Social Sciences & Humanities Open 12 (2025) 102075

Contents lists available at ScienceDirect

Social Sciences & Humanities Open

journal homepage: www.sciencedirect.com/journal/social-sciences-and-humanities-open

Regular Article

Video technologies supporting collaborative learning and knowledge building in initial teacher education: A PRISMA-guided systematic review

Ricardo R. Monginho [a,*], Frank De Jong [b], Paulo Costa [a]

[a] University of Évora – CIEP-UÉ, Portugal
[b] Open University of The Netherlands, Portugal

ARTICLE INFO

Keywords:
Video technologies
Initial teacher education (ITE)
Collaborative learning
Knowledge building
Systematic review

ABSTRACT

This systematic review, following the PRISMA guidelines, examines the role of video technologies in supporting collaborative learning and knowledge building in Initial Teacher Education (ITE). Thirty-six peer-reviewed studies published from 2000 to 2024 were examined using thematic analysis. Three primary video modalities were identified: video recordings, video-based content and live video conferencing. Research demonstrates that video recordings promote reflective practice and peer feedback, video-based content facilitates collaborative analysis and shared understanding, and live video conferencing appears to reveal emerging opportunities for real-time collaboration. The review emphasizes the pedagogical significance of these modalities and addresses gaps, especially the inadequate incorporation of synchronous tools, suggesting directions for future research.

1. Introduction

As educators and researchers have become aware of how powerful video technologies can be in transforming learning environments, the use of these technologies in teacher education has increased in recent years (Colassante, 2022). Video technologies provide adaptable and dynamic ways to improve teaching and learning which include a broad range of tools, from video recordings to live-streaming platforms (Brame, 2016).

As important components of effective teacher education, their integration into initial teacher education (ITE) has had a particularly significant impact, supporting student teachers in developing reflective practices, fostering collaborative learning and adding decisive contributions to the knowledge-building process (Borko et al., 2008; Darling-Hammond & Bransford, 2005; Scardamalia & Bereiter, 2006).

The value of collaborative learning and knowledge building has grown as traditional classroom models change to incorporate more student-centered approaches (Brown, Collins & Duguid, 1989; Scager et al., 2016). These pedagogies are highly suited to the demands of modern teacher education, such as technological proficiency and pedagogical integration, culturally responsive and inclusive pedagogy and a focus on 21st-century skills and deeper learning, as they place a strong emphasis on active participation, group inquiry and the iterative development of ideas. One of the aims of ITE in preparing future educators for the demands of modern education is to design dynamic learning environments in their classrooms, where students collaborate and actively participate in the construction of knowledge, rather than just imparting subject matter expertise and teaching techniques (Borko et al., 2008; Gillies, 2016; Scardamalia & Bereiter, 2006).

In view of this growing emphasis on the role of video technologies in shaping collaborative, knowledge-building-oriented teacher education, this systematic review aims to examine the following research questions:

1) What are the main research themes addressed in the selected papers?;
2) What are the video modalities being used in the selected papers?;
3) Are video technologies being used to support collaborative learning and/or knowledge building in the selected papers?

By exploring these key inquiries, this systematic review seeks to shed light on the evolving landscape of video-based teacher education and its implications for pedagogical innovation. Collectively, these observations regarding the increasing utilization and significance of video technologies in teacher education entail a thorough analysis of the pedagogical frameworks that support effective teaching and learning. The subsequent section examines collaborative learning and knowledge building in depth, establishing the theoretical framework for comprehending how video may enhance teacher development.

* Corresponding author. University of Évora – CIEP-UÉ, Praceta Manuel Joaquim Ourives da Silva, 2, Évora, 7005-145, Portugal.
E-mail addresses: rrm@uevora.pt (R.R. Monginho), fpcmdejong@gmail.com (F. De Jong), plc@uevora.pt (P. Costa).

https://doi.org/10.1016/j.ssaho.2025.102075
Received 22 July 2025; Received in revised form 7 September 2025; Accepted 5 October 2025
Available online 21 October 2025

1.1. Collaborative learning and knowledge building in teacher education

A fundamental pillar of 21st-century pedagogy is collaborative learning, especially in teacher training programs where aspiring teachers acquire knowledge from both mentors and fellow students. In structured group settings, collaborative learning entails problem-solving, insight-sharing, and the creation of new understanding. These very rich exchanges and interactions are extremely helpful, almost invaluable, for student teachers since they simulate the collaborative and interactive nature of the classroom teaching and learning they will eventually be leading one day (Gillies, 2016).

Video technologies provide more opportunities for collaboration by giving student teachers the opportunity to engage in peer feedback, observe and assess each other's teaching strategies and practices, while at the same time co-create solutions to pedagogical and practical teaching dilemmas even when they are separated by distance (Borko et al., 2008).

Knowledge building, a theory that emphasizes the ongoing development of ideas through group discourse and the collective sharing of knowledge, is closely related to collaborative learning but goes beyond it (Scardamalia & Bereiter, 2006). This pedagogical approach moves the emphasis in teacher education away from individual learning, cooperative learning and collaborative learning towards a more community-driven model where student teachers actively contribute collectively to the development of their ideas by using and building upon existing knowledge. This is in line with the requirements of modern learning environments, where teachers not only have to oversee a classroom but also create collaborative, critical-thinking and profoundly engaged learning environments (Van Aalst, 2009). Although frequently interconnected, collaborative learning and knowledge building constitute separate methodologies in teacher education.

Collaborative learning emphasizes organized group activities centered on problem-solving, collective insights, and the collaborative construction of knowledge. It underscores the collective effort toward achieving a common educational objective, reflecting the collaborative essence of education in schools. Knowledge building focuses on the incremental advancement of ideas through continuous dialogue and collaborative knowledge exchange. It transfers the emphasis from solitary learning to a community-oriented approach in which learners actively add to and enrich existing knowledge, thus promoting a profound, communal comprehension. Collaborative learning prioritizes teamwork, whereas knowledge building focuses on the collective construction of new knowledge and the development of shared understanding.

When it comes to encouraging knowledge-building practices, video technologies can provide unique benefits. By making use of the recordings from classroom interactions, teachers and students are given the possibility to revisit lessons, evaluate group discussions and pinpoint possibilities for further knowledge development (Sherin & van Es, 2009). Additionally, video recordings promote and support a level of reflection that is usually unattainable in other ways. In order to continuously develop themselves and gain a deeper understanding of their pedagogical strategies, teachers can record their lessons, watch them later and critically assess their teaching approaches and their students' engagement (Gaudin & Chaliès, 2015).

Having established that both collaborative learning and knowledge building prioritize active, community-oriented research, we can now examine how video technologies integrate with - and potentially enhance – these methodologies. The next section analyzes the distinct advantages of video in teacher education, emphasizing essential modalities and their educational consequences.

1.2. The role of video in teacher education

With the increasing use of digital and multimedia tools in education, new pathways for teaching and learning are being opened by the integration of video technologies into teacher training programs (see Ha et al., 2024). Video recordings, video-based content and live video conferencing are the three main ways that video technologies are used in ITE, according to Ramos et al. (2021):

- Video recordings is a modality that enables student teachers to examine and evaluate their own teaching performances, widely utilized in ITE for reflective practice. Student teachers can engage in a self-reflection process that fosters professional development by revisiting recordings of their lessons (Borko et al., 2008). Moreover, these recordings can also be shared with mentors and peers, which promotes collaborative reflection and peer feedback. The research shows how important the role of video recordings is in promoting a collaborative self-improvement culture, where teacher training programs incorporate critical reflection and feedback loops (Sherin & van Es, 2009).
- Video-Based Content: Another option for collaborative learning and knowledge building is the availability of excellent, carefully selected video content. Student teachers have access to instructional films, examples of good practices on teaching and other multimedia materials that offer tangible examples of lesson planning, classroom management and teaching strategies. In addition to being a learning tool, video-based content fosters collaboration because it allows students to discuss the subject matter in groups, offering feedback and expanding on the ideas discussed (Gaudin & Chaliès, 2015). This stimulates a shared understanding of efficient teaching practices and strategies while being aligned with the knowledge building principles.
- Live Video Conferencing: Live video conferencing is a topic that is becoming more and more interesting in teacher education, despite being less researched. With the real-time interaction this modality offers, student teachers can work together even when they are not in the same geographical location. Student teachers can take part in live feedback sessions with mentors and peers, engage in virtual classrooms and even teach in virtual classrooms by using platforms such as Microsoft Teams or Zoom. According to Roscoe and Chi (2008), live video conferencing offers an instantaneous and interactive platform for collaboration, promoting lively discussions that have the potential to improve collaborative learning and knowledge building.

