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A field study on how PE students perceive the potential of video-based peer feedback in higher education

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ABSTRACT

In the context of increasing digitalization in education, teacher education programs face the dual challenge of fostering both pedagogical and digital competences. This study explores the potential of video-based peer feedback as an innovative and practice-oriented method to support the professional development of future physical education teachers. The intervention was embedded in a university-level field hockey course and combined video analysis and peer feedback to examine students' perceptions of enhanced professional competences. Drawing on a mixed-methods design, the study first gathered quantitative survey data (N = 28), followed by nine qualitative interviews to gain deeper insights into students' experiences. From the students' perspective, video-based feedback is perceived to promote professional reflection, enhance understanding of movement execution, and support the development of didactic and general pedagogical knowledge. Furthermore, students reported that peer interaction fostered a more nuanced understanding of how to give and receive constructive feedback. The findings highlight video-based peer feedback as a scalable and meaningful way to integrate digital media into physical education teacher education and address current demands for digitally competent educators.

Keywords: initial teacher education, digitalization, video feedback, professional development, physical education teacher education

Introduction

The increasing digitalization of all societal domains—particularly education—requires future teachers to acquire not only pedagogical and content knowledge, but also technological skills and digital competence (Falloon, 2020; Mishra & Kohler, 2006). Despite considerable investments in digital infrastructure in schools, questions remain as to how these resources are meaningfully integrated into classroom practice. The challenge is clear: it is not merely about access to technology, but about pedagogical capacity to use it effectively. Universities, as key institutions for teacher education, bear responsibility for equipping students with the necessary competences. However, opportunities for structured digital competence development are often lacking in teacher education programs.

One promising and practical approach is the integration of video-based peer feedback into higher education. While students in higher education generally perceive video feedback positively—appreciating its nuanced, clear, and in-depth nature that promotes deeper understanding, critical thinking, and engaging communication (Bahula & Kay, 2021)—the specific potential of video-based peer feedback for supporting professional learning remains largely unexplored. The format is thought to encourage students to record their teaching or movement performances, analyze them together, and exchange structured feedback. In doing so, it likely promotes professional reflection and provides meaningful opportunities to work with digital media.

Especially in physical education teacher education (PETE), where performance, observation, and motor analysis but also soft skills, motivational and didactic skills are central, video-based feedback offers unique didactic potential. At the intersection of subject-specific learning, self-reflection, and digital literacy, video-based peer feedback may serve a dual purpose: supporting the development of teaching competences while simultaneously fostering digital fluency in pedagogically meaningful ways. Moreover, its peer-centered structure encourages collaboration and critical engagement, making it an effective and scalable learning strategy in university settings.

This study therefore explores the use of video-based peer feedback in a university-level hockey course (chosen because it was part of the existing curriculum and allowed for structured integration of video-based peer feedback) as a method to support the professional development of future physical education (PE) teachers. It investigates not only whether students find the approach helpful, but also how they perceive its impact on various professional competences. By focusing on students' subjective evaluations, this research aims to understand both the benefits and perceived limitations of integrating video-based feedback into PETE.

Literature review

Teachers and their professional development have been the subject of considerable research interest since the 2000s (Avalos, 2011), including in the field of PE (Wang & Ha, 2009; McEvoy et al., 2015). It is widely acknowledged that teachers have a strong influence on student learning outcomes (Hattie, 2008, 2023), particularly in PE, where their qualifications can directly affect pupils' physical abilities and motivations (Podstawski & Krzysztof, 2014). Consequently, the concept of competence-oriented teacher education has gained international importance (Pantić & Wubbels, 2010).

The development of professional competences among prospective teachers is a key objective of teacher education systems worldwide and is typically anchored in national education standards (Page, 2015). In Germany, for example, the Standing Conference of the Ministers of Education and Cultural Affairs (KMK,

2004) has outlined a binding framework that defines the core competences and qualifications future teachers are expected to acquire during their university studies.

Despite growing attention to teacher competences in general, the specific context of PETE has often been overlooked. Much of the existing research has focused on non-practical subjects such as mathematics or science (Büchel et al., 2022; Heemsoth & Wibowo, 2020; Vogler et al., 2017). While some studies have examined competence profiles (e.g. Baumert & Kunter, 2006; Francesco et al., 2019) and assessment methods for PE teachers (e.g. Putnam et al., 2021; Baumgartner, 2022), fewer have explored how these competences are actively developed during university-based training (Baumgartner, 2018b; Seyda, 2020).

At the same time, the sports domain offers a wide range of digital applications, with digital technologies playing an increasingly important role across all areas of sport science. In the context of PE, tools such as video recordings—including 360° formats—are seen as particularly effective, as they support analysis of performance, facilitate constructive feedback, and contribute to the professional development of future teachers (Østerlie et al., 2025). Embedding such tools into teacher education not only reflects the realities of contemporary sport practice, but also fosters digital competence in authentic, subject-specific contexts. In this way, video-based teaching scenarios have established themselves as valuable instruments for promoting professional learning and didactic growth in PETE.

