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Preparing K-12 Teachers for Blended Teaching: An Exploration of Peer-reviewed Research, Important Practices, and Teacher Experiences

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Preparing K–12 Teachers for Blended Teaching: An Exploration of Peer-Reviewed Research, Important Practices, and Teacher Experiences

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A dissertation submitted to the faculty of
Brigham Young University
in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

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ABSTRACT

Preparing K–12 Teachers for Blended Teaching: An Exploration of Peer-Reviewed Research, Important Practices, and Teacher Experiences

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This multiple-article dissertation explores K–12 blended teacher preparation. A literature review describes research trends from 88 articles published in peer-reviewed journals. It reports that current K–12 blended teacher preparation research focuses on explorations of blended teaching literature; professional development and coursework used for blended teacher preparation; defining, developing, and implementing blended teaching competencies; and measuring blended teaching readiness. The literature review suggests that additional work is needed to uncover specific practices that K–12 blended teachers are using across disciplines and grade levels, as well as whether there are specific pedagogies that seem to be effective within specific disciplines and grade levels.

The second article provides insight into these K–12 blended pedagogies. Researchers gathered more than 1500 examples of K–12 blended teaching practices, strategies, resources, and school profiles from The Learning Accelerator (TLA) to uncover how practices of blended teachers relate to proposed competencies for blended teacher preparation. Coding a representative sample of resources (372 of the 959 relevant resources, providing a confidence interval of 95% +/- 4) revealed that some technology skills seen as foundational to blended teaching readiness and some blended teaching competencies may be less important for K–12 blended teachers than others. Future research should address whether the skills that appear to be less emphasized from the artifact analysis are less used in practice or seek to identify specific pedagogical practices around the skills and competencies that this analysis identified as important to K–12 blended teaching.

The final article presents best practices and experiences within the blended competency area of personalization. Researchers conducted interviews with 62 blended teachers with various levels of blended teaching experience across 10 different content areas and all K–12 grade levels. Researchers found that teachers provide students with personalization across students' time, place, pace, path, and goals for learning within their classes' learning objectives, assessments, and instructional activities. These findings provide a foundational framework for describing the ways in which blended learning can facilitate personalization.

Keywords: blended learning, individualized instruction, teacher education, elementary education, secondary education

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To my parents whose examples as educators inspired my lifelong love of learning and service.

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To my wife whose love and pride in me motivated every step along the way.

To my son whose joy of exploration served as a reminder of what learning should be.

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DESCRIPTION OF RESEARCH AGENDA AND STRUCTURE OF DISSERTATION

Preparing K–12 Teachers for Blended Teaching: An Exploration of Existing Research, Important Practices, and Teacher Experiences is a dissertation written in article format. The dissertation combines the requirements of a traditional dissertation with the formatting of journal publications.

The introductory elements of this dissertation contain the university's submission requirements. The research within the dissertation is presented as journal articles and therefore conforms to the length and style requirements of appropriate journals within the field of education or educational technology. The first is a systematic mapping review of peer-reviewed journal articles that focus on specific elements of K–12 blended teacher preparation. This review has been accepted for publication in a special issue of *TechTrends: Linking Research and Practice to Improve Learning*. Citation information for the article can be found on the article's title page within this dissertation, and resources used for the article appear at the end of the section.

The second article of this dissertation presents the first of two research articles, *K–12 Blended Teaching Skills and Abilities: An A Priori Analysis of Blended Teaching Artifacts*. The second of these two research articles, *Blending and Personalizing: A Cross-disciplinary Analysis of K–12 Blended Teaching Practices for Personalization*, is presented as the third article of the dissertation. These articles, like the systematic literature review, are formatted according to journal submission guidelines. Resources used for the articles are similarly listed at the end of each section. An appendix after the final article has a copy of the institutional review board's approval letter for the research study. The second article of this dissertation has been published in the *Journal of Online Learning Research*. The final article of this dissertation has been

submitted to *Teachers College Record*. These are appropriate journals for these articles because all journals are represented within the literature review conducted as part of this dissertation and have historically published articles focused on blended teaching, teacher preparation, and/or personalization.

The end of this dissertation presents citations for references made outside of the three articles. Citations within each article are listed at the end of the appropriate article.

ARTICLE 1

Preparing Teachers to Teach in K–12 Blended Environments: A Systematic Mapping Review of Research Trends, Impact, and Themes

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Abstract

Despite evidence concerning the widespread growth of K–12 blended teaching, and the impact that emergency remote teaching during the COVID-19 pandemic has had on the spread of K–12 online and blended teaching, we could find no systematic reviews focused on preparing K–12 teachers for blended teaching. Previous literature reviews, such as those from Halverson et al. (2012) and Drysdale et al. (2013), have noted the lack of research focused on K–12 blended teaching contexts. This systematic mapping review (Grant & Booth, 2009) of 88 K–12 blended teacher preparation articles focused on identifying trends in author impact according to citation count and number of publications, journal impact according to number of publications, prevalence of research methods, and prevalence of research themes according to research questions and findings. The analysis provides a valuable snapshot of current literature, sets a foundation for a deeper thematic analysis of K–12 blended teacher preparation literature, and identifies some potential areas for future K–12 blended teaching research.

Keywords: blended learning, literature review, teacher education, elementary education, secondary education

Introduction

Graham (2019) noted that measuring the growth of blended teaching (BT) is difficult because institutions use different definitions of "blended" and lack ways to measure BT; additionally, instructors may choose to blend without the knowledge of administrators. Despite being difficult to measure, signs point toward the widespread growth of BT in K–12 contexts. Gulosino and Miron (2017) found that enrollment in full-time K–12 blended schools increased from fewer than 2,500 students in 2009 to over 25,000 students in 2014. As a response to BT growth, the United States' (U.S.) 2017 National Education Technology Plan recommended "develop[ing] a teaching force skilled in online and blended instruction" (U.S. Department of Education, p. 40). Despite this national recommendation, there is little peer-reviewed research focused on how to best prepare teachers for this emerging learning environment. BT is likely to see additional growth due to school investments in technological infrastructure, teacher professional development, and experience gained from emergency remote teaching that occurred during the COVID-19 pandemic.

Much of the research currently guiding K–12 blended teacher preparation is published in peer-reviewed book chapters and non-refereed white papers by organizations focused on BT and innovation. A 2012 review of high impact scholarship in BT found that 3.33% (only two articles) of the top-cited articles (N = 60) focused on K-12 settings (Halverson et al., 2012). Similarly, a 2013 analysis of BT theses and dissertations found that only 8% of the studies focused on K–12 contexts (Drysdale et al., 2013). A more comprehensive review of the literature noted important distinctions between BT in higher education and K–12 settings stating that "adopters need refined implementation and evaluation frameworks as well as professional development and teacher education approaches that better meet the purposes and issues unique to blended learning

in K–12 school" (Halverson et al., 2017, p. 55). A review of K–12 BT competencies also noted that "it was not so surprising to find a limited number of peer-reviewed articles in the literature around blended learning teaching competencies," and therefore included many online resources and white papers from professional organizations in their analysis (Pulham & Graham, 2018, p. 415).

Non-refereed online resources have been widely used to guide blended teacher preparation. Organizations such as the Michigan Virtual Learning Research Institute, the Christensen Institute, The Learning Accelerator, the Highlander Institute, the Blended Learning Universe, the Online Learning Consortium, the Evergreen Education Group, the Digital Learning Collaborative, iNACOL (now the Aurora Institute), ISTE, Lexia, Edutopia, ASCD, and Better Lesson have all provided resources focused on BT. A sample of such resources (N = 58) revealed that many focused on school or district-wide implementation of BT (n = 20), with much fewer focused on K–12 BT dispositions (2), readiness (2), evaluations (2), competencies (4), pedagogies (5), models (5), school profiles (5), reviews of BT literature (6), or teacher development (7) (see Table 1). While many of these resources could guide BT preparation, more resources specifically focused on preparing teachers for BT are needed.

Table 1

Examples of Online BT Resources for K–12 Contexts

Focus/theme	Source organization	Name of resource
Implementation	Michigan Virtual Learning Research Institute	District-level blended learning implementation: Readiness points and challenges
Implementation	Blended Learning Universe	We're here every step of the journey
Implementation	iNACOL	Mean what you say: Defining and integrating personalized, blended and competency education
Implementation	ISTE	Get started with blended learning
Implementation	Edutopia	Transitioning to blended learning
Development	The Learning Accelerator	Partnering with a local college to develop new teacher training opportunities
Development	Christensen Institute	The secret element in blended learning
Research	Christensen Institute	Is higher education teaching teachers to blend?
Profiles	The Learning Accelerator	See "Schools in Action" section
Models	Lexia	Four keys to success using blended learning implementation models
Pedagogies	ASCD	The basics of blended instruction
Competencies	iNACOL	iNACOL blended learning teacher competency framework
Evaluations	Digital Learning Collaborative	Does blended work? The 4Ps of evaluating your blended program's effectiveness
Readiness	Highlander Institute	Fuse RI district readiness survey

The lack of peer-reviewed resources for BT preparation combined with the call from the U.S. Department of Education to prepare teachers for BT suggests the need for a greater focus in the area. Additionally, we could find no systematic reviews of current peer-reviewed research for

state departments of education, school districts, and university programs to reference in preparing K–12 teachers for BT. To better understand the current state of research focusing on the skills, knowledge, and practices that the growth of BT demands from K–12 teachers, this systematic mapping review analyzes research trends in peer-reviewed articles focusing on preparation for K–12 BT.

Review Questions

1. How can the current state of K–12 BT research be characterized in terms of publication outlets, impact based on citation counts, and research methods?
2. To what extent has research revealed practices for preparing K–12 teachers to teach in blended settings?
3. To what extent has research sought to define K–12 BT readiness?
4. To what extent have assessments or instruments been developed and used for measuring K–12 BT readiness?

Methods

We identified peer-reviewed journal articles from 2007 through 2019, using Academic Search Premier (EBSCO), Computers and Applied Sciences Complete (EBSCO), ERIC (EBSCO), PsycINFO (EBSCO), Teacher Reference Center (EBSCO), and SCOPUS. Graham (2016) suggests a process of iterative searches using various search terms when searching for BT literature because the "conversations are not taking place in one central location; they are distributed across many disciplines and scholarly communities" (p. 28). Our search included several iterations. Table 2 presents the refined search terms for the initial database searches.

Table 2

Teacher Preparation for Blended Learning in K–12 Contexts Keyword Search

	Subject	Keywords
	K–12	"K–12" OR "K12" OR "secondary" OR "elementary" OR "high school" OR "middle school" OR "junior high"
AND	Blended learning	"blended learn*" OR "blended teach*" OR "hybrid learn*" OR "hybrid approach" OR "flip*" OR "station rotation" OR "lab rotation" OR "flex"
AND	Teacher preparation	"teacher educat*" OR "teacher prepar*" OR "teacher professional development" OR "teacher training" OR "faculty development"

Initial searches sought literature starting in 1999 because the year pre-dated Gulsino and Miron's (2017) data concerning enrollment in full-time blended schools by a full decade, which would allow for ample time in providing opportunities for research concerning BT knowledge, skills, and practices. The cut-off date of December 2019 was due to the start date of this research in early 2020. Early searches included terms for blended learning such as "hybrid," "station rotation," "lab rotation," and "flex," but these did not produce additional search results. Additionally, the search parameters initially considered search terms across multiple parameters, retrieving articles that seemed to have a preponderance of the terms. This search proved valuable but too exclusive. The final search revised the search terms, added additional parameters for each subject of the search, and applied related words when completing the search (see Table 3).

Table 3

Final Revised Keyword Search

	Subject	Keywords	Parameter
	K–12	"K–12" OR "K12" OR "secondary" OR "elementary" OR "high school" OR "middle school" OR "junior high" OR "teacher*"	Abstract
AND	Blended learning	"blend*" OR "flip*"	Subject
AND	Teacher preparation	"prepar*" OR "course*" OR "develop*" OR "training"	Abstract

Inclusion/Exclusion Criteria

To be included in this review, research had to meet the following criteria:

1. Be published in English.
2. Be published in a peer-reviewed journal, i.e., it could not be published in trade journals, white papers, or book chapters.
3. Focus on intentionally preparing K–12 teachers for BT — modeling BT through professional learning experiences or university courses would not be considered sufficient for preparing K–12 teachers for BT unless the content of such courses and seminars focused on BT skills, knowledge, or practices.
4. The use of "blended" must refer to the strategic combination of online and in-person modalities (Graham, 2006).

Outcomes of the Searches

The initial search yielded 241 articles from EBSCO databases and 31 articles from Scopus. Of these articles, 11 were duplicates from both databases, leaving 261 articles to analyze

for this review. SCOPUS yielded only one article included in the review that was not also in the EBSCO databases search. This article appeared in the EBSCO databases search during the final search, and therefore SCOPUS was not included as part of the more inclusive final search. Despite including research from 1999 onward, the earliest article in the review was from 2007. This finding is likely because blended learning, or hybrid learning, started in higher education before working its way to K–12 schools. The final search produced over 1,600 results that we reviewed to uncover which articles would meet the inclusion/exclusion criteria. Of these results, 37 articles had already been accepted for the review from initial search. These articles were removed prior to further screening. Figures 1 and 2 present the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagrams (Page et al., 2021) for each of the searches.

Figure 1

PRISMA Flow Diagram for the Initial Literature Search

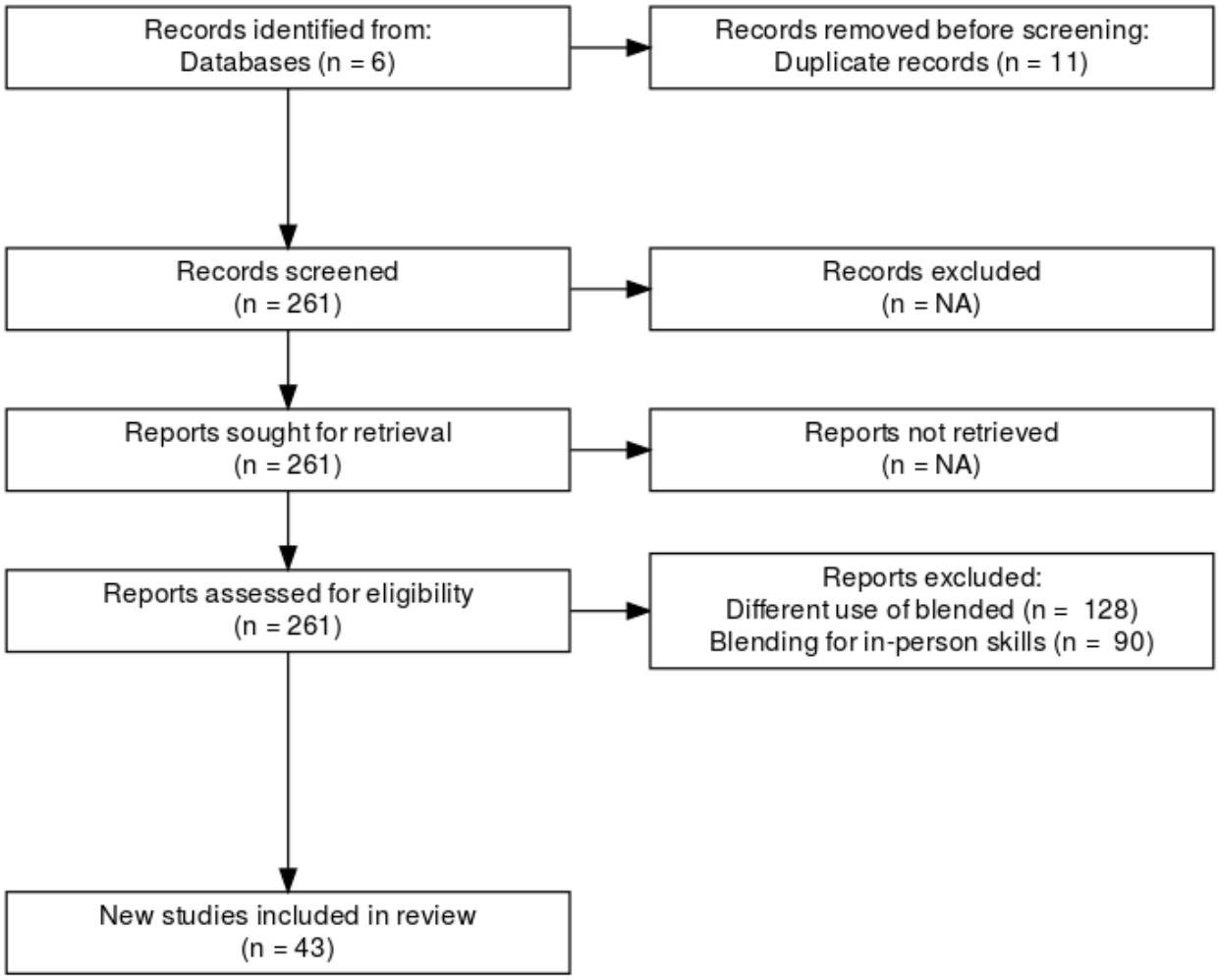
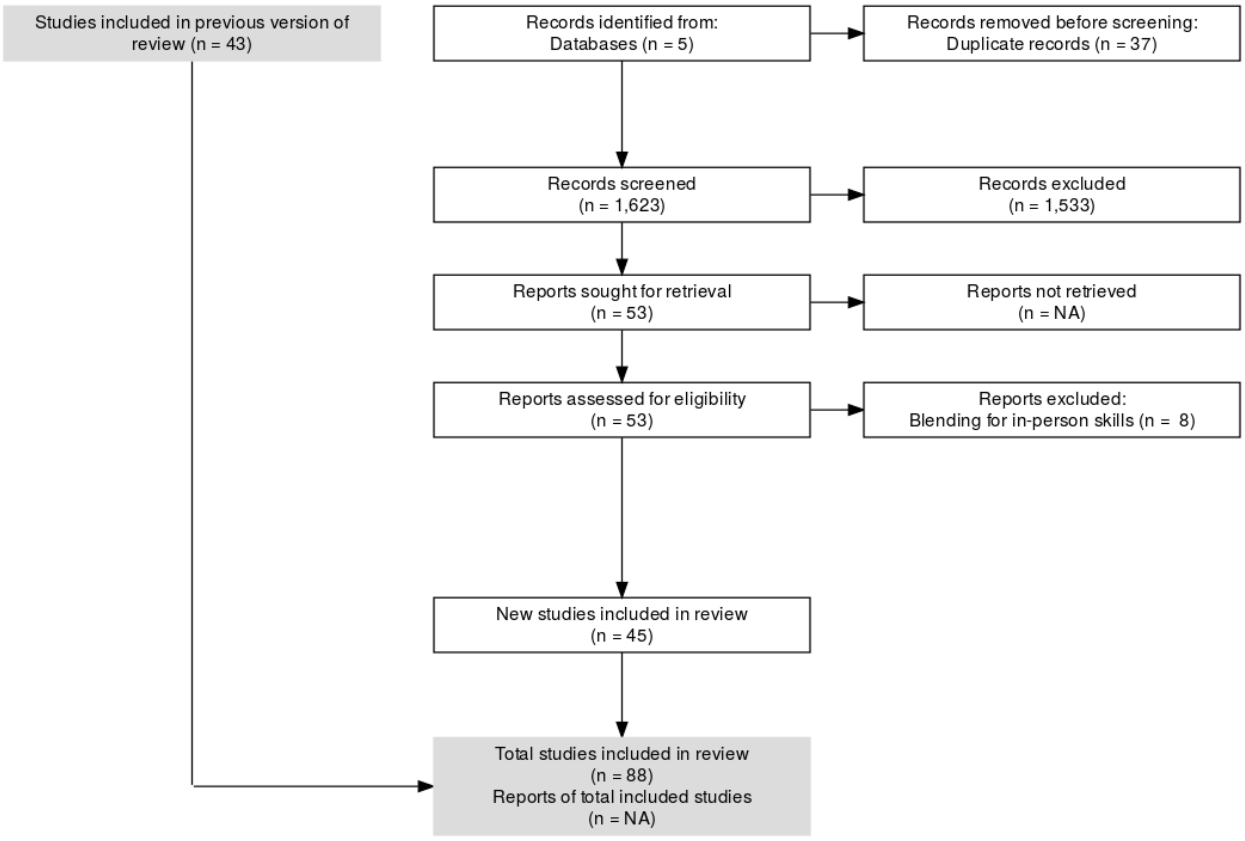


Figure 2

PRISMA Flow Diagram for the Final Search



Many articles used "blended" to describe teaching in two languages, teaching multiple subjects at once (e.g., math and science), or combining classes for in-service and pre-service teachers, but did not include the strategic combination of online and in-person modalities. Because literature that did not focus on BT as the strategic combination of in-person and online instruction and K–12 teacher preparation could not answer the research questions, we excluded articles using "blended" in other ways. In the first search, these were excluded after retrieving full text copies of each article. Due to the larger volume of search results in the second search, these were excluded prior to retrieving full text articles. Also excluded from the final search prior to retrieving full text copies of each article were articles that did not focus on K–12 contexts (e.g., articles focused on using BT in schools of medicine).

