisition), step 2 (Recognizing), and step 3 (Assessing), proposing that recognition is a prerequisite for assessment and that knowledge acquisition underpins both. Correlations among the remaining steps are not examined. In our study, we adapt this model to the context of inclusive diagnostics in heterogeneous classrooms. This means that prospective teachers are expected to specifically recognize and describe aspects related to heterogeneity and learning barriers that may indicate the need for inclusive diagnostics (Step 2); to assess whether diagnostics is necessary and determine its appropriate focus (Step 3); to generate possible diagnostic measures—including method, object, and objectives (Step 4); and finally, to make a well-reasoned decision about which diagnostic approach to pursue (Step 5).

Notably, we conceptualize professional knowledge not as a separate step, but as a cross-cutting dimension influencing all stages (Burda-Zoyke & Joost, 2023).

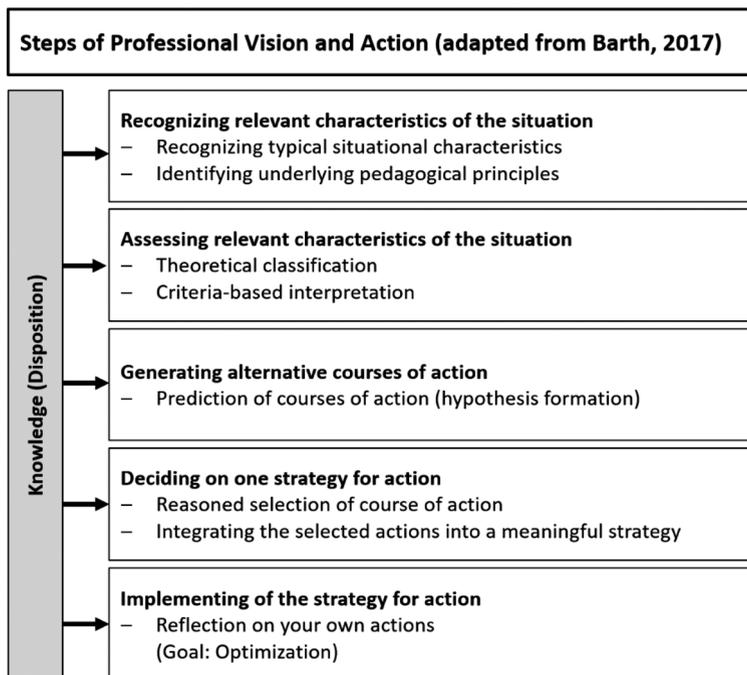


Fig. 1 Steps of Professional Vision and Action (own illustration based on Barth, 2017)

A high level of professional vision is associated with improved teaching quality and student learning (e.g., Kersting et al., 2012; Roth et al., 2011; Sherin & Van Es, 2009). This holds true especially for the generation of alternative courses of action (Step 3), which Kersting et al. (2010) hypothesize to be a measure of teachers' knowledge that can actually be used in real-life teaching situations. So, professional vision can be regarded as a highly relevant skill for teachers and an integral part of teacher training (Seidel & Stürmer, 2014). Nevertheless, professional vision is oftentimes difficult for novices like student teachers and improves over the course of their studies (Keppens et al., 2019). Barth (2017) highlights these learning needs by contrasting expert and novice teachers, showing that prospective teachers display deficits across all facets of professional vision—particularly in generating alternative instructional responses, which requires anticipating different courses of action. Santagata and Guarino (2011) attribute this difficulty to their limited professional knowledge. Nevertheless, the authors emphasize the importance of this skill and present an intervention using various types of videos, including classroom scenes from third parties as well as recordings of the future teachers themselves, after which the participants demonstrated higher-quality noticing and reasoning. Additionally, some participants were able to generate more alternative courses of action. There already have been several successful short-term interventions to foster professional vision using video-based learning arrangements (e.g., Koschel & Weyland, 2020; Van Es & Sherin, 2002). Nevertheless, as Koschel and Weyland (2020) stated, deeper insights are needed into how video vignettes can be effectively used to develop professional vision in addressing heterogeneity within vocational education settings.

Use of Video Vignettes in Teacher Education

Case-based instruction is a teaching method that engages students in actively reflecting on real or hypothetical problems typical of the discipline. The problems tend to be more vivid and contextual than those in a textbook, yet more manageable than those in reality (Shulman, 1992, as cited in Ertmer & Russell, 1995, p. 24), what makes the method suitable for novices (Syring et al., 2016). It is frequently used in teacher education, also to take account of increasing heterogeneity in the student body, and has many advantages (Darling-Hammond & Hammerness, 2002; Mostert, 2007). For example, case work can strengthen theory-practice linkage, self-efficacy of student teachers and critical reflection on one's own actions (Darling-Hammond & Hammerness, 2002). It has not been clearly proven whether it is more effective than other approaches, but there are studies speaking in favor of that (e.g., Baier et al., 2021). There are various ways to present a problem-oriented case, e.g. in text form or as a video. Both approaches are used regularly, but video cases have a significant advantage, namely their motivating effect (Syring et al., 2016). They also seem to enable more transfer than text cases (Moreno & Valdez, 2007). Typically, approaches to promote professional vision include video clips of classroom situations. These can be integrated into a wide variety of didactical settings, for example video clubs, meaning practicing teachers meeting frequently to watch and discuss video excerpts from each other's classrooms (Sherin & Van Es, 2009) or short video sequences, called video

vignettes, that are discussed with student teachers in university seminars (Krumphals & Feser, 2025).

Video vignettes present teaching situations to (prospective) teachers as prompts for reflection (Bloor & Wood, 2006; Hughes & Huby, 2002; Teese et al., 2020). They offer several advantages, including practical relevance, situativity, authenticity, and contextuality, while simplifying real-life complexity by focusing on specific aspects, making them particularly manageable for novices. Despite this reduction in complexity, video vignettes are generally perceived as realistic representations of classroom scenarios. Additionally, they eliminate immediate pressure to act and allow repeated viewing or analysis from different perspectives as needed (Lenske et al., 2022; Lindmeier, 2013; Miller & Zhou, 2014; Pauli & Reusser, 2006; Seidel, 2022).

The selection of the type and the specific videos always depends on the intended learning objectives (Adamina, 2022; Blomberg et al., 2013). A distinction is made between various aspects, e.g., whether (1) own or third-party teaching videos are analyzed (e.g., Junker & Holodynski, 2022), (2) the videos show real situations or acted scenes (Piwowar et al., 2018), (3) the videos show best, worst or typical practice (e.g., Blomberg et al., 2013) and (4) which cinematic perspectives and foci are chosen (e.g., Gröschner, 2021). In our study we use staged videos with professional actors, in contrast to real classroom situations. Although this could possibly reduce their authenticity, it has several advantages: researchers as well as teacher trainers have full control over the scripts and therefore can address all the most important and pressing issues while at the same time ruling out distracting factors. Steffensky and Kleinknecht (2016) conclude, based on their analysis of several studies, that videos featuring others tend to allow for a more critical analysis, particularly of problematic situations, including the development of alternative courses of action, which was of great importance in this study. Additionally, the quality of the videos regarding sound and lighting can be higher and full data protection of teachers and students in potentially sensitive situations can be always ensured. For some video vignettes, accompanying materials (e.g. tasks for analysis, in-depth material on the lesson shown, etc.) are provided in addition to the video clip (e.g., Burda-Zoyke & Joost, 2023).

There has been extensive proof in literature that professional competencies and specifically professional vision can be measured (Keppens et al., 2019) and fostered using video vignettes in teacher training, including the context of dealing with heterogeneity (Anast Seguin & Ambrosio, 2002; Koschel & Weyland, 2020; Reuker & Künzell, 2021) and regarding diagnostic skills (e.g., Enenkiel et al., 2022).

State of Research on Video Vignettes Dealing with Heterogeneity or Inclusion in Teacher Education

In recent years, there has been a marked increase in the use of video vignettes in teacher education (Gaudin & Chaliès, 2015; Holodynski et al., 2022). The following section provides a concise overview of a systematic literature review investigating the use of video vignettes in the context of inclusion and/or heterogeneity in school

education. A total of 22 relevant studies were identified (see Table 4 in the appendix).¹ Most studies addressing the use of video vignettes in the context of teacher education and classroom heterogeneity or inclusion have been conducted in recent years, reflecting the growing integration of video-based formats in higher education. With one exception from Belgium, all studies originate either from the United States (five studies) or Germany (16 studies). This distribution is not surprising, as the high number of German studies can be attributed to several national funding initiatives that actively promoted the use of video vignettes².

