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ARTICLE



COVID-19 and teacher education: a literature review of online teaching and learning practices

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ABSTRACT

The COVID-19 pandemic has impacted education at all levels in various ways. Institutions and teacher educators had to quickly respond to an unexpected and 'forced' transition from face-to-face to remote teaching. They also had to create learning environments for student teachers doing their preparation in the light of the requirements of teacher education programmes and the conditions in which both universities and schools had to operate. This paper provides a review of the literature on online teaching and learning practices in teacher education. In total, 134 empirical studies were analysed. Online teaching and learning practices related to social, cognitive and teaching presence were identified. The findings highlighted the need for a comprehensive view of the pedagogy of online education that integrates technology to support teaching and learning. The implications of this study for the development of online teaching and learning practices are discussed. Suggestions for further research are also examined.

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Introduction

The COVID-19 pandemic has affected education, and teacher education in particular, in various ways. As a result of the closure of universities and schools, teachers and students had to rapidly adapt to remote teaching. Teacher education is no exception. The need to create learning environments for student teachers doing their teacher education preparation implied decisions, choices and adaptations in order to meet not only the expectations of students but also the requirements of teacher education as well as the conditions in which both universities and schools had to operate (Flores and Gago 2020).

The rapid, unexpected and 'forced' transition from face-to-face to remote teaching has entailed a number of challenges and constraints but also opportunities that need to be examined. Existing literature points to an 'emergency remote teaching' (Bozkurt and Sharma 2020, i) or 'emergency eLearning' (Murphy 2020, 492) and to difficulties associated with poor online teaching infrastructure, inexperience of teachers, the information gap (i.e., limited information and resources to all students) and the complex environment at home (Zhang et al. 2020). In addition, lack of mentoring and support (Judd et al. 2020) and

issues related to teachers' competencies in the use of digital instructional formats (Huber and Helm 2020) have also been identified.

As far as teacher education is concerned, descriptions of how institutions and stakeholders adapted to the new scenario created by COVID-19 pandemic (Bao 2020; Flores and Gago 2020; Quezada, Talbot, and Quezada-Parker 2020; Zhang et al. 2020) as well as training strategies and experiences of innovation (Ferdig et al. 2020) have been reported. While accounts of how higher education institutions and teacher educators responded to the transition from face-to-face to online teaching are relevant, more needs to be done in this regard. For informed and productive online teaching and learning it is important to learn more about its potential and use. As such, it is essential to go beyond emergency online practices and develop quality online teaching and learning that result from careful instructional design and planning (Hodges et al. 2020). Focusing on how the current context has forced many teacher education programmes to adapt to an online format may provide a broad understanding of adopted practices, yet it is necessary to ensure that these practices are effective. This is, therefore, a crucial moment to synthesise the work that has been done on the topic to inform future practices. This period of change entails the necessity to provide an evidence-based perspective on what works and does not work but, most importantly, to understand the characteristics, the processes, the outcomes and the implications of online practices. Thus, this paper provides a review of the literature on online teaching and learning practices in teacher education.

There is a wide array of concepts in existing literature on online teaching and learning. These concepts encompass different meanings but they are, sometimes, used interchangeably (e.g., distance education, online teaching, emergency online education, remote teaching). A detailed analysis of such concepts is beyond the scope of this paper. Bozkurt and Sharma (2020, ii), for instance, refer to distance education as a process characterised by 'distance in time and/or space' and to remote education as a context of 'spatial distance'. For the purpose of this review, we focus on online environments that enable teachers to teach and interact with their students providing a variety of learning possibilities in a remote scenario. In such context, issues of agency, responsibility, flexibility and choice are key elements as are 'careful planning, designing and determination of aims to create an effective learning ecology' (Bozkurt and Sharma 2020, ii). As such, teaching and learning online entails a specific process which is visible in the roles, competencies and professional development approaches (Ní Shé et al. 2019) as well as in the curriculum, pedagogy, assessment and the nature of interaction among participants. It is, therefore, important to find out how online teaching and learning in teacher education occur and why, and to explore its implications, particularly in the current emergency remote scenario.

Research questions

This paper seeks to address the following research questions:

- (1) What are the most recurrent topics explored in the studies on online teaching and learning in teacher education?

- (2) What online practices related to social, cognitive and teaching issues have been demonstrated to drive impact on the teaching and learning process in the context of teacher education?
- (3) What questions need to be examined in further research?

In order to respond to these questions, a selection of studies on online teaching and learning in the context of teacher education has been reviewed and analysed. The results are presented in this paper, first from a descriptive perspective and then using the Community of Inquiry Framework (Col) (Garrison, Anderson, and Archer 2000) as an analytical tool.

Methods

The search focused on the literature on online teaching and learning in the context of teacher education published between January 2000 and April 2020. The search was limited to this period because it was after the development of the World Wide Web, and the generalisation of the use of Internet into many homes that online learning spread (Bates 2005). Within the context of the European higher education convergence as a direct result of the Bologna Process (1999), this date also coincides with the emergence of virtual learning initiatives as a consequence of the internationalisation and competition among European higher education institutions.