Many of the articles from the initial and final searches focused on using BT for teacher preparation courses or professional training but focused on developing in-person teaching skills rather than developing teachers' BT skills. While experiencing professional learning through blended learning might help prepare teachers to blend themselves, such modeling is unlikely to provide teachers with the additional knowledge and skills needed for BT. Such articles were only included if they presented evaluations of how the BT pedagogy affected teachers' perceptions of or plans for using BT.

After applying the criteria above, we selected 88 articles for this trend analysis. These 88 articles were analyzed and categorized based on the insights they provided for the research questions.

Analysis Process

We used content analysis techniques to identify patterns in the research related to the research questions and findings. We used identified patterns to synthesize findings across sources to illustrate the current state of research in this area and to suggest areas for development. Research that emerged from the 88 articles included (a) literature reviews and general descriptions of blended learning meant to provide context for K–12 BT research and practice, (b) university coursework and professional development for BT preparation, (c) competencies and implementation practices used to guide BT preparation, and (d) instruments for measuring aptitude related to BT (see Figure 1). Despite these unifying themes, our analysis suggests that additional research is needed in each of these areas to better specify practices and frameworks for guiding teacher preparation. Additionally, the analysis identified the outlets most commonly used to share research in K–12 BT, the impact of research based on citation counts, and the methods used for such research.

Limitations

We used content analysis techniques (Krippendorff, 2004) to identify patterns in the articles' research questions, methods, and findings. By uncovering patterns in research methods and topics of study, we were able to synthesize findings across sources to illustrate the current state of research in this area and to suggest areas for development. This method of analysis aligns with the methods of a "mapping review" as suggested by Grant and Booth (2009) in that it attempts to characterize a set of literature based on its key features. Such reviews provide a contextualization of research within an established group of literature and can lay the foundation for further in-depth reviews of literature. Studies from the 88 articles included (a) literature reviews and general descriptions of blended learning meant to provide context for K–12 BT research and practice, (b) design and descriptive studies of university coursework and professional development for BT preparation, (c) descriptions of competencies and implementation practices used to guide BT preparation, and (d) instruments for measuring aptitude related to BT (see Figure 3). Despite these organizing themes, our analysis suggests that additional research in each of these areas can better specify practices and frameworks for guiding teacher preparation. Additionally, the analysis identified the outlets most used to share research in K–12 BT, the impact of research based on citation counts, and the methods used for such research.

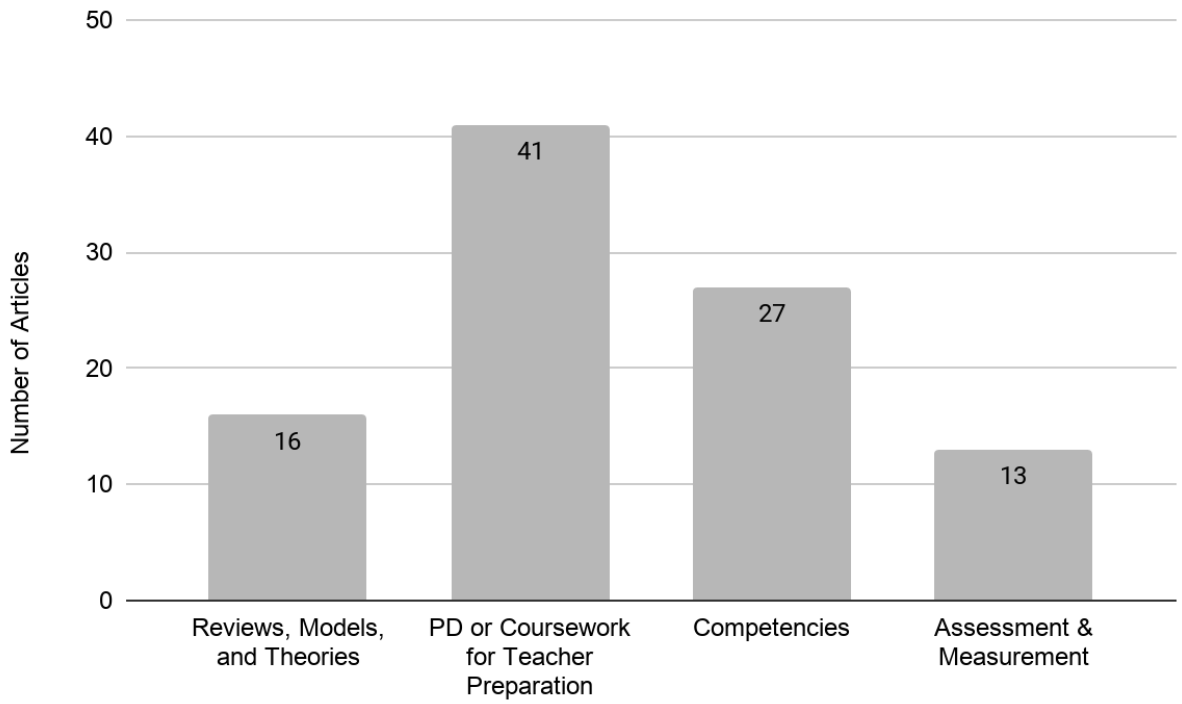
Findings

The following sections detail the findings of our analyses according to the research questions. The first section details publication outlets, demonstrating that a central location for K–12 BT research has begun to emerge, the impact of authors and articles according to citation count, and the various methods used to approach K–12 BT research questions. The second

section details findings related to research that focused on reviews, models, and theories of K–12 BT research to pave the way for future research and practice. The third section identifies themes focused on preparing teachers for BT through university coursework or professional development. The fourth section details findings related to research focused on identifying competencies needed for effective BT. The final section details findings related to research focused on K–12 BT readiness and evaluation. Figure 3 provides an overview of how many articles from our analysis are in each category discussed in the second through fifth sections. Some articles appear in more than one category due to the breadth of the research or findings.

Figure 3

Categorization of Literature According to Broad Themes



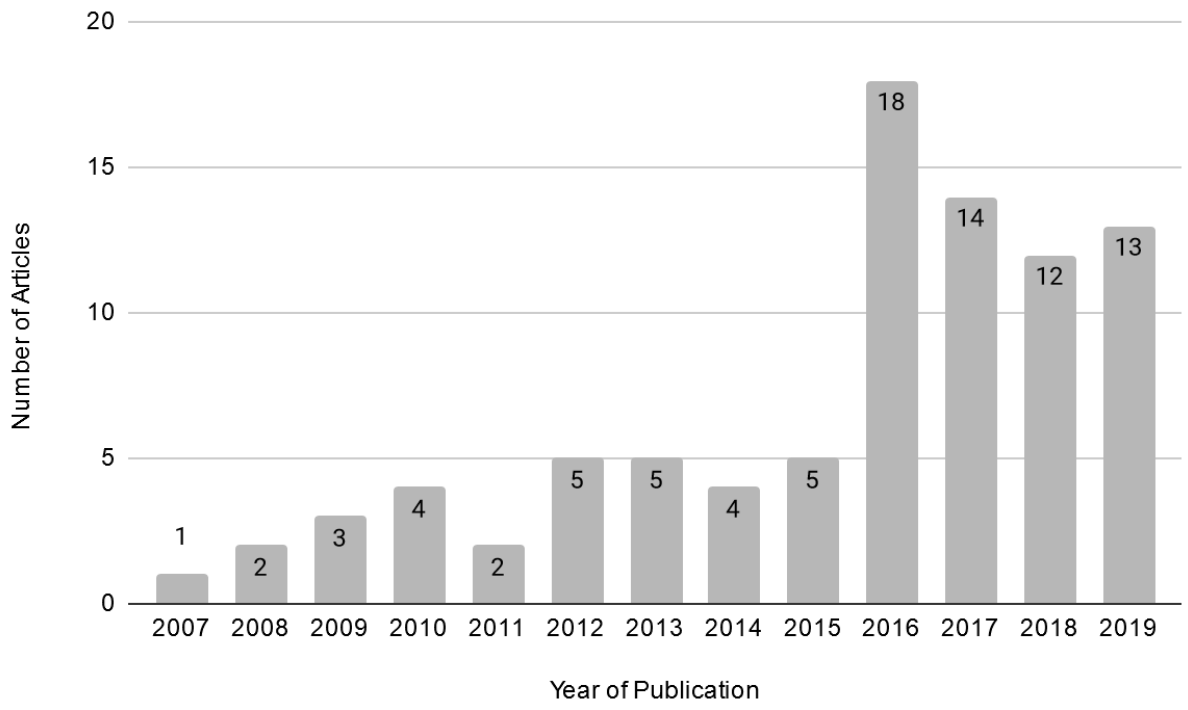
Note. PD = professional development.

Publication Outlets, Impact, and Research Methods

Most of the articles in our review were published during or after 2016 (see Figure 4), and 40.9% (n = 36) of the articles were from international contexts, either authored by international researchers or focusing on international contexts. Such diversity may account for where research is published. Multiple articles came from Australia (n = 4), Belgium (3), China (2), Greece (4), India (2), New Zealand (2), Spain (2), Taiwan (2), Turkey (3), and the United Kingdom (2), with one article each from Bahrain, Egypt, Italy, Japan, Kuwait, Malaysia, Norway, Portugal, Saudi Arabia, Serbia, South Korea, and the United Arab Emirates.

Figure 4

Years of Publication



There was a considerable rise in publications in 2016, which may be due to the creation of *The Journal of Online Learning Research* (*JOLR*), which began publishing in 2015 and specifically publishes K–12 online and blended learning research. *JOLR* produced the most

articles in our review at 13, with one article published in 2015, four in 2016, one in 2017, two in 2018, and five in 2019. As shown in Table 4, four journals published four articles each, and nine journals published two articles each. The other 42 journals cited as part of this review only produced one article each. This trend is further evidence of Graham's (2016) point that academic conversations centered on K–12 blended learning "are distributed across many disciplines and scholarly communities" (p. 28).

Table 4

Top Publishers of Articles in Our Review

No. of publications	Journal name
13	*Journal of Online Learning Research*
4	*Australasian Journal of Educational Technology*
4	*Computers & Education*
4	*Contemporary Issues in Technology and Teacher Education*
4	*Journal of Technology and Teacher Education*
2	*Contemporary Educational Technology*
2	*International Journal of Research in Education and Science*
2	*Journal of Educational Technology & Society*
2	*Journal of Information Technology Education: Research*
2	*Journal of Research on Technology in Education*
2	*Teaching & Teacher Education*
2	*TechTrends*
2	*Turkish Online Journal of Distance Education*
2	*Turkish Journal of Educational Technology*

Article and Author Impact

Despite producing the most articles for our review, *JOLR* did not produce any of the top-cited articles. Table 5 lists the top-cited articles from the review. The articles were published in both international and North American journals from 2008–2018. There were no repeated contributions by authors within the top-20 articles. Only 7 of the top-cited articles were published within the last five years, 10 were published between the years of 2011–2015, and 3 articles were published from 2008–2010. Our review identified that international articles contributed 11 of the top-20 articles and eight of the top-10. The top-performing journal was *The Journal of Technology and Teacher Education* (*JTATE*), with four articles in the top-20, followed by Computers and Education with three articles.

Table 5

Top Ranked Articles as Measured by Citation Count

Total cites	Av. cites/yr.	Year	Authors	Title	Source
260	43.33	2015	Basal	The Implementation of a Flipped Classroom in Foreign Language Teaching	*Turkish Online Journal of Distance Education*
249	19.15	2008	EL-Deghaidy and Nouby	Effectiveness of a Blended e-Learning Cooperative Approach in an Egyptian Teacher Education Programme	*Computers & Education*
240	26.67	2012	Rosen and Beck-Hill	Intertwining Digital Content and a One-to-One Laptop environment in Teaching and Learning: Lessons from the Time to Know Program	*Journal of Research on Technology in Education*

Total cites	Av. cites/yr.	Year	Authors	Title	Source
175	14.58	2009	Karasavvidis	Activity Theory as a Conceptual Framework for Understanding Teacher Approaches to Information and Communication Technologies	*Computers & Education*
152	19	2013	Jimoyiannis, Tsiotakis, Roussinos and Siorenta	Preparing Teachers to Integrate Web 2.0 in School Practice: Toward a Framework for Pedagogy 2.0	*Australasian Journal of Educational Technology*
128	32	2017	Foulger, Graziano, Schmidt-Crawford and Slykhuis	Teacher Educator Technology Competencies	*Journal of Technology & Teacher Education*
119	13.22	2012	Alayyar, Fisser, and Voogt	Developing Technological Pedagogical Content Knowledge in Pre-Service Science Teachers: Support from Blended Learning	*Australasian Journal of Educational Technology*
114	16.29	2014	Loncar, Barrett, and Liu	Towards the Refinement of Forum and Asynchronous Online Discussion in Educational Contexts Worldwide: Trends and Investigative Approaches within a Dominant Research Paradigm	*Computers & Education*
95	23.75	2017	Kurt	Implementing the Flipped Classroom in Teacher Education: Evidence from Turkey	*Journal of Educational Technology & Society*
91	18.2	2016	Hao and Lee	Teaching in flipped Classrooms: Exploring Pre-Service Teachers' Concerns	*Computers in Human Behavior*
84	12	2014	Oliver and Stallings	Preparing Teachers for Emerging Blended Learning Environments	*Journal of Technology & Teacher Education*

Total cites	Av. cites/yr.	Year	Authors	Title	Source
73	14.6	2016	Chen	Impacts of Flipped Classroom in High School Health Education	*Journal of Educational Technology Systems*
61	5.55	2010	Bjekic, Krneta, and Milosevic	Teacher Education from E-Learner to E-Teacher: Master Curriculum	*Turkish Online Journal of Educational Technology*
53	7.57	2014	Archambault, DeBruler, and Freidhoff	K–12 Online and Blended Teacher Licensure: Striking a Balance Between Policy and Preparedness	*Journal of Technology and Teacher Education*
51	5.67	2012	Dabner, Davis, and Zaka	Authentic Project-Based Design of Professional Development for Teachers Studying Online and Blended Teaching	*Contemporary Issues in Technology and Teacher Education*
50	12.5	2017	de Araujo, Otten, and Birisci	Mathematics Teachers' Motivations for, Conceptions of, and Experiences with Flipped Instruction	*Teaching and Teacher Education*
47	3.62	2008	Mouzakis	Teachers' Perceptions of the effectiveness of a Blended Learning Approach for ICT Teacher Training	*Journal of Technology & Teacher Education*
46	5.75	2013	Basham, Smith, Greer, and Marino	The Scaled Arrival of K–12 Online Education: Emerging Realities and Implications for the Future of Education	*Journal of Education*
41	13.67	2018	Pulham and Graham	Comparing K–12 online and blended teaching competencies: A literature review	*Distance Education*
40	10	2017	Song, Jong, Chang, and Chen	Guest Editorial: "HOW" to Design, Implement and Evaluate the Flipped Classroom? — A Synthesis	*Journal of Educational Technology & Society*

We also found that organizing the top-20 cited articles by average cites per year significantly changed the order. Basal (2015) remained the top-cited article but was now followed by Foulger et al. (2017). Kurt (2017) moved from the 9th position to the 4th position, followed by EL-Deghaidy and Nouby (2008), which moved from the 2nd to the 5th position. One of the significant moves was Pulham and Graham (2018), moving from the 19th to the 11th position. By positioning articles by average citation per year, articles published within the last five years moved to higher positions, showing the impact they have had in the few years they had been published.

Research Methods

Of the top-20 articles, seven articles used a combination of research methods, five presented models and theories, five presented literature review articles, and two solely used qualitative methods. All the articles that used a combination of approaches used qualitative methods, making qualitative analysis the most common method overall. This trend was typical of all 88 articles (see Figure 5). Table 6 describes the various research methods identified in the articles.