All these studies examine student teachers. Most studies concentrate on general education, specifically on primary (Anderson & Lignugaris/Kraft, 2006; Böhme, 2022; Geisen & Zender, 2024; Keppens et al., 2019) or secondary education (Buddeberg et al., 2022; Grewe & Möller, 2020; Hörter et al., 2020; Jürgens & Neuber, 2020; Meurel & Hemmer, 2020; Winter & Junker, 2020) or on a mixture of those (Abels et al., 2022; Enenkiel et al., 2022; Franz et al., 2019; Kramer et al., 2017; Kuntze et al., 2024). Few studies focus on (Baecher & Connor, 2010) or include (Enenkiel et al., 2022; Franz et al., 2019; Kramer et al., 2017; Kuntze et al., 2024) special needs education. Some studies do not specify exactly what type of school the videos are from or what school the student teachers are training for (Anast Seguin & Ambrosio, 2002; Greenfield et al., 2016; Holdbrooks Townsel, 2016; Langer et al., 2022). However, very few studies focus on (Koschel & Weyland, 2020) or at least include (Kramer et al., 2017) the context of VET, it appears to be underrepresented.

Regarding the video vignettes used, most studies rely on videos featuring third persons. Two studies additionally (Abels et al., 2022) or exclusively (Baecher & Connor, 2010) work with student teachers' own videos. Most studies employ videos of real teaching situations. One study uses staged videos (Anast Seguin & Ambrosio, 2002), another one combines both forms (Anderson & Lignugaris/Kraft, 2006). Other exceptions are a study with cartoon vignettes (Kuntze et al., 2024) and one with interview situations as content of the vignettes (Greenfield et al., 2016). Not all authors state explicitly what exactly is shown in their videos or how they were produced. Similarly, there is often no information about the accompanying materials used.

¹ For the literature search, we used EBSCO and Google Scholar with the search terms “teacher education” OR “teacher” AND “inclusion” OR “diversity” OR “heterogeneity” AND “video vignettes” OR “video”. The search terms were used in German and English. Additionally, the database of the German Initiative “Qualitätsoffensive Lehrerbildung” particularly in the category “Heterogenität/Inklusion” (heterogeneity/inclusion) and, the bibliographies of the studies found were checked for further suitable literature. Papers with no empirical data were excluded.

² Eight of the identified projects are part of the German initiative “Qualitätsoffensive Lehrerbildung” six of which stem from the project Dealing with Diversity. (“Quality Initiative for Teacher Education” [QLB] is a large-scale funding program launched by the German Federal Ministry of Education and Research in 2014. Its aim is to improve the quality and coherence of teacher education across universities in Germany. The initiative supports projects that strengthen the integration of subject-specific, pedagogical, and practical components of teacher training—often with a strong focus on inclusive education, heterogeneity, and digitalization.) In addition, two studies were conducted within the InkBi 1 funding program, also supported by the German Federal Ministry of Education and Research, while two further projects are part of coReflect@math, an Erasmus + initiative funded by the European Union.

Most of the studies examine the development of student teachers' competence (Abels et al., 2022; Anast Seguin & Ambrosio, 2002; Anderson & Lignugaris/Kraft, 2006; Enenkiel et al., 2022; Grewe & Möller, 2020; Hörter et al., 2020; Jürgens & Neuber, 2020; Koschel & Weyland, 2020; Kramer et al., 2017; Meurel & Hemmer, 2020; Winter & Junker, 2020) or attitudes (Baecher & Connor, 2010; Greenfield et al., 2016). Some exclusively aim to measure competencies (Buddeberg et al., 2022; Kuntze et al., 2024; Steinert & Jurkowski, 2023) whereas the remaining studies focus on testing a theoretical construct or a vignette-based test instrument (Böhme, 2022; Franz et al., 2019; Geisen & Zender, 2024; Holdbrooks Townsel, 2016; Keppens et al., 2019; Langer et al., 2022). Several studies report increases in student teachers' competence over time. Such studies often take place as part of a teacher training seminar (Enenkiel et al., 2022; Grewe & Möller, 2020; Hörter et al., 2020; Jürgens & Neuber, 2020; Koschel & Weyland, 2020; Kramer et al., 2017; Meurel & Hemmer, 2020; Winter & Junker, 2020). In addition to professional vision (Hörter et al., 2020; Jürgens & Neuber, 2020; Koschel & Weyland, 2020; Meurel & Hemmer, 2020), which is often the target of vignette-based training, pedagogical knowledge (Kramer et al., 2017) as well as diagnostic (Enenkiel et al., 2022; Winter & Junker, 2020) and analytical skills (Abels et al., 2022; Anderson & Lignugaris/Kraft, 2006), among other concepts, are considered.

No study reported that the targeted competence could not be promoted. However, it can be assumed that unsuccessful projects may not be adequately reflected in the literature, i.e. there may be a publication bias. Nevertheless, the high number of (successful) projects in this area certainly points to diverse potential that has not yet been sufficiently exploited, particularly in VET.

Research Design

Design of Video Vignettes

While developing and evaluating the video vignettes, we followed the approach of Design-Based Research (DBR). DBR, as outlined by McKenney and Reeves (2019), is a practice-oriented research approach particularly well suited for innovation and inquiry in teacher education. It aims to bridge educational theory and practice by addressing authentic challenges in teacher training—such as the development of inclusive diagnostic competencies. The process begins with the analysis of a concrete problem in the educational practice of prospective vocational school teachers, followed by the design and development of a targeted solution. Through iterative cycles of implementation, evaluation, and refinement in real-world settings, DBR leads to both practical improvements (e.g., in teacher education) and theoretical contributions. Its core characteristics include an interventionist focus on designing and studying solutions for real-world challenges; an iterative structure involving multiple design and testing cycles; a dual orientation toward theory and practice; and a strong emphasis on contextualization—, in our study the research takes place in authentic vocational education environments in close collaboration with student teachers, teacher educators, and other stakeholders. As part of this, we worked closely with

pedagogical practitioners such as teachers at vocational schools and other experts such as school psychologists in creating video vignette-based materials and improving them in several cycles. All participating experts possess extensive professional experience. The VET teachers were nominated as subject-matter experts by their respective school principals and contributed valuable insights from a practical teaching perspective. Their expertise is complemented by additional professionals with specialized knowledge in the areas of inclusion, diagnostics, and individualized support. After an intensive literature review, interviews with VET experts (VET teachers, special educators, school psychologists) were conducted on inclusive diagnostic tasks at inclusive vocational schools and the skills required in this context. The insights gained from these two sources were the basis for the selection of the teaching situations depicted in different (in total eleven) vignettes. The various vignettes depict authentic classroom interactions and are designed to reflect the full spectrum of VET schools in Germany, with a particular focus on the commercial sector. For this reason, vignettes show learning situations in training preparation as well as in the German dual apprenticeship system (training in several training occupations, that take place in two learning sites: vocational schools and training companies) and in full-time school-based training (various qualification levels). Additionally, in designing the vignettes, we focused on three dimensions of heterogeneity—cognition (e.g., prior knowledge, misconceptions, educational background, learning strategies), language (e.g., German as a second language, use of language registers and technical terms), and behavior (e.g., attention span, concentration difficulties, restless behavior, frustration tolerance)—which, as a literature review and expert interviews with teachers have shown, proved to be important at vocational schools (Burda-Zoyke et al., 2025).

Each vignette consists of a video clip accompanied by extensive supporting materials, such as lesson-related documents (e.g., worksheets and students' work) and contextual information that situates the scene within the curricular and teaching context. These materials serve to improve the understanding and contextualization of the teaching situation, and the behavior depicted. Their design strives to be realistic and to contribute to the representation of the situation in its complexity without causing cognitive overload.