The process for selecting the literature included in the current review started with a search in the databases Web of Science (main collection) and Education Resources Information Centre (ERIC). Publications whose title contained the term 'online learning' (or the terms 'digital learning' or 'e-learning' or 'web-based learning' or 'remote learning' or 'distance learning' or 'virtual learning') and which responded to the descriptors/topics 'teacher education' or 'teacher training' or 'teacher preparation' were sought. Although the concepts of online, e-learning, virtual, digital, web-based, remote or distance learning are rather different, they were considered relevant for the purpose of this study of examining any kind of practice in which the teaching and learning process is mediated by the use of technology in a remote scenario. A total of 134 papers fulfilled the inclusion criteria established for this research in terms of the publication source (academic journals), the nature of the studies (empirical), and the relevance of the topic (main focus on online teaching and learning practices in the context of teacher education).

The selected papers were subject to two types of analysis. First, a descriptive analysis was carried out, which implied the elaboration of a summary table for each of the papers that specified the focus of the study, characteristics of the sample, the methods and their main findings.¹ Second, a content analysis (Ryan and Bernard 2000) was conducted, which built on the Col framework (Garrison, Anderson, and Archer 2000) to sort the data into categories. This entailed the elaboration of a table which included, for each of the papers, the findings in relation to online teaching and learning practices related to social, cognitive and teaching presence according to the Col framework.

This framework, which identifies the crucial elements for 'a successful higher education experience' in a computer-based environment (Garrison, Anderson, and Archer 2000, 87), highlights that learning is the result of the interaction of three presences: a) social presence, related to the ability of participants to engage affectively with a community,

communicate purposefully in a collaborative environment, and develop interpersonal relationships by projecting themselves as the people they are (Garrison, Anderson, and Archer 2000); b) cognitive presence, or the extent to which the participants are able to construct meaning through sustained reflection and communication in a community of inquiry (Garrison, Anderson, and Archer 2000); and c) teaching presence, this is, the design, facilitation and direction of social and cognitive processes with the aim of achieving meaningful learning outcomes (Anderson et al. 2001). Subsequently, a cross-analysis of the data as related to each category (social, cognitive and teaching presence) was performed. This led to collect the findings for each category across the selected papers to find patterns that make sense beyond every specific case (Huberman and Miles 1994), without disregarding the particular features of each paper.

Two ‘verification’ strategies (Creswell 1998) were implemented to confirm the accuracy of the research process. Peer reviews conducted through regular exchanges between the two researchers and co-authors, the second not directly involved in the data collection and analysis, provided an external check of the research process (Lincoln and Guba 1985). This researcher (second author) regularly reviewed the material generated and contributed with comments on both the methodological process and the product. The insights provided by this researcher on the selection of the databases, the criteria established for the search, the types of analysis conducted and the accuracy of the analysis (process) as well as on the assessment of how the findings, interpretations and conclusions of this study are supported by the data (product) allowed to refine the research process. In addition, detailed descriptions of both the context of the studies (see Overview of the examined literature) and the results related to the social, cognitive and teaching presence of the online teaching and learning practices may allow readers to make decisions regarding transferability of the findings (Erlandson et al. 1993).

The results of both analyses are presented below: the first provides an overview of the examined research literature on online teaching and learning practices in the context of teacher education and the second describes the findings in relation to online teaching and learning practices related to social, cognitive and teaching issues.

Results

Overview of the examined literature

Although the descriptive analysis entailed a broad examination of the literature in terms of the focus of the studies, the characteristics of the sample, the methods and their main findings, due to a word limit this section will focus on the most recurrent topics of the literature examined, as well as a description of the most relevant issues related to the sample and the methods.

Regarding the focus of the literature examined, a first analysis confirms that an important number of the papers reviewed explore the impact of online learning programmes, approaches, or specific resources as tools to enhance the effectiveness of issues connected to the teaching-learning process, particularly from the perspective of teachers, student teachers and teacher educators’ perceptions or experiences (e.g., Alabbassi 2018; Bicen, Ozdamli, and Uzunboylu 2014; Daniel et al. 2016; Ducan and Barnett 2009). While these studies investigate the impact of a range of online issues on learning-related

aspects, a few of them explored the technology component as a 'medium' to enhance the effectiveness of learning practices and provided limited attention to the underlying features leading to impact.