By engaging with authentic classroom recordings, students are encouraged to critically analyze teaching practices, identify areas for improvement, and deepen their instructional understanding across various subject areas (Gaudin & Chaliès, 2015; Sablić et al., 2021; Erdemir & Yeşilçınar, 2021).

However, Krause et al. (2020) have emphasized the lack of research on technology integration in PETE and called for more discipline-specific approaches. Moreover, peer feedback has been identified as a key strategy in fostering professional learning in teacher education (Erdemir & Yeşilçınar, 2021; de la Iglesia et al., 2024). Yet its implementation in PE remains under-researched (Patton & Marty-Snyder, 2014).

The present study addresses this research gap by examining how video-based peer feedback is perceived by pre-service PE teachers with regard to its potential to foster professional competences.

Professional competences

Competence is generally understood as a learnable and developable construct relevant to professional action (Baumgartner, 2022; Blömeke et al., 2015). According to Baumgartner (2022, p. 550), a person is considered competent “if he or she has sufficient resources to fulfil the requirements to perform successfully in professional situations.” Within educational contexts, this translates to professional competence, which refers to the knowledge, skills, and attitudes required to meet the demands of the teaching profession (KMK, 2004). In PE, the teaching profession presents specific challenges due to its strong integration of cognitive, physical, and interpersonal demands (Francesco et al., 2019). PE teachers must draw on a broad range of competences developed during their university training (Seyda, 2020; KMK, 2004). Among the most important dimensions of competence for PE teachers—particularly in light of increasing digitalization and the rise of video-based learning tools (Krause et al., 2020; Gaudin & Chaliès, 2015)—are motor competence, professional knowledge, and feedback competence. The following section provides a focused overview of these three areas and summarizes existing evidence regarding their development through video-based feedback approaches.

Motor competence is a fundamental component of professional competence in physical education, as PE teachers are expected to perform and demonstrate movements accurately and serve as physical role

models (Baumgartner, 2022). High-quality demonstrations and active teacher involvement have been shown to directly influence students' physical literacy and motor learning (Chen et al., 2016; Librianty & Yetti, 2021; Silverman & Mercier, 2015). Research suggests that video-based feedback supports motor competence development by allowing learners to observe, analyze, and correct their own performances. Trabelsi et al. (2020) and García-González et al. (2013) demonstrated that video feedback improves both movement execution and tactical decision-making. In teacher education specifically, Zulkifli and Danis (2022) showed that watching their own movement recordings helped PE students identify and correct biomechanical errors (e.g. in tennis or badminton) and increased their engagement and motivation during practice.

Professional knowledge—including subject-matter knowledge, pedagogical content knowledge, and general pedagogical knowledge—is a key component of teacher competence (Baumert & Kunter, 2006; Seyda, 2020; Büchel et al., 2022). In PE, this includes understanding movement theory (Baumgartner, 2018a), instructional strategies (König et al., 2014), and typical learning difficulties (Baumgartner, 2018a). Video-based peer feedback has been shown to support the development of such knowledge, particularly by enhancing reflection. Lamb et al. (2013) demonstrated that video recordings of one's own teaching, coupled with peer feedback, fostered both individual reflection and collaborative learning. This process encouraged deeper understanding of teaching content and its transmission. Similarly, Lee and Choi (2017) found that peer interactions supported reflective practice, and Eather et al. (2017) reported improvements in self-efficacy and perceived teaching competence. Trabelsi et al. (2020) further found that video-based peer feedback improved not only motor execution but also cognitive understanding of the movement (e.g. biomechanics of long jump), particularly among female students. Zulkifli and Danis (2022) confirmed that video-based review helped students gain biomechanical insight, such as hip rotation during movement execution.

Feedback competence is an essential aspect of a teacher's professional skillset, as the ability to provide effective and meaningful feedback plays a crucial role in student learning and engagement (Hattie & Timperley, 2007; Hattie, 2008). In physical education, the quality of teacher feedback significantly influences students' self-perception of competence (Nicaise et al., 2006), which in turn affects their enjoyment, intrinsic motivation, and performance (Li et al., 2005; Barić et al., 2014). Video-based approaches can enhance future teachers' feedback competence. Baumgartner (2018b) found that working on video-based teaching cases during training had a stronger impact on feedback development than working on text-based cases. Similarly, Lamb et al. (2013) observed that pre-service PE teachers became increasingly confident in giving peer feedback after reviewing videos of their own teaching, indicating a direct influence on their feedback competence. These findings suggest that video-supported peer interactions help teacher candidates practice giving constructive, focused, and relevant feedback—an essential component of effective teaching (Koka & Hein, 2003; Nicaise et al., 2006).

