Digital Literacy in Canadian Classrooms: A Systematic Review of Teachers' Professional Development Programs

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Abstract: Recognizing the role of teachers in promoting students' digital literacy, it is essential to explore the support they receive in becoming digitally competent educators. This systematic review examined the incorporation of digital literacy in professional development programs for teachers and teacher candidates in Canada from 2012 to 2023, guided by Belshaw's 8Cs model (Cultural, Cognitive, Constructive, Communicative, Confident, Creative, Critical, and Civic). Specifically, this research addresses the following question: What were the focus areas and key elements of digital literacy emphasized in professional development programs for Canadian teachers and teacher candidates between 2012 and 2023? The research team conducted a search across eight academic databases, focusing on peer-reviewed publications. Forty-two relevant publications were identified, aligning with the following requirements: focus on teachers or teacher candidates, Canadian context, and emphasis on digital literacy professional development. These publications were analyzed according to teachers' career stage (preservice or in-service), grade level, subject(s) taught, adopted digital literacy framework, and Belshaw's 8Cs elements. Findings highlight a holistic integration of digital literacy in professional development programs, yet reveal gaps in the creative, cultural, and civic elements of digital literacy. The study underscores the need for strategies to empower Canadian educators in these three areas.

Keywords: Digital Literacy, Teacher Education, Professional Development, Systematic Review

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As digital technologies advance, individuals need to possess diverse skills to effectively navigate and resolve technological issues (Eshet & Chajut, 2009). For instance, with Internet usage among Canadians aged 15 years and older reaching 95%, digital literacy is fundamental for daily interactions and promoting lifelong learning and adaptability (Government of Canada, 2023). Accordingly, digital literacy has increasingly become a foundation for career preparedness and active, informed citizenship (Julien, 2018; Toven-Lindsey, 2017). These transformations have placed greater demands on the education system to equip future workers and citizens with the necessary digital literacy skills (McLean & Rowsell, 2019). Recognizing the role of educators in shaping students' digital competencies, digital literacy has become crucial in modern education, particularly within the professional development (PD) of teachers (DeWaard, 2022).

The COVID-19 pandemic has further highlighted the importance of digital literacy. Many nations were compelled to transition to emergency remote teaching, revealing the significant gaps in digital literacy among educators (Viner et al., 2020). The abrupt shift to online teaching during the pandemic presented unique challenges, especially for K-12 teachers who often had inadequate preparation to deliver online teaching (DeCoito & Estaiteyeh, 2022a, 2022b). These challenges have underscored the need for effective PD and support systems that enhance technical skills and foster a deeper understanding of digital literacy dimensions.

Recognizing this urgency, our study examines the digital literacy PD programs offered to Canadian teachers and teacher candidates. Specifically, this research addresses the following question: What were the focus areas and key elements of digital literacy emphasized in professional development programs for Canadian teachers and teacher candidates between 2012 and 2023? The authors conducted a systematic literature review to identify strengths, point out existing gaps, and suggest potential improvements in digital literacy PD strategies for educators.

Literature Review

Digital Literacy

Digital literacy is a concept that has been changing significantly with the evolution of digital environments. Initially, Gilster (1997) characterized digital literacy as the ability to understand and use information in multiple formats from various sources via the Internet. This definition provided a foundation for broader interpretations that included a range of skills required for active engagement in the information society (Martin, 2008).

The American Library Association built on this definition by incorporating the need to "use information and communication technologies to find, evaluate, create, and communicate information, requiring both cognitive and technical skills" (Office of Information Technology Policy & Digital Literacy Task Force, 2011, p. 1). Eshet-Alkalai (2009) further broadened the scope with a multidimensional construct that included photo-visual literacy, reproduction literacy, and branching literacy, addressing the varied challenges of the digital age.

Adding to this multifaceted view, Hague and Payton (2011) introduced the "Digital Wisdom" concept, which stressed the importance of meaningful and ethical technology integration within teaching practices. This perspective advocated that digital literacy involves more than technical skills; it requires a thoughtful, critical approach to technology integration. Chan et al. (2017) also advocated for critical thinking in digital tools rather than solely focusing on information and communication technology (ICT) skills. In the same vein, the Government of Canada (2023) maintains that students must consume digital content critically, produce it creatively, and share it responsibly. This conceptualization underlines that digital literacy transcends a fixed skill set, emphasizing a dynamic competency that includes critical thinking, digital manners, and adaptability to technology's pervasive role in society.