The following describes the content of a vignette as an example (Fig. 2). The vignette depicts a scene from a class training for the occupation of wholesale and foreign trade clerks, focusing on heterogeneity in prior knowledge (cognitive dimension). Within the curriculum, the activity is embedded in the learning unit "Processing Orders in a Customer-Oriented Manner". Following the teacher's introduction of the task, students work individually to prepare a commercial invoice based on infor-



Fig. 2 Insights into a video clip

mation provided in an email. During this phase, two students discuss various forms of discounts, while another, Niclas, appears disengaged, playing with a pen and looking around. The teacher notices both situations and prompts the students to refocus on the task. The worksheets of different students are filled out to different extents, which indicates different levels of prior knowledge. For instance, Niclas's worksheet indicates deficits in commercial arithmetic, potentially suggesting broader performance issues or a possible case of dyscalculia, and thus provides a diagnostic cue for the teacher. As part of the vignette, alongside the video clip, prospective teachers receive supplementary materials: the task instructions, a blank worksheet, the partly completed worksheet from Niclas, and a model solution. They are instructed to watch the video clip and examine the accompanying materials.

To ensure the suitability of the vignettes, experts³ were asked to assess them in interviews ($n=15$) before we used them with prospective teachers in university teacher training. Most experts regard the video clips and accompanying materials as generally realistic. The vignettes are viewed as an effective starting point for discussions on inclusive diagnostics and for gaining insight into inclusive diagnostic methods. The experts' suggestions for improvement led to minor revisions of the materials.

Further data on the evaluation of the vignettes regarding their degree of reality and suitability was collected from student teachers in the process of working with the vignettes using questionnaires with closed and open questions ($n=71$; age: $M=24.91$, $SD=3.20$; 42 female, 26 male, 3 not specified; 28 Master, 38 Bachelor, 5 not specified) and qualitative semi-structured interviews ($n=20$). The mean scores for nearly all items exceed 3 on a 4-point Likert scale (1 = lowest, 4 = highest) indicating the suitability of the vignettes: Most prospective teachers perceive the video clips ($M=3.37$, $SD=0.67$; "*The video clip shows a realistic teaching situation*") and the accompanying materials ($M=3.36$, $SD=0.58$; "*The accompanying materials are realistically designed*") as overall realistic. Working with the video vignette is rated rather positively by the majority. Foremost, the student teachers see it as "*a suitable basis for discussing inclusive diagnostics*" ($M=3.42$, $SD=0.50$) and "*a suitable tool to learn about inclusive diagnostic approaches in the classroom*" ($M=3.34$, $SD=0.51$). Furthermore, the prospective teachers on average (tend to) agree that working with the vignette has increased their awareness of inclusive diagnostics ($M=3.24$, $SD=0.63$; "*Working with the video vignette has raised my attention regarding inclusive diagnostics in the classroom*") and that they have recognized inclusive diagnostic needs that they would not have identified otherwise ($M=2.97$, $SD=0.67$; "*Working with the video vignette has helped me to identify inclusive diagnostic needs in the classroom that I would not have noticed otherwise*").

Due to their overall suitability, the vignettes were used in university teacher training to promote diagnostic skills and professional vision.

³ As experts, we consulted teachers and other professionals, all from VET (e.g., special educators or school psychologists) specifically for the individual heterogeneity dimensions with substantial professional experience. Each vignette was evaluated by at least two experts.

Task Structure

To structure student teachers' work with the vignettes, we used the model of professional vision and action developed by Barth (2017) and described in Sect. [Inclusive Diagnostics and Professional Vision](#). The users of the video vignettes (in our case: prospective teachers) must complete a task that can be divided into four different steps:

1. Describing: Describe what you recognize/perceive in the presented situation.
2. Assessing: Evaluate if it is beneficial for the students' learning process in this situation to diagnose. Please give reasons.
3. Developing courses of action: Develop ideas for alternative diagnostic measures to determine the reasons for the learning behavior exhibited. What might be worth looking at? How might you identify opportunities to use existing resources or reduce barriers to learning?
4. Deciding: Make a reasoned decision for one of the actions from Step 3. You may also decide on a sequence of diagnostic steps.

The steps addressed in our study are domain-specific regarding inclusive diagnostics, but not to VET in general. The vocational focus—specifically on economic and business education—is ensured through the domain-specific design of the video vignettes. Furthermore, it has to be considered in the results of the tasks, especially in the diagnostic measures. The study examines how pre-service teachers perceive and interpret situations that call for inclusive diagnostics, and how they derive possible courses of action. Participants are expected to identify disruptions in learning processes and recognize heterogeneity in cognition, language, and behavior in the vignette students. Based on this, they should propose suitable pedagogical responses. While Barth's first stage, professional knowledge, is acknowledged, it is treated as a cross-cutting dimension rather than a discrete step (Burda-Zoyke & Joost, 2023). Barth's final stage, implementation, was not included due to the seminar format, which did not provide opportunities for real classroom teaching.

Instructional Setting

The vignettes were used in various university teacher training seminars and a self-study setting. In addition to the structure according to Barth (2017), we incorporated other design principles for university courses for prospective teachers to promote competencies in dealing with heterogeneity and inclusion. Those include theory-practice interlinking, which has been implemented by the alternating of input and work with the vignettes, authentic cases, in our case depicted in the vignettes and the supervision by lecturers, who were approachable during seminars but also for student teachers working in the self-study environment (Burda-Zoyke & Joost, 2023).

All seminars comprised twelve to fourteen 90-minute sessions and included work on three to four vignettes. The courses were structured into two main parts. The first part focused on establishing theoretical foundations, including topics such as inclusion, heterogeneity (with emphasis on vocational schools), diagnostics (with a

focus on qualitative approaches), and the use of video vignettes. This provided student teachers with an overview of key theoretical aspects to support their work with vignettes. Additionally, professional vision was introduced based on Barth's model (2017) to deepen understanding of the tasks. The second part provided input on specific heterogeneity dimensions (cognition, language, behavior), followed by discussions of corresponding vignettes. Each video session followed a structured format: participants first viewed the vignette, worked individually on the four task steps (see Sect. [Task structure](#)), and then discussed their results in groups. Finally, the outcomes were shared and analyzed in a plenary discussion. This approach aimed to promote both individual reflection and collaborative learning through peer and instructor feedback. The video vignettes were selected based on several criteria, including the prior knowledge of the student teachers. The vignette that was primarily used in this study was chosen because it is embedded within the dual system, a distinctive feature of the German VET system. Furthermore, it addresses curricular content such as the preparation of a commercial invoice which is common to many vocational training programs and therefore relevant to all future teachers. Experts involved in the validation process confirmed both the authenticity and the suitability of the vignette. At the seminar level, care was taken to ensure that vignettes representing various heterogeneity dimensions were incorporated. The self-learning setting involved one vignette and condensed input on the topics to reduce participation barriers. Participants completed approximately 60 minutes of self-study, working on the task independently, followed by a 60-minute group discussion to review their results.

Sample, Data Collection and Analysis

All in all, the sample of this exploratory study consists of 82 student teachers (66 Economics and Business Education, 8 other courses of study, 8 not specified; 46 female, 31 male, 5 not specified) who were involved in the data collection to varying degrees. They were enrolled in either a Bachelor's (40) or a Master's (35) teacher training program (7 not specified) at two German universities in two different jurisdictions. Their age ranged from 20 to 39 years ($M=25.13$; $SD=3.15$). Their practical experience in school-settings diverged strongly, ranging from two weeks of school internships to others who teach at schools part-time during their studies. After completing their studies, participants will teach at VET schools, where they will continually encounter a diverse and heterogeneous student body. To answer the two research questions, different sub-samples were drawn from this group of student teachers based on their consistent attendance at all required seminar sessions and their voluntary consent to participate in the study. All participants declared informed consent before taking part in the study. [Table 1](#) shows the constructs used to address the respective research questions, along with the instruments employed for their measurement. [Table 2](#) provides an overview of the data collection process indicating the number of participant responses obtained from each context.