Table 6

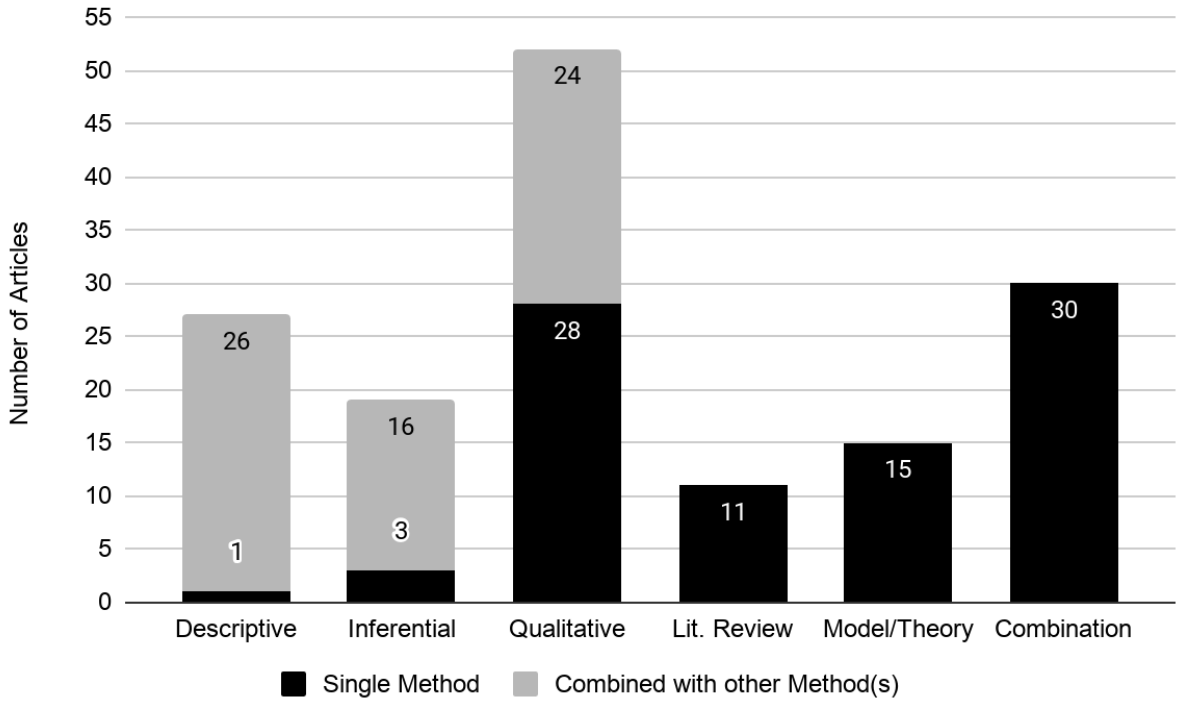
Description of Research Methods

Method	Description	Methods/characteristics
Descriptive	Used descriptive statistics	Mean, median, standard deviation, count, averages
Inferential	Used inferential statistics	Experiment, causal, correlation, ANOVA, Chi-Square, t-tests, p-value, factor analysis, component analysis
Qualitative	Used interpretive and descriptive qualitative analysis	Case study, naturalistic inquiry, interview, focus group, open-ended survey, quote, phenomenology, ethnography, interpretative lens
Literature Review	Focused on introducing or explaining the extent of prior blended learning research through an analysis of literature	Tendency to focus on blended learning trends or research in a general sense, as opposed to specific contexts or developments
Model/Theory	Suggested, extended, or applied a theory thoroughly, including implementation practices	Exclusion of frameworks merely cited to provide background or context
Combination	Used more than one kind of empirical data analysis	Any multiplicity of data analysis, regardless of which or how many

Figure 5 demonstrates the prevalence of research methods employed throughout all the articles. Qualitative approaches were employed in 52 of the 88 articles, with 28 of those solely using qualitative approaches and 24 combining qualitative analysis with other methods. Most of the articles (n = 30) used a combination of approaches in their research. Six of these articles used descriptive and inferential methods, 14 used descriptive and qualitative methods, four used inferential and qualitative methods, and six used all three approaches.

Figure 5

Research Methods Employed

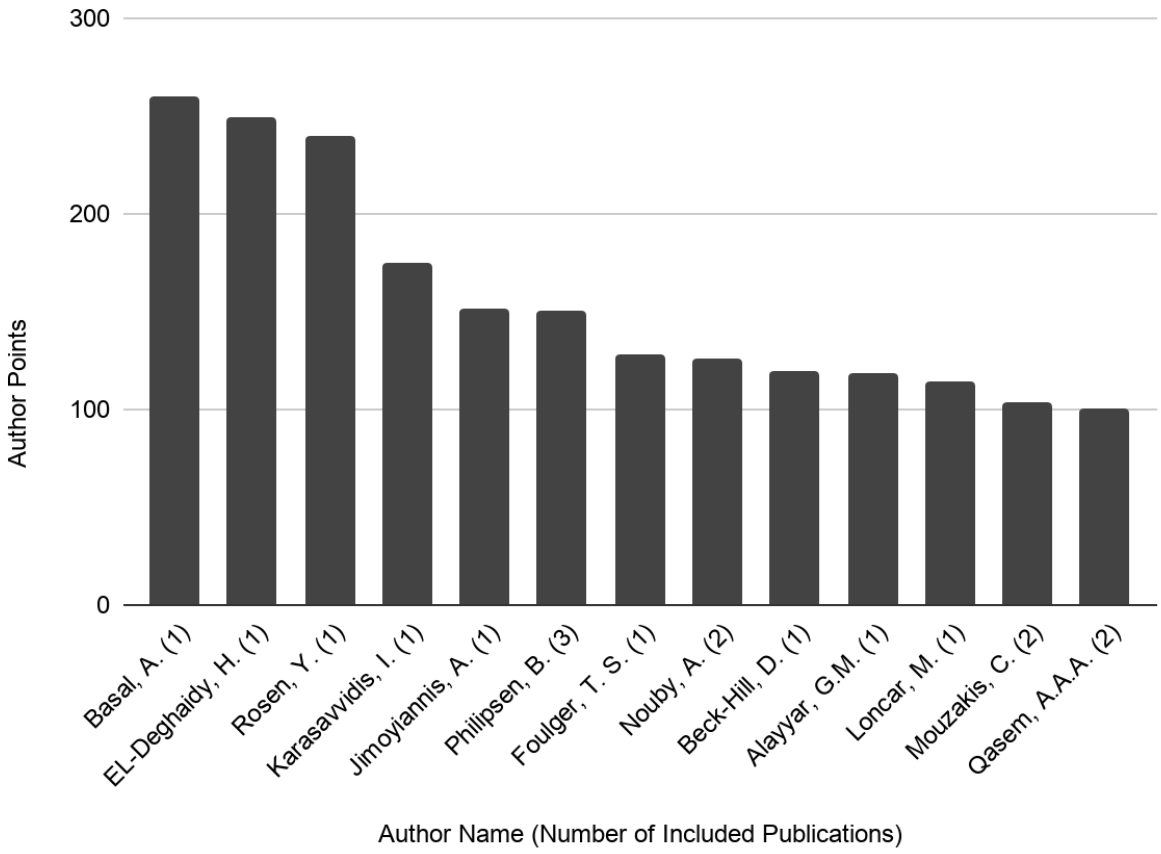


Author Impact

We awarded each author one point for a first authorship and a half-point for secondary authorships. These point totals were multiplied by the number of citations for the articles in which they were listed as an author. This method of calculating impact has been used in previous BT literature reviews (see Halverson et al., 2012). For example, Charles R. Graham had one first authorship with 14 citations and three secondary authorships with eight, 14, and 46 citations. He received 14 points for the first authorship and a combined 34 points for his secondary authorships for a total of 48 author points. Figure 6 shows the authors who received 100 or more author points.

Figure 6

Top Authors According to Author Points



A total of 183 authors contributed to the articles in this review. International authors are well represented in the top authors, the top two being from international contexts as well as nine of the top thirteen. Most of the authors on the top-ranked author list contributed only one article for which they were the primary author. Philipsen, however, ranked 6th contributed three publications as the first author. Nouby contributed two articles, both as a secondary author, including a co-authorship with EL-Deghaidy, ranked second. Mouzakis and Qasem both contributed two articles as the first author. The author with the highest author points was Ahmet Basal from Turkey earning 260 points from the top-cited article (see Table 5), for which he was

the first author. Philipsen and Qasam are the only authors to earn more than 100 author points who did not author a top-cited article.

While total citations can measure an author's impact, it is also important to note how many authors had multiple authorships. Of the 183 authors present in our review, only 19 authored more than one article. Of those 19, six had at least two first authorships, with Philipsen being the only author with three first authorships. However, the authors with the most authorships were Graham, and Borup, who both had four articles in our review. Table 7 lists the authors who had more than one authorship and their authorship position.

Table 7

Authors With Multiple Publications

Total publications	Author name	Primary authorship	Secondary authorship
4	Charles R. Graham	1	3
4	Jered Borup	-	4
3	Brent Philipsen	3	-
3	Emily B. Pulham	2	1
3	Jo Tondeur	-	3
2	Charalambos Mouzakis	2	-
2	Arwa Ahmed Abdo Qasem	2	-
2	Kristen Shand	2	-
2	Mark Stevens	2	-
2	Karen Arnesen	1	1
2	Kevin J. Graziano	1	1
2	Pinelopi Zaka	1	1
2	Michael K. Barbour	-	2
2	Susan Glassett Farrelly	-	2
2	Ahmed Nouby	-	2
2	Cecil R. Short	-	2
2	Silke Vanslambrouck	-	2
2	Gandla Viswanathappa	-	2
2	Chang Zhu	-	2

Reviews, Models, and Theories

Of the 88 articles, five articles were literature reviews, and 11 presented models and theories to guide implementation or further research. Loncar et al. (2014) presented a literature

review focused on the uses of asynchronous online discussions across K–12 and higher education settings. Like Halverson et al. (2012) and Drysdale et al. (2013), Loncar et al. (2014) found that there was a lesser focus on K–12 contexts than on higher education contexts but presented a less stark contrast — 21% of research focused on K–12 with the remainder focusing on higher education. Oliver and Stallings (2014) similarly noted in their review that "the bulk of articles referenced in this review are based in higher education, [but] the teaching considerations are generally applicable to K–12 blended learning" (p. 59). Parks et al. (2016) highlighted BT's social desirability and suggested that current professional development (PD) may not accurately measure such training's effectiveness. This suggestion is important, as Greene and Hale's (2017) thematic analysis of research on K–12 online and blended learning found that "there is a substantial need for teachers who are prepared to best facilitate learning that lives up to the potential of both modes of education," asserting that both in-service and pre-service teachers "must have opportunities for meaningful PD in the arena of blended and fully online curriculum design, pedagogy, and facilitation" (p. 147). Lastly, Hu et al. (2019) analyzed the 51 articles published in *JOLR* from 2015-2018, and confirmed *JOLR* as a center for research focused on K–12 BT.

The 11 articles focused on providing models, theories, and definitions for guiding BT preparation and implementation had various approaches to the same challenges. Eisenbach (2016), Hoskins (2011), Jimoyiannis et al. (2013), and Song et al. (2017) all noted the changes to traditional practices that must occur to implement BT. Jimoyiannis et al. (2013) explained that integrating Web 2.0 resources into the classroom requires a pedagogical strategy shift. Song et al. (2017) provided illustrations of some of these shifts when transitioning to flipped instruction. Hoskins (2011) noted that leaders of distance and continuing education who already understand

the process of transitioning away from traditional in-person teaching need to support K-12 efforts in such shifts. Basham et al. (2013) and Holland and Piper (2016) made similar calls for leadership in BT implementation. Basham noted that "leadership is required if online and blended learning is to meaningfully impact education" (p. 57).

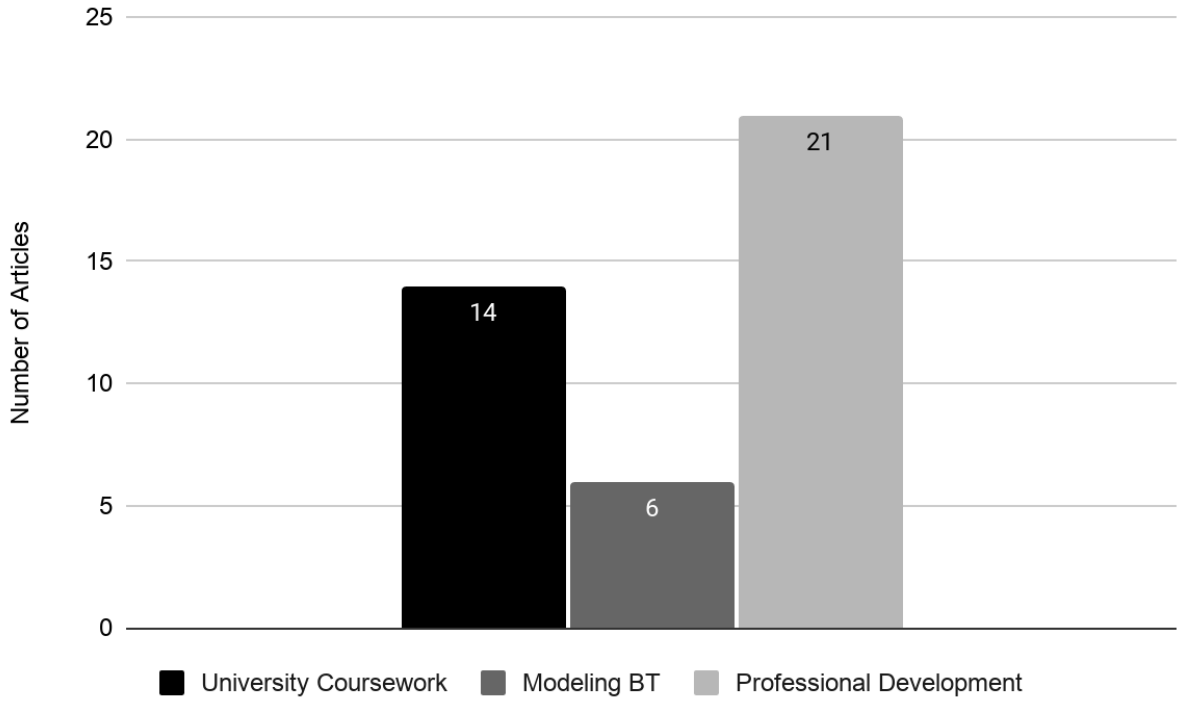
One reason leadership is seen as essential to implementing BT is that many teachers seem to have insufficient knowledge or resources to learn how to blend independently. Hadjiathanasiou (2009) noted teachers believed the implementation of BT required more preparation time than they were used to, and such time would be a deterrent to many of them. Lewis and Dikkers (2016) supported this notion, noting that many teachers felt that continued training was needed to implement BT even after receiving professional development. This determination seems to be a fairly universal experience for K–12 teachers, as Kundu (2018) noted a similar phenomenon with BT implementation in Indian elementary schools. Duhaney (2012) suggested that using BT in teacher preparation courses could help new teachers understand how to implement it in their future classrooms. Graziano and Bryans-Bongey's (2018) survey of 215 leaders of teacher education programs found that change within these programs is complicated due to the high demands already placed on teacher education.

University Coursework and Professional Development

Figure 7 illustrates the categorization of the 43 articles focused on using PD or university coursework to prepare teachers for BT. There were three methods used to prepare teachers for BT. The first was to have university coursework intentionally focused on preparing teachers for BT. Second, some teacher preparation courses used BT as a teaching method and then evaluated how it impacted teachers' perceptions of and plans for BT. Lastly, 21 articles focused on the impacts of PD on BT readiness.

Figure 7

Categorization of Articles Focused on BT Preparation



University Coursework

The 14 articles focused on BT coursework had a few thematic similarities. For example, Alayyar et al. (2012) and Turvey (2010) sought to provide frameworks for BT preparation. Turvey (2010) provided a framework for helping teachers develop their BT skills beyond the scope of a single course through reflections, while Alayyar et al. (2012) used Mishra and Koehler's (2006) TPACK framework to build BT skills with pre-service science teachers. Bromley et al. (2014), Daum and Woods (2015), EL-Deghaidy and Nouby (2008), and Piotrowski and Witte (2016), also provided research focused on BT preparation within content-specific methods courses – literature, physical education, science, and English, respectively. It was more common for articles to focus on courses geared explicitly toward BT preparation. Some of these courses were for undergraduate pre-service teachers (Arnesen et al., 2019; Luo et

al., 2017; Shand & Farrelly, 2017; Shand & Farrelly, 2018; Zhang, 2010), while others had a focus on graduate-level courses (Dabner et al., 2012; García-Sánchez & Santos-Espino, 2017; Kennedy & Hinkley, 2009; Walta & Nicholas, 2013). Most of these articles reported that students had positive perceptions of BT and would be comfortable implementing some aspect of BT in their classrooms.

Modeling BT in University Coursework

Six articles examined the use of BT for in-person teaching strategies but included some evaluation of how the BT impacted teachers' perceptions of BT and plans for BT implementation. For example, Crawford and Jenkins (2018) found that pre-service music teachers in a team teaching and BT context responded positively to the BT, with some teachers choosing to emulate the BT in their future classrooms. Kurt (2017) experienced similar findings with pre-service English teachers in Turkey. Other researchers focused on how specific BT tools impacted teachers' perceptions of BT. Doğan and Gülbahar (2018) investigated uses and perceptions of social media for BT. Donne (2012) took a similar approach to wikis. Lastly, Karasavvidis (2009) and Lee and Martin (2019) analyzed teacher's use of computer-supported collaborative learning and computer-assisted language learning, respectively, to understand how teachers' experiences with technological and pedagogical activities impacted their perceptions and plan to use such approaches in their future classrooms. Both articles identified benefits to their BT approaches that teachers wanted to implement in the future.

Professional Development for BT

Twenty-one articles focused on using PD to provide teachers with the training needed to implement BT. Many of these articles described various models for preparing teachers for BT. Some of these models used online training components to model BT practices (Al-Doseri et al.,

2016; Lim, 2017; Mouzakis, 2008; Mouzakis et al., 2010; Wayer et al., 2015; Zhou et al., 2007; Ziegenfuss et al., 2019) and others combined both online and in-person training (Rieckhoff, 2018). Other models presented programs and evaluations of programs for preparing teachers for BT (Moore et al., 2017; Philipsen, 2019; Philipsen, Tondeur, Pareja Roblin, et al., 2019; Philipsen, Tondeur, Pynoo, et al., 2019; Puhala, 2018; Qasem & Viswanathappa, 2016a; Stevens et al., 2018). These articles highlight important characteristics to consider when planning PD for BT.

