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Mixed methods research approach – Methodological reflections using the example of an individual online coaching for physical education teachers

Summary

Mixed methods approaches have often been referred to as the third research paradigm and are gaining prominence in German-speaking countries in various social, educational and behavioral science fields and disciplines. However, mixed methods approaches have not yet received this level of attention in the disciplinary discourse of sports pedagogy. The aim of this article is to illuminate this area of research further. It introduces an innovative triangulation approach based on a larger study concerning the development of teaching quality for Physical Education (PE) teachers. In this study, a quantitative method (systematic observations) is integrated with results obtained from a qualitative method (interviews). Methods are combined in a joint display, serving as a powerful tool for integrating, presenting, and interpreting the data. The presented mixed methods approach offers a more holistic view of the complex research area of teaching quality.

Zusammenfassung

Mixed-Methods-Ansätze werden häufig als drittes Forschungsparadigma bezeichnet und gewinnen im deutschsprachigen Raum in verschiedenen sozial-, erziehungs- und verhaltenswissenschaftlichen Feldern und Disziplinen zunehmend an Bedeutung. Im Fachdiskurs der Sportpädagogik erhalten Mixed-Methods-Ansätze diese Aufmerksamkeit jedoch noch nicht in diesem Umfang. Ziel des vorliegenden Artikels ist, diesen Forschungsbereich weiter zu beleuchten. Der vorliegende Beitrag stellt einen innovativen Triangulationsansatz vor, der auf einer größeren Studie zur Untersuchung der Unterrichtsqualität von Sportlehrkräften basiert. In dieser Studie wird eine quantitative Methode (systematische Beobachtungen) mit Ergebnissen aus einer qualitativen Methode (Interviews) kombiniert. Die Methoden werden in einem Joint Display kombiniert, der als aussagekräftiges Instrument zur Integration, Präsentation

und Interpretation der Daten dient. Der vorgestellte Mixed-Methods-Ansatz ermöglicht somit einen umfassenderen Blick auf den komplexen Forschungsbereich der Unterrichtsqualität.

Schlagworte: Mixed methods, Triangulation, Sportunterricht/Physical Education, Unterrichtsqualität/Teaching Quality, Online Coaching

1.   Introduction

Teaching quality can be determined by the extent to which teachers are able to create suitable structures that give students the opportunity to start and maintain learning processes with understanding (Kunter & Voss, 2011). Internationally, as well as in German-language educational research, three basic areas have been identified to describe the "deep structures" (Kunter & Ewald, 2016) of teaching across subjects, representing the levels of interaction between teachers and learners as well as their quality. Even though these three main constructs are often titled slightly differently (Klieme & Rakoczy, 2008; Pianta & Hamre, 2009), they represent the basic framework of teaching quality. This tripartite structure is based on a student-oriented and supportive climate, structured and clear instructions and classroom management, and cognitive activation (Pianta & Hamre, 2009), highlighting teaching quality as a multifaceted construct. To investigate the multi-layered and complex interrelated characteristics and processes in the classroom, it is essential to work with an appropriate research methodology. In this respect, mixed methods research is becoming increasingly relevant (Creemers, Kyriakides & Sammons, 2010; Sammons, 2010).

Especially in the study of social phenomena, a mixed methods approach can offer a more comprehensive understanding (Teddlie & Tashakkori, 2009). This may involve different actor perspectives or exploring an object from different research perspectives. Consequently, a combination of methods can help to ensure that "blind spots or explanatory gaps that the qualitative or quantitative research results leave open in each case are compensated for by the results of the other method" (Kelle, 2022, p. 173). This "multiperspective view" (Kuckartz, 2014, p. 52), as implied by mixed methods research, facilitates an in-depth and nuanced examination of the phenomenon to be researched. Nevertheless, the decision to mix must be carefully considered – mixed methods research is not a methodological panacea. Moreover, it is important to acknowledge that mixed methods research is often time-consuming and resource-intensive. Adequate alignment with the object of study that supports the decision for mixed methods is essential to ensure effectiveness (Hussy et al., 2013, p. 289). Furthermore, it is crucial to understand "how qualitative and quantitative data collection can be meaningfully integrated into an overall research process and how valid scientific statements about a particular research problem can be derived from it" (Döring, 2023, p. 72). Thus, mixed methods research offers flexibility, rigor, and depth in exploring complex educational phenomena, and was

therefore applied in this study to analyze the changes regarding teaching quality during a coaching intervention in PE from various angles.

After an introduction to mixed methods research in chapter 2, we aim to provide an example of how a triangulation in mixed methods research can be conducted, by presenting data of a larger study (Maier, 2022) in chapter 3. This study follows a parallel approach or convergent design, in which the qualitative and quantitative data were collected simultaneously and used integratively to answer the research question. This approach is suitable for gaining a multi-perspective view on teaching quality and thus gaining more valuable insights. After the presentation of the study design and the different data sets to be triangulated, chapter 4 illustrates a joint display, which is shortly interpreted for demonstration purposes. Finally, in chapter 5, advantages as well as boundaries and limitations are discussed regarding this specific triangulation.