Furthermore, the New London Group (1996) introduced 'multiliteracies', which includes the concept of digital literacies. This approach highlighted the cultural and linguistic diversity in which digital literacies operate, proposing a more inclusive view that considers the different modalities and contexts of communication. Lankshear and Knobel (2006) emphasized that 'new literacies' are social, connected, and always changing. They suggested that being digitally literate is not just about using technology effectively; it is also about understanding and engaging in the social relationships and activities that define today's digital world. All these perspectives highlight that digital literacies extend beyond individual competency to include engagement with critical, cultural, and social frameworks.

Digital Literacy Internationally and in Canada

Internationally, various countries have recognized the importance of digital literacy and its implications for educational systems. For example, Norway initiated a four-year program from 2004 to 2008 to enhance digital literacy across all sectors (Belshaw, 2012). In Australia, the Digital Education Revolution, a significant federal government program involving a multi-billion-dollar investment, sought to enhance initiatives that improved digital infrastructure by providing PD to help teachers integrate digital tools into their teaching practices effectively (Buchanan, 2020).

Since 2000, Canadian scholars intensified efforts to integrate digital literacy into classroom settings, recognizing its growing importance (Rowsell, 2019). Despite these efforts, Canada lacks a unified national digital literacy strategy, leading to diverse approaches across provinces (Hadziristic, 2018). Each provincial education system independently defines and implements digital literacy, resulting in varied educational experiences nationwide (Ivus et al., 2021). British Columbia, New Brunswick, and Ontario have established digital literacy frameworks to guide educational objectives and outcomes (DeWaard & Hoechsmann, 2016). Notably, the Canadian Council of Ministers of Education also developed a Digital Literacy Framework to align what students should learn about digital literacy at various grade levels, aiming to ensure comprehensive digital competency from kindergarten through high school.

Although these existing initiatives have established a foundation, they remain insufficient to prepare teachers for enhanced digital literacy education across all provinces. For instance, the Information and Communication Technologies in Schools Survey shows that fewer than half of principals believe that their teachers are adequately prepared to effectively engage students in using ICT (Government of Canada, 2023). Additionally, research including three Ontario teacher education programs reveals that although 94% of teacher candidates have experience with educational technology, over 30% of them feel unfamiliar with it and view themselves as novices. Moreover, 82% of candidates report a significant gap in their education regarding the use and integration of technology in education (Hamilton & Lafreniere, 2021). Similarly, during the shift to online teaching induced by COVID-19, 55.7% of Ontario teachers found this shift challenging, with over 80% facing difficulties (DeCoito & Estaiteyeh, 2022a, 2022b).

Teachers' Professional Development Programs

The Organisation for Economic Co-operation and Development (OECD) defines PD as activities that develop an individual's skills, knowledge, and expertise (OECD, 2019). Professional development is not merely a set of tasks to be completed but a lifelong process of learning and self-improvement (Abdalina et al., 2022).

Several university-led PD programs have been implemented to enhance digital literacy among educators. For example, the Digital Literacy Centre at the University of British Columbia offers workshops that integrate digital technologies into pedagogical practices, focusing on both technical skills and critical media engagement (Digital Literacy Centre, n.d.). Similarly, the University of Toronto's Digital Literacy Professional Development Program offers in-service teachers courses ranging from basic digital skills to advanced instructional technologies, emphasizing critical thinking and ethical considerations (University of Toronto, n.d.).

However, research indicates that while PD initiatives often succeed in improving teachers' technical skills, they frequently fail to enhance their ability to integrate technology in their pedagogies in meaningful ways. For example, Ertmer et al. (2012) showed that although PD programs could enhance technical proficiency, they often did not improve teachers' capacity to use technology to support critical thinking and problem-solving in the classroom. A study by Tondeur et al. (2017) found that despite increased confidence in using technological tools, teachers struggled to apply these tools in the classroom. Thus, it is essential to explore teachers' preparedness to develop the various skills associated with digital literacy. To do so, this study examines the literature related to digital literacy PD programs for Canadian teachers and teacher candidates within the time frame of 2012-2023.