Summary and aim of the study

Research strongly suggests that professional competences of future PE teachers can be fostered through the use of video technology and video-based peer feedback. Receiving video-based feedback from an educator has been associated with improvements in motor competence and indications of enhanced theoretical knowledge of a movement (Zulkifli & Danis, 2022). Peer interactions are known to facilitate reflective practice (Lee & Choi, 2017) and improve future PE teachers' self-perceived teaching competence, confidence, and self-efficacy (Eather et al., 2017), thereby contributing significantly to their professional

development (Wang & Ha, 2009). In addition, peer feedback based on recordings of teaching practice promotes reflective abilities and supports ongoing practical improvement (Lamb et al., 2013) while the integration of video technology also increases motivation and engagement among initial PE teachers during the learning process (Zulkifli & Danis, 2022). Moreover, engagement with video-based classroom cases has been shown to enhance feedback competence (Baumgartner, 2018b; Lamb et al., 2013).

However, despite these promising findings, only limited research has specifically addressed how prospective PE teachers perceive the development of their professional competences in initial teacher education. Furthermore, little is known about how peer feedback based on recordings of movement performances—which has been shown to improve not only students' motor skills but also their theoretical understanding and engagement in PE contexts (Trabelsi et al., 2020)—is experienced and evaluated by students with regard to its influence on their own professional competence development. Therefore, the present study was designed to examine students' perceptions of the impact of video-based peer feedback on their movement performance, focusing on their self-assessed development of key professional competences—namely motor competence, professional knowledge, and feedback competence—among prospective PE teachers. The study addresses the following research question:

How do pre-service PE teachers perceive the contribution of video-based peer feedback to the development of their professional competence in terms of a) motor competence, b) professional knowledge, and c) feedback competence?

Method

Design and procedure

Rather than attempting to measure actual competence gains, this study focuses on students' self-reported perceptions of the method's usefulness and relevance. Given the limited empirical evidence on competence development through video-based peer feedback in PETE, students' evaluations can serve as early, subjective indicators of professional development. Moreover, focusing on perceptions allows capturing the contextual richness of authentic learning settings and gathering in-depth insights into students' experiences with the intervention.

In this context, it explores the perceived opportunities and challenges of integrating digital tools—specifically video-based peer feedback—into PE teacher education and aims to gain deeper insight into how students themselves evaluate its impact on their learning processes and professional development. To examine the effectiveness of video-based peer feedback under authentic conditions and ensure high external validity, the study was designed as a cross-sectional field study employing a mixed-methods approach.

During and after two regular sport didactic courses in advanced field hockey at the university, bachelor's students in PE received field hockey instruction over a 15-week period. At the beginning of each session (each lasting 45 minutes), the course instructor demonstrated and explained the relevant movement techniques. In the final four sessions, video-based peer feedback was systematically integrated into the course following a preparatory introduction on how to give and receive effective feedback.

Hockey was selected as the instructional content because it was part of the existing PETE curriculum that semester, providing the necessary time and course structure to implement video-based peer feedback

under authentic conditions. Additionally, one of the authors brought several years of practical experience teaching hockey, which further supported the choice of this course for the study.

For the implementation of the peer feedback phase, students were assigned fixed pairs for the four-week period. Within each pair, one student recorded the other's movement performance using a mobile device. To ensure the protection of personal data, the mobile device of the person performing the movement was used to record the video. Both students then watched the recording together, with the recording student acting as the feedback provider and commenting on the observed motor performance. The recorded performance was compared with printed visualizations of the correct technique, enabling guided reflection and discussion. Roles were alternated several times to ensure that each student experienced both feedback roles equally.

To evaluate the use of video-based peer feedback, a sequential mixed-methods design was employed. At the end of the final session, participants were invited to complete a short quantitative online survey via smartphone. For this purpose, a QR code linking to the survey was provided on site. Participation was voluntary and anonymous. The questionnaire included several item blocks assessing key dimensions such as perceived usefulness, personal benefit, and learning effects. As all course participants were invited, the data provided a representative overview of students' perceptions regarding the peer feedback intervention.

To better understand the reasons and motivations behind students' responses—beyond the levels of agreement captured in the quantitative survey—semi-structured interviews were conducted two weeks after the final session. Participation was again voluntary. The interview guide addressed students' general experiences with field hockey and video-based feedback, as well as their reflections on the development of professional competences—such as motor skills, subject-specific knowledge, and feedback competence—through the feedback process. Interviews were conducted individually via online video calls and lasted between 15 and 25 minutes, allowing for an in-depth exploration of individual perspectives and learning processes.

The sequential design—combining quantitative breadth with qualitative depth—was chosen to generate a comprehensive and nuanced understanding of students' experiences with video-based peer feedback (DiCicco-Bloom & Crabtree, 2006), especially given the limited empirical evidence available in this area to date (Cassell & Symon, 2011).