A more detailed analysis of the topics under research reveals that some of the most recurrent themes in a number of the papers analysed ($n = 27$, 20.1%) are related to the interactions and discussions among the different participants, some of them in the context of online communities. These studies either analyse the nature or patterns of interactions between the participants (e.g., Nami, Marandi, and Sotoudehnama 2018; Sing and Khime 2006) or investigate their effects in supporting reflection (e.g., Jones and Ryan 2014; Mumford and Dikilitaş 2020), knowledge construction or learning transformation (e.g., Lee and Brett 2015; Wang, Chen, and Levy 2010) or, more broadly, the professional development of teachers (e.g., Liu 2012). The online communities, which are mainly used as a support for pre-service or beginning teachers (e.g., DeWert, Babinski, and Jones 2003; Hramiak 2010) or the continuous professional development of in-service teachers (e.g., Holmes 2013; Ribeiro et al. 2014) are also the focus of some of the studies examined ($n = 21$, 15.7%). Additional recurrent themes explored in the literature reviewed include: the factors involved in teacher participation or engagement ($n = 15$, 11.2%); the sharing, construction or the nature of knowledge ($n = 11$, 8.2%); the uses and effects of video ($n = 9$, 6.7%), particularly in professional development contexts, and; the creation, analysis or effects of feedback or peer assessment activities ($n = 8$, 6.0%) (see Table 1).

The papers examined present studies carried out in 31 different countries, with the USA the most frequent ($n = 43$, 32.1%), followed by the UK ($n = 15$, 11.2%) and Australia ($n = 14$, 10.4%). Regarding the nature of the sample, most of the studies included pre-service ($n = 63$, 47.0%), in-service teachers ($n = 47$, 35.1%), both pre-service and in-service teachers ($n = 15$, 11.2%), graduate and/or undergraduate university students ($n = 5$, 3.7%), and teacher educators ($n = 4$, 3.0%). Some studies ($n = 19$, 14.2%) also involved additional participants such as other academic or school staff, university or school students, tutors, or other professionals in the education sector.

In methodological terms, the greatest part of the articles reviewed used qualitative methods ($n = 53$, 39.6%) with samples ranging between one and 162 participants. Both qualitative and quantitative methods were used in 51 studies (38.0%) and included samples between eight and nine hundred participants. The remaining 30 studies (22.4%) used quantitative methods, with samples comprised between fifteen and thirty-seven thousand participants. The main instrument used for data collection was the questionnaire ($n = 74$, 55.2%), which was mostly used with additional data sources such as the interview ($n = 51$, 38.0%) and written records ($n = 52$, 38.8%) of messages, posts,

Table 1. Focus of the papers analysed (most relevant).

Themes	f	%
Interaction among participants	27	20.1
Online communities	21	15.7
Teacher participation or engagement	15	11.2
Teacher knowledge	11	8.2
Use and effects of video	9	6.7
Feedback or peer assessment activities	8	6.0
Other themes	43	32.1
Total	134	100

commentaries, discussions or interactions in a range of forums, platforms or other online supports.

The presences in the online teaching and learning practices

The social presence

Although only a few studies focused primarily on the social presence in online teaching and learning (e.g., Hramiak 2010; Komninou 2017; Li 2011; Satar and Akcan 2018; Yeh 2010), the vast majority of the papers examined included issues related to this presence and highlighted its centrality when it comes to teaching and learning effectiveness.

The ability of learners and teachers to interact, collaborate and build relationships with other members was a source of satisfaction for students (Biasutti 2011) and greatly influenced the cohesion of learning communities (Komninou 2017), the co-construction of knowledge among participants (Jaber et al. 2018; Jackson and Jones 2019) and the impact of online teaching and learning practices (Bicen, Ozdamli, and Uzunboyly 2014; Yeh, 2009). Only Rakap, Jones, and Emery (2015) found scarce interactions and difficulties in building relationships with classmates to have little impact on teachers' learning and focused on course content to compensate for these social limitations. Out of the social affordances of online tools, collaboration was seen as a key feature (Theelen et al. 2020) and an effective approach to social presence included consistent participation, prompt communication, regular group discussion, timely and relevant contributions and commitment to the task (Vinagre 2017).

The interactions among peers and educators were key to promote collaboration and relationships but not enough to ensure the establishment of a social presence (Mumford and Dikilitaş 2020). The connectedness of participants, their affective and effective responses to one another, and their interactions through sharing their ideas enhanced a social presence (Jones and Ryan 2014). Moreover, the creation of supportive learning environments and learning communities characterised by high levels of social presence were the result of strong collaboration, interactivity, mutual respect and interdependence (Cullen, Kullman, and Wild 2013), as well as shared values (Holmes 2013) and trusting human relationships (Li 2011). These spaces provided emotional support, helped alleviate feelings of isolation (Baker and Watson 2014; DeWert, Babinski, and Jones 2003) and increased confidence and enthusiasm for work (DeWert, Babinski, and Jones 2003).

In the development of online activities, an optimal level of social presence by instructors was shown to be essential in achieving participation, collaboration and fostering the cohesion of the learning community (Komninou 2017; Satar and Akcan 2018; Stagg and Slotta 2009): highly active instructors supported other members' participation in online communities, but also dominated the discussion and left limited room for student participation (Satar and Akcan 2018). At the time, the students played a crucial role in the impact of online learning practices: those that reported being active, holding an inclusive attitude and trusting each other maximised the possibilities of online channels (Delfino and Persico 2007; Olofsson 2007) and supported power sharing and student ownership of discussions (Thormann et al. 2013).