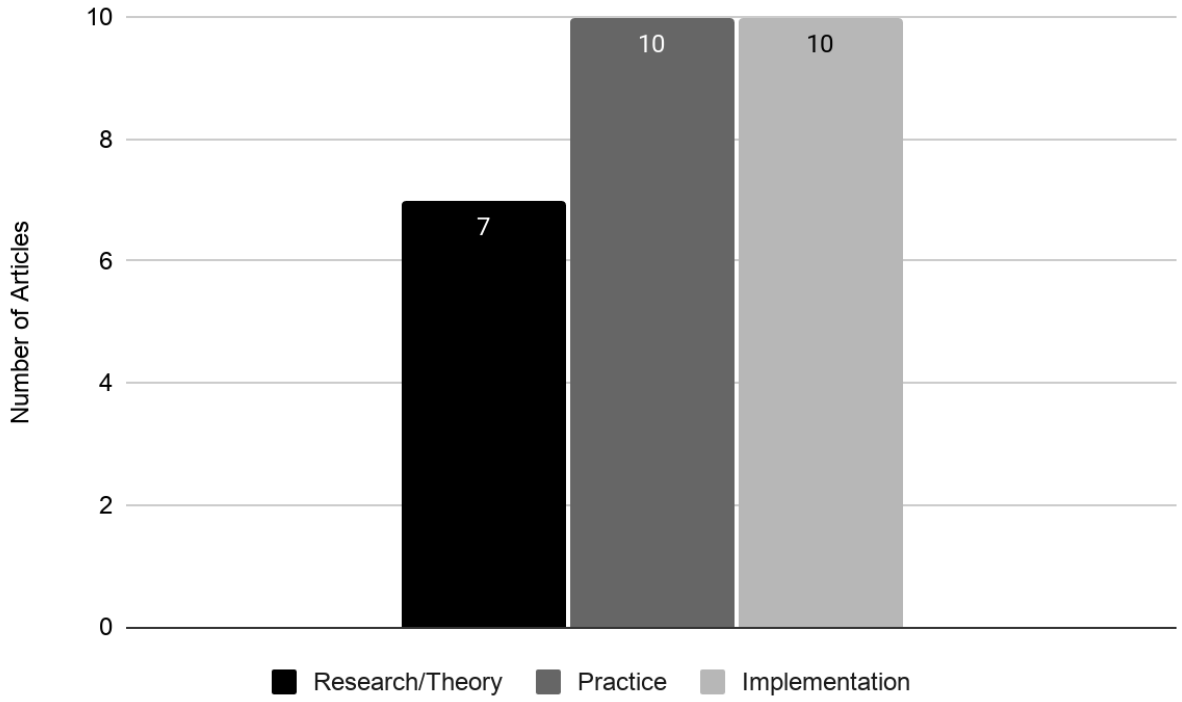
Other articles were more specific in their PD focus. For example, Azukas (2019) focused on PD for personalized learning, Bjekic et al. (2010) focused on the new roles that BT requires, and Goodnough and Murphy (2017) focused on flipped instruction. Some articles also focused on PD for specific BT tools, such as mobile technology (O'Sullivan & Seabra, 2016) or a particular learning platform (Papadakis et al., 2012). Regardless of focus, these articles provide valuable insights for researchers and practitioners seeking to lead PD for BT, and most incorporated some level of evaluation of their PD and suggestions for future research and implementation.

Competencies for BT

The competencies used to guide teacher preparation for BT fell into three categories: (1) competencies derived from research/theory, (2) competencies derived from BT practices, and (3) competencies derived from the process of implementing BT. Figure 8 illustrates article distribution among these categories. Most of the articles either presented competencies derived from examples of BT practices or experiences with BT implementation. The remaining articles derived competencies from reviews of research or theoretical foundations.

Figure 8

Categorization of Articles Focusing on BT Competencies



Research/Theory-Derived Competencies

Seven articles focused on BT competencies derived from research or theory. Some articles were broad in their focus, such as Foulger et al. (2017), which provided 12 technology-focused teacher competencies — a few directly related to BT. Others, such as Oliver and Stallings (2014), Pulham and Graham (2018), and Pulham et al. (2018), provide syntheses of existing competency frameworks to identify competencies pertinent to BT. The remaining articles took different approaches toward BT competencies. Al-Doseri et al. (2016) provided an overview of competencies created to lead their PD efforts. Archambault et al. (2014) provided an analysis of state policies related to online and blended learning, highlighting the competencies that states expect teachers to develop for BT. Bjekic et al. (2010) focused on developing a curriculum that provides teachers with the skills needed for various roles they must fulfill in BT.

In all cases, these competencies help create a theoretical framework for designing coursework or PD for BT preparation.

Practice-Derived Competencies

Ten articles derived competencies from researching established BT practices. Two of these studies compared traditional teaching practices to BT to demonstrate how traditional best practices can still be applied to BT (Anthony, 2019) but that BT allows for more adaptive approaches to instruction (Rosen & Beck-Hill, 2012). Basal (2015), Shaffer (2016), and Webel et al. (2018) focused on the competencies needed for flipping instruction, while Amro and Borup (2019), Oliveira and Pombo (2017), and West et al. (2017) focused on specific technologies important to BT — adaptive software, educational software, and videos for communication, respectively. While technology skills provide an essential foundation for BT, there is also a need for pedagogical skills. In their literature review, Oliver and Stallings (2014) included three broad skill categories to consider in designing BT. Lastly, Stevens and Rice (2016) provided some competencies for BT management through increased presence.

Implementation Competencies

The 10 articles in this final competency category presented competencies uncovered during implementing or transitioning to BT. While most of the articles focused on the skills that individual teachers need, Bingham (2016) and Sun and Gao (2019) reported the importance of clear roles for teachers, administrators, and other leaders in establishing school-wide BT. Competencies for individual teachers focused on overcoming barriers related to implementing BT. Such barriers included the lack of professional development or training for BT, the need for ongoing support, and managing the various aspects of BT, e.g., curriculum coordination between in-person and online spaces, student motivation inside and outside of the classroom, and

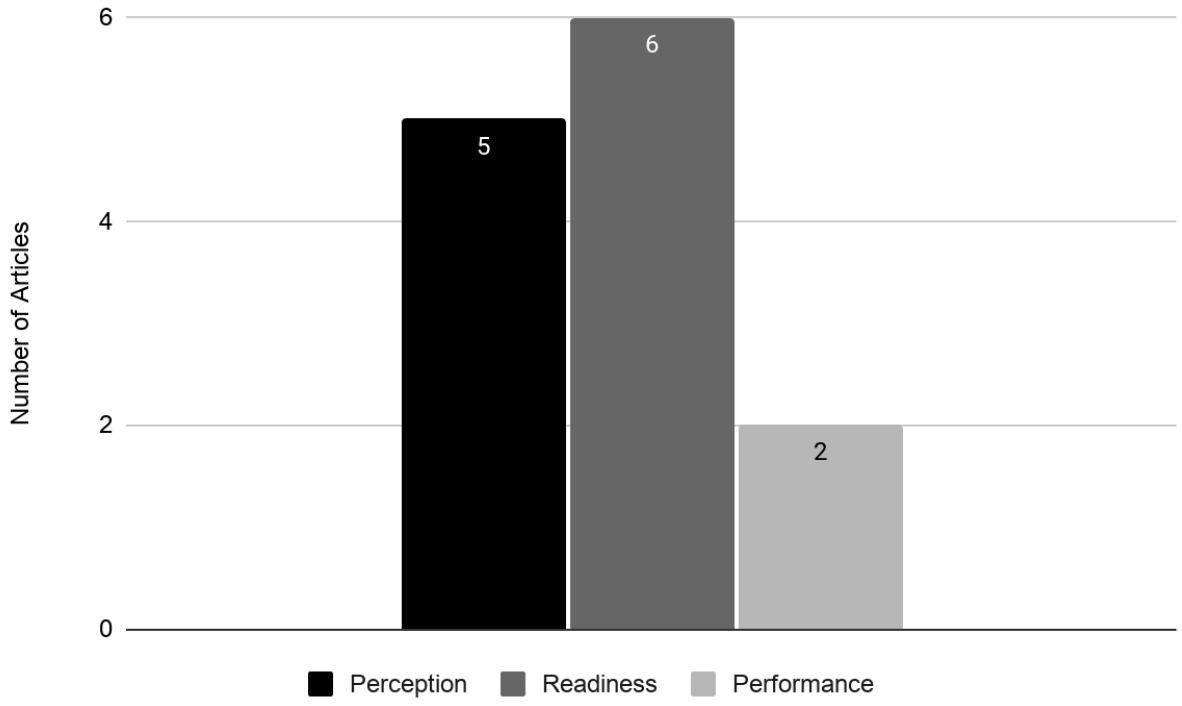
technology problems (Akarawang et al., 2015; An, 2013; Riel et al., 2016). Zaka (2013) and de Araujo et al. (2017) focused on teachers' changing roles as a specific barrier to implementation and provided some guidelines for managing such changes. Basham et al. (2013) and Chen (2016) noted that one BT change is a heavier focus on motivating students by communicating with stakeholders at home or gathering student support for practices that place more ownership on them. Lastly, Ojaleye and Awofala (2018) discussed the importance of computer literacy as a prerequisite for BT implementation.

BT Readiness and Evaluation

Figure 9 illustrates the distribution of articles within the categories of measuring teacher perception of, readiness for, or performance within BT. These categories represent the smallest of our review, hosting 13 articles total, but they are closely related to the previous category focused on competencies because most of the readiness and evaluation instruments sought to measure competencies or dispositions.

Figure 9

Categorization of Articles Focusing on BT Measurements and Evaluations



The five articles focused on measuring teachers' perceptions of BT included articles that measured in-service teachers' reactions to PD for BT and their own experiences using BT, and pre-service teachers' reactions to BT in their courses. In-service teachers generally had a positive perception of BT, recognizing its benefits to both themselves and their students (Al-Derbashi & Abed, 2017; Alfahadi et al., 2015; Qasem & Viswanathappa, 2016b). Pre-service teachers also generally reported positive perceptions of BT, stating that their experiences made them more likely to implement BT (Arnesen et al., 2019; Basal, 2015; EL-Deghaidy & Nouby, 2008).

Six articles used various instruments to measure aspects of teachers' BT readiness. Graham et al. (2019), with follow-up validation work by Archibald et al. (2021), and Wong et al. (2016) analyze teachers' dispositions toward aspects of BT, with Graham et al. (2019) providing additional measures regarding teachers' self-reported efficacy across four competency areas, and

Wong et al. (2016) exploring the relationship between different dispositions. Other readiness measures included measurements of teachers' concern about implementing BT and measurements concerning whether prior experience or education affected teachers' BT readiness. Despite teachers' levels of concern or previous experiences, Hao and Lee (2016) and Kihoza et al. (2016) suggested that all teachers needed additional BT development. The need for help, regardless of perceived readiness, could be due to teachers claiming to be efficient in BT despite their deficiencies (Belmonte et al., 2019), likely due to BT's social desirability (Parks et al., 2016).

The final two articles focused on measuring BT performance and related such measurements to BT preparation. Huett et al. (2011) used iNACOL's National Standard of Quality for Online Courses to evaluate online courses at a high school and blended courses at a middle school. They discovered that blended courses scored lower than the online courses in their evaluations and suggested the need for a separate metric for evaluating BT courses. Anthony (2019) used her own evaluation metrics to observe, measure, and compare teaching practices and student performance across six BT elementary classes divided into three high-performing and three low-performing classes. There were five areas of differences between the two groups: (1) flexibility and responsiveness of the teacher, (2) using assessment in instructions, (3) engaging students, (4) clarity of the lesson's learning outcome, and (5) reinforcing and recognizing effort. The high-performing classes demonstrated more practices related to areas 1–3, while the low-performing classes demonstrated more practices related to areas four and five.

Discussion

Due to geographical and publication location complexity, it was understandable that our literature search underwent many iterations. We noticed immediately that the articles we

uncovered used many terms for "BT." While K-12 BT research seems to shy away from the term "hybrid," it was surprising to note how many articles did not appear in the search until "flip*" was added to the search terms. Flipped instruction was separated from searches for general BT articles, while other BT models, such as the Christensen Institute's (2021) rotation models, did not appear to impact the search results. Such findings could demonstrate a conceptual separation between general BT approaches and specific BT implementations like flipped instruction.

Within many international contexts, BT was referred to as information and communication technology (ICT) integration. For example, Karasavvidis (2009), our fourth most cited article, uses "ICT" throughout the article, only referencing the idea of a "blend" twice — once in the abstract and once in describing the context of their research. Similarly, Jimoyiannis et al. (2013) use "blended" throughout their article, but not in their title or abstract. Given that 40.9% of our articles had international contexts, search term challenges are essential to overcome for anyone researching this area. It is imperative to include international research in reviews of K1-2 BT because they accounted for 15 of the 31 articles in our review published before 2016, providing a valuable foundation for the field.

Another challenge pertaining to BT literature is publication outlets. The articles in our analysis stemmed from 56 different journals, but only 14 of those published more than one article, and only five published more than two. This pattern is concerning for those seeking to publish K-12 BT preparation research. While *JOLR* appeared to be a center for many publications, it did not appear in the list of top-cited publications. This phenomenon may partly be because *JOLR* is relatively new and has not yet been indexed by some major indices (e.g., Journal Citation Reports or Scimago Journal Rank). *JOLR*'s top-cited publications in our review were Riel et al. (2016) with 27 citations, Parks et al. (2016) with 25, and Shand and Farrelly

(2017) with 23. These articles ranked 25th, 27th, and 28th for total citations, and ranked 22nd, 26th, and 27th for citations per year, respectively. These rankings may illustrate that *JOLR* is growing as a publication and that the journal may provide a more considerable impact in the future.

A final concern about K–12 BT preparation research is who is part of the conversation. As seen in Table 7, only 19 of the 183 authors in our review authored multiple articles. This trend suggests that most of the research in this field has been completed by those whose primary interests lay elsewhere. Relatively few articles directly focused on preparing K–12 teachers for BT. Most provided insights into BT preparation from either research that had a broader focus, such as Foulger et al.'s (2017) Teacher Educator Technology Competencies or Oliver and Stallings's (2014) review of BT literature across higher education and K–12 or presented implications of BT preparation gleaned from BT implementation, such as the top-cited publications from Basal (2015) and Rosen and Beck-Hill (2012). The lack of research directly related to BT preparation highlights the need for more research across all thematic areas.

For example, there does not appear to be agreement on what should constitute BT competencies. Some competencies were based on adaptations of existing frameworks, such as Pulham and Graham's (2018) review or Huett et al.'s (2011) use of iNACOL's National Standard of Quality for Online Courses. Other competencies were presented as entirely new frameworks for use in PD or university coursework (Al-Doseri et al., 2016; Bjekic et al., 2010) or as part of entirely new frameworks (Foulger et al., 2017). Research is needed to test the application of various competencies to BT preparation. Perhaps researchers could use readiness measurements described in the final section of our findings to measure how PD or coursework

based on various competencies sets affect BT readiness. Such research could provide more descriptive and inferential research to the field, as these methods were under-represented.

Other research opportunities also exist across each of the identified thematic areas. We intend to complete a deeper thematic review of all 88 articles to go beyond subject trends and focus on the articles' findings and remaining research gaps. There is also room for research exploring broader thematic gaps. For example, the flipped model seems to dominate other models in research about BT implementation. There is a need to uncover whether and how the implementation of other BT models differs from flipped instruction. There is also a need for research concerning university coursework and PD that goes beyond the limited timeframe in which teachers receive BT training. Research could focus on the long-term effects of PD in practice or of BT coursework upon entering the profession. Research could also identify best practices within PD and university coursework for BT.

Conclusion

This systematic review analyzed the research trends of 88 articles focused on preparing K–12 teachers for BT. We identified the most impactful articles and authors according to citation count, the most prolific journals, and the most common research methods. We additionally identified broad themes according to the articles' research questions and findings. Our analysis uncovered that a large percentage of research in K–12 BT preparation is from international resources, and that the largest publisher of K–12 BT preparation research is *JOLR*. Thematically, more articles focused on university coursework or professional development for BT preparation than on BT competencies. However, more research focused on BT competencies than on reviews, models, and theories for BT preparation or on assessments and measurements of BT readiness and performance. Additional research is needed to synthesize the findings of the

articles in our review. There is also a need to determine the relationships between various forms of PD, coursework, and competencies and their effect on BT implementation and performance, as well as whether implementation and preparation differ from one BT model to another.

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ARTICLE 2

K–12 Blended Teaching Skills and Abilities: An A Priori Analysis of Blended Teaching Artifacts

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Abstract

Several professional organizations, non-profit groups, and researchers have provided K–12 blended teaching (BT) competencies; however, few of these have connected competencies to concrete practices. This analysis used a set of research-based BT dispositions, technology skills, and competencies (i.e., proficiencies) to analyze a representative sample of 959 artifacts focused on BT practices to uncover the proficiencies important to K–12 BT. The dispositions recognized for BT appeared in 87.9% of the artifacts, personalization competencies in 58.3%, technology skills in 54.0%, data practices in 46.0%, implementation competencies in 37.1%, online integration competencies in 30.4%, and online interaction competencies in 5.6%. Each of these areas was analyzed in more detail, looking at specific examples and frequencies within each category. These findings provide a foundation for future research seeking to understand the competencies and practices important to K–12 BT.

Keywords: elementary education, secondary education, blended teaching, teacher education

Introduction

Prior to the COVID-19 pandemic, strong evidence supported the widespread increase in K–12 online and blended teaching (BT) throughout North America. Some measurements of BT implementation are difficult to obtain because they occur in individual classrooms, practiced by individual teachers (Graham, 2019). However, from 2016 to 2018 enrollment in full-time U.S. virtual schools increased by 2,000 students to include a total of 132,960 students in 501 virtual schools, and during the same time period, enrollment in full-time blended learning schools increased by over 16,000 to include 297,712 students in 300 schools (Molnar et al., 2019). Canada has experienced similar growth, with over 300,000 students enrolled in distance and online programs in 2019 (Archibald et al., 2020).

The expectation and trend of widespread increase in online and blended learning has raised awareness of the need for state education departments, teacher educators, and school districts to prepare teachers for teaching via the online space (Archambault et al., 2014; Ferdig & Kennedy, 2014). Additionally, the 2017 update to the U.S. Department of Education's National Education Technology Plan recommended preparing more teachers for online and blended learning (p. 40). But these statements of need have been widely unanswered (Kennedy & Ferdig, 2018), with only two states responding to mandate online and/or BT preparation as part of K–12 teacher credentialing (Minnesota S. Bill 273, 2012; Utah Office of Administrative Rules, 2019). As a result, many K–12 teachers and teacher educators were unprepared for the emergency remote learning required by the COVID-19 pandemic, lacking both the skills and resources they needed to teach effectively (Hodges et al., 2020).