Ethical approval

Ethical approval for the study was granted by the Ethics Committee of the Faculty of Social Sciences, Media and Sport at Johannes Gutenberg University Mainz (JGU) on June 20, 2023, under approval reference number 2023-06. This study used video-based peer feedback on movement execution. Recordings of the students' movements were made using their own mobile device, ensuring that only the person filmed had access to their own video recordings. The videos were not stored on any other device or server in the context of the study. Additionally, online interviews were conducted and video recorded. After transcription, the data was anonymized and each interviewee was assigned a code (B1-B9) for data analyses. Based on the ethics vote, the data was stored on a GDPR-compliant server at JGU.

Quantitative survey

Questionnaire

In addition to established scales, which were partially adapted to the context of video-based peer feedback to measure various constructs, further individual items assessing motivation and enjoyment in playing field hockey were included.

Both self-perceived field hockey competence and the perceived competence of the feedback partner were assessed using Ohanian's (1990) expertise scale (5 items each; α = .91 and α = .77, respectively), focusing on attributes such as expertise and skills. Also attitudes toward video-based feedback in sport didactics (Aydın et al., 2014; 5 items, α = .87, e.g. "I believe that using video feedback in this course will be useful in the future"), and perceived personal benefits of video-based feedback (Lewis, 2019; 6 items, α = .85, e.g. "Using video feedback helped me to implement the feedback more quickly") were requested. In addition, improvements in professional competence through giving feedback were measured using the VOFQ (Appendix Professional Competence Scale 1, Trabelsi et al., 2020; 8 items, α = .90, e.g. "If I was the one who provided feedback based on videos, it helped me promote interaction between me and my feedback partner") as well as six self-developed items (Appendix Professional Competence Scale 2, α = .90, e.g. "If I was the one who provided feedback based on videos, it helped me to reflect on movement sequences"). Improvements through receiving feedback were likewise assessed via the VOFQ (Appendix Professional Competence Scale 1, 8 items, α = .84) and six self-developed items (Appendix Professional Competence Scale 2, α = .78).

All items were rated on a five-point Likert scale ranging from 1 ("I strongly disagree") to 5 ("I strongly agree"). Demographic information (e.g. age, gender, active membership in a hockey club) was also collected. On a separate, anonymously linked page, participants were asked whether they would be willing to voluntarily take part in follow-up interviews.

The list of scales used in the questionnaire, including original sources and adapted item formulations, is provided in the appendix.

Sample

Of a total of 34 course participants, 28 completed the questionnaire in full. Among them were 17 men and 11 women. Two participants were or are members of a hockey club, each with more than six years of experience.

Results

As shown in Table 1, participants' perceptions of both their *own hockey competence* and that of *their feedback partners* were, on average, moderate, though responses varied substantially.

Attitudes toward video-based feedback were very positive, with strong agreement on its usefulness within the context of the field hockey course. Likewise, the *personal benefits of video-based feedback* were rated relatively high.

The impact of video-based feedback on competence development was examined from different angles. The perceived improvement of one's own skills through *receiving feedback* was measured using two scales (see Appendix Professional Competence Scale 1 and Scale 2). On both, participants predominantly agreed that their professional competences were enhanced through video-based peer feedback. The same scales were also used to assess competence development through *giving feedback*. Mean scores were nearly identical

for both receiving and providing feedback, suggesting that both roles contribute equally to professional growth.

Table 1 Descriptive statistics of students' assessments

Item	*M*	*SD*
Own Competence in hockey	2.96	0.87
Competence of the feedback partner	3.18	0.60
Attitude towards video-based feedback in the course	4.19	0.87
Personal benefit of video-based feedback	3.46	0.72
Improvement through *receiving* feedback – Scale 1	3.73	0.66
Improvement through *receiving* feedback – Scale 2	3.95	0.58
Improvement through *providing* feedback – Scale 1	3.78	0.71
Improvement through *providing* feedback – Scale 2	3.92	0.82

Note: Descriptive statistics of students' assessments Items were measured on a 5-point Likert scale. The higher the means, the more positive the assessment or the higher the agreement with the statements.

Semi-structured interviews

Interview Guide

The semi-structured interview guide aimed to explore students' experiences with video-based peer feedback on the field hockey course and to better understand their underlying perspectives and motivations. The guide consisted of thematic blocks including participants' prior hockey experience and self-assessed competence, previous encounters with video feedback, and the perceived benefits of video-based peer feedback for motor skill development, learning processes, and feedback competence. Particular emphasis was placed on the role of interaction during feedback exchanges and its contribution to understanding and applying feedback. The interview also addressed participants' reflections on the practical relevance of video-based feedback for their future profession as PE teachers, as well as any concerns or critical views regarding its use.

Sample

Nine semi-structured interviews were conducted with students participating in the course. Of these participants, seven were male and two were female, with ages ranging from 21 to 27 years. All reported having prior experience with video-based feedback before the field hockey course. For example, some had encountered it through their teachers in school, others had videotaped themselves while preparing for university exams or had used video-based feedback in their sports clubs.

Most interviewees had little practical experience with field hockey before the didactic course. Only two participants had more extensive experience: one had played field hockey for two years during secondary school, and the other had been actively playing the sport for 12 years since childhood.

