



Core practices in practice-based teacher education: A systematic literature review of its teaching and assessment process

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ARTICLE INFO

Keywords:

Practice-based
Teacher education
Assessment processes
Evaluation methods
Core practices
Higher education
Educational innovation

ABSTRACT

This article presents a systematic review of the literature to identify core practices, teaching strategies and assessment processes used or under development in practice-based teacher education programs. It addresses diverse core practices used in university pedagogy of practice. A finding is that the assessment of students' learning of core practices remains incipient. Our study contributes to teacher education programs that opt for a practice-based curriculum to further understand teaching and assessment of core practices. This review facilitates progress in constructing common frameworks that support pre-service teachers' training.

1. Introduction

Several teacher education programs have transformed in recent years to improve teacher education quality, which in many cases experiences a gap between theory and practice. According to a comparative study of teacher education in developed countries with well-established systems, teacher education programs attempt to connect theory and practice through the design of reflective work and the integration of high-quality clinical work (Darling-Hammond, 2017). In addition, some programs have increased the offering of practical experiences for pre-service teachers (PSTs) to learn essential pedagogical skills through on-campus courses besides school fieldwork (Dalinger, Thomas, Stansberry, & Xiu, 2020). These programs have focused intensely on helping PSTs learn how to develop teaching practices that promote student learning (Zeichner & Peña-Sandoval, 2015). This review focuses on literature regarding these programs, known in general as practice-based teacher education.

Practice-based teacher education is understood as professional preparation that focuses on novices' learning directly how to teach (Forzani, 2014). The curricula are designed specifically for teaching practices as part of course content (McDonald, Kazemi, & Kavanagh, 2013). Thus, methodological courses employ teaching practices that support understanding everyday classroom teaching (DeGraff, Schmidt, & Waddell, 2015). Practice-based teacher education rests on critical factors for improving teacher preparation and responds to the challenge

to prepare teachers adequately to educate new generations.

The teaching practices of these curricula have been called core practices. They are sets of strategies, routines, and activities that teachers can unpack for learning (Core Practices Consortium, 2020) across subject areas, grade levels, and contexts. Teaching well depends on having a flexible repertoire of high-leverage strategies and techniques that can be deployed quickly with good judgment, depending on the specific context and situation. Thus, core practices are also known as high-leverage practices (Ball & Forzani, 2009). Incorporating core practices implies rethinking how a teacher education program will ensure that PSTs have adequate skills (Ball & Forzani, 2009). Teacher Educators (TEs) must help PSTs develop relevant knowledge and disposition while, at the same time, learning to use core practices when teaching (Davis & Boerst, 2014). In addition, these programs must have meaningful processes to assess their students' progress. TEs must communicate the innovations, teaching strategies and assessment methodologies employed when teaching core practices.

In this regard, there is little research synthesizing the relationship of core practices, their teaching, and the assessment processes developed in practice-based teaching programs. O'Flaherty and Beal (2018) analyzed studies published in refereed journals between 2000 and 2016. Their systematic review of the literature analyzed core competencies and high-leverage practices of newly qualified teachers. The authors identified eight articles that dealt with high-leverage practices or core practices (examples include dialogic teaching, discussion, and a

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mathematical problem-solving approach). They suggested that careful attention must be paid to how these practices are taught and assessed. A second literature mapping study (Matsumoto-Royo and Ramírez-Montoya, 2019) presented a synthesis of the state-of-the-art in practice-based teacher education. It suggested providing scientific evidence on underdeveloped topics, such as the evaluative processes of core practices teaching. Therefore, it is necessary to have more detailed, updated research on core practices, teaching, and assessment.

This review aims to analyze the evidence in empirical studies published from 2015 to 2019 about the core practices and teaching strategies that have been used and the assessment processes applied to this approach in teacher education programs. The following research questions are addressed:

- ✓ Which core practices have been addressed in the literature?
- ✓ Which teaching strategies have been used?
- ✓ Which assessment tasks have been applied in the core practices teaching?

This systematic review contributes to the literature with an updated, in-depth examination of aspects that have not been studied. In addition, the review contributes guidance to the orientation of teacher education programs using a practice-based curriculum. Finally, this review also provides a common framework for teaching PSTs and innovations to assess their learning

2. Conceptual framework

2.1. Core practices

Practice-based teacher education can fulfill the urgency for those who prepare themselves as teachers to carry out quality teaching from the moment they enter the profession. However, learning about teaching methods is not the same as learning to put teaching methods into practice (Jao, Wiseman, Kobiela, Gonsalves, & Savard, 2018) or using those methods in various teaching situations. Therefore, the practice must be the focus of teacher preparation. It increases demands on teacher education programs because PSTs must learn to think and act as teachers and do their actual work (Darling-Hammond, 2006). This emphasis on practices implies that the curriculum deliberately focuses on specific core practices and not just school fieldwork or the fieldwork associated with on-campus courses (Grossman, Hammerness, McDonald, & Ronfeldt, 2008). Therefore, it is necessary for pedagogical programs to carefully select the core practices that PSTs should learn in their training.

Facing the challenge of identifying and selecting core practices, Grossman, Hammerness, and McDonald (2009) identified common characteristics of core practices that different researchers mention: 1) practices that occur with high frequency in teaching, 2) practices that novices can enact in classrooms in different curricula or instructional approaches, 3) practices that novices can begin to master, 4) practices that allow novices to learn more about students and teaching, 5) practices that preserve the integrity and complexity of teaching, and 6) practices that are research-based and have the potential to improve student achievement. These features have provided a common framework for scholars and TEs in identifying and selecting core practices.

TeachingWorks, a University of Michigan center dedicated to improving teachers' preparation, describes high-leverage practices as the fundamental element of teaching because they impact student learning and are necessary to advance teaching skills (TeachingWorks, 2020). The center identified 19 high-leverage practices in various subject areas, grade levels, and contexts, including leading a group discussion, eliciting and interpreting individual students' thinking, diagnosing common patterns of student thinking, and setting up and managing small-group work, among others.

Taking the framework above as a reference, the Collaboration for

Effective Educator Development, Accountability, and Reform (CEEDAR) and the Council for Exceptional Children (CEC) identified through the consensus of special educators, 22 high-leverage practices in special education (McLeskey & Council for Exceptional Children & Collaboration for Effective Educator, Development, Accountability and Reform, 2017). These practices are intended to address the most critical practices that every K–12 special education teacher should master; they are broadly applicable to all subject areas and grade levels and foster student engagement and learning (McLeskey & Brownell, 2015). Many of these practices are similar to TeachingWorks practices and vary only in intensity and focus (McCray, Kamman, Brownell, & Robinson, 2017).

Besides, the Core Practices Consortium (2020), in which TEs from various institutions, disciplines, and theoretical perspectives participate, distinguishes between general practices (for example, orchestrating class discussion, modeling, providing instructional explanations and subject practices) and subject-specific practices (for example, identifying inquiry-worthy ideas in science, modeling historical thinking skills, and facilitating text-based instruction for articles). This distinction has allowed progress in developing frameworks that offer specific guidelines for researchers and TEs. Using common concepts is highly relevant because, through a common framework, researchers can build on prior work and communicate their findings more powerfully to peers and practitioners (Grossman & McDonald, 2008).

2.2. Pedagogy of practices

The inclusion of core practices in teacher education programs implies that TEs must implement appropriate curricular methodologies, which may be new to some teacher training programs. Grossman, Compton et al. (2009) and Grossman, Hammerness et al. (2009) developed a framework based on the structure of various pedagogies deeply grounded in practice and used in professional education. This framework identified three elements that make it possible to understand a pedagogy of practices fundamental to organizing and focusing the teaching work: decomposition of the practice, representations of the practice, and approximations of practice.