Despite the potential of video technologies to enhance engagement and reflective practice in teacher education, several open questions remain. The subsequent section examines these gaps and delineates the necessity for additional study, especially in domains where knowledge regarding the effects of live video conferencing and other emerging tools is limited.

1.3. The need for further research

Despite the increasing use of video technologies in teacher education, there are still relations less focused in the literature. For example, the effects of live video conferencing on collaborative learning and knowledge building are less studied, despite the well-documented potential of video recordings and video-based material to support these goals. To more completely comprehend how real-time video interactions might support ITE communities, promote collaborative learning settings and encourage reflective practices, more study is required (Borko et al., 2008).

Furthermore, as video technologies are developing so quickly, further research on best ways to maximize them is necessary, so that they can fulfill the changing requirements of teacher education programs. Therefore, researchers need to keep looking into the best didactical ways to use video's affordances in order to develop learning environments that are more collaborative, interesting, and knowledge-rich as it becomes a more commonplace element of educational

practice (Gillies, 2016). Identifying these research gaps underscores the necessity for a comprehensive examination into how video technologies enhance collaborative learning and knowledge building. The next section delineates the objectives and importance of this systematic review, elucidating how it responds to the inquiries posed by the changing dynamics of teacher education.

1.4. Purpose and significance of this systematic review

This systematic review examines the current literature on the use of video technology in ITE to enhance the expanding research in this domain, and seeks to elucidate the complex impact of video technology in improving collaborative learning and knowledge building within ITE. In order to do so, this systematic review examines how different video modalities enable unique collaborative processes including peer feedback, collective reflection and co-creation of knowledge. This review examines how video can bridge the theory-practice divide, allowing student instructors to link theoretical concepts with practical classroom experiences, therefore promoting the development of more competent and well-prepared educators. This systematic review is pertinent to teacher education since it consolidates existing research to offer evidence-based recommendations for the appropriate incorporation of video in initial teacher education. The results will provide significant insights for teacher educators aiming to create more engaging and effective learning experiences that foster crucial 21st-century skills, including cooperation, critical thinking, and reflective practice.

This systematic review seeks to elucidate the utilization of different video modalities - video recordings, video-based content and live video conferencing - in ITE to promote and support reflection, collaboration and knowledge building. This study synthesizes previous research findings to provide a clearer framework for comprehending the pedagogical usefulness of video technologies in ITE and presents evidence-based insights to assist teacher educators in creating more collaborative, knowledge-rich and practice-oriented learning environments.

In accordance with these aims, the subsequent step is to delineate our methodological approach, informed by PRISMA guidelines. The next section describes the data collection procedure, inclusion and exclusion criteria, and search strategy, thereby ensuring transparency in the identification and selection of papers.

2. Review methodology – data collection

This systematic review utilizes a research methodology based on PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) to guarantee a thorough and transparent review procedure. The PRISMA framework is recognized as the benchmark for systematic reviews and meta-analyses, offering a definitive methodology for data collection, screening, and reporting. This review, by following PRISMA's recommendations, ensures that the selection process is systematic, transparent and reproducible, hence augmenting the reliability of its findings and conclusions (Moher et al., 2009).

The data gathering method commenced with the formulation of explicit inclusion and exclusion criteria to choose pertinent scholarly papers for review. The emphasis was on peer-reviewed journal publications published in English, guaranteeing access to high-quality research. Only papers from peer-reviewed academic publications with full-text access were included. This guaranteed that the examined research had completed stringent peer-review processes and could offer extensive insights. Documents such as reports, conference proceedings, books, theses and non-refereed publications were omitted from the systematic review to uphold scientific rigor and uniformity in the data (Liberati et al., 2009).

2.1. Eligibility criteria

Specific criteria were defined for the inclusion of papers in this systematic review to fit with the systematic review objectives. The papers were required to be written in English and published in peer-reviewed academic journals. This criterion was established to guarantee that the papers were accessible to a wider academic readership and that they conformed to scholarly publication norms. To uphold the academic rigor of the review, papers published in non-academic channels or those without peer review were eliminated (Gough et al., 2012).

The chronological period for the included papers spanned from January 2000 to December 2024. This period was selected to document advancements in video technology and its incorporation into ITE within the framework of the digital era. The turn of the century marks a pivotal transition in the integration of video technologies and digital tools in education, making an examination of this era pertinent and topical for understanding their application in ITE. By integrating papers published until December 2024, the review incorporates the latest findings and guarantees that the systematic review accurately represents contemporary trends and advancements in the field (Booth et al., 2016).

The chosen research concentrated on the application of video technology in initial teacher education. This criterion guaranteed that all examined papers were pertinent to the core research questions and provided significant insights into the utilization of video tools for facilitating collaborative learning, knowledge building and reflective practices in teacher training.

2.2. Criteria for exclusion

To preserve the integrity and relevance of the systematic review, certain categories of publications were omitted. This encompassed conference proceedings, dissertations, theses, books, book reviews, periodicals, brief surveys, short communications, correspondences, newsletters, discussions, product reviews, editorials, publisher's remarks, and errata. The omission of these sources was due to their failure to provide peer-reviewed empirical evidence or their insufficient depth to effectively enhance the systematic review. For instance, conference proceedings and editorials frequently present early findings or opinions instead of comprehensive research, rendering them inappropriate for inclusion in a systematic review centered on peer-reviewed academic papers (Petticrew & Roberts, 2006).

The systematic review concentrated on peer-reviewed journal papers, ensuring adherence to established standards for research design, data collecting and analysis. This method guarantees that the conclusions are based on sources readily available to the academic community, thereby improving the overall applicability and credibility of the systematic review (Jesson et al., 2011).

2.3. Search strategy

A thorough examination of databases was performed to locate pertinent papers. The databases comprised ERIC (Education Resources Information Center), Web of Science, Scopus, and Google Scholar, all of which offer comprehensive access to peer-reviewed academic literature in the field of education. Keywords and Boolean operators were employed to improve the search results as follows: ("initial teacher training" OR "initial teacher education" OR "student teacher") AND "video" AND ("knowledge building" OR "knowledge building theory" OR "knowledge building pedagogy" OR "knowledge building practice") AND ("collaborative learning" OR "collective learning" OR "cooperative learning") AND ("higher education" OR "university") AND ("initial teacher training" OR "initial teacher education" OR "student teacher"). To enhance the pertinence of the research, supplementary filters were implemented, encompassing language (English), publication date (2000–2024), and accessibility of full text (Booth et al., 2016).

Upon identifying the first set of papers (at the beginning of February, in 2025), the selection process adhered to the four phases of the PRISMA framework: identification, screening, eligibility, and inclusion. During the identification step, 1169 documents were identified. During the

screening step, 145 records were screened and 15 were excluded after duplicates checking, leading to 130 remaining papers for retrieval. From those sought for retrieval, 0 were not retrieved, meaning that the screening phase continued with the application of eligibility criteria. After analyzing the documents in the light of the eligibility criteria, 94 were excluded from the 130 screened records (n = 1 not in English language; n = 1 was a literature review; n = 15 not related to video technologies; and n = 77 video technologies were not central). In this eligibility phase, the complete texts of the remaining works were examined to verify their pertinence to the systematic review questions. Ultimately, the papers that satisfied all inclusion criteria were incorporated into the final analysis (by the end of February, in 2025), yielding a total of 36 papers (Moher et al., 2009) (see Fig. 1).

The complete search strings and database-specific filters are provided in Appendix A ("Search Strategy and Database Filters") to enhance transparency and replicability.

2.4. Thematic analysis

A thematic analysis was performed on the 36 selected papers to discern recurring themes and trends. Thematic analysis is a systematic procedure for categorizing and examining qualitative data, making it suitable for discovering prevalent themes in the literature (Braun & Clarke, 2006). This review employed thematic analysis to identify three distinct sub-themes regarding the use of video technologies in initial teacher education: 1) Video recordings for reflective practices, which enhances collaborative learning by facilitating peer observation and feedback, thereby promoting collaborative reflection on teaching methodologies and classroom management; 2) Video-based content for knowledge building and resource dissemination, which supports knowledge building by granting access to varied pedagogical strategies and enabling collaborative analysis of best practices; and 3) Live video conferencing for synchronous interaction which directly promotes collaborative learning through real-time discussions, joint problem-solving, and prompt feedback among student teachers.