As the pedagogical panic during the pandemic forced K–12 teachers to use online teaching methods for the first time, many K–12 teachers have observed the affordances of using

the online space as part of day-to-day instruction and want to implement some of the benefits of online instruction into their in-person practices when in-person teaching resumes (Hartshorne et al., 2020). Teachers and teacher educators must know how to combine online and in-person teaching practices. But current research into BT competencies is limited, and evidence designed to connect BT to a set of research-based and -validated competencies is even more deficient. The research reported in this article used a set of such BT competencies to understand their prevalence within the practices of experienced K–12 teachers who use blended modalities.

Literature Review

Broadly conceived, BT combines in-person and computer-mediated or online instruction (Garrison & Kanuka, 2004; Graham, 2006). Some of the most popular definitions of K–12 BT add that BT provides personalization as students can control some aspects of the time, place, pace, and/or path of instruction (Horn & Staker, 2011; Watson & Murin, 2014). Recent research, however, has suggested that while personalization can be a benefit of BT, such pedagogies are not essential to BT (Arnesen et al., 2019). Other popular K–12 definitions of BT describe specific models that may be used as part of BT implementation. Staker and Horn (2012) described four models of BT: (a) the rotation models, (b) the flex model, (c) the self-blend model, and (d) the enriched virtual model. Rotation and flex models are less disruptive to in-person learning, as the bulk of learning still takes place within the brick-and-mortar school, directed by the teachers, whereas the self-blend and enriched virtual models require that students have more control over their learning and that learning takes place mostly outside the brick-and-mortar school, respectively. Regardless of the pedagogical approach or the model employed, specific competencies are needed for K–12 teachers to blend effectively.

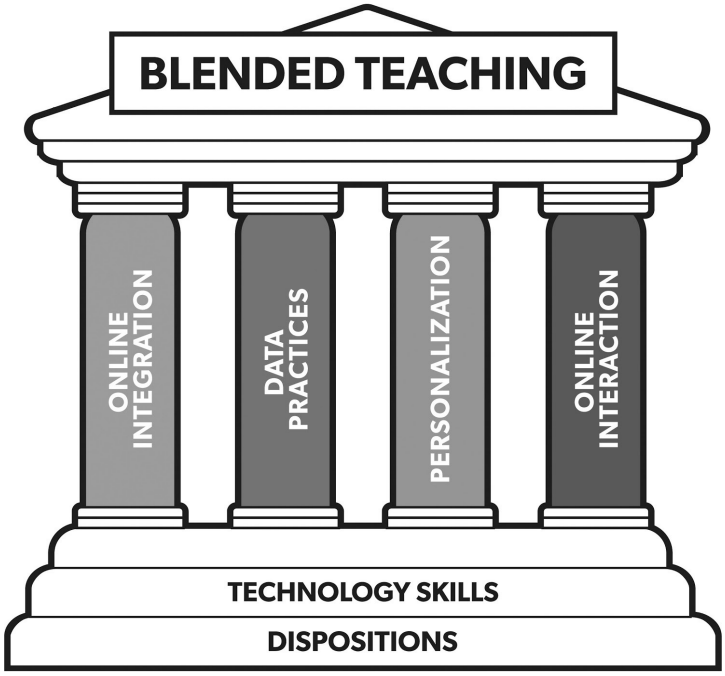
Current research concerning K–12 BT competencies (i.e., the knowledge, skills, and abilities needed to strategically combine online and in-person instruction) is limited, as K–12 online learning practices have developed more quickly than related research (Barbour, 2020). A systematic review by Oliver and Stallings (2014) concerning BT course design and teaching issues consisted mostly of literature focused on higher education; they noted that "the teaching considerations are generally applicable to K–12 blended learning, with certain recommendations likely more crucial for K–12 settings than for higher education settings (e.g., scaffolding student learning processes and technology use)" (p. 59). Research focused more directly on K–12 BT has highlighted differences between in-person or online teaching skills and BT skills, arguing that BT differs considerably from both online and in-person teaching and therefore requires preparation of distinct skillsets and pedagogies (Bjekic et al., 2010; Eisenbach, 2016; Ojaleye & Awofala, 2018; Riel et al., 2016).

Pulham and Graham (2018) responded to the need for competencies specific to K–12 BT, evaluating 18 documents containing either online or BT standards. The limited peer-reviewed research in this area confined their analysis to five white papers, two books, one literature review, and one website. Similarly, Pulham et al. (2018) analyzed four BT competency documents, four online teaching competency documents, and two technology integration competency documents to uncover competencies applicable to BT. Their analysis found that only 13% of the BT standards focused on skills directly related to BT, fewer than 1% of the online standards focused on BT, and 10% of the technology integration standards focused on BT; thus, many of the competencies currently recognized for K–12 BT do not accurately capture the specific skills and knowledge that teachers need to engage successfully in BT.

Recent research has built upon reviews of BT competencies to create a new blended teaching readiness (BTR) framework, validated by both in-service and pre-service teachers, using a BTR measurement instrument (Archibald et al., 2021; Graham, Borup, Pulham et al., 2019). These competencies later informed the competency areas used to direct the creation of Graham, Borup, Short et al., (2019), an open educational guide to K–12 BT (Figure 1). The BTR framework competency areas of online integration, data practices, personalization, and online interaction are built upon a foundation of dispositions related to BT, and the basic technology usage skills needed to facilitate BT. Only one competency pillar, online integration, is necessary for all models and forms of BT; the other three pillars represent important competencies common to many BT practices.

Figure 1

Visual Representation of the Competencies in the Blended Teaching Readiness (BTR) Framework



Note. This figure was created by Graham, Borup, Short et al. (2019).

Despite the validation of these research-based competencies and their implementation into a framework for guiding K–12 BT development, they have not been connected to a wide range of concrete BT practices. Teachers working to develop and implement BT skills need additional support, but the specific support needed is still unclear. Our research uses the BTR framework to identify and highlight essential practices of experienced K–12 blended teachers to guide the preparation of future blended teachers.

Research Questions

1. What dispositions do experienced blended teachers display as part of their blended pedagogy?

2. What technology skills do blended teachers display as part of their blended pedagogy?
3. Based on BT practices, what competencies related to online integration, data practices, personalization, online interaction, and implementation of BT designs into practice seem to be the most important for preparing teachers to practice BT?

Methods

We used an a priori coding scheme to analyze a representative sample of 959 artifacts, provided by The Learning Accelerator (TLA), focused on K–12 blended teachers' pedagogies. TLA is a non-profit organization that seeks to connect schools and teachers with the knowledge, practices, and skills needed to transform K–12 education. TLA's school partnerships have provided valuable observations, skills, and knowledge related to K–12 BT. The artifacts analyzed were observations and descriptions of K–12 BT classrooms, tools, practices, and implementation processes, as well as interviews with teachers, students, and administrators concerning BT, as collected by TLA. All artifacts are publicly available through TLA's website, housed in their collection of resources entitled "Blended & Personalized Learning at Work." These artifacts span all K–12 grade levels with examples from public and charter schools, and include various BT models such as rotation, flipped, and flex models. The following examples illustrate artifact variety:

- A video interview with a high school student and principal about managing personalized learning in a blended environment (TLA, n.d.c)
- A brief description of how teachers and students work together using technology to specifically personalize students' learning objectives (TLA, n.d.e)

- An implementation guide for scaling from a class-level blend to a school-wide blend or for choosing between the two BT systems (TLA, n.d.d)
- A school profile that provides an overview of BT and blended learning at the school along with the tools and strategies that make the blend possible (TLA, n.d.b)

TLA originally provided us with a comprehensive list of over 1,500 artifacts, but we recognized that about 40% of them either were not directly related to BT practices in K–12 classrooms (focusing on policies, implementation theories, lesson plans, student work examples, or BT research) or were duplicates of other resources. Because these resources would not contribute to answering the research questions or would provide duplicate information, we excluded them from the study. Of the remaining 959 artifacts, we analyzed a random sample of 372, providing a representative sample with a confidence level of 95% (+/- 4%), according to a sample size calculator.

By using these resources, we were able to identify K–12 BT practices pertaining to dispositions and technology skills discussed by Graham, Borup, Short et al. (2019), which expanded on the BTR instrument from Graham, Borup, Pulham et al. (2019). Table 1 lists the codes used for dispositions; Table 2 lists the codes used for technology skills.

Table 1

Disposition Codes

Code	Description
Student ownership and agency	I value shifting from teacher-led to more student-centered instruction, allowing students to take on more responsibility for making decisions about the time, place, pace, path, and goals of their learning.
Mastery learning orientation	I value focusing on mastery-based progression rather than time-based progression.
Valuing of data-driven decisions	I rely on data to help guide instructional decision making.
Growth orientation	I am willing to take instructional or pedagogical risks: failing at times, learning to recover, and making improvements after failure.
Life skills emphasis	I see value in using online technologies to enable the development of cross-curricular life skills such as creativity, collaboration, critical thinking, and communication.
Valuing of online learning	I value online activities as a core, essential part of the blend.

Table 2

Technology Skill Codes

Code	Description
Basic technology literacy	I can master new technologies on my own, successfully troubleshoot unfamiliar technological issues, and find quality, relevant online content and resources.
Digital citizenship	I can model the legal use of instructional materials, ensure student online privacy, model online safety for students, ensure academic honesty in an online learning environment, and ensure access to online learning activities for all students.
Learning management systems	I can use the tools commonly found in a learning management system (e.g., gradebook, announcements, content pages, quizzes, or discussion boards).
Educational software	I can use content-specific educational software outside of the learning management system.
Media creation tools	I can use tools to create or edit content found online to meet specific needs.
Communication tools	I can use a variety of tools to communicate with students, parents, and other stakeholders.

The a priori codes used to analyze BT artifacts for competencies were research-based competencies, also compiled by Graham, Borup, Short et al., (2019). This guidebook developed competencies based on the literature reviews of Pulham and Graham (2018) and Pulham et al. (2018) described above. These competencies are represented in Table 3. We included an *other* code within each competency area to accommodate emergent skills or knowledge that may have been overlooked when the a priori codes were created. Doing so allowed us to complete a form of negative case analysis by seeking competencies outside of the established BT framework. Coding was completed at the statement level within each artifact, then generalized and applied to

the artifact as a whole based on the prevalence of the codes within it. Through this method, we were able to identify primary and secondary codes for each artifact in the sample.

Table 3

Blended Teaching Competencies/Codes

Domain of blended teaching	Codes
Online integration	I can plan how to effectively combine in-person and online teaching. I can create activities that integrate the in-person and online spaces. I can evaluate the design of blended instruction, assessments, and activities. I can create guidelines for managing a blended lesson. I can perform other skills related to online integration.*
Data practices	I can create formative assessments with mastery thresholds. I can create a mastery tracker with assessments aligned to learning outcomes. I can identify important patterns in student performance data. I can use data to recommend focused learning activities for students. I can use data to evaluate and improve assessments and instructional materials. I can perform other skills related to data practices.*
Personalization	I can identify what personalization is.** I can develop a personalization plan for my class. I can develop a guide for personalizing students' learning goals. I can develop strategies for personalizing assessments. I can develop strategies for personalizing learning activities. I can perform other skills related to personalization.*
Online interaction	I can identify the benefits of different modes of interaction that occur within BT. I can use asynchronous technologies in my classroom practices. I can create effective online discussions. I can create a plan for facilitating online discussions. I can use asynchronous technologies to create effective feedback. I can perform other skills related to online interaction.*
Design in practice	I can curate online content to support student learning. I can plan the scope and sequence of a blended lesson. I can support my reasons for using a blended lesson. I can reflect upon and revise my BT practices. I can perform other skills related to practice design.*

Note. BT = blended teaching. *The last code in each area was created to allow for emergent coding. **The first personalization competency was dropped from analysis due to its broad scope and correlation with the other personalization competencies.

To establish reliable coding, the primary author coded a random sample of artifacts and trained the third author to use the codes. After dual coding the statements of a sample of 10 artifacts, coders reached an agreement greater than 80%, after which they coded a larger sample of approximately 40 artifacts to further establish inter-coder agreement, which was greater than 90%; the two then began coding resources independently. Resources that an author found difficult to analyze were also reviewed by the other so they could establish agreement. They coded artifacts as found on TLA's website, using the Hypothes.is software to annotate statements within each artifact. For video-based artifacts, they collected time-stamped statements related to the codes. After coding each resource, they collected the code plus a description of the artifact in a spreadsheet to assist in providing the descriptive statistics reported below.

We used a keyword search of artifact titles to determine if our random sampling method had missed artifacts that would fit under-represented codes (i.e., codes linked to 15 or fewer artifacts). The search suggested that the trends from the initial coding of the sample accurately reflected the overall trends of all the artifacts. We also reviewed the artifacts that had emergent competencies to determine the characteristics of practices that did not fit into the a priori coding scheme.

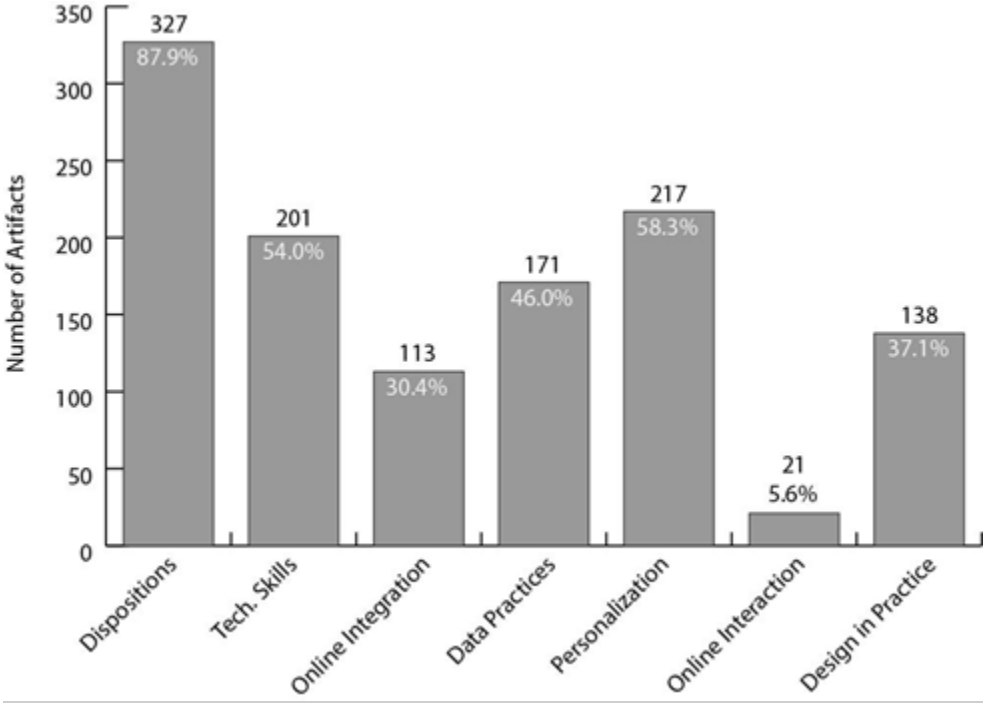
Findings

Figure 2 illustrates the prevalence of code categories across the sample. Each bar represents the number of artifacts in which at least one code from the category appeared. An artifact with competencies from multiple areas is represented in the count of each category, and

an artifact with multiple codes from a single category is represented only once in the count of that category. For example, one artifact included codes from dispositions, technology skills, online integration, and personalization, along with one code from design in practice. This resource would count as one resource for each of those areas. The bar chart enables comparisons across coding categories. The number of artifacts making up each column is listed above the column, with the percentage of total artifacts presented below the raw number.

Figure 2

Prevalence of Code Categories Across the Sample of Artifacts



Dispositions appeared most frequently across all of the artifacts. Technology skills appeared in fewer artifacts than we expected, and as explained below, the appearances of skills within the category were not evenly distributed. Of the core competency areas, personalization and data practices were the most prevalent, followed by design in practice and then online integration. Online integration appeared in 30.4% of the sample, which may be surprising since it

is technically the only competency needed to blend. Online interaction appeared in only 5.6% of the sample, most likely because it is not a central component of TLA's blended strategies. The following sections provide more details concerning the distribution of codes across the artifacts.

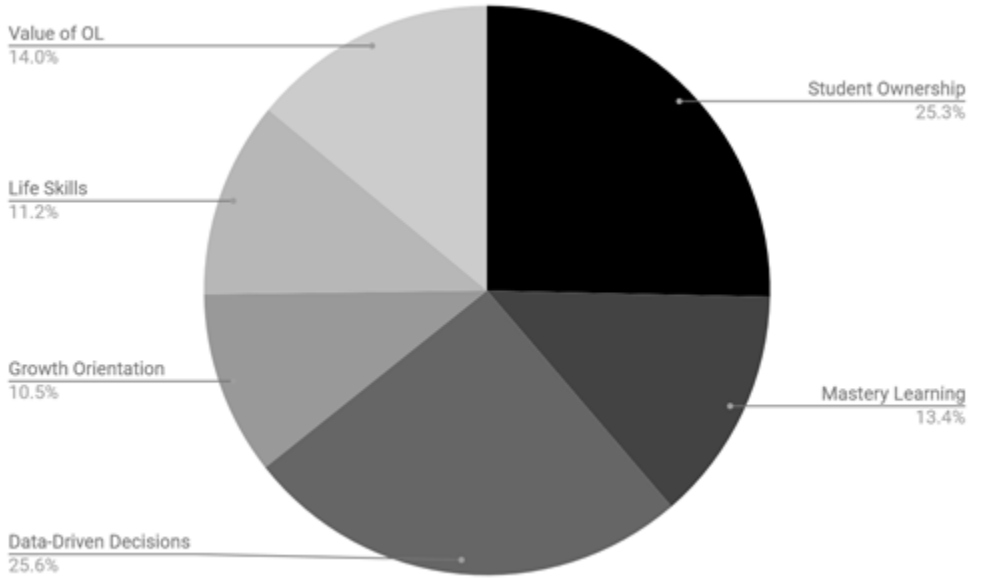
For comparing codes within categories, two tables are provided in each section. Measurements used for each table represent the number of times a code appeared in an artifact at least once. For example, an artifact focusing on the strategy of allowing students to choose their own learning objectives had multiple references to allowing students to choose their own learning activities and developing a personalization plan for the class. This resource would account for one occurrence of each of those codes.