To learn a complicated practice, the PSTs must identify parts or steps that constitute their performance. Decomposition of the practice is its segmentation or division into constitutive elements to facilitate teaching and learning. For example, PSTs prepare to conduct a parent interview by breaking down the elements that constitute each moment (beginning, development, agreements, closing). Thus, in training PSTs, the TEs must develop and use specific vocabulary to refer to each of the practice parts, name its elements, and encourage PSTs to use those terms. Decomposing the practice depends on a language and structure to describe it and enables PSTs to see, plan, and enact practices effectively (Grossman, Kavanagh, & Dean, 2018).

Representations of practice provide novices with opportunities to see and understand different ways in which a practice is performed in the professional context (Grossman, Compton et al., 2009; Grossman, Hammerness et al., 2009). Videos, lesson plans, student work samples, evaluation samples, and teaching materials can be used (Grossman et al., 2008). The selection of representations depends on the facets of practice that TEs want to present. For example, in lesson plans, PSTs can observe the teacher's pedagogical intentions, contents, activities, and material usage; still, PST cannot watch the teacher-student interactions or interactions among students in a class. For this, they can observe a video of an actual class. Modeling is also how TEs represent and decompose disciplinary thinking and pedagogical choices to make the underlying reasoning and values visible (McGrew, Alston, & Fogo, 2018). The selection of representations requires TEs to understand the core practices and content they want to make visible to the PSTs (Danielson, Shaughnessy, & Peter Jay, 2018). These representations can vary significantly, both in terms of comprehensiveness and authenticity, but they should be relevant to authentic teaching situations and be as realistic as possible.

"Approximations of practice" refers to opportunities to enact practices in conditions similar to the authentic teaching practice. These consist of bringing PSTs gradually closer to teaching, targeting specific elements of practice, creating conditions to reduce complexity, applying new strategies, and limiting the consequences of failure (Shutz, Grossman, & Shaughnessy, 2018). Such approximations must be structured and include feedback to help PSTs develop a deep understanding of teaching complexity (DeGraff et al., 2015). In such rehearsals or role-plays, the PST takes on and enacts the teacher's role. The TE supports and gives feedback to the PST, with other PSTs playing students' roles. Such approximations or rehearsals of practice will never replace the need for students to engage in actual practice settings; however, the work done in courses can prepare PSTs better for practice challenges by developing ways to interpret and understand professional practice (Grossman, Compton et al., 2009; Grossman, Hammerness et al., 2009). Therefore, it is necessary to offer PSTs multiple opportunities to approximate various practices because these bring the PST closer to authentic teaching. Such role-play is similar to a "dress rehearsal" to prepare the PST for real-world teaching.

2.3. Cycles of practice

Pedagogy of practices involves generating opportunities to decompose a practice, analyze its representations, and approximate its enactment. When these opportunities are offered systematically and repeatedly, following a sequence that enables the PSTs to achieve mastery of teaching, they are called *learning cycles of practice*. The cycle has different phases, and the stages are related to the three elements mentioned above (decompose, represent, and approximate). In this respect, McDonald et al. (2013) describe a collective learning cycle to engage in an authentic and ambitious instructional activity with four phases: introducing and learning about the activity, preparing for and rehearsing the activity, enacting the activity with students, and analyzing the enactment and moving forward.

In phase one, *introducing and learning about the activity*, the TE models a core practice or presents other resources to help PSTs better understand the core practice. Then, the practice is decomposed by analyzing various representations. In phase two, *preparing for and rehearsing the activity*, PSTs work to plan a lesson and improve it after the rehearsal or simulation. During the planning and rehearsal process, the practice is broken down to emphasize or provide feedback on a specific core practice component. This process allows opportunities to practice in a low-stakes setting (Bien et al., 2018). In phase three, *enacting the activity with students*, PSTs finalize their lesson plan and enact it in the real context. Finally, in phase four, *analyzing the enactment and moving forward*, the TE supports the PST in thinking critically and reflecting about the practice and enactment, the student's learning, and the core practices domain, according to the previous phases of the cycle (Cartun, Shutz, Kelley-Petersen, & Franke, 2018). Thus, the cycle brings together different teaching activities organized in phases and links the components of the pedagogy of practice.

2.4. Assessment of the learning of core practices

In the practice-based teacher education framework, learning assessment processes should focus on collecting information about the PSTs' enactment or performance in integrating their domain of core practices. Assessment tasks tell students what they have learned about the essential elements in a course; therefore, they are at the heart of students' learning experiences (Gibbs, 1999). The assessment helps achieve coherence of what is taught, what is evaluated, and how it is evaluated. TEs should select tools, collect materials, and construct the assessment tasks (Arbaugh, Davin, Grossman, Heller, & Monk, 2015) to assess whether PSTs are learning and integrating core practices and how they are doing it. Thus, the pedagogical program must determine the characteristics or conditions of the PSTs' learning and create assessment

tasks according to the curriculum.

2.4.1. Coherence with the pedagogy of practice

The assessment tasks should be based on procedures or activities relevant to collecting information on learning, enhance the PSTs' learning, and be consistent with content teaching. In practice-based teacher education, the assessment process must collect information and enhance PSTs' learning of core practices, consistent with pedagogy that integrates the cycle of practice. For example, examples of teacher practice or case studies describing critical incidents can be used to provide PSTs with increasingly complex, simulated contexts that help them develop and integrate the necessary knowledge, skills, and attitudes (Darling-Hammond & Snyder, 2000; Grossman, Compton et al., 2009; Grossman, Hammerness et al., 2009). Also, assessment tasks should allow PSTs to rehearse and practice what they will need to do as future professionals and discover the connections between theoretical learning and practical work (Virtanen, Niemi, & Nevgi, 2017). Additionally, enactment analysis, written journals, diaries, and papers could also constitute reflective assessment tasks. Creating portfolios helps PSTs collect evidence of their teaching performance, including their decision-making process, analyses and reflections of their performance and learning (Bakker et al., 2011). Innumerable evaluative tasks associated with the cycle of practice can be included; such tasks can enhance the PSTs' core practices learning.

2.4.2. Authentic tasks close to the professional world

Another assessment condition is that practice-based teacher education should bring students closer to the professional world with contextual, authentic tasks. This condition implies selecting and executing procedures found in actual or well-simulated practices, where PSTs perform tasks that require applying skills in similar or identical circumstances of professional life (Mateo, 2006). Such authentic tasks assess whether PSTs focus on meaningful processes and relate theoretical ideas to everyday teaching work (Álvarez, 2017) for then will integrate into their teaching habits. In this way, PSTs are expected to engage in activities that help them address real-world problems (Ashford-Rowe, Herrington, & Brown, 2014). This ability of the teacher to adapt to the situation should permanently guide the design of assessment tasks in practice-based teacher education.

2.4.3. High feedback

When observing the PSTs' performance or tasks to improve the practice, TEs should also provide feedback about their competencies, highlighting their efficient practices and improvements (Allen & Wright, 2014). Assessment is meaningful when the participants can use the results meaningfully to improve their learning (Richmond, Salazar, & Jones, 2019). Feedback provides valuable information for this. Thus, feedback is a critical component advantageous to TEs, who can adjust instruction, and PSTs can improve their learning (Pastore, Manuti, & Scardigno, 2019). Many essential skills cannot be developed without direct training, supervised practice, and rigorous feedback (Arbaugh et al., 2015; Grossman & Pupik Dean, 2019). Therefore, TEs must learn how to provide PSTs with feedback to develop their skills during the learning and assessment processes (Ball & Forzani, 2010). Timely and specific feedback should cover the many tasks related to core practices learning, particularly in rehearsals and practice enactments.