Additional strategies for the establishment of a social presence were highlighted in the literature examined. Group members with similar interests or roles (Li 2011; Rideout et al. 2008; Yeh 2010) provided further opportunities to enhance belongingness; collaboration

in small groups (Dickey 2004; Duncan and Barnett 2009; Li 2011) helped to develop trust and more cohesive communities; regular discussions and high levels of support and cooperation among group members (Burgess and Mayes 2008; Vinagre 2017; Yeh 2010) were more likely to drive constructive environments and better performance, and; authentic and practical activities (Satar and Akcan 2018; Swaggerty and Broemmell 2017; Yeh 2010) as well as relevant commenting (Tang and Lam 2014; Vinagre 2017) fostered participation and commitment to the task. The establishment of a social presence was also found when social interaction (process) was prioritised over the completion of the task (product) (Vinagre 2017).

The interactions took place through different tools (e.g., narratives, blogs, chat, forum, web conferences or video conferences, social networks) that supported the participants in affectively engaging with other members of the community (Dymont and Downing 2018; Dickey 2004; Choi et al. 2016; Farr and Riordan 2015; Gillies 2008) and enabled the creation of interpersonal relationships by projecting themselves (Farr and Riordan 2015; Dickey 2004; Choi et al. 2016; Lee and Brett 2015). While these tools leveraged their social affordances to develop online learning practices that presented different degrees of impact, social networks provided an additional component of informal learning that reinforced peer support (Prasojo et al. 2017) and a relationship bond among virtual learners that helped to form learning communities (Chuang 2016). Also, narratives allowed student teachers to feel safe to reveal their genuine identities (Lee and Brett 2015) and make sense of becoming a teacher (Choi et al. 2016). Table 2 synthesises some of the most relevant factors influencing the establishment of the social presence.

The cognitive presence

Most of the papers that examined issues related to the cognitive presence did not focus solely in this presence but reported cognitive evidence derived from actions of a social or teaching nature. In the blurring of the boundaries among the presences, the establishment of a cognitive presence showed to be dependent on other social (e.g., group cohesiveness and an optimal social presence) and teaching issues (e.g., a focus on the learning process rather than the end product or on the teacher as a facilitator rather than as a transmitter of knowledge) (see Social Presence and Teaching Presence). Moreover, while social cohesiveness was a prerequisite for a knowledge building discourse, the

Table 2. Factors influencing the establishment of a social presence (according to the papers reviewed).

Belongingness	• Shared values and interests
Cohesiveness	• Trusting human relationships • Collaboration in small groups • High levels of support • Affective responses
Optimal level of social presence	• Instructors: balance between providing support and leaving room for student participation • Learners: developing an active and inclusive attitude
Interactivity	• Regular discussions • Prompt communication • Timely contributions • Interpersonal interactions
Participation	• Authentic and practical activities • Relevant commenting • Prioritisation of social interaction over the completion of the task

higher order cognitive skills required an active intervention by educators in the process of constructing meaning (Ryan and Scott 2008; Sing and Khime 2006), including an ability to pose questions that deepen individual critical reflection and model reflective thinking (Jones and Ryan 2014) such as those that focus on individuals rather than on the group, that link theoretical perspectives from course work or that present a set of guided questions to help students understand the issues they need to consider.

The discussion of participants' experiences of teaching throughout a range of mediums was critical in understanding the challenges and the co-construction of knowledge about the teaching profession (DeWert, Babinski, and Jones 2003; Fletcher and Bullock 2015). Among others, blogs fostered narration, reflective practice and depicted cognition (Farr and Riordan 2015); online forums enabled the sharing of narratives that enhanced the skill of noticing and led to changes in their practice (Fernández, Llinares, and Rojas 2020), and; webconferences allowed students to engage critically with different educational issues (Dyment and Downing 2018). Both structured and unstructured formats of participation provided opportunities to reflect on key matters related to teaching practice; however, in doing so, Jones and Ryan (2014) showed that participants did not engage in critical reflection on their practice but developed learning by sharing experiences relevant to their specific practice-based situations. In the process of sharing personal experiences, the asynchronous features of some of these tools provided participants with additional time to reflect about each other's ideas, integrate different perspectives into their own thinking or address pedagogical challenges (Jaber et al. 2018; Rodeslier 2015). Also, those interactions that went beyond mere description of field experiences were more likely to promote in-depth discussion between participants and facilitate quality reflection (Krutka et al. 2014; Stagg and Slotta 2009).