BT Dispositions

Figure 3 illustrates the prevalence of codes within the disposition category. The most prevalent codes were valuing student ownership and agency and making data-driven decisions, each making up about 25% of the disposition occurrences. This distribution supports the artifact distribution in the overall competency areas, as these are the two most important dispositions for data and personalization practices. The other four BT dispositions were distributed fairly equally, accounting for 10–14% of disposition codes. All dispositions were present in the artifacts, illustrating their shared importance to BT.

Figure 3

Prevalence of Codes Within Dispositions

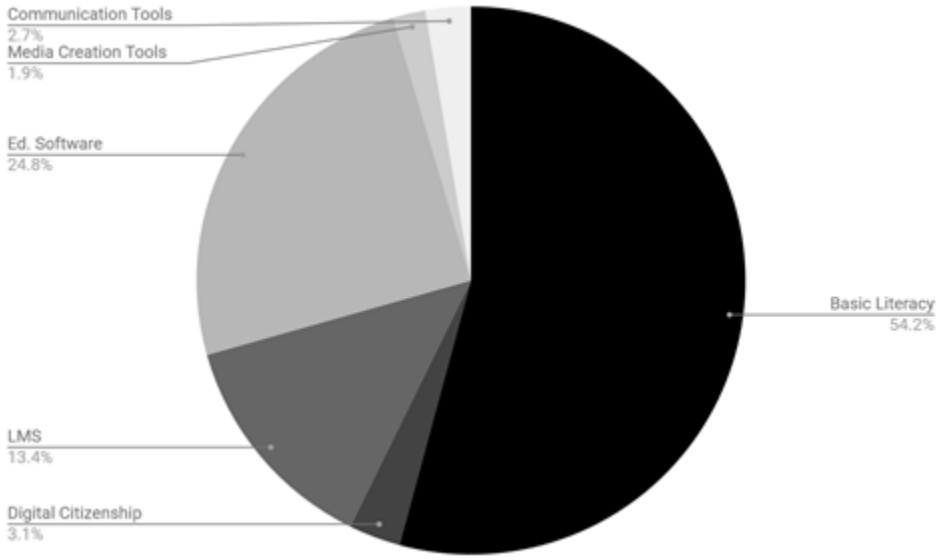


Technology Skills

Figure 4 illustrates the distribution of technology skills within the sample. Half of the technology skills appeared in fewer than 5% of the artifacts. The most prevalent technology skills appeared to be representation of basic literacy (54.2%), use of learning management systems (13.4%), and use of educational software (24.8%). Few artifacts focused on digital citizenship, and fewer focused on media creation tools or online communication tools. The prevalence of educational software skills may have replaced the need for media creation tools, accounting for the low number of artifacts in that area. The low number of communication tools mentioned in the artifacts may have been due to scarcity of online interaction practices.

Figure 4

Prevalence of Codes Within Technology Skills



BT Competencies

Many of the artifacts focused on more than one competency area, suggesting the correlation of various competency areas within BT. Table 4 illustrates co-occurrences of codes within artifacts. Each artifact was assigned a primary code, and then several secondary codes were listed based on the analysis. Each row of the table represents artifacts that were coded as primarily focusing on one of the core competency areas. The total column lists the number of artifacts with a primary code from the designated core competency area. The numbers in each cell beyond the second column represent the number and percentage of primary code artifacts with the secondary code listed in the top row.

Table 4

Co-Occurrences of Primary Codes With Other Secondary Codes

Primary code	Total	Dispositions	Tech. skills	No. with OLI	No. with DP	No. with Pers	No. with OLR	No. with DiP
Online integration (OLI)	58 (51.3)	56 (96.6)	52 (89.7)	–	17 (29.3)	27 (46.6)	5 (8.6)	25 (43.1)
Data practices (DP)	72 (42.1)	71 (98.6)	34 (47.2)	6 (8.3)	–	34 (47.2)	2 (2.8)	11 (15.3)
Personalization (pers)	131 (60.4)	128 (97.7)	60 (45.8)	24 (18.3)	61 (46.6)	–	8 (6.1)	25 (19.1)
Online interaction (OLR)	4 (19)	4 (100)	4 (100)	2 (50)	3 (75)	2 (50)	–	2 (50)
Design in practice (DiP)	75 (54.3)	68 (90.7)	51 (68)	23 (30.7)	18 (24)	23 (30.7)	2 (2.7)	–

Note. The percentage below the number in the total column reflects the percentage of the artifacts in that competency area that were primarily focused on the area. For example, 113 artifacts focused on online integration, but this area was the primary focus in only 51.3% of them: 58 artifacts.

Several trends in Table 4 are worth noting. As expected, dispositions were important for all five of the main competency areas, appearing in at least 90% of all the artifacts that focused primarily on a core competency. Technology skills were less emphatic, appearing in almost 90% of the online integration artifacts, but fewer than 50% of the personalization and data practices artifacts. This does not mean that personalization and data practices were used without technology, but that many artifacts discussed these practices without referencing the technology skills used to support them. Within the competency areas, overlap varied but was never over

50% (excluding online interaction, which was not represented as primary in enough artifacts to provide substantive claims). Online integration frequently co-occurred with personalization (46.6%) and design in practice (43.1%). Design in practice co-occurred with online integration and personalization slightly less at 30.7% for both. Data practices also frequently co-occurred with personalization (47.2%). Personalization, however, only co-occurred with online integration in 18.3% of artifacts, while maintaining a relatively high percentage of co-occurrence with data practices (46.6%). These differences suggested that data and personalization practices were frequently related, and that while the online space was often integrated to support personalization, such integrations may not be necessary for personalization. Additionally, design in practice was somewhat frequently related to online integration and to personalization.

The 10 most prevalent competencies were spread across all areas except online interaction. As shown on the ranked list in Table 5, the top three competencies each had more than 90 occurrences, with the top two having more than 115. The next three competencies had more than 70 occurrences, and the bottom four had between 54 and 38. Personalization and design in practice each had three competencies in the top 10, with online integration and data practices each having two. This distribution illustrates that while certain areas may appear more important than others, individual competencies in each area seem to be important. Despite having more occurrences than online integration, design in practice had no competencies in the top five, although online integration was the fifth ranked competency.

Table 5

Competencies Ranked in the Top 10

Rank	No. of occurrences	Competency area	Competency
1	136	Personalization	I can develop strategies for personalizing learning activities.
2	116	Data practices	I can identify important patterns in student performance data.
3	95	Personalization	I can develop a personalization plan for my class.
4	74	Data practices	I can use data to recommend focused learning activities to specific students.
5	72	Online integration	I can plan how to effectively combine in-person and online teaching.
6	71	Personalization	I can develop a guide for personalizing students' learning goals.
7	54	Design in practice	I can curate online content to support student learning.
8	52	Design in practice	I can reflect upon and revise my BT practices.
9	38	Online integration	I can create guidelines for managing a blended lesson in regards to behavior (hardware, remembering passwords, student movement).
10	38	Design in practice	I can plan the scope and sequence of a blended lesson.

Note. BT = blended teaching.

To improve understanding of specific practices within each competency area, the following subsections describe each of these areas and report the frequency of specific competencies occurring within the artifacts. The first table in each subsection shows the competencies within that area, including the number of artifacts coded for the specific competency and the percentage in comparison to all artifacts within that competency area. The

second table in each area provides examples of practices outside the a priori codes used for that competency area.

Online Integration

Each of the online integration competencies appeared across the artifacts (Table 6). The first competency was ranked as the most essential, with other competencies varying in their degree of frequency.

Table 6

List of Competencies for and Examples of Online Integration

Artifacts (Percent)	Competency	Example practice
72 (48%)	I can plan how to effectively combine in-person and online teaching.	Despite a 1:1 technology/student ratio, teachers use a 1:X model to prevent creating lessons that focus on technology use. Students spend time with in-person learning activities such as collaborative projects and hands-on learning, and they choose the technology (desktop, laptop, or iPad) most appropriate for their learning.
18 (12%)	I can create activities that integrate the in-person and online spaces.	The teacher uses data from online exams to directly inform creation of learning activities such as online personalized learning playlists and in-person group instruction.
13 (8.7%)	I can evaluate the design of blended instruction, assessments, and activities.	Teachers look at the purpose and intended use of apps to help decide which to use for their students' learning.
38 (25.3%)	I can create guidelines for managing a blended lesson in regard to behavior (hardware, remembering passwords, student movement).	Teachers use a "banking" system in which students must complete an overall average of five tasks per day at school.
9 (6%)	I can perform other skills related to online integration.	See Table 7

The most common online integration competency was planning how to combine the online and in-person spaces for instruction and activities. This competency was followed by managing a blended lesson, including student behavior as well as technology and software. The other three competencies, including the emergent competency code, were less prevalent throughout our sample, with a maximum of 12% presence. This may suggest that the most essential skills for implementing BT focus on planning blended instruction and managing BT lessons, as opposed to creating blended activities or evaluating a blended lesson — though these still seem important. The competencies in Table 7 represent themes from across the nine artifacts that had emergent competency codes. These four competencies represent skills that were not pervasive in the online integration artifacts, but that were still important parts of teachers' BT practices.

Table 7

Examples of Emergent Practices in Online Integration

Competency	Example practice
I can coordinate and work with school and district leaders to effectively implement large scale learning practices into my classroom to enhance pre-existing learning structures.	Rather than leaving teachers responsible to create all practices, administrators create structures for teachers to work within.
I can collaborate with other teachers to refine broader BT practices, not just my own.	Teachers use informal learning communities to reflect upon and improve community
I can assess technological capabilities in my classroom and ensure that they are kept up to date (computer updates, program updates, Wi-Fi speed, etc.).	Teachers use software to ensure that devices have current updates that support their teaching practices.
I can effectively pilot new educational technologies and software within my classroom based on informed decisions.	Teachers and teaching coaches create effective pilots focused on the technology itself, not just on the BT practice.

Data Practices

Each of the competencies for data practices appeared in the artifacts (Table 8), some much more frequently than others.

Table 8

List of Competencies for and Examples of Data Practices

Artifacts (Percent)	Competency	Example practice
27 (9.4%)	I can create formative assessments with mastery thresholds.	Teachers create a formative assessment that requires students to demonstrate mastery through a video recording before allowing them to take their final mastery quiz.
21 (7.3%)	I can create a mastery tracker with assessments aligned to learning outcomes.	Teachers create a spreadsheet to keep track of mastery-based scores on assignments as well as behavior.
116 (40.3%)	I can identify important patterns in student performance data.	Teachers track multiple factors (attempts to achieve mastery, time spent on a concept, etc.) to see how students are doing in class.
74 (25.7%)	I can use data to recommend focused learning activities to specific students.	A teacher uses educational software data to plan specific learning activities for specific students.
32 (11.1%)	I can use data to evaluate and improve assessments and instructional materials.	Teachers use data from anonymous student feedback to improve general class instruction.
18 (6.3%)	I can perform other skills related to data practices.	See Table 9

The most common competency in data practices was "I can identify important patterns in student performance data," reflecting its place as a foundational skill in using data. The other well-represented competency was ability to use data to recommend specific learning activities for specific students. These two competencies appear to be essential to using data as part of BT.

Four of the six data skills, including the emergent competencies, occurred in 11% or fewer of the artifacts, which may suggest that they are less essential to BT or expected of fewer K–12 teachers in general. The first competency for data practices was one of the few that were not the primary focus in any artifact, appearing only as a secondary code. This may account for its few occurrences. Emergent competencies within data practices (Table 9) were the least prevalent of coded practices, but still important to understanding for a fuller picture of data competencies.

Table 9

Examples of Emergent Competencies in Data Practices

Competency	Example practice
I can teach students to use data to drive their own learning.	Teachers empower students by helping them to analyze and reflect on their own data and progress.
I can use data to inform classroom instruction.	Teachers use state assessment data to choose between group, small group, and individualized instruction, creating more personalized plans for their classes.
I can use data to create long-term learning plans for students.	Teachers use transcripts to structure students' long-term learning and graduation plans.
I can use qualitative data to enhance student learning.	Teachers use non-numerical student feedback to direct learning.
Administrators and teachers can work together to improve student learning based on data.	Administrators use the same data as teachers to implement school-wide personalization changes.
I can define mastery in order to measure mastery-based progression.	Teachers use learning goals and objectives to establish definitions of mastery.

The first of these emergent competencies was closely aligned with the disposition of student ownership and agency. This competency was concerned with training students to interpret their own data, asserting that learning to apply data analysis and reflection "empowers [students] to understand their ongoing progress, constantly reflect, and try new strategies to

improve" (TLA, n.d.a, para. 13). Additional competencies not included as part of the a priori codes included broader practices like informing whole-class instruction or influencing long-term life goals for students. Additional practices included reporting data to district or school-level administrators to inform school-wide practices — outside the scope of the a priori codes. However, practices such as defining mastery of specific learning objectives or using qualitative data to inform instruction are practices that could be assumed as part of the first a priori competency and the fourth and fifth, respectively. But because these a priori codes did not explicitly include such skills, we felt it might be clearer to include them in the category of emergent competencies.

Personalization

Personalization (Table 10) was the most frequently coded of the BT competencies, which is not surprising given the way BT and personalization are conflated in the most prominent definition of K–12 BL (Horn & Staker, 2011).

Table 10

List of Competencies for and Examples of Personalization

Artifacts (Percent)	Competency	Example practice
95 (27.5%)	I can develop a personalization plan for my class.	Students have input in the physical design of their classroom.
71 (20.5%)	I can develop a guide for personalizing students' learning goals.	Students review and reflect on their goals in a group setting to determine how they met goals that went well, and what they could have done for goals that did not go well.
31 (9.0%)	I can develop strategies for personalizing assessments.	Students have a choice regarding the format of their assessments, such as a presentation, brochure, project, online work, group discussions, or worksheets.
136 (39.3%)	I can develop strategies for personalizing learning activities.	Students choose with whom they work and in what order they work on learning objectives.
13 (3.8%)	I can perform other skills related to personalization.	See Table 11.

Some personalization practices, like most of those above, did not explicitly include use of the online space. For example, some artifacts focused only on the physical classroom, such as choosing how to design and organize the classroom or choosing whom to work with on assignments. In other cases, however, the online space was essential as students rotated among different stations and the teacher used the online space to deliver instructions, assignments, or activities to students in different locations throughout the classroom or school.

The competency found most often was the last a priori code: "I can develop strategies for personalizing learning activities." This result was anticipated, as personalizing learning activities is a common educational practice that can be accomplished without blending. Two additional practices were also common, related to creating a personalization plan for the class and

personalizing students' learning goals. Practices related to personalizing assessments were less prevalent, possibly due to having students all take the same assessment to facilitate grading or comparing students' mastery across a class. Emergent competencies, as described below, were recorded in fewer than 5% of the sample, providing evidence that the competencies used as a priori codes seemed to be representative of those needed for personalization in BT.

Table 11

Examples of Emergent Competencies in Personalization

Competency	Example practice
I can identify how to use technology for personalized learning within a blended lesson.	Teachers detail a clear relationship showing how technology specifically impacts personalized learning.
Administrators have the tools to ensure teachers have the necessary skills/resources to best implement personalized learning.	Administrators use multiple strategies to train teachers in blended/personalized learning practices.
I can help students meet their social-emotional needs.	Counselors collaborate with teachers to ensure that teachers can meet academic and social-emotional needs of their students.

The practices that made up the emergent competencies for personalization focused on explicit uses of technology, professional development (PD), and professional collaboration to meet the needs of students. In the first example, teachers used less than 1:1 devices to ensure a clear purpose behind technology use and to enable more opportunities for personalized learning by offering face-to-face instruction, hands-on work, and collaborative learning opportunities in addition to online opportunities. The second and third examples demonstrate teachers working with district professionals to develop their personalization abilities or to meet students' non-academic needs.

Online Interaction

Online interaction codes (Table 12) appeared as a primary code for only four artifacts. Of these four, one focused primarily on the second competency and the other three focused on the fifth. Online interaction artifacts appeared in only about 6% of the sample. This could mean that K–12 BT relies mostly on in-person interactions or that the artifacts we coded do not encompass online interactions because these interactions are hard to observe during on-site visits, especially if the interactions are happening outside of the classroom and/or outside regular school hours. Due to the limited number of resources in this area, reliable findings were difficult to extract. More research should be done to uncover how K–12 BT uses online interactions as part of day-to-day practices. Table 12 details practices that were observed within our artifact analysis.

Table 12

List of Competencies for and Examples of Online Interaction

Artifacts (Percent)	Competency	Example practice
3 (10.7%)	I can identify the benefits of different modes of interaction that occur within BT.	Teachers record presentations, allowing videos to be reviewed as desired/needed.
5 (17.9%)	I can use asynchronous technologies in my classroom practices, specifically online communication.	Teachers utilize LMSs to provide feedback to their students and facilitate student interactions with each other.
0 (0%)	I can create effective online discussions.	N/A
0 (0%)	I can create a plan for facilitating online discussions.	N/A
12 (42.9%)	I can use asynchronous technologies to create effective feedback, specifically online communication.	Teachers monitor student behavior throughout class using an online behavior tracking system.
8 (28.6%)	I can perform other skills related to online interaction	Practices varied.

Note. LMS = learning management system.

Our sample did not include any practices focused on creating or facilitating effective online discussions. While some artifacts focused on effective in-person discussions, whether such practices would transfer to the online space was not clear. Of the practices that did appear in our sample, the first practice in Table 12 focused on student-content interactions but presented an opportunity for asynchronous student-student or student-teacher interactions. The use of asynchronous technologies in the artifacts focused primarily on teachers using the online space to provide feedback. Some emergent competencies were evident related to online interactions, which focused on teachers using the online space to interact with specific students, guiding their

learning activities; interacting with parents using online media; and interacting with other teachers using online media. Combined to form the emergent category, these interactions made up a larger percentage of online interaction than the first four a priori competencies.

Despite the low number of artifacts related to online interaction, some competencies were emphasized more than others: specifically, the competency related to using the online space for feedback (40% of occurrences) and the emergent competencies related to online interaction. However, if emergent competencies were separated into individual competencies, they would not appear as prevalent. More research is needed to understand the role of online interactions in K–12 BT.

Design in Practice

Design in practice (Table 13) was well represented among artifacts focused on implementing BT. We did not find this surprising, as one of TLA's central goals is helping teachers implement BT for the first time.