2.4.4. Participation of different agents: peer-assessment and self-assessment

An external expert's appraisal and the TE's are not the only feedback that leads to success in learning. Peer assessment and self-assessment or self-reflection on learning are also critical (Leko, Brownell, & Sindelar, 2015). Formative and active assessments, including self-assessment, encourage students to construct knowledge and deep understanding (Postareff, Virtanen, Katajavuori, & Lindblom-Ylänne, 2012). For future teachers, supplementing the self-assessment process (providing them with an intentional format and procedures for self-assessing their

instruction) with peer feedback leads to greater understanding and engagement in PSTs learning. In addition, it fosters teaching skills and knowledge of how to collect classroom data with feedback from their future students (Snead & Freiberg, 2019). However, a gap in student involvement in the evaluation processes remains because PSTs, graduates, and TEs typically assume that the procedures and assessment instruments do not need to involve students in the evaluation (Gallardo-Fuentes, López-Pastor, & Carter Thuillier, 2017).

3. Methodology

This article analyzes the evidence from empirical studies published from 2015 to 2019 regarding practice-based teacher education to identify core practices addressed in the literature and recognize the teaching strategies and the assessment tasks. The method involves identifying, analyzing, and interpreting available evidence of specific research questions in an unbiased and replicable manner (Kitchenham & Charters, 2007). For this purpose, we conducted a detailed and systematic search of selected articles based on explicit criteria and their uniformed application (Martín-Rodero, 2014). The systematicity of this method was achieved by rigorously applying pre-established steps.

Several references to core practice teaching and learning assessment were previously searched to identify commonly used concepts and gain a comprehensive, detailed overview of the field. The references came from digital and printed books, articles, reviews, web pages, and discussions with experts in the field. We attempted to identify the empirical experiences of practice-based teacher education mentioned in the literature regarding teaching and assessing core practices.

To explore core practices addressed in the literature, the teaching strategies used, and the assessment tasks applied, we conducted a bibliographic search by consulting two electronic databases: Web of Science (WoS) and Scopus. Both databases ensure access to articles published in high-impact journals. The terms "practice-based," "practices," and "teacher education" were also used to obtain relevant articles in this search. For each of these terms, the condition of *all fields* was noted.

The search covered only research articles written in English and Spanish and published in peer-reviewed scientific journals. Unpublished Ph.D. theses, books, and reports were not considered. Less than a decade ago, various projects focused on teaching through high-leverage or core practices (Ball, Sleep, Boerst, & Bass, 2009; Grossman, Compton et al., 2009; Grossman, Hammerness et al., 2009; Kazemi, Franke, & Lampert, 2009; Lampert, 2010; Windschitl, Thompson, Braaten, & Stroupe, 2012). Presumably, during the first years, the programs defined the necessary components because research appears not to have been published when the approach was just being established. Thus, although it may be a limitation to this study, this review covered only research articles from 2015 to June 2019.

All search results were organized in a single Excel file, and then these studies were evaluated to ensure they met the inclusion criteria. Identical results were discarded (opting for WoS in those cases), as were results that did not correspond to research articles. Results published in high-impact journals were maintained (with information about impact factors). This process resulted in 199 articles. Then the abstracts of these studies were examined. Only empirical articles were then preserved, resulting in 174 articles. The reading of each article continued, and articles from contexts other than teacher education (54) were excluded, resulting in 120 articles that constituted the basis for this review.

Moreover, a relevance criterion was established to ensure relevance to the study's objective. For this, some concepts were selected that were directly associated with the practice-based approach (practice-based, core practices, high leverage practices, teaching practices, and rehearsal). For this purpose, we considered revised titles, keywords, and abstracts for each article. If the article mentioned some of the concepts above, we assumed they were relevant for the review. The results provided 49 articles that can be consulted in the integrated archive. Fig. 1

	Excluded	Total
Filter 1 • Search in WoS and Scopus databases	0	249
Filter 2 • Duplicity criterion	11	238
Filter 3 • Articles only	19	219
Filter 4 • Published in journals with informed impact factor	20	199
Filter 5 • Empirical studies	25	174
Filter 6 • Teacher education context	54	120
Filter 7 • Relevance criterion	71	49

Fig. 1. The process to establish the articles considered in this review.

presents the process to establish the articles considered in this review.

The following data had been previously extracted from the identified studies: authors, title, year, country, abstract, and keywords. The researchers used a data extraction form specifically related to the questions under investigation. Each article was analyzed to answer each research question.

First, articles that explicitly referred to core practices or high leverage practices were identified. Then, a framework was sought to classify different core practices congruent with the core practices definition. The framework of high-leverage practices described by TeachingWorks (2020) was used. Other core practices that were mentioned but did not correspond to such a framework were added. The core practices were organized into two categories. The first category corresponded to teachers' tasks in the classroom while interacting directly with children (for example, leading a group discussion, eliciting and interpreting individual students' thinking or students, explaining and modeling content, among others). The second category corresponded to teachers' tasks outside the classroom that also support teaching (for example, design and planning for teaching, analyzing instruction, designing an appropriate assessment, among others).

In identifying core practices, the authors observed that some practices corresponded to specifications of a more general core practice or a core practice for a particular subject or content. For this reason, we subclassified those more specific core practices and maintained the association with the more general core practices.

In all studies identified above, each research context and intervention description were analyzed to answer the second research question. Then, we identified core-practice teaching strategies and organized the findings according to the underlying descriptive categories.

Finally, to answer the third research question, all studies that explicitly stated they had addressed one or more core practices in teacher education and explicitly referred to the evaluation or assessment process were selected. The descriptions of learning assessment processes mentioned in the articles were analyzed, and the findings were organized according to the underlying descriptive categories.

4. Results

Our first study results are shown in Tables 1A and 1B, which present the revised articles list by author, year of publication, title, journal, the context in which the study was developed, program duration, and program type. The results of the review are presented as follows, based on the questions that guided this study.

Table 1A
List of revised articles.