Theoretical Framework

This study adopts Belshaw's (2012) 8Cs model of digital literacy as its theoretical framework. Belshaw argues that eight elements must be present in developing digital literacy, namely the cultural element (the need to understand the various digital contexts an individual may experience); cognitive element (the 'mind-expansion' comes through the co-creation and contextualization of digital literacies); constructive element (creating something new, including using and remixing content from other sources to create something original); communicative element (communicating and networking); confident element (self-confident and responsible); creative element (doing new things in new ways); critical element (critical about content); and civic element (participation, social justice, and civic responsibility) (Belshaw, 2012).

As detailed in Table 1, this model offers a holistic perspective that reflects the multifaceted nature of digital literacy and its implications. This framework guided our analysis of PD programs in Canada. By examining how these programs incorporate Belshaw's 8Cs, this research aims to provide insights into the current state of digital literacy training and highlight areas that require further attention.

Table 1: Description of Belshaw's 8Cs

8Cs	*Description*
Cultural Element	The cultural element emphasizes understanding the social, historical, and cultural contexts that influence the creation and consumption of digital content. This component highlights an individual's ability to recognize and appreciate cultural differences, including norms, thinking habits, and behaviours that may differ (Abdurrohman & Fitriana, 2023). This element also includes recognizing and addressing biases and discrimination within digital media.
Cognitive Element	The cognitive element emphasizes mind expansion, which refers to the mental processes of understanding, using, and creating information in digital environments. This element touches on the definition of digital literacy by Gilster (1997), which espouses the ability to understand and use information in multiple formats from various sources. It emphasizes critical thinking as a fundamental skill, suggesting that digital literacy involves not just accessing information but processing and making sense of it meaningfully.
Constructive Element	The constructive element emphasizes using digital tools to create new content, innovate, and express oneself effectively and ethically in the digital environment (Belshaw, 2012). It involves not just consuming digital information but actively participating in creating and shaping digital content such as media (Buckingham, 2007). It means constructing something in a digital environment where the content can be appropriated, reused, and remixed (Erstad et al., 2007).

Communicative Element	The communicative element focuses on using digital tools to communicate and collaborate effectively using digital tools. This involves understanding and using digital communication technologies, managing digital identities, respecting privacy, and engaging appropriately in various digital platforms (Belshaw, 2012). This aspect of digital literacy extends beyond individual skill proficiency to encompass the broader capacity for social interaction and participation in the digital realm. Martin (2006) suggests that digital communication involves exchanging information and engaging in social interactions that build and support communities online.
Confident Element	The confident element emphasizes self-efficacy and personal agency that individuals must possess to navigate digital environments securely and effectively (Belshaw, 2012). Confidence in digital literacy means having the skills to use digital tools and the assurance to experiment and solve problems independently.
Creative Element	Creativity in digital literacy involves thinking innovatively and applying digital tools creatively to generate unique and impactful content or solutions. This element aligns with Lankshear and Knobel's (2006) emphasis on 'new literacies' involving creativity as part of everyday practices. Creativity in digital contexts transcends traditional boundaries and involves remixing existing materials and combining various media forms to produce new expressions or artifacts (Buchanan, 2020).
Critical Element	The critical component of digital literacy involves a discerning understanding of digital content and an analytical approach to media consumption and production. Critical digital literacy requires individuals to assess the reliability and credibility of online information and understand the underlying biases that may shape this information (Tondeur et al., 2017).
Civic Element	The civic element focuses on individuals using digital skills to engage in society responsibly and meaningfully. It includes understanding digital rights, ethics, and responsibilities and using digital tools to participate in civic activities and community engagement. Integrating civic digital literacy is essential for developing students' ability to use digital tools for personal gain and as active and informed citizens (Belshaw, 2012).

Note. Table developed by the authors based on the cited articles.

Methodology

Systematic Review

We employed a systematic literature review methodology (Gough et al., 2017). Unlike traditional literature reviews, systematic reviews follow a structured process to minimize bias and provide a reliable foundation for evidence-based practice. This method involves carefully selecting databases, explicit inclusion and exclusion criteria, and a meticulous approach to data extraction and analysis (Gough et al., 2012).