Both the scoring of the task solution quality and prospective teachers' self-assessment were applied in parallel to compensate for the methodological limitations of each approach and to generate a more comprehensive understanding of the findings. In general, learners benefit from self-assessment as an essential component of self-

Table 1 Constructs and instruments

	Constructs	Instruments
RQ1	Professional vision on inclusive diagnostics	Rating of participant solutions to 4-step task based on model of Barth (2017); one vignette, one measurement point
RQ2	Professional vision on inclusive diagnostics	Rating of participant solutions to 4-step task based on model of Barth (2017); three vignettes, two measurement points (pre + post)
	Self-efficacy in dealing with classroom heterogeneity (dimensions of cognition/language/behavior)	Self-assessments on 4-point Likert scale; 14 items per dimension

Table 2 Data collection

	Substudies	1	2	3	4	5	Total
RQ1	# Task solutions	-	16	-	20	9	45
RQ2	# Task solutions (pre + post)	-	-	-	10	-	10
	# Self-assessments cognition/language/behavior	7/8/7	16/16/16	7/4/7	13/9/11	9/4/4	52/41/45

Substudies 1/3/5: Bachelor-level teacher training seminar including a theoretical foundation on inclusive diagnostics in heterogeneous classrooms and reflection on three video vignettes (1 semester; University A; winter term 2022/23, summer term 2023, and winter term 2023/24). *Substudy 2:* Self-learning unit (1 hour; available to student teachers in both Bachelor's and Master's teacher training programs), including a theoretical foundation and reflection on one video vignette, followed by a 1-hour group discussion (University B, spring term 2023). *Substudy 4:* Master-level teacher training seminar containing theoretical foundation and reflection on three video vignettes (1 semester, University B, fall term 2023/24)

regulated learning (Ernst et al., 2025). However, doubts persist regarding learners' ability to accurately evaluate themselves. Several meta-analyses and reviews indicate that most learners either overestimate or underestimate their performance. This pattern holds across different educational backgrounds (León et al., 2023; Panadero et al., 2016), as well as within higher education contexts (Boud & Falchikov, 1989). León et al. (2023) find that learners tend to overestimate their performance overall, whereas Boud and Falchikov (1989) report no consistent pattern across all learners. Nevertheless, there is general agreement that high-achieving learners are more likely to assess themselves realistically or slightly underestimate their abilities, while low-achieving learners tend to overestimate their performance (Boud & Falchikov, 1989; Panadero et al., 2016). Several factors contribute to more accurate or less inflated self-assessments, including feedback, greater experience with self-assessment, more

content knowledge, and clearly defined rubrics (León et al., 2023; Panadero et al., 2016).

These findings are also relevant to preservice teachers. Many prospective teachers tend to either overestimate or underestimate their professional knowledge and competencies. Several studies indicate a general tendency among preservice teachers to overrate their knowledge—particularly their pedagogical knowledge (PK)—when compared to objective performance measures (Akyuz, 2018). However, other studies paint a more heterogeneous picture, reporting both overestimation and underestimation among individuals (Ernst et al., 2023). This discrepancy in self-assessment may be influenced by factors such as leniency bias, modesty bias, or the inherent challenges associated with accurate self-evaluation (Baecher et al., 2013). Moreover, self-assessments often reflect a central tendency bias, whereby individuals rate their abilities near the scale's midpoint, regardless of their actual performance distribution. This bias tends to result in low-performing students significantly overestimating their competencies, whereas high-performing students do so to a lesser extent (Max et al., 2022). Ward et al. (2002) point out the lack of a universally recognized definition of self-assessment or its accuracy. Moreover, the authors label correlations between self-assessments and objective test scores as insufficient and potentially inadequate for evaluating the accuracy of self-assessment (Ernst et al., 2023; Ward et al., 2002). Methodological limitations in determining self-assessment accuracy raise the question of whether learners are genuinely insufficient at self-evaluation or whether the tools used to measure their accuracy are themselves inadequate (Ward et al., 2002).

To describe student teachers' professional vision regarding inclusive diagnostics (RQ 1) we refer to work results for the task described in Sect. 3.2 from $n=45$ preservice teachers (age: $M=24.65$, $SD=2.26$; 28 female, 15 male, 2 not specified; 28 Master, 15 Bachelor, 2 not specified) all working with the same vignette. All solutions were scored to determine their quality. Each step of the task was assessed individually, receiving zero to three points. Coding guidelines were drawn up for this purpose, specifying which requirements had to be met for which score (see Table 3, for further information see Table 5 in the appendix). Both the correctness and completeness of the responses were considered. A score of zero was assigned if the response did not meet expectations at all—e.g., the task was not completed, or the answer was largely incorrect. One point was awarded for rudimentary explanations that largely failed to meet the predefined criteria. Responses that largely fulfilled the expectations, albeit with some shortcomings, received two points. A score of three points was given for answers that (almost) fully met the expectations, demonstrating comprehensive and correct reasoning. Specific indicators were set for each vignette to define what exactly a solution had to contain for certain points. All solutions were coded by two previously comprehensively trained raters. If they did not agree on a score, the mean value was used for further calculations. As the alternatives can be ranked, weighted Cohen's Kappa was used for intercoder reliability. Agreement for all vignettes and steps of the task was at least substantial, the majority was almost perfect ($0.77 < \kappa < 1.00$ [see Landis & Koch, 1977]).

For the evaluation of the effects of working with the video vignettes (RQ 2) we primarily refer to self-assessments of student teachers. They self-assessed their competencies in each of the three dimensions of heterogeneity (cognition, language, and

Table 3 Scoring rubrics

Score	Meaning (steps: Description/Assessment/Generation of courses of action/Decision)
0	No Description/Assessment/Generation of courses of action/Decision: The answer does not contain any relevant elements or these are not reproduced correctly.
1	Rudimentary Description/Assessment/Generation of courses of action/Decision: The answer contains a few relevant elements, most of which are reproduced correctly.
2	Description/Assessment/Generation of courses of action/Decision with some reservations: The answer contains several relevant elements, most of which are reproduced correctly.
3	Comprehensive Description/Assessment/Generation of courses of action/Decision: The answer includes (almost) all relevant elements, which are reproduced correctly almost without exception.

behavior) separately, using closed-ended questionnaires with 4-point Likert scales, each comprising 14 items. The scales were based on the model of professional vision and action by Barth (2017) as well as our model of inclusive diagnostics (authors, 2025), e.g., “*I am able to recognize aspects in the classroom that may indicate cognition-related impairments in students’ learning processes.*”. Assessments were conducted prior to engaging with the vignettes (pre-test) and again after working with a vignette addressing the respective dimension (post-test). Due to the short time span of only a few weeks between the pre-test and post-test, no major changes were to be expected. We obtained complete data sets for 52 participants in the domain of cognition, 41 in the domain of language, and 45 in the domain of behavior. The variation in sample sizes is due to the fact that only student teachers who completed both the pre-test and post-test for the respective dimension of heterogeneity were included in the analysis. The questionnaires were completed in paper form, subsequently digitized, and analyzed using IBM SPSS Statistics (Version 28). Cronbach’s alpha was calculated to assess the internal consistency of the scales. Reliability was satisfactory for both the pre-test ($0.79 < \alpha < 0.88$) and the post-test ($0.84 < \alpha < 0.91$) across all heterogeneity dimensions. To examine changes in student teachers’ self-efficacy over time, *t*-test for paired samples were conducted to compare pre- and post-test self-report scores.

To gain more in-depth insight into changes in student teachers’ competence development (RQ2), a subsample of 10 participants from substudy 4 (age: $M=24.80$, $SD=3.46$; 7 female, 3 male; all master’s students) engaged with three additional video vignettes at both the beginning and the end of the seminar. Their task responses were collected and externally rated (see Table 3) to track developmental changes and compare them with the participants’ self-assessments.

Findings

RQ 1: Prospective VET Teachers' Professional Vision Regarding Inclusive Diagnostics

To learn more about prospective VET teachers' professional vision on inclusive diagnostics we analyzed the quality of the written task responses of $n=45$ participants. Each participant worked on the task described in Sect. [Task structure](#). Each step in the task was scored on a 0–3 point scale. For every step, there were student teachers who achieved the full score as well as those who received no points at all. The overall mean score across all steps was 1.30, which is slightly below the midpoint of the scale. Participants performed best on the Describing step ($M=1.67$; $SD=1.08$). The steps Assessing ($M=1.23$; $SD=0.91$) and Generating Alternatives ($M=1.33$; $SD=0.98$) yielded mid-range results. The lowest scores were observed in the Decision Making step ($M=0.98$; $SD=0.91$), suggesting this was the most challenging component. This is supported by the fact that nearly twice as many participants received zero points in Decision Making compared to the other steps.