Article number	Author	Year	Title	Journal	Institution context	Program duration	Program type
[1]	Alston, C. L.; Danielson, K. A.; Dutro, E.; Cartun, A.	2018	Does a discussion by any other name sound the same? Teaching discussion in three ELA methods courses	Journal of Teacher Education	University	2 years	Methods course(s)
[2]	Amador, J. M.	2017	Preservice teachers' video simulations and subsequent noticing: a practice-based method to prepare Mathematics teachers	Research in Mathematics Education	University	Not informed	Methods course(s)
[3]	Anthony, G.; Hunter, J.; Hunter, R.	2015	Prospective teachers development of adaptive expertise	Teaching and Teacher Education	University	4 years	Methods course(s)
[4]	Arias, A. M.; Davis, E. A.	2017	Supporting children to construct evidence-based claims in Science: Individual learning trajectories in a practice-based program	Teaching and Teacher Education	University	2 years	Methods course(s)
[5]	Averill, R.; Drake, M.; Anderson, D.; Anthony, G.	2016	The use of questions within in-the-moment coaching in initial Mathematics teacher education: enhancing participation, reflection, and co-construction in rehearsals of practice	Asia-Pacific Journal of Teacher Education	University	4 years	Teacher education program(s)
[6]	Baz, E. H.; Balcikanli, C.; Cephe, P. T.	2018	Introducing an innovative technology integration model: Echoes from EFL pre-service teachers	Education and Information Technologies	University	4 years	Course/courses
[7]	Becker, E. A.; Eason, E. J.; Potter, S. C.; Guzman-Alvarez, A.; Spear, J. M.; Facciotti, M. T.; Igo, M. M.; Singer, M.; Pagliarulo, C.	2017	The effects of practice-based training on graduate teaching assistants' classroom practices	CBE Life Sciences Education	University	4 years	Weekly training program
[8]	Bottoms, S. A. I.; Ciechanowski, K. M.; Hartman, B.	2015	Learning to teach elementary Science through iterative cycles of enactment in culturally and linguistically diverse contexts	Journal of Science Teacher Education	University	Not informed	Methods course(s)
[9]	Brevik, L. M.; Gunnulfsen, A. E.; Renzulli, J. S.	2018	Student teachers' practice and experience with differentiated instruction for students with higher learning potential	Teaching and Teacher Education	University	1 year/ 5 years	Teacher education program(s)
[10]	Buchholtz, N. F.; Krosanke, N.; Orschulik, A. B.; Vorholter, K.	2018	Combining and integrating formative and summative assessment in mathematics teacher education	Zdm-Mathematics Education	University	Not informed	Seminar
[11]	Canrinus, E. T.; Klette, K.; Hammerness, K.; Bergem, O. K.	2019	Opportunities to enact practice in campus courses: Taking a student perspective	Teachers and Teaching: Theory and Practice	University	1 year/ 5 years	Teacher education program(s)
[12]	Chou, P. I.; Su, M. H.; Wang, Y. T.	2018	Transforming teacher preparation for culturally responsive teaching in Taiwan	Teaching and Teacher Education	University	2 years	Teacher education program(s)
[13]	Daniel, S. M.	2015	Empathetic, critical integrations of multiple perspectives: A core practice for language teacher education?	TESOL Journal	University	2 years	Methods course(s)
[14]	Davin, K. J.; Heineke, A. J.	2016	Preparing teachers for language assessment: A practice-based approach	TESOL Journal	University	Not informed	Course/courses
[15]	Davis, E. A.; Kloser, M.; Wells, A.; Windschitl, M.; Carlson, J.; Marino, J. C.	2017	Teaching the practice of leading sense-making discussions in science: Science teacher educators using rehearsals	Journal of Science Teacher Education	University	1 year/ 2 years	Teacher education program(s)
[16]	DeMink-Carthew, J.; Grove, R.; Peterson, M.	2017	The influence of the core practices movement on the teaching and perspectives of novice teacher educators	Studying Teacher Education	University	Not informed	Methods course(s)
[17]	Dotger, B. H.	2015	Core pedagogy: Individual uncertainty, shared practice, formative ethos	Journal of Teacher Education	University	Not informed	Programs and courses
[18]	Drake, M. R. A.	2016	Learning to coach in practice-based teacher education: A self-study	Studying Teacher Education	University	1 year	Teacher education program(s)
[19]	Dutro, E.; Cartun, A.	2016	Cut to the core practices: Toward visceral disruptions of binaries in practice-based teacher education	Teaching and Teacher Education	University	3 years	Methods course(s)
[20]	Francis, Olson, Weinberg & StearnsPfeiffer	2018	Not just for novices: The programmatic impact of practice-based teacher education	Action in Teacher Education	University	5 years	Teacher education program(s)
[21]	Gardiner, W.	2018	Rehearsals in clinical placements: Scaffolding teacher candidates' literacy instruction	Teacher Educator	School	1 year	Urban Teacher Residency
[22]	Goldin, S.; Flynn, E. E.; Egan, C. M.	2017	"Our greatest songs are still unsung": Educating citizens about schooling in a multicultural society	SAGE Open	University	Not informed	Course/courses
[23]	Gotwals, A. W.; Birmingham, D.	2016	Eliciting, identifying, interpreting, and responding to students' ideas: Teacher candidates' growth in formative assessment practices	Research in Science Education	University	1 year	Methods course(s)
[24]	Hammerness, K.; Kennedy, B.	2019	Teaching practices grounded in foundational knowledge, visions, and contexts	New Educator	University	1 year	Teacher education program(s)
[25]	Husbye, N. E.; Powell, C. W.; Vander Zanden, S.; Karalis, T.	2018	Coaching in practice-based literacy education courses	Reading Teacher	University	Not informed	Course/courses

Table 1B
List of revised articles.

Article number	Author	Year	Title	Journal	Institution context	Program duration	Program type
[26]	Jenset, I. S.; Klette, K.; Hammerness, K.	2018	Grounding teacher education in practice around the world: An examination of teacher education coursework in teacher education programs in Finland, Norway, and the United States	Journal of Teacher Education	University	1 year/ 5 years	Teacher education program(s)
[27]	Kademian, S. M.; Davis, E. A.	2018	Supporting beginning teacher planning of investigation-based science discussions	Journal of Science Teacher Education	University	1 year	Methods course(s)
[28]	Kavanagh, S. S.; Rainey, E. C.	2017	Learning to support adolescent literacy: Teacher educator pedagogy and novice teacher take up in secondary English language arts teacher preparation	American Educational Research Journal	University and alternative program	1 year	Course/ courses
[29]	Kazemi, E.; Ghouseini, H.; Cunard, A. & Turrou, A. C.	2016	Getting inside rehearsals: Insights from teacher educators to support work on complex practice	Journal of Teacher Education	University	Not informed	Teacher education program(s)
[30]	Kloser, M.; Wilsey, M.; Madkins, T. C.; Windschitl, M.	2019	Connecting the dots: Secondary science teacher candidates' uptake of the core practice of facilitating sensemaking discussions from teacher education experiences	Teaching and Teacher Education	University	2 years	Methods course(s)
[31]	Knackstedt, K. M.; Leko, M. M.; Siuty, M. B.	2018	The effects of secondary special education preparation in reading: Research to inform state policy in a new era	Teacher Education and Special Education	University/ School	Not informed	Course/ courses
[32]	Leeferink, H.; Koopman, M.; Beijgaard, D.; Ketelaar, E.	2015	Unraveling the complexity of student teachers' learning in and from the workplace	Journal of Teacher Education	University	4 years	Teacher education program(s)
[33]	Meuwissen, K. W.; Thomas, A. L.	2016	Can studying adolescents' thinking amplify High-leverage social studies teaching practice? Challenges of synthesizing pedagogies of investigation and enactment in school-institutional contexts	Theory and Research in Social Education	University	Not informed	Methods course(s)
[34]	Mitchell, D. M.; Reid, J. A.	2016	(Re)turning to practice in teacher education: embodied knowledge in learning to teach	Teachers and Teaching	University	3 years	Teacher education program(s)
[35]	Molander, B. O.; Hamza, K.	2018	Transformation of professional identities from scientist to teacher in a short-track Science teacher education program	Journal of Science Teacher Education	University	1 year/ 5 years	Teacher education program(s)
[36]	Muller, M.; Álamos, P.; Meckes, L.; Sanyal, A.; Cox, P.	2016	Teacher candidates' perceptions of opportunities to develop core practices in a teacher education program	Estudios Pedagógicos	University	5 years	Teacher education program(s)
[37]	Neel, M. A.	2017	Making sense and facing tensions: an investigation of core practice complexities	Teaching Education	University	Not informed	Methods course(s)
[38]	Peercy, M. M.; Troyan, F. J.	2017	Making transparent the challenges of developing a practice-based pedagogy of teacher education	Teaching and Teacher Education	University	Not informed	Methods course(s)
[39]	Reisman, A.; Kavanagh, S. S.; Monte-Sano, C.; Fogo, B.; McGrew, S. C.; Cipparone, P.; Simmons, E.	2018	Facilitating whole-class discussions in History: A framework for preparing teacher candidates	Journal of Teacher Education	University	1 year	Methods course(s)
[40]	Rogers, K. C.; Steele, M. D.	2016	Graduate teaching assistants' enactment of reasoning-and-proving tasks in a content course for elementary teachers	Journal for Research in Mathematics Education	University	Not informed	Methods course(s)
[41]	S. Piro, J.; O'Callaghan, C.	2019	Journeying towards the profession: Exploring liminal learning within mixed reality simulations	Action in Teacher Education	University	Not informed	Teacher education program(s)
[42]	Schutz, K. M.; Danielson, K. A.; Cohen, J.	2019	Approximations in English language arts: Scaffolding a shared teaching practice open access	Teaching and Teacher Education	University	Not informed	Course/ courses
[43]	Shaughnessy, M.; Boerst, T. A.	2018	Uncovering the skills that preservice teachers bring to teacher education: The practice of eliciting a student's thinking	Journal of Teacher Education	University	2 years	Teacher education program(s)
[44]	Stroupe, D.; Gotwals, A. W.	2018	"It's 1000 degrees in here when I teach": Providing preservice teachers with an extended opportunity to approximate ambitious instruction	Journal of Teacher Education	University	Not informed	Methods course(s)
[45]	Thompson, J.; Hagenah, S.; Lohwasser, K.; Laxton, K.	2015	Problems without ceilings: How mentors and novices frame and work on problems-of-practice	Journal of Teacher Education	University/ School	Not informed	Field experience
[46]	Troyan, F. J.; Peercy, M. M.	2016	Novice teachers' perspectives on learning in lesson rehearsals in second language teacher preparation	International Multilingual Research Journal	University	2 years	Teacher education program(s)
[47]	Vartuli, S.; Snider, K.; Holley, M.	2016	Making it real: A practice-based early childhood teacher education program	Early Childhood Education Journal	University	4 years	Course/ courses
[48]	Von Esch, K. S.; Kavanagh, S. S.	2018	Preparing mainstream classroom teachers of English learner students: grounding practice-based designs for teacher learning in theories of adaptive expertise development	Journal of Teacher Education	University/ School	Not informed	Math studio days
[49]	Wetzel, M.; Hoffman, J. V.; Maloch, B.; Vlach, S. K.; Taylor, L. A.; Svrcek, N. S.; Dejulio, S.; Martinez, A.; Lavender, H.	2018	Coaching elementary preservice teachers hybrid spaces for cooperating teachers and university field supervisors to collaborate	International Journal of Mentoring and Coaching in Education	University	Not informed	Program