Inclusion-Exclusion Criteria. The inclusion-exclusion criteria ensure the research is focused and relevant, allowing for a manageable and meaningful literature synthesis (Popay et al., 2006). By setting these criteria, the researchers outline the scope of their inquiry, ensuring that the articles selected are directly relevant to the research questions posed. In this study, the inclusion criteria were set to capture the literature explicitly addressing digital literacy among teachers and/or teacher candidates. Studies also had to be peer-reviewed journal articles, published within the stated timeframe between 2012 and 2023, conducted within or applicable to the Canadian context, and inclusive of PD programs on digital literacy.

The Search Process. The two authors initiated the search with Brock University Libraries, followed by a series of academic databases, including Academic Search Complete, Education Source, ERIC, LearnTechLib, ProQuest Dissertations and Theses Global, and Google Scholar. These platforms were chosen for their indexing of peer-reviewed journals and their interdisciplinary focus to ensure a broad and diverse collection of sources.

Our search strategy involved specific keywords in various combinations, including terms such as follows: "digital literacy" AND Canada AND (teachers OR teacher candidates); "digital competence" AND Canada AND (teachers OR teacher candidates); "technological literacy" AND Canada AND (teachers OR teacher candidates); "technology literacy" AND Canada AND (teachers OR teacher candidates); "technological competence" AND Canada AND

(teachers OR teacher candidates); "digital literacy" AND Canada; "digital competence" AND Canada; "technological literacy" AND Canada; "technology literacy" AND Canada; "technological competence" AND Canada. These terms were selected to align with the evolving terminology and concepts within the field and the specific nuances of the Canadian educational context. Initially, we selected 63 articles that matched our search criteria. Through team discussions, we refined our search. For example, we excluded conference papers, literature reviews, and papers that did not include PD programs. As a result, 42 papers were included for analysis in the review.

Data Analysis. The authors maintained detailed records in an annotated bibliography sheet, including publication title, year of publication, abstract, research questions, methodology, and findings. Then, we analyzed each paper according to the following themes: 1) teacher career stage, distinguishing between in-service and preservice teachers; 2) grade level, pinpointing the educational stages where the PD is implemented, such as elementary and/or secondary; 3) subject, identifying disciplines where digital literacy training is incorporated, like science or literacy; 4) adoption of digital literacy framework, highlighting the conceptual or theoretical framework used in the paper to describe digital literacy; and 5) digital literacy skills (one or more of Belshaw's elements). Regular discussions between the authors and the reiterative analysis procedure aimed at enhancing the trustworthiness of the findings (Creswell & Creswell, 2018).

Results

Among the 42 identified publications, 26 papers adopted a qualitative approach, 14 utilized mixed methods, and only two adopted a quantitative methodology. The next section presents our findings according to the five themes.

Teacher Career Stage

The review revealed a balanced emphasis on in-service and preservice teachers. Of the 42 publications, 14 addressed in-service teachers' needs and experiences, while 28 papers are centered on preservice teachers.

Grade Level

Thirty-eight papers focused on the K-12 educator group, with 14 on secondary education, nine on elementary education, eight for both elementary and secondary, and seven papers focusing on K-12 teachers but not specifying grade level. Additionally, the four remaining papers explored digital literacy in other contexts such as early childhood education, English as a Second Language (ESL), and postsecondary settings.

Subject

Our analysis revealed that 28 papers touched on specific academic subjects, with 15 papers focused on a STEM/ STEAM subject, 12 papers on the field of literacy and languages, and one paper on history. Additionally, 14 papers did not specify a particular subject but addressed digital literacy within a broader educational context.

Digital Literacy Framework

Our review revealed a gap in referencing specific digital literacy frameworks in the reviewed articles. Twenty-three papers did not specify any framework, while 19 did. Among the latter, nine papers adopted the technological, pedagogical, and content knowledge (TPACK) framework, and two papers referenced the International Society for Technology in Education (ISTE) standards.