Each sub-theme offered significant insights into the utilization of video technologies in teacher education, enhancing the comprehension of their function in promoting collaborative learning and knowledge building. Video recordings have become an essential instrument for fostering reflective practice, enabling student teachers to analyze and evaluate their teaching performances in conjunction with peers and mentors (Sherin & van Es, 2009). Likewise, the utilization of video-based content improved access to superior teaching resources, promoting collaboration among student teachers as they engaged in discussions and analyses of instructional videos (Gaudin & Chaliès, 2015). The third sub-theme, live video conferencing, although less widely studied, demonstrated real-time prospects for interaction and collaborative learning across distances (Roscoe & Chi, 2008).

The thematic analysis employed a collaborative and iterative coding procedure to guarantee qualitative rigor. Three independent coders evaluated the included studies, convening regularly to compare interpretations and reconcile any inconsistencies through conversation. In cases of dissent, themes were collaboratively revised until consensus was reached. Intercoder agreement across various coding rounds attained roughly 98 %, indicating a substantial degree of reliability. Thematic development was consistently validated by cross-referencing emergent themes with the original data to verify consistency and accuracy. This procedure bolstered the trustworthiness of the results and improved the transparency of the analytical framework.

2.5. Visual representation of the PRISMA Flow Diagram

A PRISMA Flow Diagram (Fig. 1) was created to visually depict the data gathering process, detailing the procedures used in identifying, screening, and choosing the final set of research papers. This flowchart offers a clear depiction of the process by which the original collection of papers was reduced to the 36 papers incorporated in the review. Adhering to the PRISMA process guarantees a systematic and replicable methodology, hence augmenting the credibility of the findings and recommendations (Moher et al., 2009).

By following these stringent protocols, we have assembled a robust corpus of pertinent papers. The subsequent "Results" section explores significant findings derived from this analysis, emphasizing predominant themes, the identified video modalities and their association with collaborative learning and knowledge building.

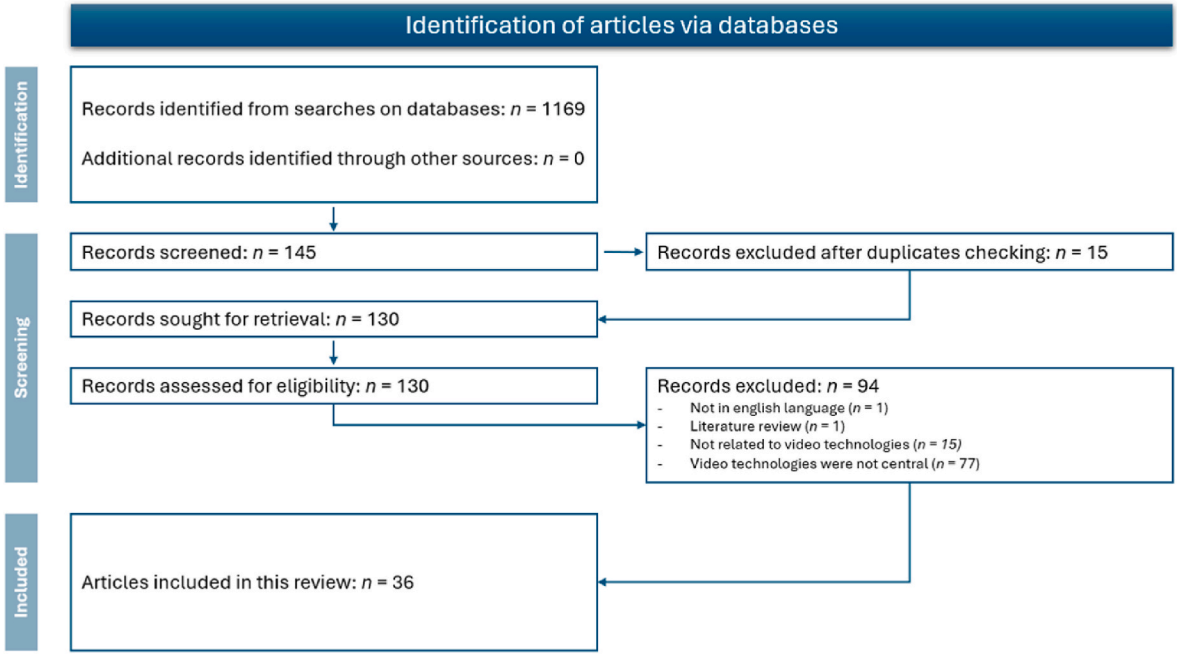

Fig. 1. – *PRISMA Flow phases and subsequent results of exclusion and inclusion.*

3. Results

3.1. Overview of the search procedure

The PRISMA comprehensive review method resulted in 36 publications that fulfilled the inclusion criteria. The papers are listed in Table 1, organized by year of publication. The systematic review, covering 2000 to 2024, indicated a significant lack of publications in the years 2000–2006, 2008, 2009, and 2014. This indicates a probable interval of restricted research engagement regarding the junction of video technology and teacher education, especially in the early 2000s, prior to the extensive use of digital video tools. The ensuing rise in publications from 2007 onward suggests an increasing interest in this domain, likely correlating with developments in video technology and its enhanced accessibility in educational environments. The final selection of 36 papers encompasses a diverse array of papers examining various facets of video technology integration in initial teacher education and the full list can be consulted at the end of this paper, after the references.

In addition to the aforementioned, as it is possible to see in Table 2, the 36 papers selected for this systematic review are distributed among 32 academic journals, demonstrating a variety of publication venues. Most significantly, only four journals published more than one paper: a) *American Educational Research Journal*, b) *Journal of Mathematics Teacher Education*, c) *Journal of Research in Science Teaching* and d) *Research in Science Education*. Their recurrence may be indicative of a robust engagement with the subject of using video technologies in mathematics and science education, exemplifying an interdisciplinary approach that amalgamates educational science, technology-enhanced learning, cognitive psychology and the learning sciences. Numerous journals, like the *American Educational Research Journal* and the *Journal of Research in Science Teaching*, are highly regarded in the field, which highlights the scholarly validity of research on video-based and/or video-supported methodologies. The evidence reveals that the application of video technologies in teacher education is garnering heightened academic interest. This focus underscores the capacity of digital resources to augment teacher training and professional growth, promote reflective practices and ultimately enhance educational outcomes. Despite the majority of journals including a single paper, their extensive dissemination indicates that the subject matter is relevant in various contexts, underscoring the significance of investigating the utilization of video technologies to enhance educational experiences.

The *corpus* selected comprises 36 papers representing 18 countries and demonstrating a wide worldwide breadth (see Table 3). The United States of America accounted for twelve papers, Sweden four, and Belgium, Finland, Hong Kong and the United Kingdom each have two. The remaining nations – Chile, China, Estonia, Germany, Ireland, Israel, Norway, Scotland, South Korea, Taiwan, the Netherlands and Turkey – each contributed just one paper, illustrating a wide geographical representation of research on the various uses of video technologies in initial teacher education and supporting collaborative learning and knowledge building. This distribution highlights a worldwide interest in comprehending how digital video technologies might improve teacher education across many educational and cultural contexts. The significant representation of the United States and Sweden suggests potential focused efforts or institutional activities in investigating and advocating for video-supported practices, while contributions from other locations

Table 1
List of 36 papers by year (2000–2024) (see list of ordered list of all the papers included in this systematic review).

Year	Papers	Total
2007	33	1
2010	35	1
2011	5, 27, 30, 31	4
2012	4, 32	2
2013	25	1
2015	23	1
2016	6, 29	2
2017	1, 26, 28	3
2018	19	1
2019	15, 18, 21	3
2020	2, 16, 20, 22, 34	5
2021	13, 14, 24	3
2022	3, 12, 17	3
2023	7, 8, 9, 10, 11	5
2024	36, 34, 33, 30, 23	5
Total		**36**

Table 2
List of 36 papers by journal (2000–2024) (see list of ordered list of all the papers included in this systematic review).