Table 13

List of Competencies for and Examples of Design in Practice

Artifacts (Percent)	Competency	Example Practice
54 (26.7%)	I can curate online content to support student learning.	Teachers used public domain resources to make materials freely available to students online.
38 (18.8%)	I can plan the scope and sequence of a blended lesson.	Teachers distribute class time between direct instruction and independent study to leverage a time-based structure to personalize instruction through data collection and intervention.
37 (18.3%)	I can support my reasons for using a blended lesson.	Teachers share best practices with others to explain the benefits of BT.
52 (25.7%)	I can reflect upon and revise my blended teaching practices.	Teachers refine their practice through support from other teachers.
21 (10.4%)	I can perform other skills related to design in practice.	See Table 13.

Note. BL = blended learning.

Distribution among the a priori codes was generally equivalent within this category, ranging from 18.3% to 26.7%, a difference of 17 artifacts. The competencies for curating online content and for reflecting on and revising blended practices each accounted for about 25% of the design in practice occurrences, while the competencies for planning the scope and sequence of a blended lesson and for supporting one's reasons for blending both made up 19% of the design in practice items.

The first design in practice competency was slightly more prevalent than the other skills. Examples included finding resources for students to use online, using educational software to provide digital content to students, and promoting access to and equity of online resources. A close second in prevalence was reflecting on and revising BT practices. This competency

included teachers finding time, resources, and strategies to work with other teachers and district professionals to create and revise BT materials.

While less common, the competencies related to planning the scope of a blended lesson and supporting the reasons for BT were still prevalent within design in practice. The remainder of the code occurrences focused on school- or district-wide implementation rather than teacher or classroom implementation, most of which were included in the 11% of design in practice emergent competencies. We found design in practice had the greatest percentage of emergent competency codes, excluding online interaction, which did not have enough representation to provide reliable measurements. The focus of the emergent competencies was outside the scope of the a priori codes, which focused on classroom level practices. A breakdown of the skills within the emergent competency category can be found in Table 14.

Table 14

Examples of Emergent Competencies in Design in Practice

Competency	Example Practice
Administrators can effectively create settings for teachers to implement blended learning.	One principal creates school-wide changes that provide teachers with sufficient space to experiment within their classroom, boosting morale and upgrading technology.
I can use district resources to work with other teachers and with administrators to design, implement, and refine blended learning.	Schools create a learning team of teachers and administrators who design workshops to meet BT goals.
I can purchase and implement new technologies based on educational needs.	Teachers or administrators weigh various features of different platforms to determine what will work best for their students.

Note. BT = blended teaching.

The first two emergent competencies focused on administrator or district level practices rather than teacher or classroom level implementation. While the competencies themselves may

seem similar to “I can reflect upon and revise my BT practices,” they differed in that the examples focused on administrators and districts providing teachers with opportunities to accomplish such practices rather than teachers implementing the practices on their own. We could have included some of these examples as part of the a priori competencies, but because the artifacts had a broader focus than a single classroom, we coded them as emergent competencies. The last emergent competency did focus on an individual teacher skill. The a priori codes did not include a competency for such a practice, and the practice was not apparent in many of the artifacts, which may justify its classification as emergent.

Discussion

Our analysis revealed several pertinent trends related to the dispositions, technology skills, and competencies needed for teachers to develop their BT practices. These trends may prove useful to those who educate teachers, provide professional development, and lead school districts in helping to prepare teachers for BT. Understanding the dispositions, technology skills, and competencies displayed by experienced blended teachers may make BT implementation more successful as BT practices become more efficient and effective. The following sections provide a larger context of meaning for the findings of our analysis as well as suggest areas for further research.

BT Dispositions

The prevalence of all dispositions in our analysis suggests that the dispositions theorized by Graham, Borup, Short et al. (2019), which expanded upon the Blended Teaching Readiness instrument from Graham, Borup, Pulham et al. (2019), are important to BT. All were present in the artifact analysis, justifying the theorized dispositions by connecting them to concrete practices. Student ownership and data-driven decisions were the most prevalent. Despite these

two dispositions being the most prevalent, the distribution of dispositions was less extreme than other areas of our analysis, ranging from 10.5% to 25.3%. This suggests that while all dispositions are important, some may be more important than others, especially in relation to specific competency areas. For example, Data Practices and Personalization artifacts made up 46% and 58.3% of our samples, respectively. These were the most prevalent competency areas in our sample. There is clearly a connection between these competency areas being the most prevalent and the dispositions of valuing student ownership and data-driven decisions.

Design in Practice and Online Integration competencies were the next most prevalent competency areas, respectively accounting for 37.1% and 30.4% of our sample. These competency areas would directly relate to valuing online learning, which was the third most prevalent disposition (14%). These connections may suggest that preparing teachers for BT, and using BT practices for personalization and data practices, may first require teachers to have the right dispositions as a foundation – valuing online learning, student ownership of learning, and data-driven decisions.

Future research in this area could focus on the role that dispositions play in preparing teachers for BT. We know from our analysis that experienced blended teachers demonstrate specific dispositions as part of their practices but understanding whether such dispositions were in place prior to the implementation of teachers' BT practices was outside the scope of this research. Understanding the ways in which the dispositions used for this analysis can impact teachers' implementation of BT practices could prove useful for districts seeking to identify teachers to pilot BT, and for PD providers or teacher educators seeking to prepare teachers for BT. Additionally, further research could seek to identify the role that dispositions play in helping teachers to successfully or effectively implement BT.

Technology Skills

The analysis of technology skills suggests that some of the skills identified by Graham, Borup, Short et al. (2019) may be more impactful than others. While basic literacy was by far the most prevalent technology skill, understanding how to use educational software and learning management systems were also prevalent. These skills may be necessary for helping teachers successfully implement BT, as they we common components of other BT competency areas.

We were more surprised by the low prevalence for digital citizenship, communication tools, and media creation tools. The absence of practices related to digital citizenship and communication tools may be due to insufficiency of artifacts focused on online interactions. Mishra and Kohler's (2006) technological pedagogical content knowledge (TPACK) framework detailed relationships of technology skills to knowledge of content and pedagogy as part of teaching with technology. We infer that if teachers begin to implement more online interactions (requiring pedagogical knowledge), then digital citizenship and communication tools (requiring technology knowledge) would become more essential to BT practices.

Implementation of media creation tools was also less evident than we expected. Media creation tools may have more impact on specific blended models, such as the flipped classroom, that require students to access information before coming to class. Models that rely more on using the online space within the classroom, such as rotation or flex models, may depend less on media creation tools. Many of the schools represented in the artifacts we analyzed used more disruptive models of blended learning and thus relied on educational software instead of teacher-created media for their online instruction and activities.

Current research has suggested a variety of technology skills that may be needed for BT, but the relative importance of these skills seems less evident. For example, Pulham and Graham

(2018) included learning management systems, software management, hardware management, and troubleshooting among their K–12 BT competencies with prevalence in that sequence. Bjekic et al. (2010) also suggested that BT requires abilities to "select and apply adequate technologies," "understand the functioning of hardware [and] software," and "effectively apply LMSs [learning management systems]" (p. 209). Riel et al. (2016) included specific troubleshooting practices such as having technology fluency adequate to address common problems and using available technology to aid in curricular activities. Graham, Borup, Pulham et al. (2019) suggested that technical literacy requires five different skills, which vary from using educational software and LMSs to mastering new technology without support from others. Our analysis offers support for some of these competencies and ideas with emphasis on basic literacy, educational software, and LMS use. However, future research is needed to understand (a) what specific technology skills look like within BT, (b) how they compare in importance, and (c) how teachers can best be prepared to utilize them.

BT Competencies

The competencies identified by Graham, Borup, Short et al. (2019) seem to encompass the skills essential for BT, as few competencies emerged outside of the a priori coding scheme. The area with the most emergent competencies was design in practice, and most of these practices focused on administrator, school, or district level competencies — outside the scope of the a priori codes used for this analysis. This validation of BT competencies is impactful in identifying the most essential competencies for BT and for understanding how such competencies relate to BT practices and PD.

Online integration is the only area required for BT according to the general definition of BT: combining online and in-person modalities. However, the top three competency areas in our

analysis were personalization, data practices, and design in practice. This result may suggest that despite the overall importance of online integration, other benefits and strengths of BT (e.g., personalization and data practices) are more important to practitioners. Or artifacts focusing on BT may assume online integration as a practice and thus directly focus on it less frequently. Design in practice could have had more overlap with online integration, but it mostly related to the creation of blended lessons and activities rather than to management of the online space, which may indicate that planning BT receives more attention in PD and practice than being able to use the online and in-person spaces together for instruction.

The top 10 BT competencies indicated that some BT practices seem to be more common than others. For example, planning for personalized learning activities, identifying patterns in student data, and developing a personalization plan for an entire class were among the most common competencies in the artifacts. While all of these practices could be accomplished without BT, integration of the online space makes them easier to accomplish. These practices can be accomplished through BT by implementing the other top 10 practices, which focus on effectively planning, implementing, and managing BT.

Table 5 also demonstrates that specific competency areas cannot be the sole focus of BT preparation. Individual competencies within each area must be highlighted in PD and teacher preparation programs. Many practices in our analysis rely on co-occurrence of competencies from several areas, which may explain why the top 10 competencies are distributed among various competency areas. Teacher education and PD programs seeking to prepare teachers for BT should help teachers understand how BT competencies are related to and in some cases dependent on each other. This complexity of BT practices may be one of the reasons so many competencies have been suggested by various organizations and researchers.

The absence of skills related to online interaction from the top 10 competencies (see Table 5) could be evidence that most current blended teachers are not using the online space to facilitate interactions. Support for this analysis can be found in the discovery of Brodersen and Melluzzo (2017) that none of the 11 BT programs in their analysis used online interactions between teachers and students. K–12 blended teachers may not realize the potential of the online space to provide rich interactions, believing that online human interaction is of lower quality than in-person interaction. While this quality assumption may be true in some cases, online synchronous and asynchronous interactions also have affordances that make them stronger in other cases (see Graham, 2006, Table 1.2; Graham, Borup, Short et al., 2019, Chapter 5). We predict that as teachers become more experienced with synchronous and asynchronous communication technologies and more aware of ways BT can provide the affordances of both online and in-person interactions, online interaction will become more prevalent.

Due to the complexity of BT competencies, future research has much to uncover. As this research found limited use of online interaction, future research could further investigate prevalence of online interactions in K–12 BT, including specific competencies needed to integrate such BT practices. Also, our analysis did not suggest a specific sequence needed for implementing BT competencies. We reported our findings in the sequence that competencies were presented by Graham, Borup, Short et al. (2019). The correct scope and sequence for BT PD needs further specification. Additionally, the scope of this analysis prevented reporting on numerous practices related to each competency or competency area. Future research could provide deeper analyses of such practices. A final suggestion is that additional competencies related to administrative, school-wide, and district-level practices of BT, as suggested by the emergent competencies of this study, be examined for better understanding and refinement.

Limitations

As with all qualitative analysis, this research was limited by interpretations of the researchers. While we had high intercoder agreement, our interpretations of some artifacts could be viewed differently by other researchers. These potential differences would likely apply more particularly to our identification of emergent competencies not covered by the a priori codes. We have tried to mitigate this limitation by providing examples of our codes and of the practices related to such codes. The research is also limited by the collection of artifacts we analyzed. While the TLA artifacts were supplied by different schools with varied student populations using various models of BT, TLA's specific focus may have emphasized or omitted observations of some BT practices. For example, online interactions are not as central to TLA's BT framework as online integration, real-time data use, personalization, and mastery-based progression.

Conclusion

Resources from professional organizations, non-profit groups, and researchers have provided blended teaching competencies, but few of these have connected competencies to concrete practices. This study has analyzed BT competencies in terms of practices from experienced blended teachers to identify competencies that may be most essential to BT preparation and PD. Nearly all areas of BT used for this analysis (dispositions, technology skills, online integration, data practices, personalization, online interaction, and design in practice) were shown to be important. In addition to findings regarding the importance of these areas to K–12 BT, inferences for ways they influence practice and teacher preparation or development have been included. Our analysis lays the foundation for additional research that could investigate (a) how these competencies are used in various ways, by various teachers, in various contexts (disciplines, grade levels, schools, districts, etc.), as well as (b) whether skills and competencies

that did not appear to have supported practices in this research (e.g., some of the technology skills and online discussion competencies) are widely used by blended teachers.

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ARTICLE 3

Blending and Personalizing: A Cross-Disciplinary Analysis of K–12 Blended Teaching Practices for Personalization

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Abstract

The 2017 National Educational Technology Plan from the United States Department of Education called for teachers to be prepared for blended and personalized learning. Definitions used to guide this preparation have been problematic as they describe a wide array of practices that are both teacher-centered and student-centered. Using a definition of personalized learning based on giving students ownership over the goals, time, place, pace, and/or path of their learning, we interviewed 62 K–12 blended teachers to uncover practices related to blended and personalized learning, analyzing the interviews based on qualitative analysis methods from Huberman and Miles (1994) and Wolcott (1994). Analysis revealed that teachers across all K–12 grade levels and content areas allow students to personalize their learning objectives, assessments, and learning activities. These findings lay the foundation for a theoretical framework that more accurately defines and describes personalized learning than earlier personalization theories. We suggest future research be undertaken related to this framework as well as to additional aspects of blended and personalized learning.

Keywords: elementary education, secondary education, blended teaching, individualized instruction

Introduction

The Every Student Succeeds Act (ESSA) became a United States federal law in 2015, bringing with it a call for personalized learning (PL), but without specifying what PL should look like. Similarly, in 2017 the U.S. Department of Education released their latest National Educational Technology Plan (NETP) outlining transformative ways technology can be used to shape educational policies and practices, but without providing a clearer definition of PL (see Table 1 below). As an educational trend, PL has achieved nearly unprecedented attention, garnering the support of philanthropic organizations such as the Bill and Melinda Gates Foundation and the Chan Zuckerberg Initiative (Boninger et al., 2019). Mark Zuckerberg, Facebook founder and CEO, stated in 2016 that "personalized learning makes sense" and "we want to see as many good versions of this idea as possible get tested in the world" (Herold, 2016, para. 3).

One such method of testing PL, blended teaching (BT), has been recognized for its contributions to personalization (Graham et al., 2019; Stein & Graham, 2014), in some cases defined by its ability to provide PL, giving students control over the time, place, pace, and path of their learning (Horn & Staker, 2011; U.S. Department of Education, 2017). Though teachers can blend without providing PL and vice versa (Arnesen et al., 2019; Short et al., 2021), the 2017 NETP included recommendations to "develop a teaching force skilled in online and blended instruction" (p. 40). Considering this recommendation, as well as the PL emphasis in ESSA, we recommend that teachers should receive training to become competent in both blending and personalizing instruction.

Many researchers and organizations have attempted to create competencies to guide such teacher preparation. The Teacher Educator Technology Competencies suggested by Foulger et

al. (2017) emphasized the need for teachers to become proficient in BT, and while they do not specifically mention PL, they do affirm the importance of "differentiat[ing] instruction to meet diverse learning needs" — a practice closely related to PL (p. 432). These competencies represent a necessary shift in teacher preparation. The skills teachers need to teach in blended environments are distinct from those needed to teach in online or non-blended contexts (Pulham & Graham, 2018; Pulham et al., 2018). Short et al. (2021) concluded through an analysis of BT artifacts that while skills related to PL seemed to be prevalent within BT, "additional research could seek to understand how these competencies are used in various ways, by various teachers, in various contexts (disciplines, grade levels, schools, districts, etc.)" (p. 32).

The qualitative analysis presented in this article addresses this recommendation for additional research by analyzing how 62 teachers across various K–12 grade levels and content areas (i.e., contexts) implemented PL as part of their BT practices. We defined PL for participants as practices that allow students some control over the goals, time, place, pace, and/or path of their own learning (Graham et al., 2019). Such insights provide teacher educators, teachers, schools, and districts seeking to blend with some of the skills and knowledge needed to personalize learning as part of BT.

Literature Review

Broadly conceived, BT is the strategic combination of online and in-person instruction (Graham, 2006). Common K–12 definitions, like those from Horn and Staker (2011) and the NETP (2017), include specific pedagogical elements as part of their definitions, stating that BT should also provide students with some aspect of personalization along the dimensions of time, pace, place, and path of learning. While these pedagogical elements can be benefits of BT, the

only requirement for in-person teaching to become blended is the integration of online learning (Graham et al., 2019).

Definitions and Differentiation

Personalization, unfortunately, is not so easily defined as it is often conflated with practices such as differentiation, competency-based learning, or learner accommodations. Table 1 presents some definitions of personalized learning from organizations that have guided PL research and practice over the last decade.

Table 1

Definitions of Personalization From Federal and Philanthropic Organizations

Source	Definition
U.S. Department of Education, Office of Educational Technology, NETP (2010)	"Personalization refers to instruction that is paced to learning needs, tailored to learning preferences, and tailored to the specific interests of different learners. In an environment that is fully personalized, the learning objectives and content as well as the method and pace may all vary (so personalization encompasses differentiation and individualization)" (p. 12).
International Association for K-12 Online Learning, Patrick et al. (2013)	"Personalized learning is tailoring learning for each student's strengths, need and interests — including enabling student voice and choice in what, how, when and where they learn — to provide flexibility and supports to ensure mastery of the highest standards possible" (p. 4).
Bill & Melinda Gates Foundation et al. (2014)	"Personalized learning seeks to accelerate student learning by tailoring the instructional environment — what, when, how and where students learn — to address the individual needs, skills and interests of each student. Students can take ownership of their own learning, while also developing deep, personal connections with each other, their teachers and other adults" (para. 1).
National Center for Learning Disabilities (2015)	"Students' learning experiences — what they learn, and how, when, and where they learn it — are tailored to their individual needs, skills, and interests, and enable them to take ownership of their learning. Although where, how, and when they learn might vary according to their needs, students also develop deep connections to each other, their teachers, and other adults" (p. 33).

Source	Definition
U.S. Department of Education, Office of Educational Technology, NETP (2017)	"Personalized learning refers to instruction in which the pace of learning and the instructional approach are optimized for the needs of each learner. Learning objectives, instructional approaches, and instructional content (and its sequencing) may all vary based on learner needs. In addition, learning activities are meaningful and relevant to learners, driven by their interests and often self-initiated" (p. 9).
Center on Reinventing Public Education, Gross and DeArmond (2018)	"Its big ideas — giving students more freedom and control over their learning, allowing students to move at their own pace, and letting students' interests and talents drive what they learn — resonate with many parents, students, and educators" (p. 1).
Christensen Institute, Fisher (2019)	"In the current education conversation, personalized learning is a pedagogical philosophy, tending to refer to a *host* of efforts and models that tailor learning and development to the individual student, based on beliefs about what outcomes we want students to reach and how to best help them get there" (para. 4).
Knowledge Works (2019)	"Personalized learning means creating engaging learning experiences customized to each student's strengths, needs and interests" (para. 2).
U.S. Department of Education, Parent and Family Learning Guide, Morin (2021)	"Personalized learning is an educational approach that aims to customize learning for each student's strengths, needs, skills, and interests. Each student gets a learning plan that's based on what they know and how they learn best. Personalized learning doesn't replace an IEP, a 504 plan, or intervention programs" ("At a Glance").
LEAP Innovations (2021)	"Personalized learning is focused on, led with and demonstrated by the learner, and is connected to career-relevant, real-world skills and opportunities" (para. 2).