2.   Introduction to mixed methods research

Although mixed methods approaches have been popular in Anglo-American research for many years, the current research literature shows inconsistent use of the respective terminologies (Hussy et al., 2013, p. 286). Accordingly, numerous definitions, systematizations and design types exist, varying depending on the author. However, there is overwhelming agreement that mixed methods research "generally refers to the combined use of qualitative and quantitative research methods, i. e., the integration of methods, procedures, and techniques that originate from two different approaches or methodological areas" (Kuckartz, 2014, p. 30). Mixed methods research is often referred to as the third research paradigm (Kuckartz, 2014; Döring, 2023). Therefore, it does not aim at replacing established methods, but rather to leverage the respective advantages of qualitative and quantitative approaches. Quantitative methods encompass standardized survey and evaluation instruments that typically examine large samples. Accordingly, quantitative research mainly relies on numerical data to describe or assess hypotheses. Evaluation is conducted statistically, ensuring objectivity. In contrast, data in qualitative research are collected using open-ended questions that have an explanatory character. Theories and hypotheses are often verbally or visually generated by means of smaller samples. Evaluation is interpretive, reflecting a higher level of subjectivity (e. g., Hussy et al., 2013). Rather than focusing on a singular analysis, the combination of quantitative and qualitative methods has many advantages. In the context of mixed methods approaches, qualitative and quantitative sub-studies are typically conducted sequentially or concurrently. They are interconnected in terms of data collection and/or analysis (Döring, 2023, p. 186). Nevertheless, the individual research steps should adhere to the quality criteria of quantitative or qualitative empirical research. High standards in the quality criteria of

each study enhance the inferential quality of mixed methods research, yielding a robust overall result for the research question (Döring, 2023, p. 114).

Exploring the diverse types of mixed methods designs is important (see e. g., Teddlie & Tashakkori, 2009; Kuckartz, 2014). It is necessary to distinguish whether the combination of methods already takes place in the application stage (i. e., data collection and analysis) or if only the results are related to each other afterwards (Kelle, 2022, p. 169). In this regard, Morse (1991) suggests a classification according to the sequence and emphasis of methods, identifying different approaches. In a *sequential approach*, a (partial) research project with one method is followed by the second method. This is represented in writing in a notating system by an arrow (→). Moreover, if one method holds greater importance, it is written with capital letters and marks the focus of the entire mixed method research project (e. g., QUAN → qual). In contrast, in the *parallel approach* the two methods are applied simultaneously to a specific research question, which is indicated by a plus sign (e. g., QUAL + quan) (Morse, 1991; see also Creswell & Plano Clark, 2018).

This early classification of mixed methods approaches has been followed by numerous others, for example advanced mixed analysis approaches such as crossover analysis (Onwuegbuzie & Hitchcock, 2015; König, 2017). Probably the most ordinary form of mixed methods research is triangulation, which "seeks convergence, corroboration [and] correspondence of results from different methods" (Schoonenboom & Johnson, 2017, p. 110). In this approach, quantitative and qualitative approaches play equal roles in the research process. Results are considered jointly regarding a research question and not sequentially (for a differentiated description of different forms of triangulation see Kuckartz, 2014, p. 67–68). As previously noted, there's ambiguity in the terminology of mixed methods. Such an inconsistency in the systematization of design types is evident in Creswell and Plano Clark's (2018) changing typology. The authors, among others the pioneers of the international mixed methods research discourse, have been constantly developing the classification of mixed methods designs in their publications since 2003. Currently, they identify three types of mixed methods designs: *convergent design*, *explanatory sequential design,* and *exploratory sequential design*. The *convergent design* aligns closely with the fundamental concept of *triangulation*, which is popular within the scientific community. It involves merging and comparing quantitative and qualitative study results before data interpretation. In an *explanatory design*, a quantitative study is conducted first. Those results then form the basis for a qualitative study explaining or elaborating on the data. *Exploratory design*, on the other hand, proceeds the other way around: based on a qualitative study, often exploratory in nature, quantitative measurement instruments are developed (Creswell & Plano Clark, 2018).