Journal	Papers	Total
Action in Teacher Education	25	1
American Educational Research Journal	15, 21	2
Asia-Pacific Journal of Teacher Education	32	1
Education Sciences	34	1
Educational Research	30	1
European Journal of Teacher Education	2	1
Frontiers in Psychology	33	1
Higher Education	5	1
International Journal of Educational Technology in Higher Education	24	1
International Journal of Research & Method in Education	8	1
International Journal of Science Education	18	1
Journal of Autism and Developmental Disorders	3	1
Journal of Further and Higher Education	6	1
Journal of Mathematics Teacher Education	9, 27	2
Journal of Research in Science Teaching	19, 28	2
Journal of Teacher Education	12	1
Journal of Teaching in Physical Education	14	1
Journal of the Learning Sciences	22	1
Metacognition and Learning	13	1
Pedagogies: An International Journal	20	1
Psychology in the Schools	4	1
Reflective Practice	17	1
Research in Science & Technological Education	10	1
Research in Science Education	26, 31	2
Research Papers in Education	11	1
Scandinavian Journal of Educational Research	1	1
School Mental Health	23	1
Teachers and Teaching	16	1
Technology, Knowledge and Learning	29	1
Technology, Pedagogy and Education	7	1
The Physical Educator	36	1
ZDM Mathematics Education	35	1
Total		**36**

Table 3
List of 36 papers by country (2000–2024) (see ordered list of all the papers included in this systematic review).

Country	Papers	Total
Belgium	11, 35	2
Chile	17	1
China	22	1
Estonia	16	1
Finland	30, 1	2
Germany	33	1
Hong Kong	32, 34	2
Ireland	20	1
Israel	13	1
Norway	10	1
Scotland	2	1
South Korea	5	1
Sweden	8, 18, 31, 7	4
Taiwan	24	1
The Netherland	14	1
Turkey	9	1
United Kingdom	3	2
United States of America	6, 25, 15, 21, 27, 19, 28, 12, 4, 26, 23, 29, 36	12
Total		**36**

underscore the increasing global acknowledgment of this methodologies. These findings demonstrate the extensive scholarly focus on video technologies to improve and support successful teaching practices for future educators.

The subsequent subsections present responses to two primary research questions posed by this systematic review, derived from the examination of the chosen literature. This paper presents references in two unique ways. In classic APA style, when a reference is cited - such as "Smith (2020)" or "as Smith (2020) describes" - the source must be mentioned in the paper's reference list. However, if a reference is cited in the text exclusively by a number (e.g., 24 or 32), it signifies a study derived from the systematic review *corpus* rather than from the reference list.

Research Question 1: *What are the main research themes addressed in the selected papers?*

In teacher education, particularly with technology integration, several recurring themes have been recognized. The examination of the 36 selected papers resulted in the recognition of four principal prevailing research themes in this domain (refer to Table 4):

1) "Technological Innovation in Education": This theme, encompassing 19 papers, constitutes the most extensive body of this systematic review. It emphasizes the novel application of technology in educational environments and its enhancement of teaching and learning processes. The papers comprised, including those by 35 and 31, examine different aspects of digital literacy, participatory culture, and the changing role of educators in technology-enhanced settings (Gaudin & Chaliès, 2015). These papers frequently examine the influence of emerging technologies, such as video, on teacher-student interactions and the cultivation of metacognitive techniques among educators (Borko et al., 2008). Papers such as 18 and 21 examine the influence of technology on promoting critical thinking and collaborative learning in educational settings, providing insights on the contribution of video technology to these processes[1].
2) The second theme, represented in 15 papers, examines the application of "Video technologies in teacher education" settings. Research in this domain, including papers 5 and 27, frequently examines the utilization of video to improve reflective teaching practices, instructional techniques, and information dissemination in teacher training programs (Sherin & van Es, 2009). A substantial amount of research examines how video recordings of classroom interactions or teaching demos offer initial teacher trainers chances for self-evaluation and peer evaluation. These papers highlight the significance of video as a means to enhance pedagogical expertise and refine instructional practices, especially when combined with collaborative reflection.
3) Collaborative Learning and Knowledge Building: This category encompasses a single paper (1), although its significance lies in its examination of the convergence of collaborative learning and knowledge building in relation to video technology utilization. This research highlights the significance of video in enhancing interactive learning methodologies within teacher education. It emphasizes that collaborative methods in teacher training, facilitated by video technology, foster the co-construction of knowledge and improve the overall learning experience (Scardamalia & Bereiter, 2006). The scarcity of papers in this domain indicates that, although collaborative learning is acknowledged as beneficial, there remains a deficiency in research explicitly linking it to video technologies and knowledge building within teacher training programs.
4) Benefits and Challenges of Video Technology: This category, represented by a single paper (13), explores the merits and drawbacks of employing video technology in education. The paper presents a detailed analysis of how video technology can both enhance and contest conventional educational methods, providing insights into its practical uses (Gaudin & Chaliès, 2015). The only paper in this category examines how video technology might improve reflective practice among educators while simultaneously addressing challenges such as technological limitations, accessibility, and the time-intensive nature of video analysis.

These themes jointly provide an extensive overview of the research regarding the application of video technologies in teacher education. The variety of themes indicates that the function of video technologies in reflective practices and instructional improvement is well-recognized.

Research Question 2: *What are the video modalities being used in the selected papers?*

The analysis of the chosen papers facilitated the categorization of video technologies employed in teacher education, according to their frequency in the literature (Table 5), into three distinct modalities as is described by Ramos et al. (2021):

1) Video Recordings: The predominant modality, comprising 24 publications, emphasizes the utilization of video recordings for self-assessment and collaborative reflection among educators. Video recordings entail documenting classroom interactions, instructional methods, or student engagements, subsequently analyzed by pre-service teachers, educators, or colleagues (Sherin & van Es, 2009). This approach facilitates reflective practice, enabling educators to critically assess their teaching, see areas for enhancement and participate in constructive peer critique. Research including 33, 6 and 7 demonstrates the significance of self-observation in fostering professional development among educators. Integrating video recordings into teacher education programs enables educators to

Table 4
– List of 36 papers by Research themes (2000–2024) (see ordered list of all the papers included in this systematic review).

Research Themes	Papers	Total
Technological Innovation in Education	35, 31, 4, 6, 19, 15, 18, 21, 16, 14, 17, 7, 8, 10, 11, 36, 33, 30, 23	19
Video Technology in Teacher Education	5, 27, 32, 25, 29, 26, 28, 2, 20, 22, 24, 3, 12, 9, 34	15
Collaborative Learning and Knowledge Building	1	1
Benefits and Challenges of Video Technology	13	1
Total		**36**

Table 5
– List of 36 papers by Video modalities being used (2000–2024) (see ordered list of all the papers included in this systematic review).

Video modality of use	Papers	Total
Video recordings	35, 27, 31, 25, 29, 1, 26, 28, 19, 15, 21, 2, 16, 20, 13, 10, 7, 8, 9, 17, 36, 34, 30, 23	24
Video Video-based content	4, 32, 18, 22, 14, 24, 3, 5, 11, 33	10
Live video conferencing	6, 12	2
Total		**36**

[1] The research team debated the potential for establishing sub-codes within the theme of "Technological Innovation in Education", but finally settled on keeping it as a broader category. This approach reflected our aim to encompass the diverse applications of video technology in ITE, avoiding the fragmentation of findings into narrower categories that could mask significant trends. Moreover, the coding team believes that the diversity within this topic should be perceived as a continuum of innovation rather than distinct subthemes, therefore preserving analytical consistency while enabling significant links to be established across research.

cultivate a culture of ongoing development and collaborative learning (Gaudin & Chaliès, 2015). Video recordings serve as collective artifacts that include knowledge-building principles, specifically those of collaborative inquiry and collective idea refinement, by offering tangible evidence for reflective discourse and the iterative enhancement of teaching methodologies.

2) Video-Based Content: Consisting of 10 papers, this modality pertains to the utilization of pre-recorded educational videos obtained from digital repositories or curated collections. Video-based content provides a versatile and accessible method for student teachers to interact with instructional material, frequently facilitating personalized learning experiences (Borko et al., 2008). Papers such as 5, 30 and 32 investigate the utilization of video content to illustrate best practices, highlight varied teaching methodologies, and present tangible instances of classroom management tactics. This modality is especially successful in facilitating dialogic teaching methods and fostering collaborative learning and feedback among student teachers, as it allows for the discussion and critique of instructional videos in group environments.
3) Live Video Conferencing: the least prevalent modality, examined in merely 2 papers, concentrates on the utilization of live video conferencing platforms, such as Zoom or Microsoft Teams, to enable real-time, synchronous communications (Roscoe & Chi, 2008). This modality could be beneficial in remote learning environments, where student teachers and instructors may be geographically separated. Live video conferencing might facilitate instantaneous feedback, collaborative lesson development, and peer discourse, emulating a classroom setting in a digital version. Papers 6 and 12 emphasize the capability of this technology to establish virtual learning communities and facilitate collaborative teaching methodologies across distances.