Regarding their self-perceived motor competence (after completing two semesters of the didactic course), the majority of the pre-service PE teachers classified themselves as beginners or between beginner and advanced levels.

Data analysis

After transcription of the interviews, a qualitative content analysis according to Mayring's technique of summarizing (Mayring, 2010) was conducted using the Software MAXQDA 24 V5. The main categories were built deductively, based on the interview guideline structure. Sub-themes which emerged during the coding process were built inductively (highlighted in italics in the following).

Results

The qualitative analysis was organized around three core categories reflecting the central professional competences identified in the literature and mirrored in the interview guide: *Motor Competence*, *Professional Knowledge*, and *Feedback Competence*. These categories correspond to the key competence areas emphasized in both the theoretical framework and participants' responses. The following sections provide a detailed account of these categories and their associated sub-themes, offering deeper insight into the mechanisms underlying the benefits of video-based peer feedback.

Motor competence. Participants predominantly reported development in their motor competence regarding the field hockey techniques practiced. Even when a technique was already well-mastered from a student's perspective, they noted that finer details could still be optimized.

> It [video-based peer feedback] helped a lot, even to improve nuances that were just missing. (B7, m)

Alongside these positive assessments, some critical perspectives emerged. One participant, an advanced hockey player before the intervention, did not perceive an improvement in technique but emphasized that the intervention was useful for their peers. Another participant felt the intervention did not enhance motor competence because, in the participant's view, the integration of video-based feedback reduced actual movement practice time, limiting opportunities to develop a bodily sense of the execution.

However, for those who perceived performance improvements, the video medium was consistently recognized as a valuable tool. Even among those without perceived improvements, respondents acknowledged the general usefulness of video-based feedback for refining movement technique. The primary factor contributing to motor competence improvement, as reported by participants, was the *identification of errors in their own movement performance* through video analysis. Their ability to observe their performance from an external perspective was highlighted as crucial. This external viewpoint was considered significant because participants frequently noted a discrepancy between their self-perception and the actual execution of movements.

> I perceive things differently than the camera does from the outside, and it helped a lot to be able to see what my movement looked like. Sometimes I perceived it differently to how it was shown in the video. Seeing from the outside how I actually do this movement and what looks the same when you compare it to a technical model helped me to compare where I am and what it should look like, where the differences are. (B6, f)

Secondly, errors in performance were easier to detect because students could watch their movement repeatedly and in slow motion. This enabled them to focus on specific details and components of their movements.

> I believe that the video provides a very good additional tool to watch it [the movement performance] in slow motion again. [...] For example, to see when I swing my hockey stick,

> or when I turn one of my legs or whether my leg actually turns enough. You can simply pay much better attention to individual things and that's the big benefit of it. (B5, m)

Beyond error recognition, one interviewee emphasized that the video also helps to acknowledge what one is already doing well. Another recurring theme was the motivational effect of being recorded, which encouraged students to perform at their best—even when they felt they had already mastered a technique. Thus, the presence of the video was seen as a motivational factor promoting maximal effort.

In addition to the benefits derived from the video medium itself, peer feedback provided an additional layer of insight. The *peers' perspectives on movement execution were considered a valuable complement to self-observation*, reinforcing the idea that "four eyes are better than two" (B6, f).

> Having someone else look at it [the video] gives you a different point of view and perspective. You have different knowledge, so it's always good to have someone else look at it. You see things that other people don't see. […] You have a broader perspective. That's the advantage, I would say. (B1, m)

Professional Knowledge. Regarding the development of professional knowledge, participants highlighted several aspects spanning subject-specific knowledge, didactic knowledge, and general pedagogical knowledge.

Concerning subject-specific knowledge, participants reported that watching the video recordings prompted *self-reflection on their movement performance*, which clarified their understanding of the movement concept.

> I watch the video and then automatically reflect on what was good, what wasn't, and what doesn't work at all. I think there is always an automatic process of reflection. (B2, m)

This point was also supported by another interviewee:

> […] You could look at it [the video] and yourself and see exactly 'okay, maybe I need to bend my hips a bit further here' [...]. You had direct evidence of what was going wrong, where I could have done better and that also improved my perception of movement. (B8, m)

Moreover, participants *engaged in detailed discussions* about movement techniques with their peers, attempting to explain, based on movement theories, which technical adjustments were needed and why. This collaborative analysis supported a deeper and more precise understanding of the movement concept, thereby fostering the acquisition of subject-specific knowledge. In this context, the video medium proved highly valuable as it facilitated interactive, step-by-step movement analysis and enhanced conceptual understanding.