Interactions within online learning communities also provided teachers with a valuable support for peer collaboration, increased reflection and improved ability to adopt a more critical perspective in the context of their everyday practice (DeWert, Babinski, and Jones 2003; Holmes 2013). By testing learning theories, discovering different perspectives through discussion, changing teachers' beliefs and uncovering new teaching concepts (Baran and Cagiltay 2010), practitioners used online communities to construct meaning of their teaching practice. Within and outside these online communities, videos of real classrooms were outstanding tools to drive teacher reflection (Bates, Phalen, and Moran 2016; Beilstein et al. 2020), obtain practical knowledge about the profession (Baran and Cagiltay 2010; Liu 2012), and connect with course content in a practical way (Lenkaitis 2020). The most practical videos within authentic classroom situations (Baran and Cagiltay 2010; Bates, Phalen, and Moran 2016; Beilstein et al. 2020; Theelen et al. 2020) promoted the highest levels of teacher reflection and knowledge development. They supported students in accessing a range of classroom practices in a safe environment (observation), linking theory and practice in a supportive setting (contextualisation), supporting professional dialogue through the joint construction of knowledge (reflection) and developing critical personal teaching practices (action) (Wang and Wiesemes 2012).

In addition to the videos, the environments or instructional interventions that offered more opportunities for getting and providing formative peer feedback, reviews or assessment promoted learning support, interactive collaborations and reflection (Dooly and Sadler 2020; Gikandi and Morrow 2016; Luo, Murray, and Crompton 2017), and were more likely to drive to knowledge development (Evens et al. 2017; Hong 2014; Jones 2010;

Nicholas and Ng 2009). From a different perspective, evidence from participants carrying out training programmes based on the Technological Pedagogical Content Knowledge (TPACK) framework² reported gains across the different knowledge domains and a more integrated knowledge structure (Doering et al. 2009; Niess and Gillow-Wiles 2014) that, in the latest study, also influenced their thinking about the concerns associated with technology. This is particularly relevant given that individuals' attitudes and previous experiences can determine their predispositions to learn to reflect and mediate in the skill of reflection itself (Mumford and Dikilitaş 2020). Table 3 synthesises some of the most relevant factors contributing to the enhancement of the cognitive presence.

The teaching presence

Although not always as the main focus of research, the element of teaching presence was included in all the papers analysed as it supported social and cognitive presence with the aim of achieving certain learning outcomes. This has already been evident in the presentation of the findings related to the other two presences, where components of a teaching presence were described to show its influence on their development. The findings presented here will therefore focus on additional, more specific pedagogical issues leading to teaching presence related to the design and facilitation of the educational experience (Holmes 2013).

Key issues in the design of effective online learning environments included an accurate pedagogical approach, relevant and authentic assignments, and appropriate tools and technology. Several aspects related to the former led to teaching and learning impact: providing flexibility to foster self-paced learning while at the time setting clear expectations and timelines for the students (Ducan and Barnett 2009; Jin 2005); targeting individual needs, strengths and interests (Burgess and Mayes 2008; Chambers, Threlfall, and Roper 2012; Coole and Watts 2009; Tai et al. 2019), including also preferred e-learning styles (Coole and Watts 2009; Ducan and Barnett 2009), and users' technology experience (Chieu, Herbst, and Weiss 2011); focusing on formative assessment to enhance students' learning (Delfino and Persico 2007; Uribe and Vaughan 2017), with a special attention to peer-to-peer forms of assessment to promote learners' participation and meaningful engagement (Gikandi and Morrow 2016; Wen and Tsai 2008); splitting the whole cohort into smaller groups (e.g., through breakout or chat rooms) for undertaking specific tasks (Biasutti and EL-Deghaidy 2014; Delfino and Persico 2007; Ducan and Barnett 2009; Nicholas and Ng 2009), and; providing an integrated approach in relation to the different knowledge domains (Anderson, Barham, and Northcote 2013; Evens et al. 2017; Niess and Gillow-Wiles 2014) as well as the elements involved in the online teaching and learning

Table 3. Factors influencing the establishment of a cognitive presence (according to the papers reviewed).

Concrete experience	● Sharing teaching experiences ● Observing the most practical videos within authentic classrooms situations
Contextualisation	● Facilitating the active intervention of both instructors and learners in the process of constructing meaning
Conceptualisation	● Promoting interactions that go beyond mere description of field experiences ● Reflecting on each other's ideas ● Integrating different perspectives
Action development	● Developing critical personal teaching practices ● Addressing pedagogical challenges

process (course content, technologies, students and teachers) (Borba, Santana de Souza, and Rangel 2018).

Regarding the development of relevant and authentic assignments, some design principles included: adding an interactive component to online learning activities that enabled a constructive, dialogic approach to e-learning (Baker and Watson 2014); focusing on problems of the everyday teaching practice that promoted learners' participation and their ability to apply new knowledge (Burgess and Mayes 2008; Evens et al. 2017; Lee and Martin 2017), and; providing assignments that built on one another (Swaggerty and Broemmel 2017). Similar to the inclusion of videos (see Cognitive Presence), the use of contextualised case stories as instructional anchors made assignments more relevant to participants' lives and supported reflection and knowledge development (Luo et al. 2018).