- Step 1: Describing:** Specifically, several criteria needed to be fulfilled in step 1. The description was considered complete only when both the general setting and the student (Niclas) and small group of students central to the scene were mentioned. These descriptions were required to be accurate and mostly objective, ideally incorporating appropriate technical terminology. When examining the descriptions of the situations, it becomes evident that only a few contained errors. Most points were deducted due to a lack of detail or the absence of aspects essential to the situation. Furthermore, the avoidance of evaluative judgments was difficult for some prospective teachers. For example, while one participant met these expectations by writing about a student in the video: *“Niclas taps his pen and plays with his fingers. Not all the blanks on his worksheet are filled in yet”*, another participant was describing the same behavior by stating *“lack of concentration, limited prior knowledge”* without specifying any observable indicators, which does not fulfill the task requirements.
- Step 2: Assessing:** When assessing, most student teachers view inclusive diagnostics as beneficial in the given situation. Out of 45 student teachers, only one opted against diagnostics, while eleven student teachers did not make a clear decision by stating whether they would regard pedagogical diagnostics as beneficial in the given situation. Most points were deducted for missing or unsuitable justifications.
- Step 3: Generating Courses of Action:** A closer analysis of the Generation of courses of action developed by the participants reveals that on average, each student teacher generated two alternative actions, though the standard deviation ($SD = 1.61$) indicates considerable variation. There are also notable differences between individual settings. Diagnostic dialogues with students were the most frequently mentioned action step (29 mentions, e.g. *“One could generally have conversations, for example with the student with low self-confidence, maybe have a conversation together with a school psychologist to find out the reasons for his*

learning difficulties”), consistently appearing across all settings. Furthermore, there was a significant overlap in the frequency of individual options mentioned across the various seminars. The primary challenge for most student teachers does not lie in naming different courses of action but rather in sufficiently describing them—specifically, the method, goal, and subject of the diagnostic action—and adapting them to the situation.

Step 4: Deciding: In the final step, Deciding, ten student teachers chose a single diagnostic step, while 17 student teachers selected an action strategy comprising multiple diagnostic steps. One excerpt from a coherent sequence of actions is: “...*basically first observe what and how the students work. Maybe there are a few problems in the work (group or individual level). If you see they have problems [...] I would confront them orally with the goal to find out what the reason is. That way you could maybe quickly remove existing learning barriers. Afterwards, written results could be looked at if a closer diagnosis is needed...*”). Both approaches were suitable for completing the task and earning full points. However, 18 student teachers did not opt for a diagnostic action, indicating that the task was either incomplete or that non-diagnostic action steps were selected. Often, the chosen actions were purely support of the students, lacking diagnostic elements, such as repeating specific content (e.g., “*Go through the example task again. Let a student explain the task. That means, let students explain the task. Go through the example calculation at the beginning. Give more support to the students during the working phase*”). Whether considering individual action steps or comprehensive action strategies, which may or may not include multiple steps, personal conversations with students emerged as the most frequently chosen diagnostic action (16 out of 45 cases). Observing students’ behavior was also commonly mentioned (12 mentions), followed by discussions with other teachers (9 mentions) and using tests to assess students’ prior knowledge (also 9 mentions). Six student teachers opted to collect the worksheets completed by students in the scene to gain further insights.

We additionally calculated Pearson correlations between the different steps of the task (see Table 6). All steps showed moderate to strong positive associations (Cohen, 1992), which is consistent with the understanding of professional vision as one competence, despite being composed of distinguishable steps. However, the strength of the correlations does not support a clear division between step 1 (noticing) and steps 2, 3, and 4 (reasoning). Likewise, there is no evidence of particularly strong associations between steps 1 and 3 (which emphasize hands-on or action-oriented components) and between steps 2 and 4 (which focus more on decision-making, justification, and reflection).

It can be concluded regarding research question 1 that the student teachers achieve higher scores in Describing than in the other three steps. This fits well with the literature that novice teachers find noticing easier than reasoning. The individual steps show high intercorrelations, supporting the interpretation of professional vision as an integrated competence.

RQ 2: Development of Prospective VET Teachers' Self-efficacy and Professional Vision Regarding Inclusive Diagnostics

To evaluate the change in student teachers' perceived abilities regarding dealing with challenging teaching situations in heterogenous classes, we analyzed the results of the participants' self-report data on self-efficacy (41 to 52 assessments for each of the three heterogeneity dimensions addressed, see Fig. 3). Paired-sample *t*-tests revealed a significant increase in student teachers' self-efficacy from pre- to post-test across all dimensions of heterogeneity. Self-efficacy regarding cognition ($t(51) = -5.310$, $p < .001$, $n = 52$, $d = -0.74$), language ($t(40) = -4.984$, $p < .001$, $n = 41$, $d = -0.78$) and behavior ($t(44) = -4.184$, $p < .001$, $n = 45$, $d = -0.62$)⁴.

To gain deeper insights into the effects of working with video vignettes, a subgroup of participants ($n = 10$) additionally engaged with three further video vignettes—one for each dimension of heterogeneity—at two separate points in time. This enables an assessment of whether student teachers show development both in their self-perceived competencies and in the objectively rated quality of their task performance. At t_0 the student teachers achieved moderate scores (for scores per step of the task and measurement point see Fig. 4). At t_1 , higher average values were achieved in all steps, which does not imply that the score of every single person has improved. The highest average score at t_0 is achieved in Describing, followed by Generating alternative courses of action. At t_1 , Describing still has the highest average but Generating actions the lowest. This is because the increases in all vignettes are lowest in Generating actions (0.15 points on average). In contrast, the highest gains were

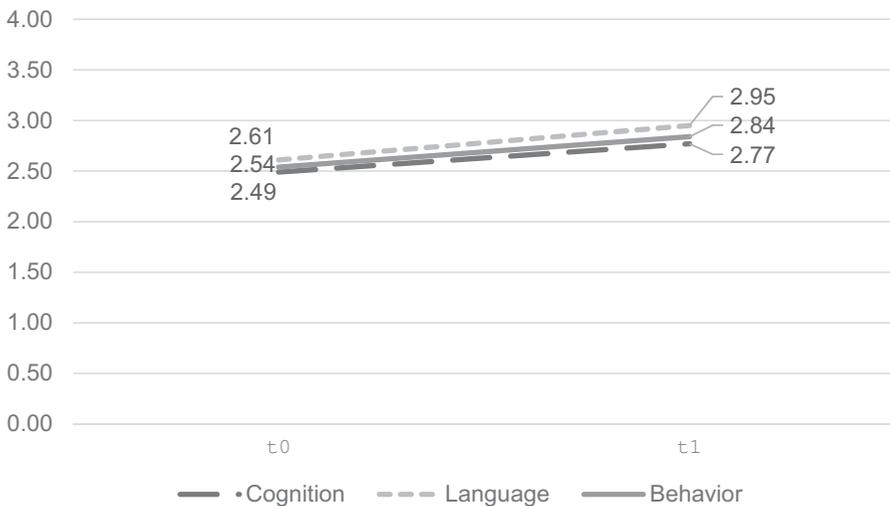


Fig. 3 Development of self-efficacy in three heterogeneity dimensions (self-report)

⁴ A Shapiro-Wilk-test shows that all variables are normally distributed except from cognition at t_0 ($W = 0.929$, $p = .037$) and behavior at t_1 ($W = 0.914$, $p = .014$). That is why non-parametric Wilcoxon-tests were calculated for comparison, which also showed significant effects for cognition ($z = 4.40$, $p < .001$) and behavior ($z = 3.51$, $p < .001$).