Elements of the 8Cs

To explore the landscape of digital literacy within teacher PD research, we analyzed how each paper aligned with Belshaw's elements of digital literacy: cultural, cognitive, constructive, communicative, confident, creative, critical, and civic. Table 2 summarizes how often elements of the 8Cs were addressed by the papers we selected. More details about which of the 8Cs was/were addressed in each of the 42 articles can be found in Appendix A. In summary, we found that the cognitive, constructive, confident, and critical elements were highly addressed in the reviewed papers. However, three elements were less frequently addressed: cultural, creative, and civic. Furthermore, to provide more details and practical examples, Table 3 explains how selected research papers addressed each of Belshaw's 8Cs.

Table 2: The Count of Papers Addressing Each of the 8Cs

	Cultural (C1)	*Cognitive (C2)*	*Constructive (C3)*	*Communicative (C4)*	*Confident (C5)*	*Creative (C6)*	*Critical (C7)*	*Civic (C8)*
Yes	15	40	38	25	34	18	31	10
No	27	2	4	17	8	24	11	32

Table 3: Examples of How Selected Articles Addressed the 8Cs

8Cs	*Examples*
Cultural	• Baroud and Dharamshi (2020): The first formal assessment of the course asked teacher candidates to construct their personal literacy autobiographies through digital storytelling. The goal was to support students in understanding the cultural and social dimensions of literacy. • Hagerman and Coleman (2017): The Digital Hub project's emphasis on creating a web presence and interacting with the broader educational community fits this category. Using technologies and web platforms to express one's educational journey shows an understanding of the digital culture.
Cognitive	• Beach et al. (2021): Gaining insight into the value of informal online PD by examining elementary teachers' cognitive processes and web-based actions during self-directed online learning sessions. • Milner-Bolotin (2016): Focused on improving teacher candidates' subject-specific pedagogical knowledge using electronic response systems, PeerWise, data collection and analysis tools, computer simulations, and modelling software.
Constructive	• Baroud and Dharamshi (2020): The structure of the assignment to share visual narrative literacy autobiographies using a digital platform, with the intent for teacher candidates to gain knowledge on integrating technology into their own classroom practices. • Hébert et al. (2021): Teachers were not just passive consumers of digital content; they were actively constructing and adapting their teaching materials by developing new competencies in using digital games and potentially creating their own content for classroom use.
Communicative	• Baroud and Dharamshi (2020): The use of Flipgrid, a short video platform, to foster an authentic, ongoing dialogue that connects theory and practice and provide teacher candidates with the opportunity to share reflections both in and out of the classroom. • Fu et al. (2022): Teacher candidates practiced assessing peers using peer feedback with a digital portfolio, engaging in the communicative element of digital literacy. • Goodnough and Murphy (2017): Activities and interactions between teachers included constant communication, reliance on each other, sharing documents via Google Docs, discussing planning, reviewing results, and teleconferencing.
Confident	• Araujo et al. (2019): The course structure included hands-on activities with different technologies and encouraged open discussions and reflections to build confidence among teacher candidates in using and teaching digital tools. • Fu et al. (2022): Teacher candidates were initially reluctant to use technology but eventually succeeded in acquiring digital technical skills and fully embracing digital portfolios as part of the learning and assessment process.
Creative	• Cap and Black (2012): Teacher candidates used Comic Life to create comic homework. • Horst et al. (2023): The use of an online, creative social media platform such as PhoneMe for developing place-based community and creative expression.
Critical	• Goodnough and Murphy (2017): Evaluating several technology tools and selecting specific tools, like a mind mapping tool and an animated video creation tool.

Civic	• Hagerman and Coleman (2017): Students thinking critically about their online representation and how it aligns with their professional identity. • Horst et al. (2023): Using a virtual place-based community during a period of limited physical interaction and using place-based poetry to create a sense of community and shared experiences with educators directly. • Manning-Lewis and Sanford (2022): Teacher candidates were encouraged to discover new multimodal strategies and share their observations regarding exposure to multiple literacies across social, cultural, and national boundaries. • Rehn et al. (2018): The discussion on the social role in videoconference teaching, particularly focusing on getting community buy-in and creating a sense of real presence.

Discussion and Conclusion

This systematic review examined digital literacy in Canadian teacher PD programs, encompassing an analysis of 42 publications from 2012 to 2023. The exploration across five distinct themes—teacher career stage, grade level, subjects, adoption of digital literacy framework, and Belshaw's 8Cs framework—has provided an overview of the current state and trends in digital literacy within teacher PD programs in Canada.