> Normally, if you practiced with a fellow student, the movement was viewed as a whole: 'That was quite good, that wasn't so good' and then the individual point was addressed once. The video feedback created a real conversation around it. We were saying why we were doing the movement, so we tried to explain why we should perform this movement or this aspect of the movement in this way. When you filmed it again, you recognized your own mistakes, reflected on them and a pleasant conversation developed. (B3, m)

Along these lines, another participant remarked:

> It has certainly improved my understanding of the movement [...] because the interaction makes you engage more with the movement. [...] You are working on a movement together,

> someone is giving you feedback, and you are communicating about the movement. I think that helps with the idea of movement. (B4, m)

Two further points related to didactic knowledge emerged: *improved awareness of typical movement errors* and an *enhanced ability to verbalize movement techniques*. Since most participants were beginners learning field hockey, they observed their own typical beginner mistakes on video, which became more salient to them. Consequently, their knowledge expanded to include an increased awareness of what to focus on when teaching these movements to beginners.

> You have seen on yourself [...] what mistakes you make as a beginner that you should pay particular attention to when teaching. (B7, m)

Regarding the ability to verbalize movement technique, students reported that performing a movement differs significantly from being able to articulate it. Their self-reported improvement in conceptual understanding was associated with subjectively increased verbalization skills, indicating better communication of movement concepts to future PE students.

> Because it's [the movement] usually subconscious, but being able to verbalize it is something completely different and it helped a lot. (B1, m)

Additionally, participants highlighted perceived *gains in general pedagogical and methodological knowledge* related to teaching movements. They recognized the increasing role of digitalization in education and valued the intervention for providing new teaching approaches. They saw potential for video-based peer feedback to be applied beyond field hockey—in other sports like swimming, gymnastics, and athletics—and within gameplay scenarios to teach tactical skills (e.g. in handball). Alongside opportunities, participants also became aware of challenges such as data protection issues, reflecting a more nuanced understanding of implementing technology in school settings. This broadened their general pedagogical knowledge.

> It has given me another way to teach movement better because the students can learn more on their own. It's an additional option. (B3, m)

Feedback competence. Interviewees who reported improvements in their feedback competence emphasized that the intervention provided *valuable practice in giving feedback* generally, helping them *develop a better sense of how to formulate feedback*—especially with regard to being sensitive to the recipient's feelings.

> You practiced it, and I think you were able to give better feedback […]. I would say it has improved [...]. (B1, m)

Reinforcing this point, another respondent explained:

> When you received feedback, you noticed 'somehow, that it was very, very direct, maybe it would have been better for me personally, if it had been formulated differently.' That gave you an idea of how you feel when you get feedback on a movement that is not yet so good. […] Receiving feedback has given you a bit of a feel for how you should give feedback, how you can feel as a feedback recipient. Giving feedback has improved the competence that you need as a teacher in the future and possibly even brought it to a higher level because you haven't done it that often yet. (B7, m)

Another important aspect was an increased confidence in providing feedback to future PE students on movements they had learned, grounded in their *enhanced ability to recognize errors in movement execution*.

> The more time passed, the less I had to watch the video to give specific and good feedback. (B3, m)

Furthermore, the video medium was consistently recognized as significantly adding value to the peer feedback process, both when giving and receiving feedback. The recording allowed students to retain detailed information about their peer's performance and to refer back to it when needed, which made giving feedback easier and boosted their confidence. Interviewees also noted that peers receiving feedback perceived it as more credible and objective due to the presence of the video. The recordings served as concrete evidence that feedback was based on observable movement performance rather than subjective judgment, thereby increasing acceptance of peer feedback.

> You also accept the feedback better because you have the video and because it's not just based on a subjective perception. (B6, f)

This view was echoed by another participant:

> When you have the video in front of you, you can repeat it endlessly and if you only see the movement once [without video], you become much less confident because [...] there's so much you must pay attention to at the same time. The video makes it [the feedback] much more precise, much better. (B2, m)

Overall, the findings suggest that students felt their motor competence, professional knowledge, and feedback skills improved through video-based peer feedback. They highlighted both motivational and instructional benefits, noting its role in promoting reflection, error detection, and the perceived ability to communicate movement concepts more effectively.

Discussion

This study examined how pre-service PE teachers perceived the contribution of video-based peer feedback to the development of their professional competence in terms of motor competence, professional knowledge, and feedback competence. The quantitative findings indicate consistently positive evaluations of video-based peer feedback, with comparable benefits reported for both receiving and providing feedback. The qualitative data further support these results. Students stated that combining video analysis with peer interaction fosters reflective processes, helps detect errors, improves understanding of movement, and supports the formulation of constructive feedback. In line with prior research on motor competence (Trabelsi et al., 2020; Zulkifli & Danis, 2022), professional knowledge (Eather et al., 2017; Lamb et al., 2013; Lee & Choi, 2017; Wang & Ha, 2009) and feedback competence (Baumgartner 2018b; Lamb et al., 2013), the findings suggest that video-based peer feedback yields synergistic effects across competence domains. Overall, the study underscores the potential of digitally supported peer feedback as a meaningful approach to promoting multidimensional professional competence development in PETE.

