Online Teacher Professional Development in Canada: A Review of the Research

Le développement professionnel en ligne des enseignants au Canada : Une revue de la recherche

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Abstract

This paper presents findings from a systematic review of 11 studies examining online teacher professional development (oTPD) in Canada between 2000-2020. A thematic content analysis of the articles led to four main themes associated with research on oTPD: 1. knowledge exchange; 2. reflective practice; 3. multifaceted learning opportunities; and 4. just-in-time support. The study contexts, research methods, and other relevant study characteristics are also reviewed and discussed. The results shed light on the current research trends on oTPD in Canada and highlight the need for continued research in this area. Data from diverse research methods across Canada's geographical regions can contribute to greater insight into the types of oTPD occurring in Canada and how various platforms and professional development opportunities can best support teachers' professional learning.

Keywords: online learning; teacher professional development; review

Résumé

Cet article présente les résultats d'une revue systématique de 11 études portant sur le développement professionnel en ligne des enseignants (DPELE) au Canada entre 2000 et 2020. Une analyse thématique du contenu des articles a permis de dégager quatre thèmes principaux associés à la recherche sur le DPELE : 1. l'échange de connaissances ; 2. la pratique réflexive ; 3. les multiples facettes ; et 4. le soutien opportun. Les contextes d'étude, les méthodes de recherche et d'autres caractéristiques pertinentes des études sont également examinés et discutés. Les résultats mettent en lumière les tendances actuelles de la recherche sur le DPELE au Canada et soulignent la nécessité de poursuivre des recherches dans ce domaine. Les données provenant de diverses méthodes dans les

différentes régions géographiques du Canada peuvent contribuer à mieux comprendre les types de DPELE qui ont cours au Canada et la manière dont les diverses plateformes et possibilités de développement professionnel peuvent soutenir au mieux l'apprentissage professionnel des enseignants.

Mots-clés : apprentissage en ligne ; développement professionnel des enseignants ; revue

Introduction

Teaching is a highly complex professional responsibility and requires continuous learning to support diverse student needs in a changing society. To this end, nearly all Canadian teachers engage in some form of professional development (PD) on a regular basis to learn new content, gain insight, and apply new understandings (Canadian Teachers' Federation, 2014). Teachers across geographical regions have reported that the PD activities in which they participate have had an impact on their teaching practices (Ainley & Carstens, 2018), suggesting the powerful impact that effective PD can have on teachers' pedagogical techniques. Increasingly, teachers are turning to the Internet to seek out PD opportunities. The Internet allows teachers to engage with teaching material and collaborate with teachers globally to gain insight into educational issues and research-informed practices (Beach, 2017; Macià & García, 2016). Access to online learning resources and platforms and participation in local and global online networks during or outside a teacher's workday can expand opportunities for teachers' PD (Learning Forward, 2017).

While online teacher professional development (oTPD) is a growing area of research, studies exploring oTPD have largely been conducted in the US, Australia, and the UK (Lantz-Andersson et al., 2018; Macià & García, 2016; Parsons et al., 2019). Teacher PD is often influenced by educational policies, politics, curriculum, and licensing specific to a geographical context. For instance, in the US teachers are required to earn credits to maintain their teaching license. While commonalities across geographical contexts exist, each context is unique and differs with respect to external factors (e.g., government mandates of curriculum expectations), values (e.g., teacher's pedagogical philosophy may be influenced by their pre-service program), and beliefs (e.g., teacher's educational view may depend on their years of teaching experience). As such, each geographical context can offer unique contributions to the literature.

The aim of this review was to identify and synthesize the existing research on oTPD in Canada. The Canadian context focus was chosen because the authors are researchers at a Canadian institution and an initial search on the topic resulted in no reviews of Canadian studies examining Canadian oTPD. In addition, the authors are involved in research studies examining how and why teachers use online environments for their PD. Given these reasons as well as the diversity of the Canadian context and the lack of reviews of oTPD in Canada, this review was conducted. It is hoped that this article will lay a foundation for Canadian researchers studying oTPD and contributing a Canadian viewpoint to the broader literature.

A broad date range was set, between 2000-2020, with the aim of obtaining as much information as possible relative to the research objectives. Lantz-Andersson et al. (2018) stated that a 20-year range

"allows comparison between different forms of both formally-organized and informally-developed online teacher communities—from the early online discussion/ bulletin boards of the early 2000s to the social media platforms of the 2010s" (p. 304).

Two recent reviews that explore studies across geographical contexts guided this review: Macià and García's (2016) review of 23 studies exploring informal PD communities and Lantz-Andersson et al.'s (2018) review of the past twenty years of informal professional learning. These reviews use the term professional learning, as opposed to the term chosen for this research, professional development. Professional development is described by Elliott (2017) as "an ongoing scholarly process for teachers throughout their careers" (Elliott, 2017, p. 114). Professional development can also be thought of as the spaces for professional learning to occur. As a process of deepening one's professional knowledge and refining skills, professional learning can occur through various PD opportunities (Muijs et al., 2014). As outlined by Muijs et al. (2014), teachers' professional learning processes include cueing prior knowledge, becoming aware of new information/skills and integrating them into current values and beliefs system, and creating dissonance with current positions. These processes are prompted through selected forms of PD, whether these are formal courses or more informal communities of practice.