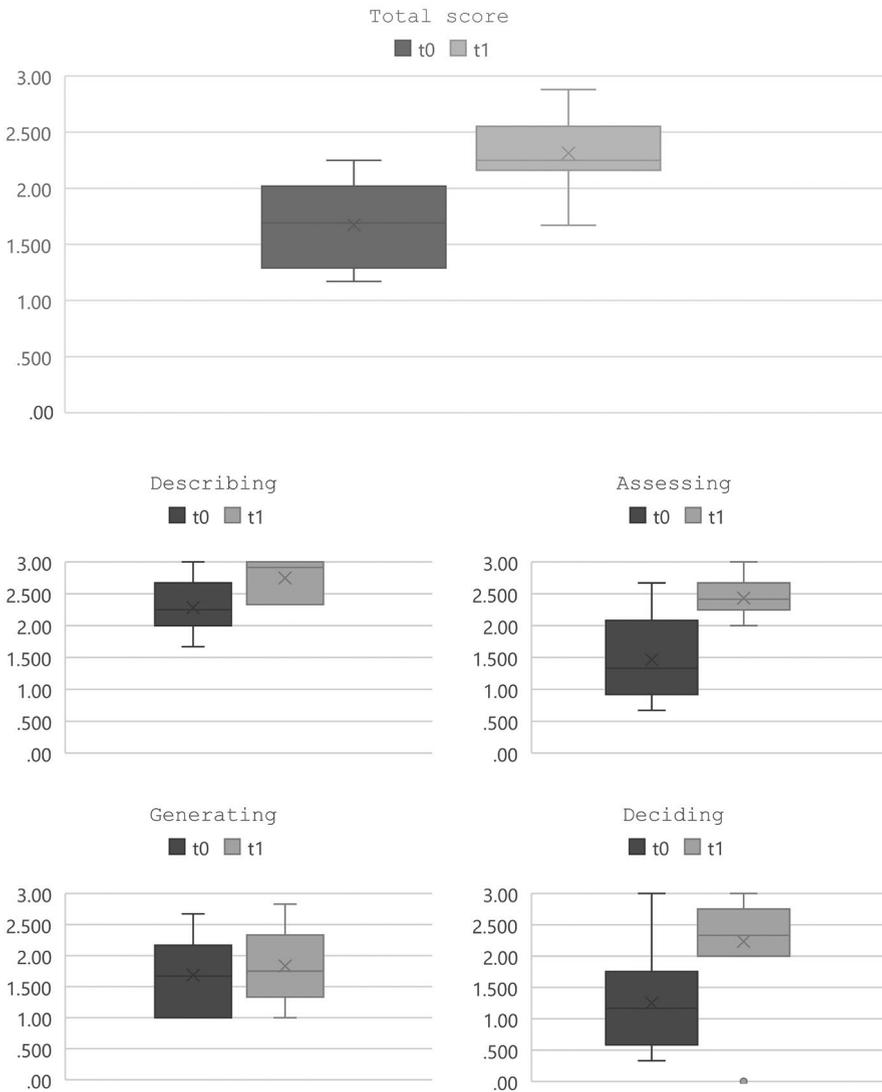


Fig. 4 Development of student teachers' professional vision (quality rating, mean across all three vignettes)

achieved in Assessing (0.98 points on average). As the results of the rating are mostly not normally distributed according to a Shapiro-Wilk test, non-parametric Wilcoxon tests are carried out. These show that the student teachers' scores increased significantly from t_0 to t_1 for Describing ($z = 1.96, p = .050$), Assessing ($z = 2.67, p = .008$) and

Deciding ($z=2.40, p=.016$) but not for the Generation of alternative courses of action ($z=0.56, p=.570$).

All student teacher's scores for Describing are already above the arithmetic mean of the scale from 0 to 3 on which they are rated at t_0 . Nevertheless, with one exception, the quality of all student teacher's responses improves from t_0 to t_1 , the answers become more detailed and the focus on relevant factors is increasing. Response quality when Assessing the situation at t_0 is widespread. Nevertheless, already at t_0 most respondents assess inclusive diagnostics to be advantageous, in some cases no clear decision was made. At t_1 , all respondents clearly decided in favor of inclusive diagnostics. The response quality stays constant from t_0 to t_1 in one case and otherwise improves, in some cases strongly so, mostly because of better justifications for the student teachers' decisions. The response quality when Generating alternative courses of action is widely scattered at both t_0 and t_1 . More alternative courses of action were named at t_1 compared to t_0 . At t_1 , the student teachers generated new alternative courses of action for each situation, particularly in multi-professional collaboration, e.g., with school psychology and the training company ("*...She [the teacher] could also talk to colleagues to see if Stefan [student in the vignette] exhibits similar behavior there. A school psychologist could also be consulted...*"). At t_0 , they were very focused on the narrow context of teaching, whereas at t_0 their view broadened. It is striking that almost half of the student teachers achieved a lower score at t_1 than at t_0 . Specifically, however, only in four cases were the same number or fewer alternative courses of action identified. In most cases, the number of diagnostic courses of action was increased, but partly these were insufficiently described. At the second measurement point, student teachers often answered in bullet points and did not sufficiently describe the focus, method and objectives of the diagnostics or resorted to general lists of diagnostic methods instead of relating them to the specific situation. It is possible that diagnostic methods from the work with the other vignettes were transferred, but these could not be adapted to the situation at hand. Mostly, the student teachers' responses with previously rather low quality improve, while those with the highest quality at the beginning deteriorate. Regarding Decision making we encounter the strongest dispersion at t_0 . Differences in the decision made between the two points in time are marginal. The quality of the justifications given increases significantly at t_1 with one exception (deterioration at a very low level overall, possibly task not correctly understood as no decision for a diagnostic alternative). The justifications contain more references to both theory and the situation itself. Working with more video vignettes therefore seems to mainly promote the quality of the student teachers' reasoning compared to their noticing.

Overall, the standard deviation is particularly high at t_0 ranging from 0.49 to 1.23. At t_1 , the standard deviation decreases significantly for all steps. The minimum points achieved increase across all three vignettes for Describing, Assessing and Generating Actions. Working with the vignettes in the seminar not only seems to have improved the average solution quality, but above all has a balancing effect, so that the student teachers are at a more similar level than at the beginning.

Conclusions

Summary and Discussion

In our study, we first examined student teachers' professional vision, and their self-efficacy related to inclusive diagnostics. Second, we investigated the extent to which these variables can be fostered using video vignettes. As a prerequisite, we found that student teachers largely perceive the video vignettes and accompanying materials to be realistic and beneficial for learning about inclusive diagnostics, with only minor differences in perception across different vignettes. Experts also endorsed the vignettes, finding them realistic, authentic, and useful for developing diagnostic skills through critical discussion. This aligns well with the goal of producing the vignettes, as they were designed not to show a model solution but to contain many starting points for controversial discussions.

RQ 1 (Prospective VET teachers' professional vision regarding inclusive diagnostics): The study examined student teachers' professional vision across four steps (Describing, Assessing, Generating alternatives, and Deciding) with mixed results. Student teachers performed best in Describing and struggled most with Decision-making. The results align with existing research, confirming that noticing is easier for student teachers than reasoning. It was to be expected that novices would find it most difficult to generate alternative courses of action (Barth, 2017). Unexpectedly, we found student teachers challenged more by justifying their decisions rather than generating alternative courses of action. Nevertheless, the differences were not significant, and fostering reflection on alternative courses of action remains highly relevant, as it is a precondition for making adequate decisions and seems to be associated with student learning (Kersting et al., 2010).

RQ 2 (Promotion of prospective teachers' self-efficacy and professional vision regarding inclusive diagnostics): We also analyzed the impact of working with video vignettes on student teachers' self-efficacy and competence in handling heterogeneous classes. Overall, self-efficacy significantly improved over time (from pre- to post-test) across all dimensions, with medium effects. Prospective teachers tend to report high levels of self-efficacy regarding various teaching tasks, accompanied by an upward trend over the course of learning opportunities in teacher training (Hardy et al., 2015; Reaves et al., 2023). This is confirmed in our findings with respect to self-efficacy concerning inclusive diagnostic tasks. While student teachers showed significant gains in Describing, Assessing, and Decision-making tasks, improvements in Generating alternative courses of action were minimal. Despite an increase in the number of alternatives generated at the second measurement point (which is in line with the results of Santagata & Guarino, 2011), many responses at t_1 lacked detail and adaptation to the situation at hand. The seminar sessions appeared to enhance student teachers' reasoning quality, leading to more detailed justifications and a more balanced performance among student teachers over time. Nevertheless, some pro-

spective teachers also exhibited a decline in performance. The reasons for this are not entirely clear. One possible explanation is that working with video vignettes may not be beneficial for all prospective teachers. Krumphals and Feser (2025), in their intervention using video vignettes, describe various learning trajectories, including negative ones. Alternatively, it is possible that the task was misunderstood or completed with less motivation at t_1 . It would be interesting to explore the differences between the initial (t_0) and subsequent (t_1) and their learning processes in between together with the participants.

Limitations

A key limitation of this study lies in its sampling: only a small number of student teachers from two German universities participated. Although participation in the study was voluntary, participation in the seminars in which it took place was compulsory. Not all student teachers were present at all points of data collection, which could have biased the sample further if the absences were not completely at random. Additionally, the absence of a control group has a limiting effect. Therefore, any increase in self-efficacy or competence cannot be causally attributed solely to the treatment, i.e., working with the vignettes. All student teachers participated in other courses during the semesters in question. Although none of those directly addressed the topic, competence increases due to other learning opportunities in teacher training cannot be ruled out.