This classification of video modalities illustrates both the diversity of technical tools utilized in teacher education and their specific pedagogical aims. Although video recordings is the primary and extensively studied tool for personal reflection and self-assessment, video-based content and live video conferencing might also be interesting at promoting collaborative learning and knowledge construction in teacher training programs.

Video-based content offers shared, contextually rich examples that serve as common reference points for discussion. This facilitates knowledge building by allowing participants to collaboratively examine, evaluate and enhance teaching practices - a process essential to knowledge creation and advancement. Consistent with knowledge-building principles, such shared artifacts foster a community of inquiry where ideas are freely exchanged and built upon. Likewise, live video conferencing could facilitate dynamic, synchronous interactions that replicate real-world collaboration settings. By enabling prompt discourse, peer feedback, and collaborative problem-solving, it is suitable to support collaborative learning principles that highlight social engagement, co-construction of knowledge, and the cultivation of collective expertise. This immediate interaction allows teacher trainees to explore creative teaching techniques, reflect on diverse perspectives and collaboratively develop a more sophisticated comprehension of good pedagogy.

These modalities enrich the teacher training experience by encouraging individual reflective practices and fostering a dynamic, interactive learning community dedicated to continual improvement and collective professional development.

Research Question 3: *Are video technologies being used to* support *collaborative learning and/or knowledge building in the selected papers?*

Video technologies have developed into useful teaching aids, providing a variety of opportunities to promote collaborative learning and knowledge building. By offering forums for communication, reflection and collaborative research, these tools improve instruction as well as learning. Based on their application in educational settings, it is possible to divide the main video modalities into three categories in this systematic review: "Video Recordings", "Video-Based Content" and "Live Video Conferencing". Important insights into how video technologies are being used to facilitate collaborative learning and knowledge building in teacher education were gained from the analysis of the various modalities.

With 24 papers devoted to its investigation, the "Video Recordings" category is the most often researched modality. Papers in this category frequently recorded lessons, interactions in the classroom, or student activities, which were then used for in-depth analysis and self-evaluation (papers such as 29, 16 or 20). This reflective process is crucial in teacher education as it fosters collaborative knowledge construction and continuous improvement (Borko et al., 2008; Sherin & van Es, 2009). Video recordings act as dynamic catalysts for collaborative inquiry and iterative refinement, allowing participants to co-create pedagogical insights aligned with knowledge-building principles - such as progressive problem-solving and collective accountability - thereby augmenting collaborative learning. According to research, video recordings work especially well to promote collaborative learning since they create chances for group reflection and improving student teachers' ideas of teaching and learning. So, in addition to enhancing individual teaching methods, this approach fosters a community of practice among educators, wherein group learning experiences support the development of knowledge on both a personal and professional level (Gaudin & Chaliès, 2015; Van Es & Sherin, 2002). Additionally, teachers can review difficult classroom situations, assess student participation, and examine classroom dynamics over time with the use of recordings. This modality gives teachers a better grasp of student interactions, classroom management and successful teaching strategies by capturing subtleties in teaching and learning that could be overlooked during in-person sessions.

With 10 papers devoted to its investigation, the "Video-Based Content" modality offers a more conventional but incredibly adaptable application of video in learning environments. This approach makes use of pre-produced instructional movies, which are frequently found in curated collections or digital repositories (papers such as 22 or 11). These resources are made to meet certain pedagogical demands, giving teachers and students access to excellent teaching tools that support their learning goals. The versatility of video-based content is one of its main advantages. Teachers can choose movies that best fit their learning objectives, whether those objectives are to highlight varied learning environments, optimal teaching approaches, or specific examples of classroom activities. Since they enable contextualized learning without necessitating direct participation in a live classroom setting, authentic viewing experiences – where students observe real-life scenarios of teaching and learning – are especially beneficial for student teachers (Borko et al., 2008). Furthermore, using video-based content frequently incorporates collaborative learning. Teachers might, for instance, watch instructional videos together and participate in peer feedback sessions where they discuss and evaluate the teaching methods that are demonstrated in the movies. These conversations promote collaboration and mutual learning, enabling teachers to benefit from one another's knowledge and experiences. Collaborative efforts among educators enhance their understanding of effective teaching methods by facilitating critical interaction with authoritative video content, which acts as a standard for the continuous improvement of teaching practices (Gaudin & Chaliès, 2015). Moreover, well-chosen video materials help educators remain current with the newest developments in education, which supports the ongoing process of knowledge building in classrooms (Borko et al., 2008).

Only two publications examined "Live Video Conferencing", the third and least studied modality. Even if it wasn't used much in the chosen papers, live video conferencing has a lot of promise to help teachers and students collaborate in real time and expand their knowledge (Means et al., 2010). Live video conferencing has been utilized in teacher education to bring geographically separated participants

together, enabling peer discussions, collaborative lesson planning and instant feedback in a virtual environment (Roscoe & Chi, 2008). While asynchronous learning is frequently a part of "Video Recordings" and "Video-Based Content", "Live Video Conferencing" allows teachers and students to work together synchronously, promoting lively discussions and instantaneous idea sharing (as can be seen in papers 6 and 12). In distance learning, where in-person sessions might not be feasible, this mode is especially helpful. Tools for live video conferences open up possibilities for interactive learning where participants can ask questions, have conversations and give immediate feedback. The papers in this systematic review, despite their narrow scope, indicate that live video conferencing promotes active, immediate engagement that enhances collaborative learning and the co-creation of knowledge. By facilitating simultaneous discourse and prompt feedback, it promotes collective cognitive responsibility, wherein each participant actively contributes to and enhances the mutual comprehension of pedagogical methods. This iterative communication adheres to knowledge-building principles by fostering the continuous improvement and integration of ideas, ultimately enabling educators to collaboratively cultivate a more rigorous and evidence-based pedagogical approach. (Bower et al., 2015; Roscoe & Chi, 2008).

These findings collectively illustrate the complex functions that video can assume in promoting reflective practice and collaborative knowledge creation in ITE. The last section summarizes the findings, articulates the main conclusions and examines practical effects, limitations and opportunities for further research.

4. Conclusion and discussion

The potential of video technologies to improve knowledge building and collaborative learning has led to a surge in interest in integrating them into initial teacher education (ITE) in recent years. Video technologies offer an invaluable resource for teacher training programs as education moves toward more interactive, reflective and technologically advanced settings. Three main video usage modes were identified by this systematic review, which was carried out using the PRISMA method: video recordings, video-based content and live video conferencing. Each of these modalities supports knowledge building and collaborative learning in ITE in a unique way that complements one another whether by fostering peer-based inquiry, critical feedback loops and/or the collective development and improvement of pedagogical knowledge.

These findings generally align with prior literature reviews that highlight the capacity of video-based technologies to enhance teacher education through the facilitation of reflective practice, peer interaction, and collaborative knowledge building (e.g., Borko et al., 2008; Gaudin & Chaliès, 2015). Consistent with previous research, this systematic review emphasizes that video recordings improve collaborative reflection, video-based content expands access to diverse pedagogical perspectives and live video conferencing promotes immediate, community-driven inquiry. Despite the limited emphasis on synchronous modalities in previous and current studies, our findings corroborate the consensus that the intentional integration of video technologies can substantially enhance collaborative learning and promote deeper engagement with knowledge-building processes in initial teacher education.

This systematic review exhibits robust methodological rigor by strictly following PRISMA guidelines, conducting an extensive multi-database search over a significant time period and employing thematic analysis to bring together findings across several research papers. In addition to cataloging existing research, it provides a unique contribution by highlighting a shortage of studies that explicitly incorporate video technologies, collaborative learning and knowledge building, thus pinpointing a significant gap and establishing a framework for future research.