Both the Macià and García (2016) and Lantz-Andersson et al. (2018) reviews provide valuable insights into the theoretical frameworks and methodological approaches used by research to make sense of online learning. They also generate important information about the nature of professional learning networks and the barriers to learning online and PD opportunities. This review will extend the findings of these reviews by providing a context-specific perspective, that of studies conducted in Canada. Both formal and informal PD are included, thereby examining oTPD on a broader scale.

Situating the Review

Teacher Professional Development

There is a need for teachers, like other professionals, to update their skill and knowledge base on an ongoing basis (Day & Sachs, 2005 Guskey, 2002). What often differentiates teachers from other professionals is that teachers' short term and immediate goals are reflective of their unique classrooms and teaching contexts, including the daily demands from students, parents, and education systems as well as their professional peers (Day & Sachs, 2005). As a result of these demands and unique classroom contexts, teachers generally engage in PD because they are motivated to expand their knowledge and skills and enhance their effectiveness with their students (Guskey, 2002).

Teachers report engaging in multiple PD activities throughout the school year, including formal and informal PD activities. The definition of formal PD used here (e.g., a face-to-face workshop) stems from Lantz-Andersson et al.'s work (2018), which defines formal PD as "top-down professional development endeavours, initiated by schools, districts and government agencies […] organized with predefined content and goals" (p. 304). In contrast, informal PD (e.g., self-directed online learning) can be defined as "bottom-up initiatives involving a group of practitioners who choose to come together to discuss, share information and work together" (Lantz-Andersson et al., 2018, p. 304). Informal PD is

unique to each teacher; learning opportunities are chosen by an individual teacher who has a particular goal in mind (Callanan et al., 2011).

Whether formal or informal, effective PD is interactive, collaborative, interest-driven, and differentiated (Darling-Hammond, 2005; Katz & Dack, 2016). Professional development has the potential to impact a teacher's practice when it provides resources, is ongoing, and implemented in day-to-day teaching. Garet et al. (2001) emphasize three core features of high-quality PD, including a focus on content knowledge, opportunities for active learning, and coherence with other learning activities. Based on their survey analysis, Garet et al. (2001) found these core features were more likely to produce enhanced teacher knowledge and skills. Desimone (2009) proposes a model with similar characteristics and suggests an interactive, non-recursive relationship between critical features of PD, teacher knowledge and beliefs, classroom practice, and student outcomes. According to Desimone (2009), effective PD should follow four main steps:

1. Teachers experience effective professional development; 2. The professional development increases teachers' knowledge and skills and/or changes their attitudes and beliefs; 3. Teachers use their new knowledge and skills, attitudes, and beliefs to improve the content of their instruction or their approach to pedagogy, or both; 4. The instructional changes foster increased student learning. (p. 70)

In their seminal review, Opfer and Pedder (2011) identified three "overlapping and recursive systems" of PD: the individual teacher, the school, and the activity (p. 384). Like the above models, Opfer and Pedder (2011) highlight teachers' prior knowledge and experiences as well as teachers' orientation to and beliefs about learning as integral in the process of teacher learning. Additionally, Opfer and Pedder (2011) stress the context of the school and how it supports teacher learning as a critical component of effective PD. Finally, they discuss the learning activities as having a large impact on the process of learning. The relationship between these features is reciprocal where a change in one area has a direct impact on the others.

Online Teacher Professional Development

Today, PD is embracing the use of digital tools and online platforms. Teachers can access a variety of online PD opportunities and resources to support their professional growth. These opportunities and resources include, and are certainly not limited to, course modules and webinars, demonstration videos, virtual learning spaces, podcasts, and blogs, as well as popular social media platforms like Twitter and Facebook groups and social sharing networks like Pinterest (Beach, 2018). Online PD allows teachers to "lead their own learning" and engage in knowledge exchange activities (Campbell et al., 2017, p. 7); teachers can interact with other teachers as well as with relevant and meaningful material at their own pace and convenience. Learning online has taken on a more fluid approach that can often be controlled and shaped by the individual (Parsons et al., 2019).

Although online learning is not a new enterprise for teachers and other professionals, educational researchers' empirical understanding of oTPD remains largely under-developed (Lantz-Andersson et al., 2018). Two major reviews by Macià and García (2016) and Lantz-Andersson et al. (2018) provide a

glimpse into the field of oTPD. Macià and García (2016) focused on informal online professional communities across 11 countries, with most studies from the US (no Canadian studies were included in their review). As a result of an initial and subsequent search, Macià and García selected 23 studies for an in-depth thematic analysis. Themes that emerged from their analysis include the following: social factors influencing participation, dialogue established for participation, barriers to participation and peripheral participation, evaluation of participation, community moderation, and professional development. The authors concluded that the area of oTPD is broad and at a relatively early stage of development. They also suggested that studies in this area have not fully examined the impact of oTPD on teachers' skill development and classroom practice. Moreover, this research field has not yet offered an exploration of how professional learning communities influence the depth of teachers' learning and reflection. Most studies in Macià and García's review were limited to teacher reports and feedback. While these types of methods offer insight into teachers' perceptions of their learning, they do not communicate the impact a PD experience has on classroom practice and student achievement.