These findings carry several implications for PETE in academic practice. First, the collaborative analysis of recorded performances appears to provide a structured opportunity to interlink subject-specific knowledge with didactic decision-making. By fostering students' ability to verbalize movement concepts, identify typical beginner errors, and anticipate learning difficulties, video-based peer feedback supports the

integration of subject-specific knowledge and pedagogical content knowledge, which is regarded as a foundation for effective instruction (Büchel et al., 2022). Teacher education programs should therefore deliberately embed structured video-based reflection phases into practical courses to promote this connection rather than treating motor learning and the acquisition of professional knowledge as separate domains.

Second, the reported gains in feedback competence underline the need to conceptualize feedback not merely as an intuitive skill, but as a professional competence that requires guided practice. In line with Baumgartner (2018b) and Lamb et al. (2013), the present findings suggest that the combination of video evidence and peer dialogue enhances the objectivity, credibility, and empathy of feedback processes. Systematically integrating video-based peer feedback into PETE curricula could therefore help address a frequently underdeveloped area of teacher preparation by offering repeated, low-threshold opportunities to practice constructive and learner-sensitive feedback.

Third, the synergistic effects of combining video and peer feedback indicate that digitally supported reflection formats may serve as a bridge between students' perceived motor skill development and their self-reported professional competence formation, highlighting the potential of video-based peer feedback as a tool to support multidimensional professional learning. Strengthening pre-service teachers' perceived motor competence could potentially influence how they present tasks and may contribute to the quality of motor learning in school PE, according to prior literature (Chen et al., 2016; Silverman & Mercier, 2015) and participants' self-reports.

At the same time, enhanced professional knowledge and feedback competence are associated with improved student performance, motivation, and enjoyment (Mahler et al., 2017; Baumert et al., 2010; Nicaise et al., 2006; Li et al., 2005; Koka & Hein, 2003). From this perspective, integrating video-based peer feedback is not merely a methodological enrichment, but a strategically relevant contribution to preparing digitally and pedagogically competent PE teachers.

However, this study has some limitations. The mixed-methods, cross-sectional design prioritizes ecological validity but limits the ability to control for confounding factors such as variable attendance and team consistency. Moreover, this study represents a single case example focused on a university-level hockey course, so the transferability of findings to other sports or teaching contexts remains uncertain. Factors such as group dynamics, overall learning climate, and interpersonal relationships likely influenced the outcomes but were not systematically controlled or measured. Additionally, results rely on self-perceptions rather than objective competence measures. This approach was chosen because students' evaluations provide context-rich insights and serve as early indicators of perceived professional development, especially given the limited empirical evidence on competence gains through video-based peer feedback in PETE. Future studies should incorporate performance assessments and longitudinal designs to evaluate actual competence growth and transfer into classroom practice (Baumgartner, 2022; Francesco et al., 2019; Blömeke et al., 2015). The intervention's limited timeframe also suggests that extended implementation might enhance outcomes.

Conclusion

In conclusion, the present study highlights the considerable potential of video-based peer feedback as an integrative and effective approach within PETE. By combining video analysis with collaborative reflection, this method not only enhances pre-service PE teachers' perceived motor competence but also strengthens

their perceived professional knowledge and feedback competence in a mutually reinforcing way. Consequently, embedding such digitally supported, interactive learning formats in PETE curricula appears to be a promising pathway for fostering the multidimensional professional development of pre-service PE teachers.

Despite the constraints mentioned in the discussion section, this study offers valuable insights into PETE in academic practice and illustrates the potential of video-based peer feedback to simultaneously foster pedagogical and digital competences. It responds to calls for expanded research in this emerging field (Krause et al., 2020) and lays the groundwork for future explorations of technology-enhanced learning in teacher preparation.

Declarations

The authors disclose that they have no actual or perceived conflicts of interest.

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Appendix

Scales used in the questionnaire

All items were measured on a 5-point Likert scale.

Attitudes towards video feedback in hockey course: adapted scale according to Aydın et al.'s (2014) Amotivation Scale

What do you think about the use of video feedback in the context of hockey teaching methodology based on your current experiences? Please indicate below the extent to which you agree with the respective statements.

Original	Adaption	German translation
To be honest, I don't see any reason for learning biology.	I can see many reasons why learning how to use video feedback as part of this course will help me to play better hockey.	Ich sehe viele Gründe, durch den Einsatz von Video-Feedback im Rahmen dieses Kurses besser Hockey spielen zu lernen.
Actually, I don't think the subjects that I learn will be useful for me in the future.	I believe that using video feedback in this course will be useful in the future.	Ich glaube, dass der Einsatz von Video-Feedback im Rahmen dieses Kurses in der Zukunft nützlich sein wird.
Honestly, I don't know why I should learn biology.	I know why I should learn how to use video feedback in this course.	Ich weiß, warum ich den Einsatz von Video-Feedback im Rahmen dieses Kurses lernen sollte.
I have no idea. I don't understand how useful the things I learn will be.	I understand how useful using video feedback in this course will be.	Ich verstehe, wie nützlich der Einsatz von Video-Feedback im Rahmen dieses Kurses sein wird.
In fact, I don't like participating the activities in biology.	I am happy to take part in this course on using video feedback.	Ich nehme gern an diesem Kurs mit Einsatz von Video-Feedback teil.