Although there is widespread recognition across various disciplines within educational research regarding the benefits inherent in mixed methods approach-

es, including the attainment of a nuanced and profound comprehension of educational phenomena, it is striking that this methodological paradigm finds itself met with hesitance within the domain of Physical Education (PE) research (König, 2017, p. 153). Grimminger-Seidensticker and Krieger (2022) recently published an overview of the limited number of existing studies that implemented these different mixed methods designs in the field of sports pedagogy. They exemplarily describe studies regarding their implementation of mixed methods designs in this area of research. As an example, they use Grimminger (2013) for convergent designs, Richartz, Hoffmann and Sallen (2009) for explanatory sequential designs and Wiesche (2016) for exploratory sequential designs. Depending on the design type, the presentation of the results varies. In a triangulation or convergent design, the quality of the mixed methods study is characterized by the presentation of joint displays, which equally consider quantitative and qualitative results and classify them regarding the research question (Kuckartz, 2014, p. 136; Döring, 2023, p. 115). Joint displays play a crucial role in mixed methods research, aiding researchers in achieving integration and transparency (McCrudden et al., 2021). These displays, like tables or figures, organize both qualitative and quantitative data analysis (Fetters, 2020, p. 194). However, unlike standard research presentations, joint displays explicitly combine these data strands to illustrate their integration. They are not limited to sharing findings but can also guide data collection and analysis decisions throughout the research process (McCrudden et al., 2021). Thus, they offer a means to enhance understanding, strengthen findings, and provide a more holistic view of complex research problems.

3.   Excerpt from a mixed methods study on teaching quality

The study presented follows a mixed method design of triangulation/convergent design. In its purpose, however, it differs from classical procedures that combine questionnaires and interviews. It exemplifies the development of teaching quality in the context of a coaching intervention study for PE teachers. To exemplarily display the triangulation of different data sets, one of the study's five research questions is presented in this article. The question of concern is: *What do the individual changes regarding teaching quality look like during the coaching?* This overarching question is to be addressed by a quantitative part: How did the CLASS scores change over the duration of the coaching? – and a qualitative part: How do the PE teachers describe their individual learning outcomes? To focus on the methods and their triangulation in more detail, data sets of solely one exemplarily PE teacher called Bob (pseudonym) are presented in this article. Thus, to answer the research question, quantitative and qualitative approaches were triangulated (Figure 1). The quantitative approach adopts rating scores from a systematic observation instrument for assessing the quality of interactions between teachers and students in educational settings called Classroom Assessment Scoring System (CLASS; Pianta,

La Paro & Hamre, 2008). The qualitative aspect involves the interviews with the teachers and their perceived learning gains throughout the intervention. In this chapter, the study design is presented first. As the coaching intervention is built on the generic observation instrument CLASS and its underlying theory, the instrument is introduced afterwards together with the intervention design, followed by a description of the two data sources integrated in the triangulation.
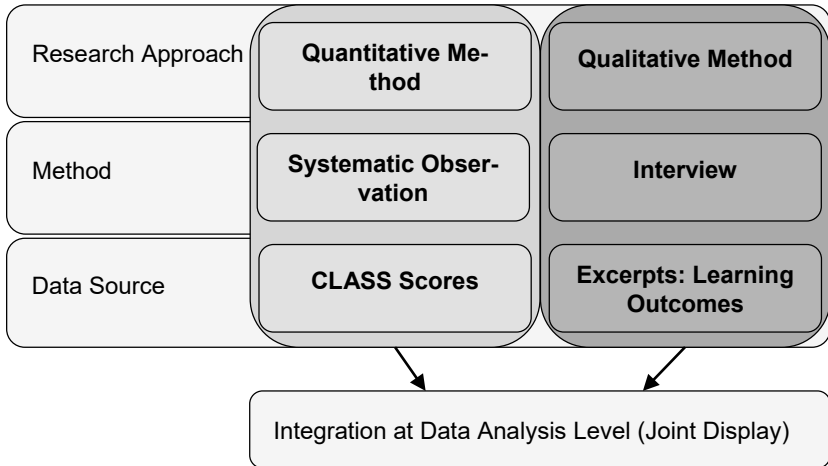
Research Approach	Quantitative Method	Qualitative Method
Method	Systematic Observation	Interview
Data Source	CLASS Scores	Excerpts: Learning Outcomes

Integration at Data Analysis Level (Joint Display)

Figure 1. Mixed methods approach of the present study (own figure)

3.1   Study design

This mixed methods approach enables a multi-perspective view to answer the research question more comprehensively. Therefore, a qualitative research approach using episodic problem-centered interviews was used and supported by data generated from a quantitative research approach, namely systematic observations. The systematic observations were conducted with the CLASS instrument, resulting in data in the form of CLASS scores. The interviews were transcribed verbatim, and statements made regarding the learning gains represent the qualitative data of this triangulation. Both the quantitative as well as the qualitative data are comparable due to its underlying theory – the dimensions of teaching quality from the CLASS K-3 manual. This allows a triangulation of the different data that recurs to the same evidence-based construct. In this context, PE lesson video recordings were ranked according to CLASS, resulting in CLASS scores on a scale between 1 and 7. The extent to which the teachers themselves noticed a change in their teaching quality and which dimensions seem important to them, on the other hand, are mainly revealed in the interviews. In the interviews, the teachers were only asked for general learning gains, not asking them what they perceived to have learned in a spe-

cific dimension, to increase the degree of freedom of the response and possibly reveal further learning gains outside of CLASS. However, the answers were then assigned to the respective CLASS dimensions for the data to be comparable in the triangulation.