Lantz-Andersson et al. (2018) reviewed 52 studies that examined online teacher professional communities, both formally organized and informally developed. The authors found five different themes related to the nature of teachers' participation in formally organized and informally developed online teacher communities. Formally organized communities were found to be a means of exchanging and sharing information, a source of collegial support, and a source of emotional engagement and reflection. Informally developed initiatives were found to be an immediate source of sharing new ideas, an accessible space for curating new ideas, and a form of emotional and professional support. Clearly these two types of PD share some common themes, however the authors also concluded that there was a notable distinction between these formal and informal online communities. One of the main differences was the period in which they found studies within each category, with more formally organized online communities occurring prior to 2010. The reason for this difference could be due to the expansion of social media in the 2010s and an increase in Internet accessibility. This increase in accessibility of informal online communities and PD had the potential to provide teachers with more immediate connections with other teachers and educators. The authors also found that the main topic of the reviewed studies was technology use in the classroom. This suggests that research needs to examine PD across domains, for example, how teachers learn from literacy-oriented PD websites. Diversity of topics is limited, and therefore warrants greater attention.

Purpose of the Study

Macià and García (2016) and Lantz-Andersson et al. (2018) provide valuable insight into oTPD, including the progress that this field has taken over the past decades, as well as limitations, challenges, and methodological gaps. As an extension of their work, this research focuses on the Canadian context and scrutinizes oTPD studies conducted in Canada with Canadian teachers, particularly elementary and secondary school teachers. In particular, this paper reviews emerging themes associated with the selected studies. The study contexts, research designs, and other relevant study characteristics are also

reviewed and discussed. Ultimately, the goal of this paper is to contribute to the field of teacher PD in the Canadian context, and more broadly to oTPD internationally.

The research questions to be answered in this review are the following:

1. What are the main themes associated with research examining oTPD in Canada?
2. Which methods have been used to document oTPD?
3. How do the provincial and territorial contexts of the studies compare?
4. What other characteristics of the reviewed studies can inform future research?

Methods

Analysis Procedure

In light of the multi-disciplinary and multi-dimensional nature of oTPD, this study used three different databases chosen for their size and their scope: ERIC, EBSCOHost and PsycNet. ERIC, an acronym for Education Resources Information Centre, is an American educational database, though it has been described as the largest in the world (ProQuest, 2017). Similarly, PsycNet, belonging to the American Psychological Association, served as an additional source of international education research studies. Finally, EBSCOHost was selected for its user-friendly interface and ability to search numerous interdisciplinary databases simultaneously. Together, these databases provided the context and orientation of this research.

First, the authors conducted repeated searches within these three databases using the same keywords and filters. The search started with several combinations of the following keywords: teacher professional learning, teacher professional development, online, and Canada.

In each of the three databases, the searches relied on the use of the Boolean operator "OR" to construct keyword phrases such as teacher professional learning OR teacher professional development. Additionally, use of the Boolean operator "AND" enabled the authors to create keyword phrases such as teacher professional development AND Canada.

Additionally, the search strategy involved enclosing the terms "teacher professional learning" and "teacher professional development" in quotation marks such that the search returned results that captured the entire phrase rather than the individual words. After the initial search, limiters such as "peer-reviewed" and "full-text" were applied along with language (English). Finally, the date range was set between 2000-2020 with the aim of returning results that would provide as much information as possible relative to the research objectives. From there, the authors sifted through the results, narrowing the focus to Canadian sources. The authors also examined the citations of Campbell et al.'s (2017) *The State of Educators' Professional Learning in Canada* to find sources not captured by the search. While there is little information in the report on teachers' online learning, the report summarizes the evidence, experiences, and examples of teachers' professional learning across Canada. A simple search of the keyword combinations, before applying any filters or limiters, returned 614 results, as shown in Table 1. The breakdown of these results can be seen in Table 2.

Table 1

Keywords and Total Initial Results

Keywords	Total initial results (all databases)
"teacher professional development" AND online AND Canada	575
"teacher professional learning" AND Canada	9
"teacher professional learning" AND online	20
"online teacher learning" AND Canada	5
"teacher professional development" AND elementary AND Canada	5

Table 2

Keywords Categorized by Database

Keywords	Database results		
	Eric	PsycNet	EBSCOhost
"teacher professional development" AND online AND Canada	507	34	34
"teacher professional learning" AND Canada	2	4	3
"teacher professional learning" AND online	7	11	2
"online teacher learning" AND Canada	1	3	1
"teacher professional development" AND elementary AND Canada	3	2	0

Keyword Combinations

"Teacher Professional Development" AND Online AND Canada

Across all three databases, the results that most closely aligned with the research objectives came from combining these keywords. This allowed the authors to narrow the scope of the literature search to the Canadian context. PsycNet and EBSCOHost returned several results that were related to professional development for postsecondary faculty and, thus, not relevant for the current study. Some of the other results, however, such as Anwaruddin (2015) and Hamel et al. (2012), appeared to be highly applicable and were flagged for further examination, which included reviewing their references.