4.1. Video recordings: an instrument for collaboration and reflective practice

According to the systematic review, the modality that has been studied and used the most is "Video Recordings". This emphasizes how important it is for student teachers' reflective practice and collaborative self-improvement. Student teachers can record their lessons, examine classroom dynamics and evaluate their own teaching methods by using video recordings. Professional vision, or the capacity to recognize and analyze significant classroom occurrences, is developed through this process (Sherin & van Es, 2009).

Research shows that teachers can review particular moments, assess their activities and obtain new perspectives on their teaching practices by using video recordings, which enables a more thorough and precise form of reflection than traditional methods.

Video recordings also encourage peer collaboration. Student teachers can discuss their recorded lectures in group settings while getting helpful criticism from mentors and peers. As they all work together to enhance their teaching methods, these group reflections support them in investigating different pedagogical philosophies and promoting knowledge building. Teachers engage in a collaborative learning process that enhances their comprehension and improves their teaching abilities as they consider their documented experiences and exchange feedback (Gaudin & Chaliès, 2015).

These findings indicate that curriculum designers and teacher educators should incorporate organized video recordings as essential components of Initial Teacher Education programs rather than optional activities. Creating modules that mandate student teachers to document, annotate, and collaboratively analyze classroom episodes can facilitate structured involvement with reflective practice. Moreover, teacher educators might facilitate this process by supplying rubrics or key queries that direct attention to essential learning moments, thus optimizing the collaborative and knowledge-building potential of video analysis.

4.2. Video-based content: improving collaborative learning and knowledge access

A more conventional but adaptable modality is video-based content, which gives teachers access to pre-produced instructional videos, lesson demonstrations and best practices from experienced educators. One major benefit for ITE is the availability of these resources from curated collections and digital repositories. These videos serve as case studies that motivate student teachers to critically evaluate teaching strategies in addition to being utilized for educational purposes. When seen in a group setting, video content can serve as a topic of conversation among peers, allowing students to think critically about the teaching strategies shown in the videos and how they might be used or modified in their own work (Borko et al., 2008).

As student teachers discuss their perceptions, ask questions, and offer ideas based on the video content, collaborative learning is supported. As each member offers their own viewpoints to the conversation, this engagement aids in the co-construction of knowledge. Therefore, video-based content plays a crucial role in encouraging a dialogic approach to learning, in which student teachers actively participate in creating a shared understanding while also absorbing information (Gaudin & Chaliès, 2015). This modality provides pre-service teachers with an alternatative way to interact with excellent pedagogical content, which is especially helpful in circumstances when they might not have access to live classroom observations.

4.3. Synchronous collaboration in a virtual environment with live video conferencing

Despite being the least studied modality, live video conferencing has a lot of potential to improve collaborative learning in real time in virtual settings. Through synchronous contacts, this modality enables mentors

and student teachers to share ideas, provide and receive real-time feedback and work together on teaching strategies or lesson planning. With the popularity of blended learning and distant learning, live video conferencing provides a means of overcoming geographical obstacles that can hinder face-to-face collaboration (Bower et al., 2015).

Student teachers can observe virtual classrooms and have live conversations with mentors and peers via live video conferencing. Since participants can ask questions and get real-time clarification on topics, this modality allows for active engagement in the learning process. Live video conferencing has the potential to facilitate collaborative learning and information sharing in teacher education, despite the fact that research on this modality is still infrequent. Live interactions will probably become more crucial in teacher preparation as online learning platforms develop further (Roscoe & Chi, 2008).

Fig. 2 summarizes how the three identified video modalities contribute differently to collaborative learning and knowledge building. While video recordings primarily foster peer feedback and reflective practice, video-based content facilitates access to authoritative pedagogical resources and supports collective analysis. Live video conferencing, though less studied, enables synchronous interaction and joint problem-solving, highlighting its emerging potential in ITE.

4.4. The evolving role of video technologies in initial teacher education

This systematic review provides a comprehensive summary of video technology in ITE but is naturally constrained by its dependence on published research, potentially neglecting new innovative practices in collaborative learning and knowledge building that have not yet been publicly recorded.

The rapidly evolving nature of video technologies, especially in enabling synchronous and asynchronous interactions, demands continuous investigation. However, this systematic review reveals a notable gap in the literature: only one of the 36 studies explicitly integrates video technologies with both collaborative learning and knowledge-building frameworks. This underrepresentation highlights a misalignment between the theoretical importance attributed to these pedagogies and the empirical attention they have received so far. Strengthening this connection is critical, as understanding how video technologies can purposefully support these approaches would offer deeper insights for designing ITE programs that foster innovation, collective inquiry and shared knowledge creation. While previous reviews have emphasized the significance of reflective video-based practices, our PRISMA-guided systematic review integrates these findings into a unified framework that illustrates the interplay between various modalities (video recordings, video-based content, and live video conferencing) and collaborative knowledge-building pedagogies. This comprehensive viewpoint not only corroborates previous findings but also delineates the research environment more clearly, thereby assisting educators and policymakers in strategically utilizing video technologies to enhance teacher education.

4.5. Further research needed

But even with these technologies' obvious advantages, there are still research gaps that need to be filled. This systematic review emphasizes the need for more research on how video technologies affect student outcomes and teacher development over the long run. Moreover, further research is required to completely comprehend how live video conferencing can be enhanced to facilitate knowledge building and collaborative learning in online and hybrid learning contexts, especially due to the fact that it was not possible to find much research directly linking the use of video technologies with knowledge building and collaborative learning.

This systematic review adhered to PRISMA principles to reduce bias and enhance transparency; however, some limitations must be recognized. Initially, limiting the search to peer-reviewed journal papers in English may have omitted pertinent studies published in other languages or formats, thus constraining the breadth of findings. Moreover, although the selected keywords and databases were extensive, there remains a potential for overlooking pertinent publications not included in the initial search criteria. This review relied on the explicit reports of researchers about collaborative learning and knowledge building, indicating that relevant practices or outcomes may have been overlooked if authors did not clearly position their research within these frameworks. Although the incorporation of quantitative meta-analytic tools could have enhanced the findings, this approach was impractical due to the characteristics of the available research. The majority of the examined papers did not use quantitative experimental designs, such as pre-test/post-test controlled group studies with statistical effect size reporting. The methodological diversity and the prevalence of qualitative or mixed-method studies render a quantitative synthesis ineffective and unreliable. A thematic analysis was selected as the most suitable

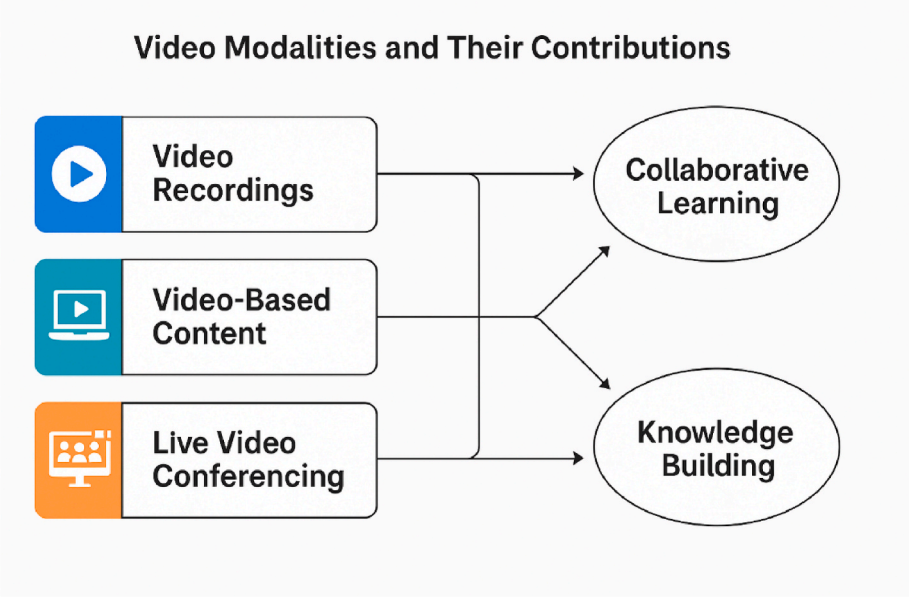

Fig. 2. – Video modalities and their contributions to collaborative learning and knowledge building.

method, allowing us to discern patterns, correlations, and insights among research papers despite their diverse designs. As a final note, adding to what was already referred, this systematic review is based on a corpus that disproportionately features studies with positive outcomes. This may have created a bias by highlighting the advantages of video technologies while minimizing potential obstacles or downsides.