3.2   Intervention

The online coaching intervention was designed by Richartz (2018) and adheres to the structure of the MTP-program (Allen et al., 2011), which is grounded in CLASS. CLASS is a generic observation instrument for the assessment of teaching quality based on interaction processes in the classroom (Pianta et al., 2012). It is based on the Teaching Through Interactions framework (Hamre et al., 2013) demonstrating the 3-domain structure – Emotional Support, Classroom Organization and Instructional Support – across all age groups. These three domains and their associated quality dimension have shown to contribute to effective teaching and learning. For instance, research indicates that students in classrooms with more emotional support have higher social competence and academic performance (Burchinal et al., 2010; Mashburn et al., 2008). Moreover, effective classroom organization and instructional support are positively linked with behavior competence (Burchinal et al., 2014) and enhanced skills across various subjects (Hamre et al., 2014). The instrument has displayed high interrater reliability in numerous studies (between 78 % – 96 %, Sandilos & DiPerna, 2011). CLASS has been translated into the German language, adapted, and applied in a controlled manner (Richartz & Zoller, 2011). Moreover, it has proven to be valid in projects in extracurricular sports (Richartz & Anders, 2017; Richartz et al., 2018).

The coaching intervention involved five PE teachers in Germany. The ages of the four male and one female participant ranged from 27–50 years (M = 37.40, SD = 8.75). The recruitment can be defined as a convenience sampling as the participants were chosen on whether they were willing to participate in the study and the easiest to access (Teddlie & Yu, 2007, p. 78). As this was an exploratory study with no intention of generalization this sampling method seems appropriate. Regarding the coaching design, the intervention started with an online seminar, during which the participants received information on teaching quality based on CLASS, including the presentation of best-practice video clips portraying individual quality dimensions, produced primarily to the intervention. Subsequently, the five participants were visited in one of their lessons, which served as measurement point one. Video recordings of the PE lessons were conducted, accompanied by surveys targeting teachers and students. Moreover, every participant was granted access to a video library, including the beforementioned best-practice clips, as well as additional information on teaching quality based on CLASS, for their own individual development. The participants were subsequently videotaped during one of their PE lessons once per month. From this video footage their coach extracted short

video clips based on a single quality dimension of CLASS and commented on these sequences. Even though, of course, the whole lesson was observed, and critical incidents were discussed as they occurred, a single dimension was always in focus when cutting and commenting on the individual video clips. At the beginning of the intervention, the focus was displayed in the dimension of Positive Climate. Thus, the relationship between the teacher and their students as well as the students among themselves, positive affects, positive communication, and respect displayed in the sports hall were in focus (Pianta et al., 2008, p. 23). The reason for starting with focusing on this dimension was to focus on the positive aspects happening in the lessons, showing the teachers what they already did well in this regard and thereby fostering a positive work-relationship between the teachers and their coach (Richartz, 2015). After this, the teachers/coachees were in charge when it came to which dimension should be in focus for the next lesson. This was discussed in the Zoom meeting, which was held after the teachers watched the commented clips of their lessons. Based purely on their interest and the aspects discussed in the meeting, they could choose which dimension they wanted to work on next. This was recorded by their coach in the action plan, together with a short protocol of the topics discussed as well as references to the video library regarding additional information, as well as best-practice clips they could watch (concerning the next dimension) for the preparation of the next video recording. This five-step cycle (video recording, cutting, and commenting video sequences (by the coach), viewing the presented video clips (by the teacher/coachee), Zoom meeting, action plan) was repeated six times. After this period, another video recording took place, and questionnaires were administered to both students and teachers. Thereafter was a three-month follow-up period, with the last video recording and subsequent student questionnaires. The last step of the intervention was an online interview in which all the five teachers participated.