Effective practice relating to the use of pedagogical tools and technologies (e.g., gamification, animated clips, videos, wiki tools, podcasts, voice boards, virtual worlds, e-book readers, e-folio, MOOC) showed the need to use technologies that are appropriate for the task (Biasutti and EL-Deghaidy 2014; Cullen, Kullman, and Wild 2013). Moreover, the literature highlighted the need to not only mastering the tools, but to understand their pedagogical possibilities to suit their own teaching purposes (Comas-Quinn 2011; Cullen, Kullman, and Wild 2013). As teachers' predispositions towards technological tools can influence the use of these tools and their perceived value within teaching and learning contexts (Turvey 2010), understanding the pedagogical possibilities of the online tools may help address teachers' attitudes and competence related to them. An additional technology-related element leading to impact was the ease of use of online tools (Hollingsworth and Lim 2015; Ryan and Scott 2008; Teo and Wong 2013), that enhanced participation and effective online discussion.

In terms of issues leading to teaching presence associated with the facilitation part, the examined literature revealed the importance of environments characterised by interaction and collaboration (see also Social Presence), as well as the active participation of both teachers and students in the online teaching and learning process. Some conditions that supported collaboration were already highlighted in the Social Presence section. However, from a pedagogical standpoint, additional intervention strategies included: to clearly outline participation requirements of the course, to ask questions addressing the integration of ideas, and to play a visible role in guiding students towards the achievement of learning goals (Pawan et al. 2003). By placing more responsibility on the students to drive their own learning (Forbes and Khoo 2015; Regan et al. 2012), the role of the teachers in effective online environments was more about facilitation than about knowledge transfer (Chigeza and Halbert 2014). Some teachers also provided students with the opportunity to perform as discussion moderators (Chieu, Herbst, and Weiss 2011; Phirangee 2016), enhancing their active role in the online process and making them co-responsible of both their own and peers' learning.

Evidence on the facilitation process shed light on the importance of acknowledging and addressing socially appropriate online practices in particular countries, cultures and professional environments to positively influence students' motivation to participate in online environments (Moloney 2013; O'Dowd, Sauro, and Spector-Cohen 2019; Phirangee 2016). An essential component of teacher facilitation was also the provision of timely, constructive, specific and detailed feedback (Thurlings et al. 2014) at different stages of the learning process. This highlighted the formative component of the learning

experience and put a focus on feedback as a vehicle for learning (Uribe and Vaughan 2017) (see also Cognitive Presence).

Beyond the role adopted by the instructor, Muir et al. (2019) and Norton and Hathaway (2008) found that engagement and perceived quality levels of the online learning experience were the result of students' attitude and commitment. Effective learning occurred when the student was dedicated, prepared, self-motivated, had good support (Muir et al. 2019), and provided relevant comments that increased participation and quality interaction (Reeves and Pedulla 2011; Tang and Lam 2014). In some studies, however, this was challenged by contextual limitations related to access to internet and technology (Bicen, Ozdamli, and Uzunboyly 2014; Delfino and Persico 2007; Gillies 2008; Heirdsfield et al. 2007), which disrupted students' motivation and learning. Table 4 synthesises some of the most relevant findings related to the teaching presence.

Discussion and conclusion

This study has provided a review of the literature on online teaching and learning practices in teacher education and has analysed them in relation to social, cognitive and teaching presence according to the Col framework. Figure 1 synthesises the main issues connected to these presences leading to teaching and learning impact.

This study has highlighted the blurring nature of the components driving to a social, cognitive and teaching presence. The ability of teachers and learners to engage affectively in relationships showed to be central to meaningful educational experiences. At the time, its interplay with components of cognitive and teaching nature was crucial to ensure teaching and learning impact. The interactions that supported social presence were multiple, iterative and reciprocal (Hou 2015) and strongly relied on mutual respect, interdependence and trust to focus on the interpersonal connection between the members involved (Ham and Davey 2005).

The establishment of a cognitive presence was also subject to actions of a social and pedagogical nature, although limited attention to the specific features supporting its development was sometimes detected. Either the difficulty to distinguish the elements of the learning environments that influenced knowledge development (Evens et al. 2017) or the lack of a sound pedagogy of online education (Ham and Davey 2005) may explain this

Table 4. Factors influencing the establishment of a teaching presence (according to the papers reviewed).

Pedagogical approach	● Learner at the centre ● Teacher as a facilitator ● Knowledge integration
Learning design	● Flexible ● Personalised ● Contextualised ● Social ● Formative
Facilitation	● Use of appropriate tools and technology ● Clear expectations ● Appropriate questions ● Acknowledgement of cultural issues ● Timely, constructive, specific and detailed feedback ● Students' attitude and commitment