Interestingly, despite the established theoretical links among collaborative learning, knowledge building, and video technologies, this systematic review identified only one paper that explicitly combined collaborative learning and knowledge-building frameworks with video usage. This was rather unforeseen, considering the increasing focus in teacher education on practices that promote collaborative research and the improvement of ideas. The limited study explicitly integrating these concepts may indicate a burgeoning area of interest, presenting prospects for additional empirical investigation and a more precise articulation of how video-supported activities can enhance the co-construction of knowledge.

4.6. Main conclusion

4.6.1. Contributions of this systematic review

This systematic review offers three primary contributions to the field of ITE:

1. Identification of video modalities – We categorize three primary applications of video technologies in ITE: a) video recordings, b) video-based content and c) live video conferencing, highlighting their specific purposes and roles in teacher preparation.
2. Thematic connections to collaborative learning and knowledge building – We outline how these modalities contribute to pedagogical practices: a) video recordings promote iterative reflection and systematic peer feedback; b) video-based content offers shared, authoritative resources for collaborative analysis; and c) live video conferencing facilitates real-time collaboration and the co-construction of pedagogical insights.
3. Identifying research gaps – We emphasize the insufficient attention to synchronous modalities and the lack of studies that clearly incorporate video technologies, collaborative learning and knowledge building, while delineating an explicit agenda for subsequent research.

The conclusions of this systematic review highlight the diverse functions that video technology provides in initial teacher education. One particularly effective technique for introspection and group development is video recordings. Similarly, video-based content facilitates critical thinking and knowledge building while giving teachers access to a wealth of teaching materials. Although it is yet relatively unexplored, live video conferencing is a developing field that might have potential to greatly improve synchronous cooperation in online environments.

From a practical standpoint, this systematic review offers teacher educators and curriculum designers explicit guidelines on the strategic integration of diverse video modes into teacher training programs. This synthesis emphasizes the importance of aligning specific pedagogical objectives - such as reflective practice, peer-based problem-solving, or real-time collaboration - with the most suitable video tools by highlighting the distinct contributions of video recordings, video-based content and live video conferencing. Furthermore, acknowledging the potential for collaborative learning and knowledge building through the strategic use of video facilitates structured feedback, enhances professional conversation and promotes the continuous improvement of classroom practices. The primary conclusion of this systematic review is that video technologies, especially when integrated with clearly defined pedagogical objectives, can significantly improve teacher education by promoting deeper reflective practices, collaborative learning and collective knowledge building. Each video modality contributes uniquely; nonetheless, the consistent conclusion is that a thoughtful, context-aware incorporation of video in initial teacher education can significantly enhance the quality of future teachers' professional development.

In the end, teachers' approaches to collaborative learning and knowledge building are changing as a result of the increasing use of video technologies in teacher education. There is still much to learn about the full potential of these tools, especially in the context of live video conferencing, even if recent research offers compelling evidence of the advantages of video recordings and video-based content. This underrepresentation may stem from practical constraints such as technological access, infrastructure limitations, and the relative novelty of integrating synchronous platforms into teacher education; yet addressing these challenges could unlock valuable opportunities for research and foster more innovative practices. Video technologies will probably become more and more important in determining how teacher preparation and professional development are conducted in the future as the field of education develops.

A promising avenue for future research is to examine the hypothesis that the strategic integration of video technologies in knowledge building substantially enhances the depth and effectiveness of initial teacher training. It is essential to examine whether a more intentional, theory-based application of video artifacts - where student teachers not only observe and discuss video cases, but also collaboratively generate new pedagogical insights - enhances reflective practice, fortifies collaborative learning communities and ultimately elevates classroom outcomes. This research could illuminate how video technologies and tools may evolve from supplementary resources to essential drivers for innovation and ongoing professional development in initial teacher education and teacher professional development.

CRediT authorship contribution statement

Ricardo R. Monginho: Writing – review & editing, Writing – original draft, Resources, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Frank De Jong:** Writing – review & editing, Validation, Supervision. **Paulo Costa:** Writing – review & editing, Validation, Supervision.

Declaration of the use of AI assisted technologies

During the preparation of this work the author(s) didn't use any AI assisted technologies. The author(s) reviewed and edited all the content as needed and take(s) full responsibility for the content of the publication.

Ethics statement

Ethical approval is not applicable to this manuscript, as the research did not involve human participants or animal experiments.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Ricardo R. Monginho reports financial support was provided by Foundation for Science and Technology. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Funding statement

This work is financed by national funds through FCT – Fundação para a Ciência e a Tecnologia, I.P., within the scope of the PhD scholarship « UI/BD/151036/2021»

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ssaho.2025.102075.

Data availability statement

The data that supports the findings of this study are available in the article and its supplementary material.

References

Booth, A., Papaioannou, D., & Sutton, A. (2016). *Systematic approaches to a successful literature review* (2nd ed.). SAGE Publications.

Borko, H., Jacobs, J., Eiteljorg, E., & Pittman, M. E. (2008). Video as a tool for fostering productive discussions in mathematics professional development. *Teaching and Teacher Education, 24*(2), 417–436. https://doi.org/10.1016/j.tate.2006.11.012

Bower, M., Dalgarno, B., Kennedy, G. E., Lee, M. J. W., & Kenney, J. (2015). Design and implementation factors in blended synchronous learning environments: Outcomes from a cross-case analysis. *Computers & Education, 86*, 1–17. https://doi.org/10.1016/j.compedu.2015.03.006

Brame, C. J. (2016). Effective educational videos: Principles and guidelines for maximizing student learning from video content. *CBE-Life Sciences Education, 15*(4), Es6. https://doi.org/10.1187/cbe.16-03-0125

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Darling-Hammond, L., & Bransford, J. (Eds.). (2005). *Preparing teachers for a changing world: What teachers should learn and be able to do*. Jossey-Bass.

Gaudin, C., & Chaliès, S. (2015). Video viewing in teacher education and professional development: A literature review. *Educational Research Review, 16*, 41–67. https://doi.org/10.1016/j.edurev.2015.06.001

Gillies, R. M. (2016). Cooperative learning: Review of research and practice. *Australian Journal of Teacher Education, 41*(3), 39–54. https://doi.org/10.14221/ajte.2016v41n3.3

Gough, D., Oliver, S., & Thomas, J. (2012). *An introduction to systematic reviews*. SAGE Publications.

Ha, X. V., Murray, J. C., & Reynolds, B. L. (2024). "without the video I wouldn't have known": An experienced EFL teacher learning to provide oral corrective feedback. *International Journal of Applied Linguistics, 34*, 1141–1158. https://doi.org/10.1111/ijal.12556

Jesson, J., Matheson, L., & Lacey, F. M. (2011). *Doing your literature review: Traditional and systematic techniques*. SAGE Publications.

Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gøtzsche, P. C., Ioannidis, J. P. A., Clarke, M., Devereaux, P. J., Kleijnen, J., & Moher, D. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions: Explanation and elaboration. *PLoS Medicine, 6*(7), Article e1000100. https://doi.org/10.1371/journal.pmed.1000100

Means, B., Toyama, Y., Murphy, R., Bakia, M., & Jones, K. (2010). *Evaluation of evidence-based practices in online learning: A meta-analysis and review of online learning studies*. U.S. Department of Education.

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & The PRISMA Group. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLOS*.

Ramos, J. L., Cattaneo, A., De Jong, F., & Espadeiro, R. G. (2021). Pedagogical models for the facilitation of teacher professional development via video-supported collaborative learning. A review of the state of the art. *Journal of Research on Technology in Education*, 1–24.

Roscoe, R. D., & Chi, M. T. H. (2008). Tutor learning: The role of explaining and responding to questions. *Instructional Science, 36*(4), 321–350. https://doi.org/10.1007/s11251-007-9034-5

Scager, K., Boonstra, J., Peeters, T., Vulperhorst, J., & Wiegant, F. (2016). Collaborative learning in higher education: Evoking positive interdependence. *CBE-Life Sciences Education, 15*(4), ar69. https://doi.org/10.1187/cbe.16-07-0219

Scardamalia, M., & Bereiter, C. (2006). Knowledge building: Theory, pedagogy, and technology. In K. Sawyer (Ed.), *The Cambridge handbook of the learning sciences* (pp. 97–118). Cambridge University Press. https://doi.org/10.1017/CBO9780511816833.008.