"Teacher Professional Learning" AND Canada

Similarly, these keywords offered interesting results across the three platforms. Once limiters were applied to the search field, the sources that resulted were fewer than expected. Since there have been few studies on the subject within the Canadian context, the results were under the anticipated threshold of 20 articles. Although there was some variation in the results, Ciampa and Gallagher (2015)

appeared across all platforms, and the article was pulled for further study. In EBSCOHost, the article by Beach (2017) was also selected as it directly related to the subject of this research.

"Teacher Professional Learning" AND Online

As mentioned above, the results within the Canadian context have been limited. These keywords yielded the least relevant results and only one article through EBSCOHost was pulled for further study, which came up in multiple keyword searches: Beach (2017). A theme that emerged in this search and in multiple searches was the use of technology within the classroom as it pertained to teachers supporting students through the use of technology.

"Online Teacher Learning" AND Canada

Using these keywords, PsycNet produced a result that was outside the Canadian context. Both EBSCOHost and ERIC returned the article by Beach (2017). A second article pulled for further examination was Ciampa and Gallagher (2015).

Thematic Content Analysis

Using the first combination of keywords, several relevant articles were identified in both international and Canadian contexts. Once the focus was narrowed to Canadian sources, the process of reviewing the literature began. Each reviewer independently scanned the chosen articles from the three databases and then met to discuss which articles met the inclusion criteria. From this meeting, 15 articles were selected for further examination. Of these, four were excluded as they related solely to professional development rather than oTPD.

Then, thematic content analysis involved identifying the key themes and topics in the 11 articles with attention to overlap. Themes were established inductively, using an open-coding technique. The aim was to determine the commonalities among the articles relative to the current study's research objectives. It is noteworthy that these articles were published in moderate and high-quality educational journals.

Next, the authors discussed several emergent themes, such as online communities, self-reflection, communication and sharing, collaboration, social networking, and self-directed learning as well as ease of access. Themes were refined into four main themes: a) knowledge exchange, b) reflective practice, c) multifaceted learning opportunities, and d) "just-in-time" support. Once established, the authors reread each article and categorized them accordingly. The themes are presented in Table 3 along with their related articles. Each theme is elaborated upon in the results and discussion section, along with other key characteristics of the articles.

Table 3

Themes of the Reviewed Studies

Theme	Description	n	Studies
Knowledge Exchange	The dynamic and iterative process of accessing and exchanging information.	10	Anwaruddin (2015); Armstrong and Manson (2010); Ciampa and Gallagher (2015); Dalgarno and Colgan (2007); Francis and Jacobsen (2013); Hamel et al. (2012); Ostashewski et al. (2011); Trust et al. (2016); Zhou et al. (2007)
Reflective Practice	A self-awareness of one's own learning processes as well as an understanding of one's professional needs, interests, and goals.	3	Anwaruddin (2015); Ciampa and Gallagher (2015); Hamel et al. (2012)
Multifaceted learning opportunities	An array of online learning opportunities, including formal and informal professional development.	11	Armstrong and Manson (2010); Anwaruddin (2015); Beach and Willows (2014); Beach (2017); Ciampa and Gallagher (2015); Dalgarno and Colgan (2007); Francis and Jacobsen (2013); Hamel et al. (2012); Ostashewski et al. (2011); Trust et al. (2016); Zhou et al. (2007)
"Just-in-Time" Support	On-demand support that is responsive to a teacher's needs, timely, and effective during or outside a teacher's workday.	6	Beach (2017); Beach and Willows, 2014; Dalgarno and Colgan (2007); Hamel et al. (2012); Ostashewski et al. (2011); Trust et al. (2016)

Ensuring Trustworthiness of the Results

The authors of this paper conducted the analyses for this review and, following the final search, met to discuss inclusion criteria for the articles. The authors independently scanned each article, making notes on why it should or should not be included. After meeting to discuss agreements and address discrepancies, each author reread and coded the refined list of articles. After the four main themes were agreed upon, each author again reread the articles using the new coding scheme. The authors noted phrases that corresponded to the codes and organized them accordingly. Through ongoing discussion during and after the final reviews, the authors established the themes and specified the characteristics of the study. This iterative, collaborative process aimed to increase the trustworthiness of the results.

Results and Discussion

Given the complexity of this review, the results and discussion are organized together according to the research questions. This section ends with a general discussion of the results.

Research Question 1. What are the main themes associated with research examining oTPD in Canada?

As noted above, Table 3 presents the main themes and the articles associated with each theme. Below the themes are discussed in detail and examples are provided from the associated articles.