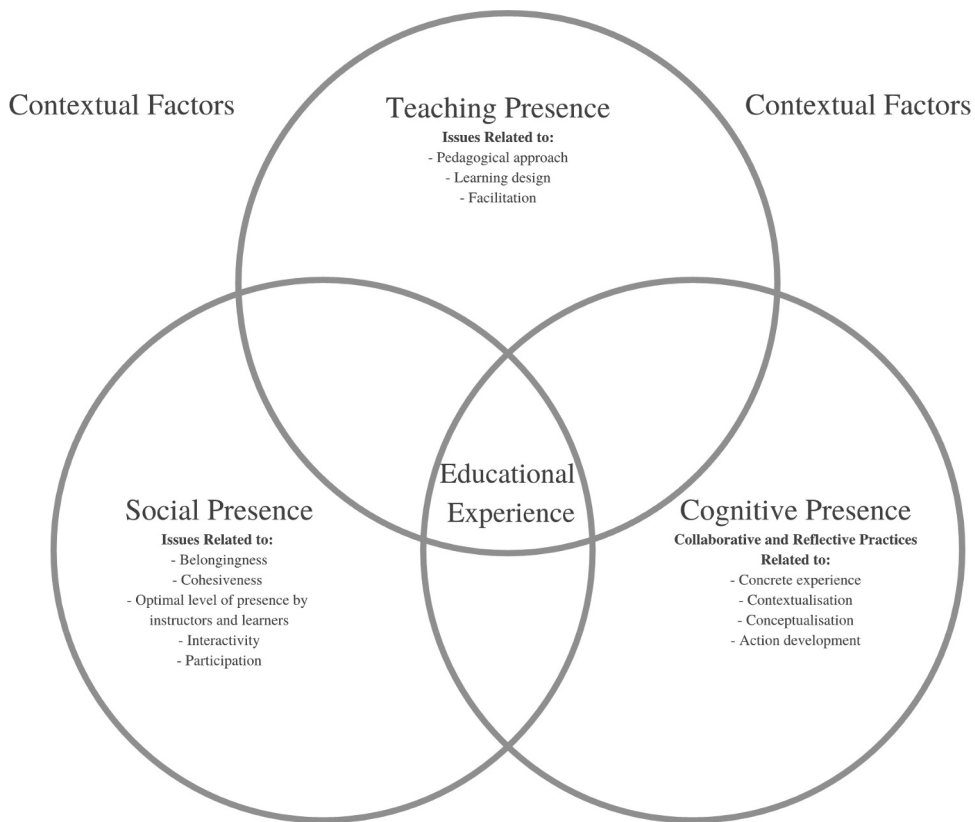


Figure 1. Factors impacting online teaching and learning practices (according to the papers reviewed).

issue. However, from the examined literature, it was clear that the development of high-order cognitive skills required not only strong social presence, but also the ability of the teacher to guide students' collaborative efforts in the transition from content reflection to critical reflection (Kreber and Cranton 2000). This occurred as a response to a triggering event (concrete experience), which was followed by a collective process that entailed making sense of this event (exploration), integrating different ideas into a more coherent framework (integration), and developing personal teaching practices (resolution) (Garrison, Anderson, and Archer 2000).

As the binding element to any educational intervention, a teaching presence interacted with the social and cognitive components in online learning practices. Several practices related to the design and facilitation of online teaching and learning were highlighted, as well as to broader issues related to the pedagogical approach. Among other aspects, practices that are contextualised (e.g., based on everyday teaching situations), personalised (e.g., targeting individual differences), social (e.g., resulting from the interaction with others), formative (e.g., focusing on the process), and integrated (e.g., considering both formal and informal ways of learning) showed to influence the effectiveness of the online teaching and learning process. In addition, an active and thoughtful participation of all the members involved in the online learning environment was core to the achievement of effective practices. Previous studies have placed a greater focus on

role of the instructors (Komninou 2017; Stagg and Slotta 2009); however, this review has made clear that an effective online teaching and learning is subject to the development of a student presence that enhances supportive and productive interactions that mediate the learning process across the presences.

In pedagogical terms, the need of a comprehensive and solid view of the pedagogy of online education seems obvious. This should integrate technology as an inherent part of the online teaching and learning process and take into account the pedagogical possibilities associated with online tools, i.e., the suitability and affordances of the various technologies or online resources (e.g., blogs promote discussions and facilitate reflective practice; videos help develop practical knowledge about the profession and connect educational theory with practice; online forums enable the sharing of narratives that enhance the skill of noticing; breakout or chat rooms foster belongingness and high levels of support and cooperation among group members) to make sure that the chosen tools or resources help learners achieve the desired results. In addition, this comprehensive view of the pedagogy of online education should acknowledge the complex interactions between the components involved in the online teaching and learning process (e.g., instructors, students, task and technology factors (Borba, Santana de Souza, and Rangel 2018; Mumford and Dikilitaş 2020), including instructors' and students' previous experiences and dispositions towards online teaching and learning tools, to develop effective educational experiences that address their different (and changing) roles as well as instructors' and students' evolving identities.

Contextual factors impacting the quality of the experience should not be ignored: limited access to technology and internet was a reality and continues to be a reality that the recent lockdowns and adoption of remote learning have exacerbated. These have not only affected the normal development of teaching and learning practices, but have also uncovered issues of digital inequality emerging from access to technology as well as differences in digital literacy that are deeply embedded in social, economic and cultural context (Beaunoyer, Dupéré, and Guitton 2020). The COVID-19 pandemic has increased digital inequalities further and has revealed an additional impact in terms of social support networks that are so crucial for the preservation of our interpersonal ties and social structures (Beaunoyer, Dupéré, and Guitton 2020).