4.1. Which core practices have been addressed in the literature?

Of the 49 articles reviewed, 34 explicitly mentioned core or high leverage practices. The context of these 34 studies was mainly university teacher education programs (12), and other studies focused on specific courses within a teacher education program (19). Several articles (20 of 49) do not refer to the duration of the studied teacher education program. The remaining 29 articles are distributed among programs with a duration from one to five years. Similar duration patterns occur in the 34 studies that explicitly mentioned core practices.

The 34 articles were further analyzed to identify which core practices were mentioned. This identification process resulted in a large number of core practices, as shown in Table 2. This table shows the articles organized into two categories: 1) associated with tasks developed in the

classroom while interacting directly with children, and 2) associated with tasks developed outside the classroom teaching. Furthermore, the table presents the association between core practice and the paper(s) in which they were mentioned and the association between general core practices and specific core practices.

We observed that the studies discussed diverse core practices in the educational process of PSTs. They cover various teacher performance areas associated with tasks developed in the classroom while interacting directly with children and supporting teaching tasks. Some core practices corresponded to a more specific core practice or a specific subject's core practices.

To complement this information, Fig. 2 presents core practices with more than one mention. Specific core practices were incorporated into the general core practices. The core practices with more mentions were:

Table 2
Core practices in articles.

Core Practices	Articles	Total
Associated with tasks developed in the classroom while interacting directly with children		
Conduct small group school work.	[36]	1
Constructing and maintaining democratic classroom communities	[24]	1
Creating meaningful and multiple oral language opportunities	[16]	1
Dealing with difficult interactions	[47]	1
Eliciting and interpreting individual students' thinking	[3], [8], [18], [20], [21], [23], [28], [33], [36], [37], [39], [41], [43], [45]	
Eliciting and responding to students' ideas and orienting them to each other's thinking and big mathematics ideas.	[29]	16
Eliciting of students' initial ideas and experiences about the anchoring event	[44]	
Empathetic, critical integrations of multiple perspectives	[13]	1
Explaining and modeling content, practices, and strategies	[18], [20], [27], [28], [36]	
Making a literacy strategy explicit by using graphic organizers	[41]	
Posing questions about the content	[16]	8
Questioning for building	[46]	
Giving clear directions	[16], [38], [47]	3
Giving appropriate scaffolding	[46]	
Giving opportunities for students to use English both receptively and productively	[38], [46]*	3
Scaffolding argumentative historical writing	[37]	
Implementing organizational routines	[18], [21], [24], [28], [36], [41]	6
Leading a group discussion	[1], [5], [18], [19], [20], [21], [30], [36], [37], [39], [41], [42], [47]	
Orchestrating group work and mathematical argumentation	[3]	
Facilitating discussions that make sense in science	[15]	
Facilitating investigation-based discussions	[27]	18
Orienting students to each other's ideas. Orienting students to the content.	[28]	
Orienting to students to each other's thinking and the big ideas in mathematics	[29]	
Leading a text-based discussion	[37]*	
Positioning students as competent learners	[3], [28], [47]	
Involving engagement in scientific practices to construct new knowledge relevant to the phenomenon that anchors the unit	[44]	5
Knowing students engage prior knowledge and using culturally relevant teaching materials	[16]	
Pressing for evidence-based explanations	[4], [8], [45]	
Supports students in rallying all ideas and evidence assembled during their study to make revisions to their models and revisit explanations for the anchoring event.	[44]	4
Providing feedback to students	[17]	1
Reading aloud to primary school children and engaging them with a text through questioning	[34]	1
Recognizing common patterns in student thinking	[18]	1
Representing mathematical thinking	[3]	1
Supporting interaction and target language comprehension	[46]	1
Teaching grammar using an inductive approach	[46]	1
Using methods to check or to assess students understanding	[18], [20], [28], [36], [46]	5
Associated with tasks developed outside the classroom and support teaching		
Analyzing instruction, materials, and student learning	[14], [18], [20], [36]	4
Communicating with other professionals	[18]	1
Designing an appropriate assessment	[14], [36], [37]	3
Engaging in strategic relationship-building conversations with students	[17]	1
Initiating and engaging in critically reflective dialogue with urban school stakeholders	[24]	1
Planning for teaching	[36], [44], [45]	
Using assessment findings to design instruction	[14]	
Formulating teaching hypothesis	[36]*	6
Generating content and language objectives	[38]	
Using content and language objectives to guide instruction and measure students' learning outcomes	[46]	

* The article present differentiation by general and specific practice.

leading a group discussion (18) and eliciting and interpreting an individual student's thinking (16).

4.2. Which teaching strategies have been used?

All those studies in which core practices were mentioned were reviewed. Of the 34 articles, 31 described some type of teaching strategy. The teaching strategies referred to in each study were analyzed and organized. This process enabled us to recognize three teaching strategies. Table 3 presents the teaching strategies and articles that mention them.

4.2.1. Collaborative field and campus coursework

Four studies described teaching strategies developed inside and outside the field (schools) for cooperative work among various teacher education actors (PSTs, field supervisors, mentor teachers). These strategies consisted of coordinated activities where the PSTs related the campus class content to the field experience and linked these with mentoring teachers and school students. In this instance, PSTs who visit classrooms and schools can observe a strategy being used, discuss the application of a strategy, conduct interviews (teachers or students), and reflect on strategies, specific techniques, and outcomes. Some specific strategies are rounds (visiting classrooms as part of the course sessions) and forming dyads of cooperating teachers and PSTs who analyze and discuss different activities and methods.