3.3   Quantitative data – CLASS scores

As mentioned, CLASS is an instrument to assess interactions between teachers and students with a manual for a specific age-group at its core. The three core domains are further divided into quality dimensions, which are manifested slightly different for specific age groups (from toddler to secondary) resulting in different manuals for the specific age groups. The K-3 manual has been used up to grade six and is applied in this study. However, the domain of Instructional Support is frequently discussed in a more subject specific content (Niederkofler & Amesberger, 2016). Therefore, a slight adjustment was made regarding CLASS, following Richartz argumentation (2015) for the assessment of PE lessons. The dimensions Concept Development and Language Modeling have been left out of the CLASS ratings. They did not seem to be applicable in the sports context for this age group. Thus, the remaining eight dimensions of the K-3 manual were rated, and no further adjustments were made to maintain true to the instrument. The dimensions in the K-3 manual applied in this study

are Positive Climate (PC), Negative Climate (NC), Teacher Sensitivity (TS), Regard for Student Perspectives (RSP), Behavior Management (BM), Productivity (P), Instructional Learning Formats (ILF) and Quality of Feedback (QF). Ratings of a lesson sequence are made on a 7-point rating scale on the dimensional level (Pianta et al., 2008), with seven indicating a high expression of several behavioral markers in a specific quality dimension. All dimensions are observed and rated simultaneously. A total of eight videos were taped for each individual teacher. From these eight videos, specifically the first, third, fifth, seventh and eighth video, every second lesson and additionally the follow-up video recording were chosen. From each of those selected videos, two 20-minute cycles were cut resulting in a total of ten clips per teacher. The clips were than rated with the CLASS K-3 manual (Pianta et al., 2008) by two individual CLASS K-3 certified raters.[1] These raters were not involved in the coaching process and the clips of the different measurement points were randomly rated to ensure objectivity and reduce bias.

3.4   Qualitative data – interviews

After the coaching intervention, each of the five teachers participated in an additional interview, which was performed online via Zoom. The objective of the interviews was to determine the PE teachers' own experiences, reconstructing their perceived learning gains and thus the development of the teaching quality. To ensure comparability, all interviews were conducted by the same researcher, which was, however, again not their coachee to avoiding bias from a coach-coachee relationship or social desirability (Seale, 1999). The interviews centered on the experiences the participants had throughout the coaching intervention. It is based on the interview-construct by Richartz (2015) and has episodic, as well as problem-centered parts. Episodic, as it links narrative generation with question collection (Flick, 1996, pp. 147) and problem-centered, as the interview can be described as a dialog with pre-formulated questions and follow-up questions, if necessary (Witzel, 2000; Mayring 2002, p. 67). Thus, the interviews have been conducted as semi-structured interviews, employing closed and explorative parts. This structure allows the interviewer to direct interaction, but also leaves the participants partly in control as to where the interview would lead. Closed sections aimed at maintaining construct consistency across methods, for the planned triangulation with the other data set. Thus, question stimuli are given that connect to evidence-based constructs, while explorative parts allow going beyond the given constructs, going into more depth, or even discovering new areas beyond the underlying theory. The interviews have all been recorded and transcribed verbatim following the transcription rules according to Dresing and Pehl (2011, pp. 18–24). Following, the transcripts were analyzed with the MAXQDA 18 software based on the seven

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[1] We would like to sincerely thank Alfred Richartz and Kathrin Kohake for rating the video clips for this study part.
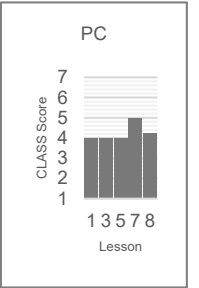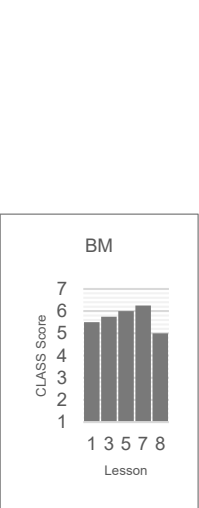
steps for structuring qualitative content analysis of Kuckartz (2018). On one hand, the transcribed interviews were structured by a deductive category system, which was developed based on the CLASS dimensions. On the other hand, additional data from the interviews was coded into inductive categories, supplementing the code system. Both deductive codes and inductive codes were integrated into the analysis. In this triangulation only responses from Bob to the question "What did you learn from the coaching intervention?" are presented. These were extracted from the transcripts and assigned to a specific quality dimension of CLASS.