Theme 1: Knowledge Exchange

Online teacher professional development often involves the exchange of knowledge. The process of accessing and exchanging knowledge and information online is dynamic and iterative and provides opportunities for online communities or individuals seeking out information to build their knowledge while at the same time being able to post and share material with others. Given the topic of this review, it is not surprising that 10 of the reviewed articles related to this theme. PD opportunities from the reviewed studies allowed for online dialogue of shared experiences, social networking, and collaborative inquiry.

For instance, in their multiple methods study, Ciampa and Gallagher (2015) examined blogging as an approach to ongoing, online dialogue during a collaborative inquiry project. Elementary and secondary teacher participants were encouraged to blog their lesson development, from creation to delivery, as well as respond to blogs written by their peers. Exchanging shared experiences involved information sharing, problem-solving, and knowledge construction. Participants felt that blogging provided an "atmosphere of equal voice" (p. 896); blogging offered participants an inclusive forum where they could comfortably share their ideas and voice their opinions. Blogs were viewed as a tool for facilitating the sharing of knowledge and networking among colleagues.

While blogging was used as a specific PD space for knowledge exchange, the other reviewed articles used specific platforms to help establish a collaborative learning community for the exchange of information. Ostashewski et al. (2011) used an online educator community platform that included social networking tools commonly found in social media sites like Facebook. Similarly, Francis and Jacobsen (2013) reported on the experiences of mathematics teachers within an online, synchronous learning community. Dalgarno and Colgan (2007), Armstrong and Manson (2010), and Trust et al. (2016) also refer to the sharing opportunities online communities can offer.

Theme 2: Reflective Practice

Online teacher professional development is an ongoing reflective practice and involves a self-awareness of one's own learning processes as well as an understanding of one's professional needs, interests, and goals. While just three articles related to reflective practice (Anwaruddin, 2015; Ciampa & Gallagher, 2015; Hamel et al., 2012), this theme was deemed highly relevant to oTPD. The articles explicitly drew on ideas of metacognition and aspects of thinking about one's own learning and analyzing one's own teaching during online learning to improve practice. Self-efficacy, teacher perceptions, the focus on student needs, and the promotion of participant voice were aspects of reflective practice that were especially relevant in these three articles.

For instance, Anwaruddin (2015) recounts his experiences of "self-directed professional learning in an interest-driven online community of teachers" (p. 806). Anwaruddin discusses how reflection is a central component of human activity and can be used as a method of inquiry for understanding past events and experiences. For Anwaruddin, the process of reflection during self-directed online learning helped him gain awareness of his experiences in an online learning community to attain new insights about teaching and learning. Ciampa and Gallagher (2015) and Hamel et al. (2012) also discuss the significance of reflection during teachers' participation in an online professional learning community, particularly in relation to teachers' current practice. The online PD spaces used in these three studies promoted reflective practice and provided opportunities for teachers to consider their own beliefs and discoveries related to knowledge gaps and future directions.

Theme 3. *Multifaceted Learning Opportunities*

As discussed earlier in the literature review, teacher PD is multifaceted (Campbell et al., 2017). This remains true in online environments where teacher PD can be self-directed and teacher-driven or ministry-led, formal or informal, fully online or blended. Not surprising, this highly applicable theme related to all 11 of the reviewed articles. Given this result, this theme was divided into two subthemes: formal and informal PD (Table 4).

Table 4

Formal and Informal Professional Development

Forms of oTPD	n	Studies
Formal	5	Armstrong and Manson (2010); Ciampa and Gallagher (2015); Dalgarno and Colgan (2007); Francis and Jacobsen (2013); Zhou et al. (2007)
Informal	8	Anwaruddin (2015); Beach (2017); Beach and Willows (2014); Ciampa and Gallagher (2015); Dalgarno and Colgan (2007); Hamel et al. (2012); Ostashewski et al. (2011); Trust et al. (2016)

Three articles were categorized as formal PD, four articles were categorized as informal, and two articles included aspects of both formal and informal PD, suggesting that Canadian teachers have been involved in a mix of oTPD over the past twenty years. Interestingly, three of the articles categorized as formal PD were published on or prior to 2010 (Armstrong & Manson, 2010; Dalgarno & Colgan, 2007; Zhou et al., 2007), while almost all the articles categorized as informal PD were published between 2011 and 2017 (Anwaruddin, 2015; Beach, 2017; Beach & Willows, 2014; Ciampa & Gallagher, 2015; Dalgarno & Colgan, 2007; Ostashewski et al., 2011; Trust et al., 2016). This finding is consistent with Lantz-Andersson et al. (2018) who suggested that the expansion of social media sites in the 2010s and an increase in Internet accessibility around this time could help explain the increase in more informal oTPD.

Theme 4. *"Just-in-Time" Support*

Online teacher professional development often involves just-in-time support where professional learning material and teaching resources are accessible at any point during or after the school day.

Through social media, like Twitter, or PD websites, like Ontario's Ministry of Education Edugains website, "real time" or "on-demand" support allows for openness and interconnectedness, is responsive to a teacher's needs, and can be timely and effective (Carpenter & Krutka, 2015; Greenhalgh & Koeler, 2017). Six of the reviewed articles related to just-in-time support: Beach, 2017; Beach and Willows, 2014; Dalgarno and Colgan, 2007; Hamel et al., 2012; Ostashewski et al., 2011; and Trust et al., 2016.