4.2.2. Learning cycles of practices

Of the studies analyzed, 16 refer to a teaching process that involves offering PSTs some systematic and repeated opportunities to understand the pedagogical practice and approximate the tasks that a teacher enacts. The process follows a sequence. These cycles include different phases that generally are characterized as structured, iterative, and collaborative, with the participation of TEs, PSTs, and their peers. Most studies in this category mention lesson planning as a constituent activity of the cycles. All studies mention the stage or phase known as rehearsal, simulation or microteaching that primarily occur on campus and in which their peers and TEs have an essential role to play. Some studies consider enactment in fieldwork as part of these cycles. Almost all studies mention the analysis and reflection phase of both rehearsal and field experiences. Some studies in this category (6) do not explicitly refer

Table 3 Teaching strategies in articles.

Teaching strategies	Articles number	Total
Collaborative work between field and campus course	[20], [33], [45], [47]	4
Learning cycle of practice	[3], [4], [8], [14], [16], [19], [23], [24], [26], [28], [29], [34], [36], [37], [39], [42]	16
Simulations or rehearsals	[5], [15], [17], [18], [21], [27], [30], [41], [43], [44], [46]	11
Total		31

to a cycle. However, they describe sequential instructional activities related to the learning cycle corresponding to the same or similar activities associated with the cycle.

4.2.3. Rehearsal or simulation

Of the studies analyzed, 11 refer to a teaching process that involves activities related to those described above in the learning cycles but focuses on the rehearsals or simulations. In this category, the studies emphasize the guide provided by the TEs (and peers in some cases) through rehearsal pauses, feedback, and coaching as a teaching strategy. The TEs mainly carry out the interventions for decomposing the practice, clarifying a content, returning to the objective, attending to salient features of the activity structure of the lesson, attending to salient features of student engagement or participation, and attending to salient features of the classroom. Two of these studies also mention a PST's enactment in the real classroom after the rehearsal.

These teaching strategies have been implemented in early childhood teacher education, elementary teacher education, and secondary teacher education. In addition, they have been applied in courses or teacher education programs for diverse disciplines. Table 4 shows teaching strategies, level, and specific subject teacher education.

In summary, we distinguished three types of teaching strategies in the analyzed studies: (1) collaborative work between field and campus courses, (2) the learning cycle of practice, and (3) simulations and rehearsal. These teaching strategies have been applied in courses or teacher education programs for varying levels and various teacher education subject areas.

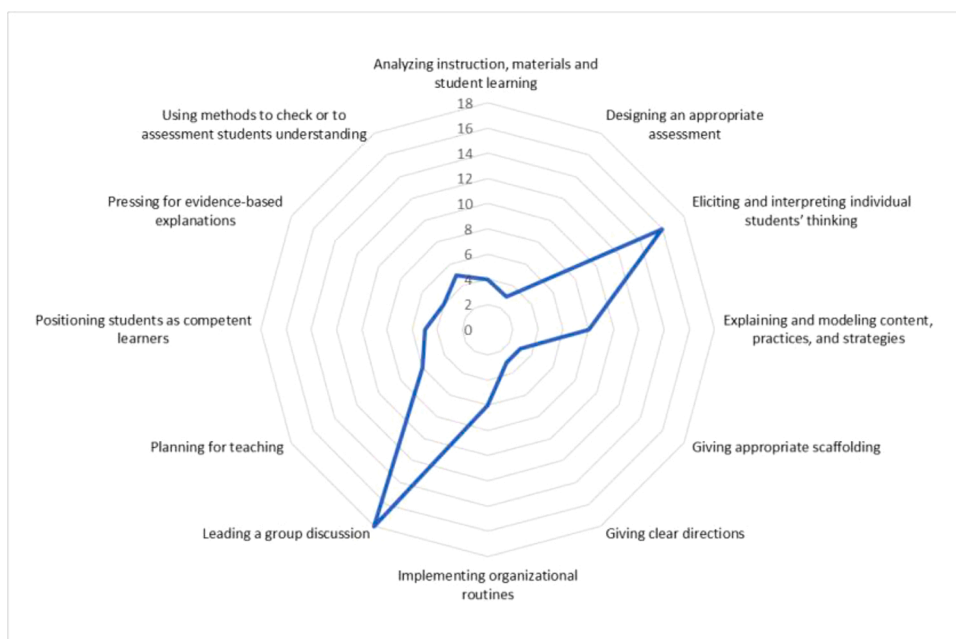


Fig. 2. Core practices with more than one mention and the number of articles referring to them.

4.3. Which assessment processes have been applied in the teaching of core practices?

All studies that explicitly refer to assessment processes and describe one or more core practices have been considered. The evaluation processes are described based on the types of tasks described in the articles and the participation of different agents (self-evaluation and peer evaluation).

4.3.1. Assessment tasks

We noted that ten of the analyzed studies described a type of assessment process involving four tasks related to three teaching strategies: (1) performance observation, (2) portfolios, (3) questions/pauses during rehearsals, (4) reflective texts written by the PST. Fig. 3 presents the association between teaching strategies and assessment tasks described in the studies.

4.3.1.1. Performance observation. Three of the ten articles mentioned assessment tasks corresponding to performance observation. This observation is associated with a teaching enactment. It can be in person or by a video record and developed in an authentic situation (school) or a simulation. In the article [34], the authors described developing a program in which peers and mentor teachers do the performance observation. In this study, each group was combined with two other groups for practice performances (simulations) and recorded using a video camera for later review and reflection. The PSTs received feedback from their peers and more on-the-spot coaching from the mentor teacher as appropriate. In article [16], the authors described one course in which each PST was recorded in three simulations throughout the semester; for each opportunity, the PSTs provided feedback on the recorded performances of their peers, according to established core practices. The authors of article [43] focused on assessing PSTs' skills to elicit student thinking. Each PST interacts with a person (a simulated student) whose actions and statements are guided by a carefully articulated protocol grounded in a student's way of thinking about a mathematics problem in a simulation that occurs on campus and is directly observed by TEs.

4.3.1.2. Portfolios. Among the ten articles referring to evaluation processes, four describe portfolios as assessment tasks associated with core practice acquisition. Those articles explain how PSTs analyze and reflect on their learning. For example, article [34] describes PSTs as co-

researchers of their learning, using the sequence of video recordings for review, reflection, and formal demonstration of their professional development in an e-portfolio. In article [14], the portfolio contains assessment resources and pieces of evidence designed and applied by PSTs. For each assessment, the PSTs maintained a private Google website that included (a) an assessment description, (b) an assessment rationale, (c) data and analysis, and (d) a reflection. In yet another article [47], the portfolios provide opportunities for an inquiry, discussion, reflection, and study of the impact of teaching processes upon child learning. Finally, article [20] describes an electronic ePortfolio. It explains a culminating assignment for program completion, where the PST must demonstrate the capacity to enact and produce evidence of proficiency with the core practices targeted throughout the program.

4.3.1.3. Questions/pauses during rehearsals. As noted above, rehearsal is one of the phases of practice cycles. In some studies, the TE's interventions during or after the rehearsal constitute a strategy for core practices teaching. Two of the ten articles mentioned assessment tasks corresponding to questions to PSTs or pauses during rehearsals. In this regard, article [15] studied the pauses within rehearsals to support science PSTs in meaningful discussions. Among the pauses' purposes, the most frequent was problem-solving, highlighting performance and providing feedback about the PSTs' enactment.