4. Joint display
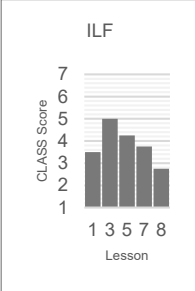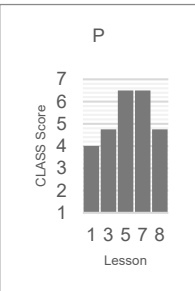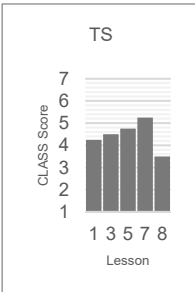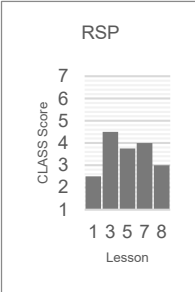
To illustrate the triangulation of the two data sources presented above, a joint display was created for one teacher (Bob, Table 1). This teacher was exemplarily chosen due to his clearly visible changes based on CLASS and the alignments as well as divergences between the generated qualitative and quantitative data, highlighting the value of adapting a mixed methods approach. In this table, the qualitative data (excerpts from the interview regarding Bob`s learning gains[2]) and the quantitative data (development of the CLASS scores for one quality dimension) are presented simultaneously and interconnected. The type of joint display used in this article can be described as an "integrated results matrix, [that] shows quantitative and qualitative findings side-by-side which helps the researchers compare the findings and generate meta-inferences" (McCrudden et al., 2021, p. 2). The aim is to provide a more comprehensive understanding of the research problem. The table chronologically presents the six coaching sessions along with the corresponding quality dimension in the first column, establishing a structural framework for this chart. After starting with Positive Climate, this was followed by the preferences of the teacher, so on what he wanted to work thus, which dimension should be in focus for the respective lesson. The assorted colors indicate the different domains to which the quality dimensions are assigned. Light grey indicating the domain Emotional Support and dark grey the Classroom Organization domain. In the second column excerpts from the interview regarding the teacher`s learning outcomes were extracted and assigned to the respective CLASS dimensions. In the last column, the changes of the CLASS scores for a single CLASS dimension are presented and again assigned with the respective dimension. The charts presented in the last column display the five different measurement points on the x-axis and the mean score of four individual ratings from two different raters on the y-axis. Thus, one row represents a triangulation of the two different data sets for one specific quality dimension and its development over the course of the intervention.

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[2] The provided quotations underwent a translation process from their original German language into English and duplicate words were excluded, to enhance the overall readability and coherence of the text.

Table 1.   *Joint display of the individual development of Bob*

Coaching Session[3]	Changes in CLASS scores	Learned as stated in the interview
1. PC		"[…] respectively then how to talk to the students in advance." (Bob, Pos. 175)
2. BM		"Yes, that/when you get into the sitting circle now. This is a sitting circle and not a triangle. I had made a triangle during a lesson; benches were placed in a triangle. You must always get the children together. And then, of course, some of them sat down in the corners and I could not see them. Maybe they did not listen as attentively. I took that into consideration in the next lesson and in the following lessons and still now." (Bob, Pos. 97) "And, that everyone can see me." (Bob, Pos. 99) "[...] how to keep everybody in sight." (Bob, Pos. 175) "[...] what I take away the most is, taking the time, really until everybody is quiet. […] I always want a high movement time in my lesson and accordingly I try to start the announcements then also, yes sometimes already, if also not all are ready to start yet. That is, when everyone is not yet listening, some still tie their shoes. And to take this time/to interrupt the first time/the exercise, to get everyone together, everyone looks at you, everyone is quiet, no one does anything anymore. This will then benefit you in terms of the execution of the exercise. And in many lessons, I was simply too impatient. And this patience, I just have to get more into it. That everyone really listens to me. And I think that was the main point that I'll take with me for the next lessons, for the next years as a teacher." (Bob, Pos. 175)

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[3] PC = Positive Climate, BM = Behavior Management, ILF = Instructional Learning Formats, P = Productivity, TS = Teacher Sensitivity, RSP = Regard for Student Perspectives

3. ILF	ILF	"Yes, we had discussed something on the subject of team division, which I can also use again and again, which I will use." (Bob, Pos. 175) "We had on the topic of transparency: how do the students best understand what I say? Yes, short little sentences, instead of constantly explaining a lot of things, which then/where not everyone listens anyway." (Bob, Pos. 175)
4. P	P	"Yes, then of course always what is very practical, that the waiting times shortened/by giving movement opportunities. That the/yes, that it becomes a movement lesson and not a waiting lesson. There I think actually also always otherwise in such a way, […] and I will integrate into my future instruction everyday life." (Bob, Pos. 99)
5. TS	TS	-
6. RSP	RSP	-

In this specific case, the results of Bob, a 40-year-old male teacher, teaching PE and German at a Comprehensive School[4] in Lower Saxony's countryside, are presented. Next to his 12 years of teaching experience, he has 25 years of experience in coaching sports, but did not have any experience with online learning prior to this intervention. Looking at his preferences, Bob initially chose to address all dimensions of the Classroom Organization domain in the following order – Behavior Management, Instructional Learning Formats and Productivity. The last two dimensions he wanted to focus on were from the Emotional Support domain – namely Teacher Sensitivity and Regard for Student Perspectives. Thus, leaving out the only dimension from the Instructional Support domain in this study – Quality of Feedback. No excerpts of learning gains could be assigned to this dimension.

The specific interest in the domain Classroom Organization, as he wanted to focus on the respective dimensions of this domain first, is in line with his perceived learning outcomes. Except for one comment, all aspects extracted from the interview regarding his learning gains can be assigned to dimensions from this specific domain. This highlights the possible relation between personal interest in a specific area and learning outcomes.