This study has several implications for teacher education. First, it puts accent on the need to go beyond emergency online practices to provide an evidence-based approach to online teaching and learning that acknowledges the particularities of this pedagogy and its implications. Second, it emphasises the need for a pedagogical approach that relies heavily on the social and collaborative components of learning as a starting point for the development of online teaching and learning practices (Olofsson 2007) but also of broader support structures of higher education institutions in partnership with governments and organisations to achieve equity and inclusion. Thus, it is important to minimise the factors that may contribute to exclusion and inequalities and to maximise students' participation in their learning process. Such factors include issues related to access to technological means but also issues associated with pedagogical approaches (e.g., clear goal-setting, coherent and flexible designs, explicit tasks, consistent and clear monitoring and evaluation) and different levels of interaction and engagement. Third, it highlights the different nature of the roles and competences required to teach effectively in the online higher education environment (Ní Shé et al. 2019) and at the same time makes

clear the need to equip teacher educators with a set of competences in which the socio-affective is at its very core. And, finally there is a need to go beyond an instrumental approach to online teaching and learning and to include into the equation its ethical, political and pedagogical dimensions. For instance, student teachers and teacher educators' roles and responsibilities in online teaching and learning and their implications for the process of learning to teach have to be taken into account. This also includes the consideration of issues of power and control over teaching and learning, i.e., questions related to not only what and how but also who and why, which are aspects that stand at the core of the development of professional knowledge and identity.

Further research and limitations

This study has made evident that some areas of research deserve further attention. First, more attention needs to be paid to practical learning areas such as learning design (see also Best and MacGregor 2017). Although this study has highlighted online learning design elements that were likely to lead to teaching and learning impact, these were not the primary focus of the studies examined. Second, more attention needs to be directed towards the pedagogical underlying issues leading to cognitive gains. While some studies described educational interventions that supported reflection and knowledge development (e.g., Baran and Cagiltay 2010; Mumford and Dikilitaş 2020), not all of them provided specific details on the pedagogical issues connected with them. Third, further research needs to be carried out in order to evaluate the impact of an integrated pedagogy of online teaching learning. More and more studies are acknowledging the different pedagogical approach required for an effective online learning experience (e.g., Doering et al. 2009; Niess and Gillow-Wiles 2014), but still more research needs to be conducted using a comprehensive framework to examine issues related to teaching and learning in such environment. Finally, more focus needs to be placed on educational experiences that are procedural and conceptual in nature. Although the studies that focus on the practicum in the context of online teacher education explore these kinds of issues (e.g., Rideout et al. 2008; Prilop, Weber, and Kleinknecht 2020; So, Hung, and Yip 2008), additional research on experiences about the practicum and other procedural areas (e.g., Music, Visual Arts or Physical Education) would be welcome.

This study has reviewed literature on online teaching and learning in the context of teacher education and has analysed practices leading to impact. However, due to the large number of studies under examination and the constraints in terms of word limitation, this paper has highlighted the most recurrent themes or aspects that have been considered to be the most relevant for the purpose of this paper and have not included other important issues (e.g., other online tools such as podcasts, MOOC, gamification or virtual worlds and the description of their affordances and constraints; the ways in which teachers' and students' attitudes, beliefs and dispositions mediate the teaching and learning process in online environments; a more detailed explanation of the technological, sociocultural and other contextual issues that may challenge online educational experiences) that are likely to influence the development of online practices. Also, this review has included literature published between January 2000 and April 2020 despite the rapidly changing practices in this area and the relatively few papers published during the period 2000–2010 ($n = 36$), which may suggest that these papers do not really represent the current state of online

learning. In addition, the inclusion of papers until April 2020 leaves outside the more recent studies that examine issues on online teaching and learning in the exceptional circumstances of the COVID-19 pandemic. The context and circumstances in which higher education institutions have had to develop these practices are important to understand the particularities of the moment and the decisions made in the transition from the face-to-face to the online format. As teacher education is an iterative and complex process that needs to look 'backwards, forwards, inside-out and outside-in' to respond to the evolving needs of a world that is 'moving, blurring and shifting' (Ling 2017, 562), acknowledging and addressing the current and changing exceptional circumstances that teachers and students are experiencing in these unprecedented times are necessary and would provide valuable information to continue informing future online practices.

Notes

1. Due to a word limit, the table is not included in this paper. Therefore, only the references mentioned in the main text are presented in this paper.
2. The TPACK model (Mishra and Koehler 2006) provides a framework on the essential knowledge required for technology integration in educational practices. Rather than presenting the different kinds of knowledge as separate bodies, the TPACK highlights the complex interplay between and among knowledge about Content (C), Pedagogy (P), and Technology (T) to achieve effective practices.

Disclosure statement

The authors declare that there is no conflict of interest.

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