In synthesizing our findings, we observe several positive patterns. For instance, the existence of 42 papers in this period with balanced focus on both preservice and in-service teachers underscores a commitment to promoting digital literacy among teachers in Canada. However, our analysis reveals a few gaps in the research on digital literacy. For example, as K-12 STEM curricula worldwide rapidly incorporate new disciplines like computer science, programming, robotics, environmental science, computer modelling, and technology education (Martinovic et al., 2019), it becomes crucial to examine the readiness of teachers to integrate these technologies effectively in their classrooms. Yet only two studies directly address these emerging subjects. This disparity highlights a research opportunity to develop more comprehensive PD approaches that can keep pace with the dynamic evolution of STEM education, ensuring that teachers are well-prepared to implement these advanced technologies effectively (Heitink et al., 2016).

Additionally, our review highlights a gap in adopting/applying digital literacy frameworks within the studies examined. This variability indicates a need for cohesion in researching and teaching digital literacy (Martínez-Bravo et al., 2022). This variability may also affect how digital literacy is taught to preservice teachers, potentially impacting their ability to effectively integrate these skills into their teaching practices (Uribe-Banda et al., 2021). Establishing common principles is needed to ensure clarity and consistency in the research and education of digital literacy (Sparks et al., 2016).

Furthermore, this systematic review highlights the inconsistent incorporation of digital literacy elements within Canadian teacher PD programs. We identify a positive focus on the cognitive, constructive, confident, and critical elements. However, significant gaps exist in addressing the creative, cultural, and civic elements of digital literacy. The creative element is necessary as it encourages educators to apply digital tools innovatively, fostering environments and stimulating student engagement and adaptability (Belshaw, 2012). Creativity helps educators integrate technology with their teaching methods more effectively, fostering flexibility and student engagement (Eberly et al., 2001). However, despite its importance, many programs do not fully utilize the potential of educators to act as creators and innovators in technology-enhanced educational settings (Corrigan et al., 2013).

Moreover, the cultural and civic elements are essential for educators to navigate the diverse socio-cultural dynamics (Belshaw, 2012). In Canadian multicultural classrooms, enabling educators to understand and integrate cultural differences can lead to more inclusive and equitable educational practices (Estaiteyeh & DeCoito, 2024a, 2024b; Rybinska et al., 2020). By engaging students with digital technologies through a cultural lens, educators not only build digital and critical competencies but also deepen students' understanding of their identities (Baroud, 2020). This approach is valuable for PD programs as it helps educators understand diversity and creates a more inclusive learning environment for their students. Similarly, there is a need for teachers to possess skills that facilitate digital civic engagement (Manning-Lewis & Sanford, 2022). Teachers equipped with this knowledge are better prepared to guide students in participating effectively in social movements, civic activities, and policy discussions via digital

platforms (Belshaw, 2012). Collectively, these findings underscore a significant opportunity to expand the exploration of the cultural, creative, and civic aspects of digital literacy in future PD programs.

Limitations of the Study

Our study's focus on the Canadian context within a specific time frame restriction may have limited the insights from earlier foundational work in this research area. Also, despite efforts to maintain objectivity, the systematic review may have also been influenced by the researchers' viewpoints through selection bias, potentially overlooking some relevant studies. Moreover, we chose Belshaw's 8Cs framework, which offers a comprehensive approach to digital literacy. However, relying on one framework may have excluded other perspectives that could have provided different insights.

Implications

This paper informs educational research, practice, and policy by identifying areas of strength and opportunities for improvement in digital literacy research in Canada. The objective is ensuring that current and future educators are not only technically adept but also able to engage critically and ethically in digital environments. This paper shows the ongoing need for promoting digital literacy throughout a teacher's career. As such, this work must be emphasized as a continuum, ranging from preservice teacher education to in-service teachers' PD, thus sustaining a long-lasting impact.