Expectations were that CLASS scores would steadily increase over the course of the intervention, or at least after being addressed in one session. However, for Bob CLASS scores for the dimension Positive Climate only increased after the intervention suggesting challenges in improving this dimension and the need for patience and effort. Additionally, only one statement from the interview could be assigned to this dimension, which refers to how to talk to the children in advance. Thus, he does not seem to have perceived a great learning gain in this area, which is in line with the CLASS scores. Even though CLASS scores dropped slightly at the follow-up, they are still slightly higher than at the beginning of the intervention. This is especially to highlight as this dimension is prone for possible bias at the first measurement point due to wanting to make a good first impression at the start and thus, scores at the beginning are to be interpreted with caution. Moreover, it is important to highlight that the follow-up measurement was the last lesson before the summer break. In many PE classes this means that mainly games are played and there is less of a focus on learning progression. Additionally, a CLASS-study by Casabianca and colleagues (2015) showed that teaching quality steadily declined throughout the school year, even though declines were only described as modest. Another possible explanation for the drops in all dimensions could be that he could not keep up his improvement without external input.

For the first dimension he wanted to focus on, namely Behavior Management, the development of his CLASS scores followed expected patterns. After focus-

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[4] German translation: Gesamtschule

ing on this dimension, scores consistently increased until after the intervention, with only a drop at follow-up, which was already addressed before. Excerpts from the interview supported this positive trend, as this is the dimension to which the most interview excerpts regarding his learning outcomes could be assigned. He emphasizes having all the children in sight, but likewise making sure that they see him. In this context he also talks about how to go about seating arrangements. Additionally, he highlights being patient and ensuring that he has everybody's attention first before delivering announcements. These are typical behavioral aspects that can be assigned to the dimension Behavior Management emphasizing a structured and disturbance-preventive environment. This point also links in with the other two dimensions of this domain, as he wants to wait until he has everyone's attention, to then state his announcements clearly (→ Instructional Learning Formats) and by this increasing the movement time of the children (→ Productivity).

The second dimension he wanted to focus on was Instructional Learning Formats, thus, the main aspect for the analysis of the third lesson filmed. The development of his CLASS scores was as expected in this regard, as there was a high increase (from $M = 3.5$ to $M = 5.0$) on the 7-point scale between the first and third video. Although scores decreased afterwards, they still remained higher after the intervention (at measurement point seven), than the initial measurement. In the interviews he states that during the discussion he and his coach talked about announcements needing to be short and precise. However, it might be the case that he put specific effort into this, when the dimension was in focus, but might have fallen slightly back into old habits afterwards. Thus, although this was still present when recalling his learning gains, the decrease of the CLASS scores emphasizes a constant reminder to apply clear and on-point instructions.

Looking at the dimension Productivity based on the CLASS scores, there has been a steady increase from the first to the fifth lesson, being stable throughout the seventh video recording and again the slight drop at the follow-up. Despite limited interview excerpts related to this dimension (only one excerpt could be assigned to this dimension), his scores indicated progress. Thus, even though, he might not be able to specifically describe all the small things he has changed in his PE lessons regarding this dimension, the respective indicators for this dimension, namely maximizing learning time, routines, transitions and preparation (Pianta et al., 2008, p. 45) have increased based on the systematic observations. Interestingly, the high improvement based on the CLASS scores from the third to fifth lesson is in line with Productivity being addressed in the fourth lesson. Another possible explanation for this high increase might be that Productivity might be an easier dimension to quickly improve in, as for example Quality of Feedback. Moreover, maybe even minor changes in this dimension can have big impacts, like for example giving children an additional task on their way back after an activity to increase move-

ment time, even though it might not be perceived as a remarkable change in own`s own behavior.

The dimension Teacher Sensitivity highlights the importance of the CLASS scores. Although, none of his statements from the interview could be assigned to the dimension of Teaser Sensitivity, Bob's CLASS scores steadily increased throughout the intervention. This indicates that he might not have recognized the changes himself, but observations by a third party were able to see a higher degree of awareness and responsiveness regarding emotional or learning problems of his students.

As for the previously mentioned dimension, Bob did not mention any perceived changes that could be categorized as belonging to Regard for Student Perspectives. However, there is a clear improvement in his CLASS scores from the first to the third lesson. Although the scores slightly decrease after this, they again increase to the seventh recording, so after the dimension was in focus at lesson six. Despite the scores slightly dropping again at follow-up, they are still higher than at the beginning, which might demonstrate an overall higher sensibility for including students' opinions and perspectives on his side.