Perceived personal benefits of video feedback: adapted scale according to Lewis' (2019) Perceived Usefulness (PU) Scale

Opinions on the usefulness of video feedback vary widely. To what extent do you agree with the following statements based on your personal experiences?

Original	Adaption	German translation
Using [this product] in my job would enable me to accomplish tasks more quicky.	Using video feedback helped me to implement the feedback more quickly.	Der Einsatz von Video-Feedback hat mir geholfen, die Rückmeldungen schneller umzusetzen.
Using [this product] would improve my job performance.	Using video feedback improved my performance in this course.	Der Einsatz von Video-Feedback hat meine Leistung im Rahmen dieses Kurses verbessert.
Using [this product] in my job would increase my productivity.	Using video feedback had a positive effect on how quickly I learned the hockey moves (increased efficiency).	Der Einsatz von Video-Feedback hat sich positiv darauf ausgewirkt, wie schnell ich die Hockeybewegungen erlernte (erhöhte Effizienz).
Using [this product] would enhance my effectiveness on the job.	Using video feedback increased my effectiveness in hockey.	Der Einsatz von Video-Feedback hat meine Effektivität beim Hockey erhöht.
Using [this product] enhances my effectiveness in my job.	Using video feedback helped me to perform the hockey moves correctly.	Der Einsatz von Video-Feedback hat es mir erleichtert, die Hockeybewegungen richtig auszuführen.
I would find [this product] useful in my job.	Using video feedback was useful to me in this course.	Der Einsatz von Video-Feedback war nützlich für mich im Rahmen dieses Kurses.

Professional Competence Scale 1: adapted scale according to Trabelsi et al.'s (2020) Video-Mediated Oral Feedback Questionnaire

*Please indicate to what extent you agree with the following statements about receiving / giving video peer feedback. If I was the one who **received / provided** feedback based on videos, it helped me to...*

Original	Adaption	German translation
Promote interactions between me and my classmates.	... to promote interaction between me and my feedback partner.	… die Interaktion zwischen mir und meiner/meinem Feedback-Partner*in zu fördern.
Motivate me to produce a greater amount of feedback.	... to receive/provide a large amount of feedback.	… Feedback in einer großen Menge zu erhalten/geben.

Help me with understanding and analyzing the content in an easier and faster way.	... to understand and analyze the facts quickly and easily.	… den Sachverhalt einfach und schnell zu verstehen und zu analysieren.
Draw my attention much more.	.... to generate a high level of attention.	… meine Aufmerksamkeit in hohem Maß zu generieren.
Assist me in understanding my peer's feedback in a more favorable manner.	... to understand the feedback received/provided.	… erhaltenes/gegebenes Feedback zu verstehen.
Help me improve the quality of my produced feedback.	... to receive/provide high-quality feedback.	… qualitativ hochwertiges Feedback zu erhalten/geben.
Help me remember all recorded notes about my peer's performance in order to provide him with feedback.	... to remember all the information about my performance/my peer's performance in order to receive/provide feedback.	… alle Informationen über meine Leistung/die Leistung meines Gegenübers in Erinnerung zu behalten, um Feedback zu erhalten/geben.
Make my peer's feedback more convincing and reliable.	... to make the feedback received/provided convincing and reliable.	... das erhaltene/gegebene Feedback überzeugend und zuverlässig zu machen.

Professional Competence Scale 2: own items developed based on literature review

*If I was the one who **received / provided** feedback based on videos, it helped me to...*

English	**German translation**
... to recognize mistakes in my movement sequences.	… Fehler in meinem Bewegungsablauf zu erkennen.
... to improve my own competence in giving feedback.	… meine eigene Kompetenz im Feedback geben zu verbessern.
... to reflect on movement sequences.	… die Bewegungsabläufe zu reflektieren.
... to understand movement sequences.	… die Bewegungsabläufe zu verstehen.
... to be able to teach movement sequences myself.	… die Bewegungsabläufe selbst vermitteln zu können.
... to feel confident in giving feedback.	… mich selbst sicher im Feedback geben zu fühlen.

Ohanian's Expertise Scale (1990)

*How would you describe **yourself / your feedback partner** in terms of **your / his, her** expertise in hockey?*

Original	**German translation**
Expert – not an expert	Kein/e Experte/in – Experte/in
Experienced – inexperienced	Unerfahren – Erfahren
Knowledgeable – unknowledgeable	Unwissend – Wissend

Qualified – unqualified	Unqualifiziert – Qualifiziert
Skilled – unskilled	Inkompetent – Kompetent

Note: In our translation, we have placed the negative descriptions on the left and the positive ones on the right to maintain the logic of the questionnaire.