Moreover, article [5] presents questions to the PSTs after rehearsals. The PSTs were challenged to speak about their learning and thinking, reconsidering and reflecting on their ideas. These discussions yielded useful formative assessment information and enabled learners to practice, share their thinking, and modify their schema using others' ideas.

4.3.1.4. Reflective texts written by the PST: Journals, papers, and notes to self. These assessment tasks correspond to written texts in which the PST records their analyses of their enactment and reflections on their learning. Three of the ten articles described this type of task, corresponding to a journal, paper, or note to self. In article [3], the authors focused on developing adaptive expertise in the PSTs, implementing a learning cycle of practices. The journal content consists of the PSTs' reflections in each phase of the cycle. The PSTs must record their reflections, and according to the authors, this journal is part of the formative assessment required in the course. In article [37], the authors decided to work with cycles to model and deconstruct practices and prepare the first enactment and reflection. The PSTs watched a video of

Table 4
Teaching strategies and the level and subject teacher education in the study.

Teaching strategies	Subject	Early Childhood	Elementary	Elementary and Secondary	Secondary	Not specified	Number of articles
Collaborative work between field and campus course							4
	Science				1		
	Social studies				1		
	Different disciplines				1		
	Not specified	1					
Learning cycle of practice							16
	English Language				1	1	
	History					1	
	Literacy and English Language			1			
	Mathematics		1		1	1	
	Science		1		1	1	
	Social studies			1			
	Writing					1	
	Different disciplines			1			
	Not specified		2			1	
Simulations or rehearsals							11
	Science		1		3		
	English language					1	
	Literacy			1			
	Mathematics		1	1		1	
	Different disciplines			1			
	Not specified			1			
Total		1	6	7	9	8	31

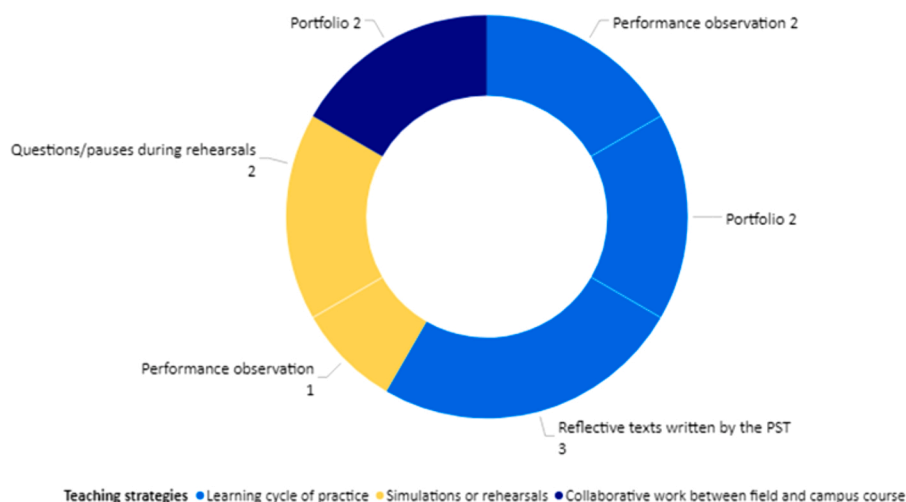


Fig. 3. Teaching strategies and assessment tasks.

their enactment, focused on their understanding during the lesson, and wrote a paper citing examples from the enactment that demonstrated how effectively the student used explicit reasoning explicit (or not). Article [16] describes how PSTs wrote a short paper reflecting on their learning process through collaboration, the practice approximation, practice reflection, and feedback. The same article refers to PSTs, who wrote reflections and notes-to-self about what they learned in other education program's courses by the teacher.

4.3.2. Participation of different agents in the assessment processes: self-evaluation and peer evaluation

In our review, it was possible to observe that some of the articles described self-evaluation and peer evaluation processes. The self-evaluation processes were principally associated with texts written by the PST and portfolios. An example of this is article [3], in which PSTs completed a journal. In this assessment task, they wrote about their perceptions of group work, self-assessment of their current and future group work and mathematical discussions, and their perceptions of the practice learning cycle. Two articles studied [37] [16] present self-evaluation processes that constitute the assessment tasks content in assigned papers. In the studies, PSTs work with practice learning cycles. In the first article, PSTs watched the video of their enactment. They used assessment principles as a metric to assess their performance as they critiqued the instructional activities. In the second article, PSTs reflected on their practice using the class-made, shared language criteria through each literature cycle for adolescents and wrote a paper with their reflective remarks. In both cases, the self-evaluation process was developed from previously agreed-upon criteria.

The peer evaluation processes principally provide feedback to PSTs about task performance. These processes can be integrated into the practice learning cycles, specifically preparing and rehearsing an activity. For example, in article [16], PSTs provided feedback about the assessment materials designed by peers. These quizzes were returned to the author for review and consideration of a peer's observations. In the rehearsal moment, peers also provided feedback, and PSTs then applied that feedback during future approximations. A similar situation was described in article [34], reporting how PSTs recorded their group simulations and then received written and oral feedback from other PST groups. Finally, peer evaluation and self-evaluation were associated with revising an assessment task, as shown in article [47]. According to the authors, this evaluation process helped students deconstruct practice and reflect upon teaching strategies and child learning.

5. Discussion

Teacher education programs at universities are changing in response to practice-based pedagogical challenges. According to the information presented in Tables 1A and 1B, nearly all of the studies analyzed in this review correspond to experiences developed in university contexts of teacher education programs, their specific courses, and some subject-specific teaching methodologies. These findings coincide with what some authors have asserted as impossible to ensure that all PSTs have equal opportunities to practice their skills during their field experiences (Dalinger et al., 2020). Therefore, practical preparation must be present in university courses; learning about teaching methods is not the same as learning to put teaching methods into practice, in other words, to do the actual work of teaching (Jao et al., 2018). Many university programs are adopting practice-based teacher education and are transforming their campus courses to offer PSTs various expanded practical experiences.

5.1. Core practices

Undoubtedly, there has been greater incorporation of core practices in recent years. The review by O'Flaherty and Beal (2018) identified only eight high-leverage practices between 2000 and 2016. As shown in Table 2, two-thirds of the articles analyzed explicitly mention core practices and refer to a large number and variety. Among the core practices mentioned, we recognize high-leverage practices described by TeachingWorks (2020), especially the frequently mentioned ones. We also recognize some high-leverage practices in special education (McLeskey & Council for Exceptional Children & Collaboration for Effective Educator, Development, Accountability and Reform, 2017), e.g., provide appropriate scaffolding and communication with other professionals. Identifying core practices through different frameworks is relevant because by speaking the same language, i.e., having the same framework for discussion, researchers can build on prior work and communicate their findings more powerfully to each other and practitioners (Grossman & McDonald, 2008). Doing so may influence and facilitate the incorporation of findings into teacher education programs.

Some core practices described in the articles corresponded to core practice specifications in a particular subject area. Table 2 presents general core practices (e.g., conduct small-group work) and specific core practices in a particular subject (e.g., scaffolding argumentative, historical writing). This differentiation aligns with the Core Practices Consortium (2020), distinguishing between general practices and subject-specific practices. In other cases, a specific core practice linked to a particular move or skill (e.g., posing questions about the content) could correspond to a general core practice decomposition component

and not necessarily to a core practice per se. Although the detail specified in the core practices could contribute to more precise work by the TEs (e.g., focusing on teaching subject areas and the content and skills of these areas), it could also hinder a common language that defines the various core practices in teacher education.