5.   Discussion

The presented study follows an innovative mixed methods approach, which is characterized by a combined methodological approach aiming at linking inductive and deductive research logic (König, 2017). The quantitative data are based on systematic observations, enabling objective statements about the development of the investigated teaching quality regarding the CLASS dimensions. The first data set triangulated are the CLASS scores developed by two independent CLASS raters from five different measurement points – representing the quantitative data. On the other hand, the qualitative data are generated from an episodic problem-centered interview with the respective teacher from after the intervention. These data reflect his learning outcomes. Therefore, the qualitative data consider the subjective perception of a potential change of teaching quality within individual CLASS dimensions. These two different data sets were consequently merged into a joint display combining the data sets for the respective quality dimensions. This integration can help identify patterns, connections, and relationships that might not be apparent when analyzing each data type separately. Both approaches focus on the same research question: *What do the individual changes regarding teaching quality look like during the coaching?*

The summary of the results represented in form of a joint display (chapter 3) shows the individual development regarding the change of teaching quality during the coaching intervention, which is based on the example of one teacher (Bob). This joint display shows both congruent results and differences in the

available data. The advantage of the quantitative method can be seen in the fact that all dimensions of teaching quality were considered, even those which were not consciously perceived by the teacher and therefore not mentioned in the interviews (e. g., Teacher Sensitivity). Hence, one can infer that Bob does not attach significant importance to it; nevertheless, the objective data indicate an observable improvement. On the contrary, the findings reveal a notable parallelism in the assessment of Behavior Management, evident in both the framework of the CLASS scores and Bob's personal perspective. In this particular dimension, the quantitative and qualitative partial results are congruent. Moreover, qualitative data show where the teacher wanted to focus his coaching on and in which areas he perceived the greatest learning outcomes. Therefore, the development of teaching quality during the coaching intervention can be regarded as more differentiated than it would have been the case by using only one method. The presented mixed methods approach thus provides a differentiated insight into the complex structure of teaching quality.

Overall, this research is a mixed methods design according to a process of triangulation or, using Creswell and Plano Clark's terminus (2018), this study follows a convergent design. The mixed methods approach chosen in this study focuses on the data analysis whereas the data was conducted separately, but with an equal weighting regarding the research questions. Regarding the field of sports pedagogy, this approach was likewise adapted in the study by Grimminger (2013). It is a parallel approach, however, with emphasis on the qualitative part in the form of interview data, to present the development of teaching quality from the perspective of the participant. Though, the quantitative data consisting of CLASS scores at five different measurement points complements these results from a distinct perspective. Therefore, this mixed method design can be classified as "QUAL + quan" (Morse, 1991, p. 121). Both procedures are characterized by adequate consideration of the respective central quality criteria, whereby the inferential quality of the statements can be classified as high (Döring, 2023). High quality of both study parts is essential to maintain an overall high quality in mixed methods research, aiming at reducing/avoiding weaknesses and inaccuracies of mono-methodological approaches (König, 2017).

Besides the mentioned advantages of a mixed method approach as described in this article, there are limitations and challenges to this approach. Primarily, to achieve a thorough triangulation of the outcomes, it is essential for the approach to rest upon a shared foundational theory. This challenge was surmounted by establishing a theoretical foundation using the CLASS instrument. Moreover, this article only focuses on the development of an individual teacher. Considering the total sample of five teachers, a large amount of effort is required to generate all forms of different data (video recordings, CLASS ratings, coaching clips, interviews, etc.). Difficulties in triangulating the data are particularly apparent when two dimensions of teaching quality, which were rated by

the CLASS instrument, are not mentioned in the interviews. If a methodological approach does not provide data on individual aspects, triangulation cannot take place. Furthermore, the approach is a case-by-case analysis that does not present generalized answers, as it is often typical for quantitative data. However, by combining these two different methods, an objective view can be generated regarding teaching quality based on a validated instrument, which is diversified by a more in-depth perception of the respective individual.

6. Conclusion

A central element of this study part was to gain a deeper understanding of the development of teaching quality during a coaching intervention in PE. By combining different methods, a broader range of perspectives was captured than it would have been possible with a single method, which leads to greater perspective enrichment (Teddlie & Tashakkori, 2009). Qualitative methods are used to obtain data on the PE teacher's own experiences and perceived learning gains, while quantitative methods are used to obtain data on observable changes in behavior to increase confidence in the validity and reliability of the results regarding teaching quality. The combination of both methods provides more valuable insights and a greater degree of differentiation and depth of insight. In summary, the advantage of this mixed methods design can be seen in the fact that the results of these sub-studies are systematically related to each other. This study successfully integrates the conclusions from the quantitative and qualitative data sources at a superordinate level, thereby adequately addressing the research question concerning the development of the multi-layered construct of teaching quality and presenting a broader picture of what happened during the intervention (Kelle, 2022, p. 170). Thus, a comprehensive and multifaceted methodology incorporating mixed methods is imperative for advancing future inquiries within the domain of teaching quality in PE. This approach is vital for illuminating the intricate nuances of this multifaceted construct through the examination of various perspectives and dimensions.

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