Furthermore, Koschel and Weyland (2020) conclude that didactic embedding and the methodical approach seem to be pivotal when working with vignettes. Our environment was not strictly standardized. Since the vignettes were used at different universities in different semesters by different instructors, there may have been differences in the didactic embedding that could limit the comparability of the findings. There were differences in the results across the various settings. However, the exact reasons for these differences could not be systematically or conclusively determined within the scope of this exploratory study. Notably, the outcomes for the self-learning condition were situated in the mid-range, suggesting that neither the task solutions nor the self-assessments alone provide clear evidence that this approach is more or less effective. Qualitative feedback, however, suggests that participants perceive the social component of the seminars as enriching. These differences, combined with the small sample size, also limit the generalizability of the findings, as the vignettes could potentially have different effects in another environment with different didactic choices.

Also, we assessed self-efficacy regarding the heterogeneity dimensions of cognition, language, and behavior, only through self-assessment and assuming them to be different constructs. Since self-efficacy regarding all heterogeneity dimensions developed similarly, an investigation into whether this may be one construct is necessary. Another limitation lies in our data collection methods. Firstly, we used rat-

ings of task solutions, which were evaluated based on predefined coding guidelines. However, it is uncertain how comprehensively these coding guidelines were able to capture the nuances of each individual case, and to what extent the four included levels sufficiently differentiated the quality of all task solutions. Secondly, we relied on self-assessment data. Learners frequently do not assess their abilities and competencies accurately (Boud & Falchikov, 1989; León et al., 2023; Panadero et al., 2016). Consequently, we must assume that the prospective teachers in our sample also either overestimate or underestimate their abilities, which constitutes a significant limitation of the study.

Implications for Teacher Education and Research

Increasing heterogeneity in VET creates a need for action at multiple levels: On a policy level, for instance discussions around improved data collection and sharing across institutions have been ongoing (e.g., Goldhaber et al., 2022). At the school level, structures for collegial and multi-professional collaboration are needed (e.g., Sonntag, 2022). On the individual level, VET teachers are increasingly required to recognize and address heterogeneous learner needs in their daily practice for which systematic preparation is necessary (Kärkkäinen & Tarnanen, 2022; Nakar & Bag-nall, 2024).

This includes more opportunities to practice skills essential for inclusion, particularly in inclusive diagnostics, within teacher education. Universities could more consistently integrate inclusion-focused training into their mandatory curricula. Additionally, specialization opportunities could be offered during teacher education, allowing student teachers to build in-depth competencies for working effectively with heterogeneous learner groups. Against this backdrop, the present study focuses on the development of professional competencies in prospective VET teachers, with a particular emphasis on the role of teacher education programs in fostering inclusive teaching skills. Video vignettes offer a valuable learning opportunity in this context, especially for fostering professional vision as a central component of inclusive pedagogical diagnostics. They allow student teachers to practice and reflect without the immediate pressure to act in a real classroom. Moreover, the use of video vignettes has shown promising results, not only in the present study but also in previous research (e.g., Anast Seguin & Ambrosio, 2002; Enenkiel et al., 2022; Koschel & Weyland, 2020). Therefore, their use should be made permanent in university teacher training. To further improve learning opportunities, it's important to consider that scores vary depending on the setting, indicating its significance.

Furthermore, the value student teachers place on discussion and social interaction in seminars highlights the benefits of this format over self-learning. This may be linked to the inherently social nature of professional vision and noticing student behavior, which is shaped by societal norms and assumptions about what constitutes typical or deviant behavior. In the context of inclusion, such perceptions are particu-

larly relevant, as different paradigms (e.g., person-oriented, situational, interactionist and labeling approach, see Stein & Stein [2020]) imply different interpretations of learning barriers. Seminar-based discussions provide a critical space for prospective teachers to reflect on their own perspectives while also confronting and negotiating dynamic and continuously changing societal norms. Similar aspects are emphasized by Brands et al. (2025), who call for VET programs to acknowledge the diverse socio-cultural contexts in which professional vision occurs and to explicitly discuss and negotiate different perspectives. Moreover, it can be assumed that professional vision differs between novices and experts (e.g., Brands et al., 2025; Meschede et al., 2017; Pouta et al., 2021); future research should therefore investigate how experienced teachers work with the vignettes to better understand the development of professional vision regarding inclusive diagnostics over time.

Further research is also necessary to explore the specific conditions under which video vignettes are most effective, especially for teacher candidates in vocational schools. An in-depth examination of the optimal conditions for learning with these vignettes is crucial for maximizing their impact. To develop these practices further, future studies should also use vignettes with larger sample sizes and include control groups.

Appendix

See Appendix Tables 4, 5 and 6.

Table 4 Studies on video vignettes related to heterogeneity or inclusion in teacher training (sorted alphabetically)

No	Project Name Authors (Year)	Sample/Country	Details about the Vignettes	Study Design	Results
Development of Competencies					
1	Nawi-In Abels et al. (2022)	Primary and secondary education, $N = 76$ Germany	1 vignette, 5 min, real situation, third person and 2 vignettes, own teaching	3 measurement points (same vignette) and reflection on own teaching	Increase of analytical skills
2	Multicultural/Diversity Assessment Project Anast Seguin and Ambrosio (2002)	United States	6 vignettes, staged videos, third person	Pre-post-design	Student teachers identify problems related to diversity but propose only simplistic solutions, better solution quality when working with more vignettes
3	MSMC Anderson and Lignugaris/Kraft (2006)	Primary education, $N = 45$ United States	3 vignettes, staged videos, 1–2 min and real situations, 20–30 min, third person	Modified time-series design, 3×2 -hour training session and 11 (experimental group)/12 assessment sessions (control group) in groups of 10–20 participants	Increase in analytical skills
4	ViviAn Enekiel et al. (2022)	Primary and special needs education ($n = 83$); secondary education ($n = 20$), $N = 103$ Germany	8 vignettes, 3–5 min, real situation, third person	Seminar context, 2 measurement points (same vignettes) 5 training vignettes	Increase of diagnostic skills
5	Dealing with Diversity Grewe and Möller (2020)	Secondary education, $N = 96$ Germany	1–2 min, real situations, third person	Seminar context	Increase of self-efficacy
6	Dealing with Diversity Hörter et al. (2020)	Secondary education, $N = 196$ Germany	3–5 min	Seminar context	Increase of professional vision
7	Dealing with Diversity Jürgens and Neuber (2020)	Secondary education, $N = 28$ for one seminar, 4 seminars Germany	7 vignettes, 3–5 min, real situations, third person	Seminar context, pre-post-design	Initial results show that promotion of professional vision regarding equal participation of students in sports games is possible

Table 4 (continued)

No	Project Name Authors (Year)	Sample/Country	Details about the Vignettes	Study Design	Results
8	Dealing with Diversity Koschel and Weyland (2020)	VET, $N = 86$ Germany	6 vignettes	Seminar context	Increase of professional vision
9	ViLLA Kramer et al. (2017)	Primary (19%), secondary (43%), special needs education (36%), VET (2%), $N = 222$ Germany	4 vignettes, 1–2 min, third person	Seminar context	Increase in pedagogical knowledge and situation-specific skills
10	Dealing with Diversity Meurel and Hemmer (2020)	Secondary education, $N = 71$ Germany	3–5 min, real situations, third person	Seminar context, pre-post-design, control group	Increase in professional vision, especially in evaluating, interpreting and generating alternative courses of action
11	Dealing with Diversity Winter and Junker (2020)	Secondary education, $N = 77$ Germany	6 vignettes, real situation, third person	Seminar context, control group	Increase in diagnostic and reflection skills, especially in noticing and generating alternative courses of action
Development of Attitudes					
12	VAT Baecher and Connor (2010)	Special needs education, $N = 1,200$ annually since 2006 United States	More than 2,000 vignettes, 5–8 min, own teaching	Seminar context, videotaping of tutoring sessions with students with learning disabilities	Improved confidence and reduced skepticism towards certain teaching practices
13	Greenfield et al. (2016)	$N = 15$ United States	Series of video vignettes, approx. 10 min	Pre-post convergent parallel mixed method design	Student teachers' perceptions regarding students with learning disabilities shifted positively in response to the course
Assessment of Competencies					
14	WiSsTin Buddeberg et al. (2022)	Secondary education, $N = 34$ Germany	Real situation, third person	Seminar context	Student teachers recognize different facets of social participation
15	coReflect@maths Kuntze et al. (2024)	Primary education ($n = 14$), secondary education ($n = 16$), special needs education ($n = 2$), $N = 32$ Germany	8 vignettes, cartoon format	Vignette-based questionnaire	Low quality of multi-criterion noticing among student teachers
16	coReflect@maths Steinert and Jurkowski (2023)	Primary education, $N = 124$ Germany	1 vignette, 3 min, third person	Seminar context, pre-post-design, video vignettes part of post-test	Low levels of knowledge about teaching in inclusive classes
Validation of Construct or Instrument					