It is also important to note that with the emergence of digital technologies, the concept of digital literacy is constantly evolving. Accordingly, some of the presented findings in this paper may become less relevant in the future. For instance, with the emergence of artificial intelligence (AI) in education, more implications for teacher education are arising (Estaiteyeh & McQuirter, 2024; Pedro et al., 2019). Artificial intelligence tools have the potential to improve teacher education outcomes; yet educators need to examine accompanying ethical, social, technical, and cultural considerations (Salas-Pilco et al., 2022; Zawacki-Richter et al., 2019). As such, AI literacy is now becoming an important element in teacher education and professional development programs, thereby warranting further research in this field.

Appendix A

Table 4: Elements of Belshaw's 8Cs Addressed in Each of the Selected Papers

Authors	*C1*	*C2*	*C3*	*C4*	*C5*	*C6*	*C7*	*C8*
Araujo et al. (2023)	Yes	Yes	Yes	No	Yes	No	Yes	No
Arntzen (2015)	No	Yes	Yes	No	Yes	No	Yes	No
Baroud (2020)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Baroud and Dharamshi (2020)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Beach et al. (2021)	No	Yes	Yes	No	Yes	No	Yes	No
Boreland et al. (2023)	Yes	Yes	Yes	Yes	No	No	Yes	No
Briffa (2015)	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Cap and Black (2012)	No	Yes	Yes	No	Yes	Yes	No	No
Corrigan et al. (2013)	No	Yes	Yes	No	Yes	No	Yes	No
DeCoito and Vacca (2020)	No	Yes	Yes	No	Yes	Yes	No	No
DeCoito and Richardson (2018)	No	Yes	Yes	Yes	Yes	No	Yes	No
Fu et al. (2022)	No	Yes	Yes	Yes	Yes	Yes	Yes	No
Gadanidis et al. (2017)	No	Yes	Yes	No	Yes	Yes	No	Yes
Goodnough and Murphy (2017)	No	Yes	Yes	Yes	Yes	Yes	Yes	No

Hagerman and Coleman (2017)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Hébert et al. (2021)	No	Yes	Yes	No	Yes	No	Yes	No
Hechter and Vermette (2013)	No	Yes	No	No	Yes	No	Yes	No
Horst et al. (2023)	No	No	Yes	Yes	No	Yes	Yes	Yes
Howard et al. (2015)	Yes	No	No	Yes	No	No	Yes	Yes
Jaipal-Jamani et al. (2015)	No	Yes	Yes	No	Yes	No	No	No
Karamifar et al. (2019)	No	Yes	Yes	No	No	No	No	No
Li et al. (2013)	No	Yes	Yes	Yes	Yes	Yes	Yes	No
MacKinnon et al. (2012)	No	Yes	Yes	No	Yes	Yes	Yes	No
Manning-Lewis and Sanford (2022)	No	Yes	Yes	Yes	Yes	Yes	No	Yes
Martinovic et al. (2019)	No	Yes	Yes	Yes	Yes	No	No	No
Martinovic and Zhang (2012)	No	Yes	Yes	Yes	Yes	No	Yes	No
Milner-Bolotin (2016)	No	Yes	Yes	Yes	Yes	Yes	Yes	No
Rehn et al. (2018)	No	Yes	Yes	Yes	Yes	No	Yes	Yes
Robertson et al. (2012)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Scoppio and Luyt (2017)	No	Yes	No	Yes	No	No	Yes	No
Smith et al. (2015)	Yes	Yes	Yes	Yes	No	Yes	Yes	No
St. Hilaire and Gallagher (2020)	No	Yes	Yes	No	Yes	No	No	No
Uribe-Banda et al. (2021)	Yes	Yes	No	No	Yes	No	No	No
Vacca (2020)	Yes	Yes	Yes	No	Yes	Yes	Yes	No
Van Thiel (2018)	No	Yes	Yes	No	Yes	No	No	No
Watt (2019)	Yes	Yes	Yes	Yes	Yes	No	Yes	No
Wilson (2012)	Yes	Yes	Yes	No	Yes	No	Yes	No
Wong et al. (2021)	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Younghusband (2021)	Yes	Yes	Yes	Yes	No	No	Yes	Yes
Zhang (2019)	Yes	Yes	Yes	Yes	Yes	No	No	No
Zhang (2023)	No	Yes	Yes	Yes	No	Yes	Yes	No
Zhou et al. (2016)	No	Yes	Yes	Yes	Yes	No	Yes	No

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