Sherin, M. G., & van Es, E. A. (2009). Effects of video club participation on teachers' professional vision. *Journal of Teacher Education, 60*(1), 20–37. https://doi.org/10.1177/0022487108328155

Van Aalst, J. (2009). Distinguishing knowledge-sharing, knowledge-construction, and knowledge-creation discourses. *International Journal of Computer-Supported Collaborative Learning, 4*.

Van Es, E. A., & Sherin, M. G. (2002). Learning to notice: Scaffolding new teachers' interpretations of classroom interactions. *Journal of Technology and Teacher Education, 10*(4), 571–596.

Ordered list of all the papers included in this systematic review with PRISMA

Näykki, P., Jarvenoja, H., Jarvela, S., & Kirschner, P. (2017). Monitoring makes a difference: Quality and temporal variation in teacher education students' collaborative learning. *Scandinavian Journal of Educational Research, 61*(1), 31–46.

Dovigo, F. (2020). Through the eyes of inclusion: An evaluation of video analysis as a reflective tool for student teachers within special education. *European Journal of Teacher Education, 43*(1), 110–126.

Egarr, R., & Storey, C. (2022). Model teachers or model students? A comparison of video modelling interventions for improving reading fluency and comprehension in children with autism. *Journal of Autism and Developmental Disorders*, (52), 3366–3382.

Thomas, C. N., Hassaram, B., Rieth, H., & Raghavan, N. S. (2012). The integrated curriculum project: Teacher change and student outcomes within a university-school professional development collaboration. *Psychology in the Schools, 49*(5), 444–464.

Choi, H. J., & Yang, M. (2011). The effect of problem-based video instruction on student satisfaction, empathy, and learning achievement in the Korean teacher education context. *Higher Education, 62*, 551–561.

Leggatt, S. (2016). Overcoming the barriers of distance: Using mobile technology to facilitate moderation and best practice in initial teacher training. *Journal of Further and Higher Education, 40*(3), 432–446.

Karlsson, G., & Nilsson, P. (2023). Capturing student teachers' TPACK by using T-CoRe and video-annotation as self-reflective tools for flexible learning in teacher education. *Technology, Pedagogy and Education, 32*(2), 223–237.

Aspelin, J. (2023). Microscopic relational analysis: A method for researching the teacher-student relationship. *International Journal of Research and Method in Education, 46*(1), 56–69.

Yildiz, D. G., Osmanoglu, A., & Alayli, F. G. (2023). Providing a video-case-based professional development environment for prospective mathematics teachers to notice students' misconceptions in measurement. *Journal of Mathematics Teacher Education, 26*, 179–209.

Fredgsvik, M. S. (2023). The challenge of supporting creativity in problem-solving projects in science: a study of teachers' conversational practices with students. *Research in Science & Technological Education, 41*(1), 289–305.

De Coninck, K., Keppens, K., Valcke, M., Dehaene, H., De Neve, J., & Vanderlinde, R. (2023). Exploring the effectiveness of clinial simulations to develop student teachers' parent-teacher communication competence. *Research Papers in Education, 38*(1), 69–101.

Watkins, J., & Portsmore, M. (2022). Designing for framing in online teacher education: Supporting teachers' attending to student thinking in video discussions in classroom engineering. *Journal of Teacher Education, 73*(4), 352–365.

Michalsky, T. (2021). Integrating video analysis of teacher and student behaviors to promote preservice teachers' teaching meta-strategic knowledge. *Metacognition and Learning, 16*, 595–622.

van Doodewaard, C. (2021). "They may be a level one student, but I love them all": Preservice teachers negotiating inclusion and diversity in their classes. *Journal of Teaching in Physical Education, 40*, 547–555.

Roth, K., Wilson, C., Taylor, J., Stuhlsatz, M., & Hvidsten, C. (2019). Comparing the effects of analysis-of-practice and content-based professional development on teacher and student outcomes in science. *American Educational Research Journal, 56*(4), 1217–1253.

Allas, R., Leijen, A., & Toom, A. (2020). Guided reflection procedure as a method to facilitate student teachers' perception of their teaching to support the construction of practical knowledge. *Teachers and Teaching, 26*(2), 166–192.

Ruffinelli, A., Valdés, C.Á., & Aguayo, M. S. (2022). Strategies to promote generative reflection in practicum tutorials in teacher training: The representations of tutors and practicum students. *Refective Practice, 23*(1), 30–43.

Nilsson, P., & Karlsson, G. (2019). Capturing student teachers' pedagogical content knowledge (PCK) using CoRes and digital technology. *International Journal of Science Education, 41*(4), 419–447.

Russ, R. (2018). Characterising teacher attention to student thinking: a role for epistemological messages. *Journal of Research in Science Teaching, 55*(1), 94–120.

Hinchion, C. (2020). A "filmic anthropology" of classroom practice: student teachers enacting pedagogy. *Pedagogies: An International Journal, 15*(3), 183–202.

Osborne, J., Borko, H., Fishman, E., Zaccarelli, F. G., Berson, E., Busch, K. C., … Tseng, A. (2019). Impacts of a practice-based professional development program on elementary teachers' facilitation of and student engagement with scientific argumentation. *American Educational Research Journal, 56*(4), 1067–1112.

Chen, G., Chan, C. K., Chan, K. K., Clarke, S. N., & Resnick, L. B. (2020). Efficacy of video-based teacher professional development for increasing classroom discourse and student learning. *The Journal of the Learning Sciences, 29*(4–5), 642–680.

Wang, L., Gulish, K., & Pollastri, A. (2024). *Understanding teachers' attributions and responses to student misbehavior: The roles of explanatory rationale and personal beliefs* (pp. 1094–1106). School Mental Health.

Tseng, S.-S. (2021). The influence of teacher annotations on student learning engagement and video watching behaviors. *International Journal of Educational Technology in Higher Education, 18*(7).

Danielowich, R. M., & McCarthy, M. J. (2013). Teacher educators as learners: How supervisors shape their pedagogies by creating and using classroom videos with their student teachers. *Action in Teacher Education, 35*(3), 147–164.

Colasante, M. (2022). Not drowning, waving: The role of video in a renewed digital learning world. *Australasian Journal of Educational Technology, 38*(4), 176–189. https://doi.org/10.14742/ajet.7951

Dalvi, T., & Wendell, K. (2017). Using student video cases to assess pre-service elementary teachers' engineering teaching responsiveness. *Research in Science Education*, (47), 1101–1125.

Norton, A., McCloskey, A., & Hudson, R. A. (2011). Prediction assessments: using video-based predictions to assess prospective teachers' knowledge of students mathematical thinking. *Journal of Mathematics Teacher Education, 14*, 305–325.

Tekkumru-Kisa, M., Stein, M. K., & Coker, R. (2018). Teachers' learning to facilitate high-level student thinking: Impact of a video-based professional development. *Journal of Research in Science Teaching*, (55), 479–502.

Lopez, L. A. (2016). Using chronologically oriented representations of discourse and tool-related activity as an instructional method with student teachers. *Technology, Knowledge and Learning, 21*, 125–141.

Tiainen, O., Lutovac, S., & Korkeamaki, R.-L. (2024). Rethinking approaches to reflection in initial teacher education. *Educational Research*, 245–262.

Nilsson, P., & van Driel, J. (2011). How will we understand what we teach? - Primary student teachers' perceptions of their development of knowledge and attitudes towards physics. *Research in Science Education*, (41), 541–560.

So, W. W.-m. (2012). Quality of learning outcomes in an online video-based learning community: potential and challenges for student teachers. *Asia-Pacific Journal of Teacher Education, 40*(2), 143–158.

Kosel, C., Bauer, E., & Seidel, T. (2024). Where experience makes a difference: teachers' judgement accuracy and diagnostic reasoning regarding student learning characteristics. *Frontiers in Psychology*.

Li, Y. (2024). Characterising student teachers' noticing habits in technology-enhanced dialogic reflection. *Education Sciences*.

Depaepe, F., De Corte, E., & Verschaffel, L. (2010). Teachers' metacognitive and heuristic approaches to word problem solving: analysis and impact on students' beliefs and performance. *Mathematics Education, 42*, 205–218.

Krause, J., & O'Neil, K. (2024). *The impact of role models and experiences on prhysical education teacher education students' technological, pedagogical, and content knowledge* (pp. 429–448). The Physical Educator.