Table 4 (continued)

No	Project Name Authors (Year)	Sample/Country	Details about the Vignettes	Study Design	Results
17	DIAMOS Böhme (2022)	Primary education, $N = 151$ Germany	Real situation, third person	Seminar context	Acceptance of video vignettes among student teachers
18	EKoL Franz et al. (2019)	Primary (43%), secondary (40%) and special needs education (13%), others (5%), $N = 706$ Germany	6 vignettes, third person	Cross-sectional design	Confirmation of a model regarding adaptive teaching and an associated vignette-based test
19	Geisen and Zender (2024)	Primary education, $N = 16$ Germany	2 vignettes, third person	Cross-sectional design, web-based video tool	Student teachers perceive various aspects relevant to learning processes but find it difficult to conclude and specify further steps
20	Holdbrooks Townsel (2016)	$N = 6$ United States	3 vignettes, 4–5 min, third person	Seminar context	Video vignettes as useful tool to critically discuss professionalism regarding diversity
21	Potential: Power to teach all Keppens et al. (2019)	Primary education, $N = 272$ Belgium	15 vignettes, approx. 2 min, real situations, third person	Cross-sectional design, online environment	Confirmation of a vignette-based instrument for measuring student teacher's professional vision of inclusive classrooms (focusing on teacher-student interactions and differentiated instruction); student teachers' ability to notice improves over the course of their studies
22	QiS Langer et al. (2022)	$N = 234$ Germany	7 vignettes, 1–2 min, real situation, third person	Cross-sectional design	Preliminary results point to the suitability of the vignette-based instrument to assess noticing in inclusive physical education

Table 5 Exemplary solutions scoring rubrics

Score	Meaning	Example solutions for each step			
		Description	Assessment	Generation of courses of action	Decision
	(steps: Description/ Assessment/ Generation of courses of action/Decision)				
0	No Description/ Assessment/ Generation of courses of action/Decision: The description/... does not contain any relevant elements or these are not reproduced correctly.	Students are having problems, but the teacher doesn't care.	The teacher could recognize that Niclas is doing well, reassure him and thus help him. She could also help Clara and Yusra with the task.	One approach could be to encourage Niclas to search for the correct tax rates to see if he is able to carry out the calculation.	I would decide to do group work so that students can exchange ideas and support each other without fear of being judged by the class.
1	Rudimentary Description/ Assessment/ Generation of courses of action/Decision: The description/... contains a few relevant elements, most of which are reproduced correctly.	The teacher explains the task, and the students have no questions. The assigned individual work is carried out more in groups than individually. The teacher walks around in the room but does not intervene. Niclas is nervous and says he cannot fully solve the task.	In my opinion, only the student at the end of the video needs to be diagnosed. The student seems bored, but also nervous in the video sequence. He won't solve some tasks. He does not do this even when asked by the teacher.	<ul style="list-style-type: none"> • Record previous knowledge from the last lesson: short test/oral question, quiz • Systematic observation of behavior and conversations • Individual discussions: Why are you stuck? 	<ol style="list-style-type: none"> 1. observe the behavior of the students in different social forms and methods 2. write a test in the class and observe students in question 3. ask other teachers in the class about conspicuousness in the students and talk to them about it 4. talk to students and collect suggestions for solutions together

Table 5 (continued)

Score	Meaning	Example solutions for each step			
2	<p>Description/Assessment/Generation of courses of action/Decision with some reservations:</p> <p>The description/... contains several relevant elements, most of which are reproduced correctly.</p>	<p>Explanation by the teacher, then individual work, students write on their worksheets. Clara addresses Yusra, they are uncertain about payment terms and look it up in the text book; teacher does not offer assistance. Niclas plays with pen and does not finish his worksheet, where few numbers are still missing</p>	<p>An inclusive diagnosis is useful because the students show difficulties in solving the tasks (lack of knowledge of Clara and Yusra, nervous sliding back and forth and pen clicking by Niclas). Their learning processes are inhibited.</p>	<p>I would try to have a one-to-one conversation with the students and ask for their honest opinion as to whether they have cognitive knowledge gaps or motivation problems. If it really is a case of knowledge gaps, you could repeat basic business tasks (in this case, creating an invoice). However, this is only possible to a limited extent in class, so I would possibly also give him individual tasks to work on. I could also talk to other teachers to see if the student shows similar patterns of behavior in class.</p>	<p>Collect the worksheets to identify difficulties. It is noticeable that all students have problems with the task, so it should be checked where exactly these are in order to promote the learning process.</p>

Table 5 (continued)

Score	Meaning	Example solutions for each step			
3	<p>Comprehensive Description/Assessment/Generation of courses of action/Decision:</p> <p>The description/... includes (almost) all relevant elements, which are reproduced correctly almost without exception.</p>	<p><i>Setting:</i> teaching situation, dual vocational training, wholesale and foreigntrade clerks, content: commercial invoice. Explanation by the teacher, then individual work (20 min), yet conversations between students, other students write on their worksheets</p> <p><i>Clara & Yusra:</i> Clara addresses Yusra, uncertainty about payment terms, specifically the differences between discount and cash discount; mention of the training company where “everything is easier”; independent lookup by Yusra in the textbook; no initiative from Clara in this regard (“you always know where everything is”); teacher overhears and encourages looking it up in the textbook, offers no further assistance</p> <p><i>Niclas:</i> Signs of restlessness in Niclas: plays/clicks with pen; bounces leg; looks at the ceiling or around the room; runs a hand through his hair; has, however, filled out almost everything on the worksheet. Teacher encourages further work; he says he “won’t get the last numbers anyway”</p>	<p>It is advantageous to diagnose in an inclusive manner. The students have different levels of prior knowledge in relation to the exercise on the worksheet. Clara and Yusra ask each other something about a term/approach to the task and help each other, whereas Niclas in the video doesn’t know what to do and therefore decides not to continue with the task. He has no self-confidence and the reasons why he does not seek help should be found. Clara and Yusra try to solve the problem with the book, but one of them relies on her classmate instead of taking action herself. It is important to identify what is harming their learning process.</p>	<ul style="list-style-type: none"> • It could be worthwhile to determine the current level of learning or the prior knowledge of the students in order to see where deficits can be identified • Talk to the Niclas after class to find out reasons for lack of self-confidence • Look at the student’s task solution, collect worksheets from the whole class (at class level) to check how far Niclas has understood the material and determine where there are deficits • Find out where the gaps in knowledge are. It would be good for the teacher to know whether it is due to the motivation or the individual prior knowledge of the students. • Conduct personal one-to-one discussions to find out exactly what the problem is. Find out whether the work assignment was not understood or whether the topic is generally unclear. • Observe individual students over a longer period of time in order to analyze their behavior 	<p>During the work phase, I would first observe what and how the students are working. If you see that students are having problems with their work, I would try to find out in a conversation what the problem is. This could quickly remove any existing learning obstacles. Written results could then be looked at if a more detailed diagnosis is necessary. By evaluating the results, I could, for example, identify calculation errors and thus gain a more detailed understanding of the students’ mistakes and therefore prior knowledge.</p>

Table 6 Correlations between steps of task (RQ1)

	<i>n</i>	Step 1	Step 2	Step 3	Step 4
Step 1	45	-			
Step 2	45	0.618**	-		
Step 3	45	0.492**	0.496**	-	
Step 4	45	0.508**	0.329*	0.555**	-

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

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Data Availability The data that support the findings of this study are not publicly available yet due to ongoing analysis related to qualification work. After the completion of the project, which is funded by the German Federal Ministry of Education and Research, the data will be transferred to a suitable repository and made available.

Declarations

Competing interests The authors declare no competing interests.

Ethical Approval The ethics board of the University of Mannheim approved the study (EK Mannheim 47/2023). All participants declared informed consent before participating in the study.

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