For instance, Hamel et al. (2012) discussed the supports and guides necessary for teachers' innovative practice when integrating new conceptual and technological tools in their practice. Based on their study, the authors concluded that just-in-time online PD involves several PD activities including technological start-up, techno-emotional watch, troubleshooting and reconstruction of technical problems, planning and coordination of learning activities, pedagogical support and guidance, and reflection on experience. They specifically noted the interplay between technology and pedagogy and that technological support contributed to pedagogical enrichment.

Research Question 2. Which methods have been used to document oTPD?

As presented in Table 5, most of the reviewed articles used qualitative research methods (n = 7). Within this cohort, a variety of specific qualitative methods were used including autobiographical reflection, the think aloud method, focus groups, interviews, an interpretive hermeneutic approach, and designed-based methodology. The other four articles employed quantitative methods (experimental and survey) or multiple methods.

Table 5

Methods Used in Reviewed Studies

Approach	Methods	N	Studies
Qualitative	Autobiographical reflection	2	Anwaruddin (2015); Armstrong and Manson (2010)
	Think aloud	2	Beach (2017); Beach and Willows (2014)
	Focus group	1	Dalgarno and Colgan (2007)
	Interview	1	Dalgarno and Colgan (2007)
	Interpretive hermeneutic	1	Francis and Jacobsen (2013)
	Survey	1	Trust et al. (2016)
	Design-based	1	Ostashewski et al. (2011)
Quantitative	Experimental	3	Ciampa and Gallagher (2015); Hamel et al. (2012); Zhou et al. (2007)
Multiple Methods	Focus groups, interviews, surveys, blog entries, blog tracking tool	2	Ciampa and Gallagher (2015); Zhou et al. (2007)

Given the variety of methods used in the reviewed studies, we asked the question: how can these methodological approaches inform future research on oTPD? Qualitative methods have the advantage of exploring teachers' experiences, providing a depth to participants' voices, as identified in the reviewed studies. Qualitative methods can capture attitudes, opinions, and "lived experiences." At the same time, quantitative methods are more apt for analysing larger datasets which can contribute to insights into broader trends and patterns. Future research examining oTPD should continue to build onto the methodological approaches used in the reviewed studies and explore ways in which teachers' experiences, including their in-the-moment learning experiences, can be documented.

Research Question 3. How do the provincial and territorial contexts of the studies compare?

Table 6 presents the contexts of the reviewed studies. Unsurprisingly, the studies from the reviewed articles occurred in three of Canada's most populous regions: Alberta (n = 3), Ontario (n = 6), Quebec (n = 1), unspecified (n = 1). While each study is context specific and therefore provides a unique contribution to the field, no studies in the reviewed samples examined oTPD across Canada. This could be a next step for researchers in this field. Campbell et al.'s (2017) report on the state of educators' professional learning in Canada, for instance, is based on survey respondents from across Canadian provinces and territories. The authors report on teacher PD more generally; however, this report does provide insight into Canadian teachers' preferences and perceptions of PD. While research specific to each region should continue, future research can build onto Campbell et al.'s (2017) report by conducting pan-Canadian studies on oTPD.

Table 6

Provincial/Territorial Context of Research in the Reviewed Studies

Province/ Territory	n	Studies
Alberta	3	Francis and Jacobsen (2013); Ostashewski et al. (2011); Zhou et al. (2007)
Ontario	6	Anwaruddin (2015); Armstrong and Manson (2010); Beach (2017); Beach and Willows (2014); Ciampa and Gallagher (2015); Dalgarno and Colgan (2007)
Quebec	1	Hamel et al. (2012)
Unspecified	1	Trust et al. (2016)

Research Question 4. What other characteristics of the reviewed studies can inform future research?

Theories Framing the Reviewed Studies

A theoretical framework creates an opportunity to identify the broader area of research, provides a grounding for the work, and helps communicate conclusions in relation to the literature. Theoretical frameworks were reported in five of the reviewed studies (Table 7). Of those studies that discussed a

theoretical framework, collaborative inquiry (n = 1), constructivist theory (n = 1), and self-directed learning (n = 2) were most prevalent to the topic of oTPD.

Table 7

Theories Framing the Reviewed Studies

Theoretical frameworks	n	Studies
Collaborative inquiry	1	Ciampa and Gallagher (2015)
Conception of three spheres of human existence	1	Anwaruddin (2015)
Constructionist theory	1	Ostashewski et al. (2011)
Self-directed learning	2	Beach (2017); Beach and Willows (2014)
Unspecified	6	Armstrong and Manson (2010); Dalgarno and Colgan (2007); Francis and Jacobsen (2013); Hamel et al. (2012); Trust et al. (2016); Zhou et al. (2007)

The theories provided by the five studies set a foundation for the work and are pertinent to each study's overall topic, the study context, and the type of learning being examined. Each theory also has strong roots in the education literature. While these theories are highly relevant and are well-recognized in the field of education, it is important to consider whether oTPD requires its own comprehensive theory, one that can offer a central conversational point for researchers interested in oTPD.