The core practices taught in various courses and programs generally are associated with tasks developed in the classroom while interacting directly with children. Many studies mentioned practices that developed students' thinking in the classroom in this type of core practice. For example, as we can see in Fig. 2, the core practices of leading a group discussion and eliciting and interpreting individual students' thinking are mentioned by 18 and 16 studies, respectively. Both practices consisted of the teacher helping students build their knowledge from others' ideas or provoking and interpreting each student's thinking. This finding shows that teacher education programs encourage PSTs to learn complex core practices and prepare them for teaching (Ball & Forzani, 2009). The focus on complex core practices favoring students' thinking is very encouraging for having future teachers who transmit content and generate higher-level cognitive processes, contributing to improved learning among new generations.

5.2. Teaching strategies

Practice-based teacher education is a recent addition to the teacher education field; notably, the pedagogy of practices that represent, approximate, decompose and reiterate cycles of practices is being developed by numerous programs. As shown in Table 3, this review describes teaching strategies being developed. The learning cycle of practices is mentioned in 16 articles. As described, the decomposition, representation, and approximation of practice guide the various instructional activities offered to the PSTs in these cycles. This preparation is consistent with understanding a pedagogy of practice in which the three concepts are fundamental to organize and focus the daily work of teaching (Grossman, Compton et al., 2009; Grossman, Hammerness et al., 2009). In practice learning cycles, the activities organized in phases are similar to the cycle for learning to engage in an authentic and ambitious instructional activity collectively (McDonald et al., 2013). The cycles in this review describe activities such as preparing and rehearsing the activity, enacting it with students, analyzing it and moving forward.

The approximation is a pedagogy of practice component. Its simulation is an approximation because it provides opportunities to enact practices similar to an authentic classroom situation. In this review, simulations were mentioned in 11 articles as a teaching strategy. Implementing simulations into campus courses requires a high level of innovation from the teacher education programs and TEs. It can prepare novices for challenges by developing ways to interpret and understand professional practice (Grossman, Compton et al., 2009; Grossman, Hammerness et al., 2009). These findings of this approach are optimistic because these teaching strategies offer the PSTs multiple opportunities to approximate real practice. They are recognized and developed by programs preparing teachers for a wide variety of levels and subjects.

5.3. Assessment process

Although few studies cover explicit evaluation processes (only 10), among those that do, assessment tasks positively linked to the teaching strategies of core practices and pedagogical practice predominate. The assessment tasks are associated with enactment experience (simulations and performance observations), written reflective processes (reflective journals, notes, and papers), and portfolios. The portfolios enable collecting evidence of teaching performance and reflection processes (Bakker et al., 2011). Notably, all tasks are associated with the practice learning cycle, especially rehearsing the activity, enacting the activity with students, and analyzing it. These assessment tasks also consider what the PSTs will need to do as future professionals. They bring them

closer to the professional world with authentic tasks and contexts.

Some studies referred to the peer and self-assessment process. Self-evaluation principally involves assessment tasks where the PSTs analyze and reflect on their enactment in journals, notes to self, papers, and portfolios. Peer evaluation involves feedback in the practice learning cycles. Unlike those indicated by Gallardo-Fuentes et al. (2017), the PSTs in these studies are actively involved in the evaluation processes. Feedback to the PSTs is provided by peers about their competencies, highlighting what is efficient and needs improvement (Allen & Wright, 2014).

Moreover, self-evaluation is another way to promote student participation. Self-evaluations are done per evaluation criteria with levels that establish what is considered well-done (García-Jiménez, 2015). These are formative, active assessments that encourage students to construct knowledge and deep understanding (Postareff et al., 2012). Thus, it appears that incorporating self-evaluation processes and peers' feedback offer opportunities to improve PSTs' learning and teaching skills development.

Teacher education programs are changing to highlight practicing and developing the methodologies of the pedagogy of practice. Of the 49 studies analyzed, 34 made explicit mentions of core practices. Of these, 31 described the teaching strategies of core practices, but only 10 described the learning assessment process. This review found that practice-based teacher education programs develop principally in university contexts, where learning assessment is critical. Although this review demonstrates some innovations in the assessment processes and high coherence with teaching, few studies provide information about learning assessment processes. The assessment process is relevant to modulate the learning process (Richmond et al., 2019) because it powerfully conditions it. Therefore, no curricular innovation will be significant if designs do not include the ways assessment is conceived (López-Pastor, 2009). Thus, making advances in the implementation of practice-based approaches must also include developing assessment innovations for the learning of PSTs.

5.4. Limitations

This study aimed to determine the core practices addressed in the literature and how they are taught to PSTs. The review also sought how PSTs and their TEs have learned to employ core practices. This review does not seek to assess the coverage of core practices within teacher education programs or evaluations of the quality or effectiveness of programs that have adopted a core practices approach.

Although the study sought to review an exhaustive search of the literature, it had limitations. Limiting the search strategy to studies published in English and Spanish between 2015 and 2019 was necessary but may have prevented reviewing other relevant publications in other languages. Moreover, the review may have omitted relevant publications before or after this period. Additionally, consulting only two databases limited the reviewed scientific evidence. Finally, it is necessary to specify that, as indicated in the methods section, the information on teaching strategies and assessment processes correspond to the descriptions in each of the articles, which in most cases, do not focus solely on those aspects.

6. Conclusions

Analyzing the empirical studies published between 2015 and 2019 regarding practice-based teacher education enabled us to detect that several teacher education programs at universities are changing to respond to the challenges of practice integrations. The programs teach many core practices, which is progress compared to the period from 2010 to 2016 but raises questions about whether this vast array of core practices hinder the construction of a common framework. The core practices addressed in the programs and courses corresponded mainly to teachers' tasks in the classroom while interacting directly with children.

In these, the core practices that address developing students' thinking in the classroom, such as leading a group discussion and eliciting and interpreting individual thinking, were mentioned a significant number of times.

Practice-based teacher education has advanced in integrating core practices using pedagogy with representation, approximation, and decomposition integrated into iterative cycles. Teaching strategies include learning cycles of practice and simulations. Programs with varying levels and subject areas of teacher education develop these.

Teacher education programs highlight practices and develop methodologies of pedagogical practices; however, few studies have studied the development of learning assessment processes. The assessment tasks correspond to execution type procedures in the PSTs' enactment experiences and reflective processes. These assessments include portfolios, questions during rehearsals, performance observations, and reflective texts written by the PSTs, such as journals, papers, and notes about self-reflection. These tasks bring PSTs closer to the professional world. Interestingly, some studies referred to the self and peer assessment process (peer feedback) that improved PSTs' learning and teaching skills.

This review contributes to the literature by providing detailed evidence toward understanding adequate teaching of core practices. It covers selecting core practices, applying specialized methodologies, designing authentic assessment tasks that resemble those of the professional world, and promoting assessment processes that encourage the various actors to participate. The review also facilitates progress in constructing common frameworks that promote training coherence and TEs orientation, guiding their teaching innovations and learning assessment processes. It is expected that PSTs can effectively develop and support their future students' learning through practice-based teacher education.

Future research should explore how TEs can be relevant change agents for teacher education programs and how they train, plan the class sessions they carry out and implement and evaluate them. Furthermore, the opinion of PSTs participating in practice-based teacher education should be analyzed to discover what they feel they need to learn currently but are not. Finally, more thorough and detailed analyses of applied evaluative processes can provide valuable information about the complexities that need more profound understanding.

Supplementary data

Supplementary data to this article can be found online at <http://tiny.cc/xw07tz>.

Declaration of Competing Interest

The authors report no declarations of interest.

Acknowledgments

This study is carried out in the context of the Education in the knowledge society PhD programme University of Salamanca.

The authors would like to acknowledge the financial support of Universidad del Desarrollo, Chile and the technical support of Writing Lab, Institute for the Future of Education, Tecnológico de Monterrey, Mexico, in the production of this work.

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