Participants in the Reviewed Studies

The number of participants in the reviewed studies ranged from a single participant (Anwaruddin, 2015) to over 400 participants (Hamel et al., 2012), with five of the studies including 10-16 participants (Table 8). Given that most studies used qualitative methods, it is not surprising that most of the studies involved under 20 participants. Elementary teachers were most often included in the reviewed studies. For instance, Dalgarno and Colgan (2007) examined how an online mathematics community provided support to 27 novice elementary teachers. Literacy coaches and school principals were also included in two of the reviewed studies (Ciampa & Gallagher, 2015; Hamel et al., 2012). Trust et al.'s (2016) study included international participants from diverse countries, including the United States, Canada, Australia, Great Britain, Indonesia, Serbia, and the Philippines.

The sample sizes only represent a portion of Canadian teachers (according to Statistics Canada, in 2017 there were 408,810 teachers), and while larger sample sizes reflective of Canada's diverse geographical regions are necessary for future research, even the small sample sizes can contribute stories, personal experiences, and snapshots of teachers' oTPD.

Table 8

Participants in the Reviewed Studies

Study	Number of Participants	Type of Participants
Anwaruddin (2015)	1	English Instructor
Armstrong and Manson (2010)	22-27	K-12 Classroom Teachers
Beach (2017)	15	K-6 In-Service Teachers
Beach and Willows (2014)	11	Pre-service and In-Service Teachers
Ciampa and Gallagher (2015)	15	Grade 8-9 Classroom Teachers; Literacy Coaches
Dalgarno and Colgan (2007)	27	Novice Elementary Teachers
Francis and Jacobsen (2013)	10	Grade 5-9 Classroom Teachers
Hamel et al. (2012)	432	Teachers; School Principals
Ostashewski et al. (2011)	Not stated	Teachers
Trust et al. (2016)	38	Canadian Teachers (among 732 international teachers)
Zhou et al. (2007)	16	High School Teachers

Domain or Subject Area of the Reviewed Studies

All the reviewed studies mentioned the subject area of the oTPD (Table 8) with language and literacy (n = 4), mathematics (n = 2), information and communication technology (n = 2), and science and technology (n = 1) as the subjects reported.

Table 9

Domain or Subject Area of the Reviewed Studies

Domain or Subject Area	n	Studies
English as a Foreign Language	1	Anwaruddin (2015)
Literacy	4	Armstrong and Manson (2010); Beach (2017); Beach and Willows (2014); Ciampa and Gallagher (2015)
Mathematics	2	Dalgarno and Colgan (2007); Francis and Jacobsen (2013)
Information and Communication Technology	2	Hamel et al. (2012); Zhou et al. (2007)
Science and Technology	1	Ostashewski et al. (2011)
Range of domains	1	Trust et al. (2016)

Given that language and mathematics are considered foundational courses across regions, it is not surprising that these are the subject areas teachers are most often seeking out for their PD. The findings are consistent with Macià and García (2016) who reported that topics of common interest for participants from their reviewed studies largely related to language and literacy, science teaching, and technology. While there were specific domains named in most of the studies they reviewed, Macià and García (2016) also found that the majority of studies were generic.

Learning Platforms of Reviewed Studies

As Table 10 shows, the learning platforms of the reviewed studies included online communities (n = 3), institutional platforms (n = 4), professional development websites (n = 3), electronic applications (n = 1), and social media (n = 1).

Table 10

Learning Platforms of Reviewed Studies

Learning platform	n	Studies
Electronic applications	1	Hamel et al. (2012)
Institutional platform (e.g., Moodle)	4	Armstrong and Manson (2010); Ciampa and Gallagher (2015); Francis and Jacobsen (2013); Zhou et al. (2007)
Online community	3	Anwaruddin (2015); Dalgarno and Colgan (2007); Francis and Jacobsen (2013)
Professional development website	3	Beach (2017); Beach and Willows (2014); Ostashewski et al. (2011)
Social media	1	Trust et al. (2016)

It is important to note that the learning platforms were not specific to a particular period. For instance, one might expect that online communities would be more common in more recent years; however, Dalgarno and Colgan (2007), the earliest article in our review, used an online community platform in their study.

Types of Technology Used in Reviewed Studies

The types of technology used in the reviewed studies are presented in Table 11. Several of the reviewed studies included more than one type of technology. For instance, Ostashewski et al. (2011) used a social networking site, online forum, demonstration videos, and file-sharing folders. Online forums were most commonly reported (n = 5).

Table 11

Types of Technology Used in Reviewed Studies

Type of technology	n	Studies
Blogs	3	Anwaruddin (2015); Ciampa and Gallagher (2015); Ostashewski et al. (2011); Trust et al. (2016)
Social networking sites	2	Anwaruddin (2015); Ostashewski et al. (2011); Trust et al. (2016)
Online forum	5	Armstrong and Manson (2010); Dalgarno and Colgan (2007); Francis and Jacobsen (2013); Hamel et al. (2012); Ostashewski et al. (2011); Trust et al. (2016)
Demonstration videos	3	Beach (2017); Beach and Willows (2014); Ostashewski et al. (2011)
Virtual/Interactive tours	2	Beach (2017); Beach and Willows (2014)
Images	2	Beach (2017); Beach and Willows (2014)
Lesson Resources/Exemplars	2	Beach (2017); Beach and Willows (2014)
Interactive course	2	Francis and Jacobsen (2013); Zhou et al. (2007)
File-sharing folder	1	Ostashewski et al. (2011)
Video conferencing (iVisit)	1	Hamel et al. (2012)

Discussion

The main goal for this review was to shed light on studies that have been conducted on oTPD in Canada, including the main themes of the studies, the methods used to document oTPD, how the provincial and territorial contexts of the studies compare, and additional characteristics that can inform future research. Overall, this review provides a unique perspective from a distinct context and can be used to inform the study of oTPD. Specifically, three main aspects for consideration for future research in oTPD are offered. First, it is recommended that researchers examining oTPD continue to consider the unique context online PD provides. Based on the analysis of the themes of the reviewed articles, online contexts are spaces where teachers can exchange and share knowledge, sometimes quickly during the day during practice. Online teacher professional development is also a reflective practice, creates multifaceted learning opportunities, and provides "just-in-time" support. Several of the articles referenced online communities as particularly beneficial in providing teachers with opportunities to reflect on their practice (e.g., Ciampa & Gallagher, 2015; Hamel et al., 2012). The benefits of online communities were also discussed in Macià and García's (2016) review. They found that the studies in their review suggested that communities of practice promoted a sense of community, a common domain, and shared practices.

While Lantz-Andersson et al. (2018) focused on online communities, they too found that the PD opportunities in their reviewed studies were multifaceted and included both informally developed (n = 28) and formally organized (n = 24) online teacher communities. In alignment with Lantz-Andersson et al. (2018), the findings here highlight informal PD as a growing area of oTPD, suggesting that this area of research should continue to be explored. For instance, identifying the impact of informal oTPD on teachers' beliefs and practices could provide insight into whether this form of PD is in fact valuable.

The thematic content analysis also revealed the value of online PD as providing "just-in-time" support, where several of the articles reviewed referenced the timely support provided to the teacher participants in their studies (e.g., Dalgarno & Colgan, 2007; Hamel et al., 2012; Ostashewski et al., 2011). Several studies in Lantz-Andersson et al.'s (2018) review also found that participating in online discussions "provided real-time, ongoing, work-embedded support that helped teachers with busy schedules" (p. 310). It is suggested that researchers continue to examine how "just-in-time" support is realized by the classroom teacher and whether this type of support can produce long-term change in teachers' practice.

Secondly, it is suggested that oTPD researchers continue to use a range of methods. From providing depth to participants' voices to insights into broader trends and patterns, each approach provides a different lens into teacher learning. More Canadian studies are called for which use methods that can capture teachers' decision-making processes and learning behaviours that occur during PD activities. Additionally, more representative samples of teachers across Canada's diverse regions need to be explored. Each region listed in the reviewed studies is unique and can only represent the teachers of those contexts. It is possible that studies not reviewed here have been conducted in other provinces and territories; however, this current search did not result in studies beyond the three provinces listed in Table 6. Researchers are called to always discuss the context in which the research is being conducted. Additionally, while small qualitative studies contribute unique stories and perspectives to the literature, these studies are also limited in their diversity and generalizability. The studies reviewed here included limited information about their participants, including the years of teaching experience and educational backgrounds. Future research should consider participants' years of experience and how teachers experience online PD throughout their career.

Finally, future research should consider examining, to a greater extent, the role of content areas and content-specific online PD platforms on teachers' online PD. This is especially important, as one of the reviewers of this article pointed out, given that research on pedagogical content knowledge suggests that content-specific PD is more effective than general PD approaches.

Conclusion

Studies across the globe indicate that teachers are using the Internet to seek out information for their practice (Kyndt et al., 2016). However, less is known about the types of PD occurring in online environments and how these online PD opportunities, whether informal or formal, impact teachers' learning and classroom practice. This is particularly true in the Canadian context. In addition, there

continues to be a lack of research examining the long-term effects of oTPD on teacher change. In line with work related to Guskey's (2002) views on how PD opportunities can initiate change in teachers' attitudes, beliefs, and perceptions, there is a need to further assess changes in teachers' pedagogical and content knowledge and classroom practice as they participate in online PD.

By identifying and synthesizing the research on oTPD in Canada conducted over the past twenty years, it is hoped that insight into the work of Canadian researchers in this area has been provided as well as the gaps that still need to be addressed. The more understanding there is of the characteristics of oTPD, the more online platforms and learning support tools can be based on research-informed practices. Online teacher professional development that is conducive to teacher learning has the potential to lead to teachers being more skilled, which ultimately can contribute to gains in student academic achievement.

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