As Table 1 shows, PL is defined in different ways by different people and organizations. Some definitions focus broadly on educators' abilities to tailor learning to specific student needs, interests, or strengths, while other approaches focus more on providing students with control over their own learning. Shemshack and Spector's (2020) systematic review of personalized learning terms presented a definition that conflates PL with a technology integrated environment in a way similar to ways the K–12 definitions of BT conflate BT with PL:

> We started with the definition of personalized learning . . . which requires a digital learning environment to be classified as a personalized learning environment to be

> adaptive to individual knowledge, experience and interests and to be effective and efficient in supporting and promoting desired learning outcomes. (p. 2)

Like the quotations in Table 1, this definition of PL broadly encompasses several different practices related to personalization.

When pedagogical definitions become too broad, they lose the ability to describe individual approaches to learning. To combat the broad definitions of PL from the U.S. Department of Education, Walkington and Bernacki (2020) used the U.S. Department of Education's (2010) definitions of *personalization*, *differentiation*, and *individualization* to distinguish what separates PL from other pedagogies. They concluded that PL includes "learning activities [that] are meaningful and relevant to learners, driven by their interests, and often self-initiated;" whereas, differentiation "involves tailoring to learning preferences by changing the method or approach of instruction," and individualization "involves pacing instruction according to learning needs" (p. 238). This distinction of PL from related pedagogies is provides clear descriptions of what should and should not be considered PL.

In this study we used the definition of PL presented by Graham et al. (2019), a concise and direct definition that describes a specific pedagogy: "Personalization gives students some control over customizing the goals, time, place, pace, and/or path of their learning experience" (Ch. 4, para. 9). This definition builds on the pedagogical implications of BT presented by Horn and Staker (2011) and the U.S. Department of Education (2017) by adding a fifth dimension to PL — goals. This definition also separates personalization from other adaptive pedagogies by placing the power of adaptation in the hands of learners. This distinction aligns with Tomlinson's (2000) assertion:

> At its most basic level, differentiation consists of the efforts of teachers to respond to variance among learners in the classroom. Whenever a teacher reaches out to an individual or small group to vary his or her teaching to create the best learning experience possible, that teacher is differentiating instruction. (p. 2)

Put simply, our research espouses the position that when educators "tailor" instruction to learners' needs, interests, or abilities, instruction is differentiated, and when learners adapt instruction or learning activities based on their own needs, interests, or abilities, instruction is personalized.

Personalization in Practice

The broad definitions used to describe PL pedagogies complicate the challenge of gathering a unified corpus of work that describing K–12 PL practices that focus on student-centered applications. For example, Cuban (2018) described PL practices as occurring along a continuum from teacher-centered practices on one end to learner-centered practices at the other. Cuban (2018) claimed that one end of the continuum does not inherently have more value than the other end, or more value than practices in the middle that combine both teacher-centered and learner-centered practices. We agree that both student-centered PL and teacher-centered differentiation are valuable pedagogies. However, preparing K–12 teachers to implement blended and personalized learning (BPL) requires understanding the extent to which BT facilitates PL. For example, DeBruler and Green (2020) explained that K–12 blended teachers display PL practices, but do not detail what such BPL entails. Short et al. (2021) found that blended teachers provided PL within a course's goals, assessments, and learning activities, and that such BPL often required a PL plan for the class; however, they did not describe the goals, time, place, pace, and/or path along which instruction was personalized. Our study revealed how

K–12 teachers across grade levels and content areas use BT to provide students with PL along the dimensions of goals, time, place, pace, and path within learning objectives, assessments, and learning activities.

Research Questions

With the goal of uncovering specific ways in which K–12 teachers implement and manage BPL, we sought to answer the following questions:

1. What does personalization look like in K–12 blended contexts?
    a) What dimensions of personalization (goals, time, place, pace, and/or path) are K–12 blended teachers implementing and what does this implementation look like?
    b) Are there patterns or differences in these practices across dimensions of personalization, subject area, or grade level?
2. Are the skills or knowledge that teachers use for BPL similar to those provided by existing professional development and/or teacher preparation frameworks, such as Graham et al.'s (2019) *K–12 Blended Teaching: A Guide to Personalized Learning and Online Integration*?

Methods

Data were collected from semi-structured interviews with blended teachers across K–12 grade levels, subject areas or disciplines, and BT models such as the Christensen Institute's station rotation, lab rotation, flipped classroom, and flex models. We partnered with districts throughout various regions of the United States, including districts located in Georgia, Missouri, Nevada, Utah, and Virginia, as well as one international school. The interviews lasted approximately 90 minutes and focused on multiple aspects of BT. To obtain coverage across a

wide range of K–12 grade levels and disciplines, we conducted interviews with 62 teachers, librarians, and instructional coaches. The distribution of teacher contexts is presented in Table 2.

Table 2

Interview Sampling Strategy

No. of interviews	Grade levels	Subject areas
15	K–6	General
7	6–12	Science (e.g., biology, chemistry, earth science)
2	7–12	Technology (e.g., computer coding)
6	6–12	Math
6	6–12	English language arts
5	6–8	Foreign language (e.g., American Sign Language, English as a second language, French, Spanish)
6	7–12	Social sciences (e.g., social studies, history, geography)
5	7–12	Arts (e.g., visual arts, performing arts, music)
6	7–12	Other (e.g., physical education, health, family and consumer sciences)
4	K–12	Support staff (e.g., librarians, instructional coaches)

Teachers who taught Grade Six were classified based on whether they were general teachers or subject-specific teachers. K–6 teachers were grouped together because they teach students with limited literacy, which presents different challenges for BT than middle and upper grades. Of the K–6 group, four teachers had experience with grades K–3, with the other 11 teaching in grades 4–6. Of the teachers with K-3 experience, two taught multiple grades between K–6 and the other two taught either kindergarten or second grade.

Interviews were conducted by researchers working on various projects related to understanding K–12 BT. Interviewees were identified based on the researchers' social networks as well as through an open call using various avenues of communication: conference presentations, a research listing on EdTechBooks.org, and requests for chosen participants to

share the call with other teachers. Interested participants were asked to submit some basic information regarding their blended teaching contexts and practices. After participants were selected, interviews were conducted and recorded through Zoom. All interviews were stored within a secure cloud server until researchers had created de-identified transcripts for the interviews. Once transcripts were verified, all recordings were deleted. This process was meant to protect the identities of the teachers involved in the research. Participants were compensated for their participation, and the data collection methods were approved by the institutional review board of the authors' academic institution.

Analysis Methods

Once the interview transcripts were complete, the interviews were analyzed according to qualitative analysis methods suggested by Huberman and Miles (1994) and Wolcott (1994). These methods were selected according to their rigor for analyzing qualitative data and their ability to provide answers to the research questions. Creswell and Poth (2018) identified similarities between these methods, but the methods also complement each other in a way that was important to our research.

Both methods include taking notes while reading interview transcripts, reducing codes to themes, and displaying and reporting data in ways that allow for contrasts and comparisons. Huberman and Miles (1994) offered more discrete steps between these processes. We included these steps in our analysis based on our need for understanding BT practices reported in the interviews. Huberman and Miles (1994) did not include a method for contextualizing analyses and findings within existing theoretical frameworks, but Wolcott (1994) included this step as part of his process and provided more in-depth descriptions of how to display final data. Table 3 lists the steps of our analysis. Although the steps are numbered, their sequence was somewhat loosely

"choreographed," with some steps co-occurring and with progress sometimes following a spiral pattern (Huberman & Miles, 1994).

Table 3

Interview Analysis Steps

Step	Description
1	Read the transcripts of interviews and make marginal notes of first impressions (Huberman & Miles, 1994) and/or create separate notes related to the research questions as part of the initial reading (Wolcott, 1994).
2	Write a brief reflection concerning the transcript that can help guide future steps in the analysis (Huberman & Miles, 1994).
3	Identify codes within the interview transcripts and write brief notes describing such codes (Huberman & Miles, 1994).
4	Determine essential patterns and themes through organizing the codes collected in the previous step (Huberman & Miles, 1994; Wolcott, 1994).
5	Provide descriptive statistics of the codes (Huberman & Miles, 1994).
6	Use themes and descriptive statistics to compare relationships between codes and themes, while building logical assertions based on these relationships (Huberman & Miles, 1994).
7	Analyze the relationships among codes and themes as they relate to frameworks from the literature (Wolcott, 1994). The framework used for this analysis was the personalized learning competencies from Graham et al. (2019), which were used in a prior BT analysis completed by Short et al. (2021).
8	Report and display findings through a combination of tables, charts, diagrams, and/or figures (Wolcott, 1994), as well as provide comparisons between K-12 blended teaching contexts (Huberman & Miles, 1994; Wolcott, 1994).

Coding of the transcripts was completed using NVivo 12, and codes were applied to descriptions of individual practices, which varied in length from one or two sentences to two or more paragraphs. After the principal author coded each interview, members of the research team reviewed the codes for accuracy. When a coding disagreement occurred, researchers met to discuss the coding and decide whether to remove, alter, or keep the original. While our analysis

used the dimensions of personalization as an a priori coding scheme, codes within each dimension and other codes related to PL practices and implementation were categorized into organizing themes.

Findings

Graham et al. (2019) described five competencies for PL (Table 4). Our analysis revealed that teachers' implementation of BPL required knowledge and pedagogies across all five of these competencies, answering our second research question.

Table 4

Personalization Competencies From Graham et al. (2019)

Competency number	Competency
1	I can identify what personalization is.
2	I can develop a personalization plan for my class.
3	I can develop a guide for personalizing students' learning goals.
4	I can develop strategies for personalizing assessments.
5	I can develop strategies for personalizing learning activities.

Teachers had a working knowledge of PL, as defined by allowing students to control their own learning across the dimensions of goals, time, place, pace, and/or path, and they created personalization plans for their classes enabling personalization of learning objectives, assessments, and learning activities. As PL can have so many broad interpretations, the interview protocol used the definition from Graham et al. (2019).

Each of the 62 interviewed teachers reported allowing students to personalize at least one element of instruction — learning objectives, assessments, or learning activities — through student control of at least one of the dimensions of personalization — goals, time, place, pace, or

path. Regarding elements of instructions, all 62 teachers allowed personalization of the learning activities, 51 allowed personalization of assessments, and 24 allowed personalization of learning objectives. Considering the dimensions of PL, all 62 teachers allowed for personalization of pace, 59 for personalization of path, 54 for personalization of place, 49 for personalization of time, and 38 for personalization of goals. Descriptions of these codes are listed in Table 5.

Table 5

Code Descriptions for Aspects of Personalization

Aspect of personalization	Code	Description of code
Instructional elements	Learning objectives	Practices related to allowing students to have ownership and agency over what they wish to learn within a specific subject area or domain, or a broader learning goal like pursuing personal, academic, professional, or special interests.
	Assessments	Practices related to allowing students to have ownership over how, when, or where they demonstrate understanding, proficiency, or progress.
	Learning activities	Practices related to allowing students to have ownership over how they want to learn, how quickly they complete activities, which activities they complete, and when or where they complete these activities.
Dimensions of personalization	Goals	Student ownership over *what* they wish to learn, or *how* they wish to learn (e.g., choosing subjects to study, setting deadlines, choosing resources).
	Time	Student ownership over *when* learning will occur (e.g., during class, at home, or at work).
	Place	Student ownership over *where* learning occurs — at home, in the classroom, at school outside of the classroom, etc. — or *with whom* learning takes place — working with other students, adults, aides, etc.
	Pace	Student ownership over *how quickly* learning progresses.
	Path	Student ownership over *which activities* they complete within a learning unit or lesson or *how* they demonstrate understanding.

Implementation Strategies for BPL

At least one teacher from each context mentioned their BPL implementation strategies, totaling 50 teachers. Table 6 displays the various implementation strategies that teachers used as part of their BPL plan.

Table 6

Implementation of Blended and Personalized Learning Practices

Code occurrences: No. of interviews (overall instances)	Implementation practice	Implementation code description
27 (43)	Combining online and in-person instruction	Teachers explain planning or plans for combining in-person and online instruction for BPL.
18 (19)	Setting apart time	Teachers give students time that is built into the day/week for working on PL activities or goals.
14 (23)	Creating multiple paths	Teachers plan multiple ways for students to approach or complete an assignment.
11 (16)	Curating resources	Teachers curate various resources and allow students to choose the resources that will help them complete learning objectives.
10 (13)	Enabling student-centered design	Teachers plan activities or lessons based on various students' needs and abilities.
8 (10)	Planning ahead	Teachers have future lessons ready so students can work ahead.
6 (7)	Adapting classroom setup	Teachers change the physical layout/furnishings of their classroom to accommodate students' preferences.
5 (5)	Encouraging student-driven learning	Teachers train students to be independent learners.
3 (3)	Utilizing at home technology	Teachers use an understanding of what technology is available at home to plan appropriate activities.

The most common implementation practice was strategically combining learning that was happening online and learning that was happening in-person. Integrating the online space included (a) using videos in a learning management system to allow students to listen and relisten to instructions and examples of Spanish in an elementary Spanish class, (b) reviewing

music fundamentals in a secondary choir class that needed class time for rehearsals, and (c) providing a collection of resources for students to choose from in a secondary social studies class. Finding time in class for students to pursue their own learning objectives was mentioned by at least one teacher in every context, as was creating multiple paths.

Personalization of Instructional Elements

Learning objectives were the least frequently personalized element of instruction among the three elements, likely because most learning contexts are guided by state-mandated learning standards. Table 7 illustrates how many teachers within each context provided PL opportunities within each instructional element. Some cross-context comparisons were difficult to make due to lower numbers of participants in that context, such as comparisons including technology teachers, of which there were only two.

Table 7

Personalization Across Instructional Elements and Educational Contexts

Content area (No. of teachers)	No. of teachers personalizing each area		
	Learning objectives	Assessments	Learning activities
Elementary education (15)	7	10	15
Science (7)	1	7	7
Technology (2)	2	2	2
Math (6)	1	5	6
English (6)	1	6	6
Foreign language (5)	2	4	5
Social sciences (6)	3	6	6
Arts (5)	4	3	5
Other (6)	1	5	6
Support staff (4)	2	3	4
Total	24	51	62

Nearly half of the elementary teachers in our sample (46.7%) reported providing PL for learning objectives, 10% greater than the percentage of middle and secondary teachers who provided this personalization (36.2%). Most of the teachers allowed students to personalize their learning objectives for meeting previously established state or district learning standards. For example, in a history class the learning standard required that “students will examine various

perspectives on a current rights-related issue" (Utah Education Network, U.S. Government Standard 2.2), but within that learning standard students were given choice over which rights-related issues they examined. Table 8 displays the ways in which classes' learning objectives were personalized.

Table 8

Personalization of Learning Objectives

Code occurrences: No. of interviews (overall instances)	Personalization of learning objectives, themes	Thematic code description
15 (21)	Personal interests	Students choose what to learn based on career or topical interests.
6 (23)	Student-teacher meetings	Students set goals for their learning through meeting with their teachers.
6 (10)	Difficulty level	Students select the difficulty of the learning objective based on their abilities or prior knowledge.
4 (6)	Learning standards	Students choose their own learning standards based on abilities or interests.
4 (4)	Guiding questions	Students create their own learning objectives based on a question posed by the teacher.

Only the eight teachers whose practices fell into the learning standards and guiding questions categories allowed students to choose their own learning standards. Teachers who reported using the other strategies in Table 8 gave students flexibility within meeting a pre-assigned learning standard. Table 9 provides further examples of personalizing learning objectives across the categories described in Table 8.

Table 9

Examples of Personalizing Learning Objectives

Themes for personalization of learning objectives	Examples of practices (context)
Personal interests	● "During the civil rights unit, my students were given an opportunity to investigate who they wanted. A lot of my students who are immigrants wanted to investigate Cesar Chavez. Allowing them within a class like social studies, they can choose something that's relatable to them." (9–12, History) ● "Essentially, they choose the topic that they want to research; they choose how it's going to be researched, whether it's going to be hands on or online learning . . . [One student] wanted to know if different polymers that were being used had different intervals to the forces that then affected their elasticity and he looked at how far they could stretch. How many times it could be stretched before it broke. He really had that personalization part of it. And I was incredibly impressed with what he did . . . he's now in school to become a mechanical engineer, which doesn't surprise me because that's what engineers do, they take an idea and they're like, 'How can I make this better? How can I fix it?'" (9–12, Science)
Student-teacher meetings	● "I was in a conference in Seattle about grading and a woman gave me this idea. She called it a three-minute conference. The first question is, 'what are you working on?' Just get the student to explain that process. The second discussion is, 'I'm going to give you feedback on your process, not your product, your process because you're in the middle of it, right?' . . . And then the third one, the students and I set a goal together." (9–12, English)

Themes for personalization of learning objectives	Examples of practices (context)
Difficulty level	● "Yoga is considered P.E. under the state requirements and they do fitness testing three times a semester. At the beginning of the year, and they compare [their results] to some national [data]. Then they make a short-term goal and a long-term goal. Then at mid-term we do another fitness test, and they see that they reach their goal, or they forgot they had a goal, or what their goal was, or they reach the goal and make a new goal, or they realize their goal was really unrealistic. We teach in our district what's called SMART goals . . . I like that because it's really authentic learning. They're seeing their own progress, and they're not doing it for me." (9–12, P.E.) ● "This girl came, and she's done some textile things that she was really comfortable with. Um, but 3D printing terrified her. She was very, very timid very afraid of making a mistake. When we did 3D printing, she had this idea to do a mobile and it was the most ambitious 3D printing thing I'd ever seen, and I kept saying, 'Is this really, you know, this is what you want to do?' 'No, this is what I want to do.' And I'm like, 'Okay.' Bless her heart. She worked on that for a solid month, and to see her confidence now versus that little girl that came to me last year, I get emotional because this girl really overcame her fears. And now she owns it! Like this year when I said, 'You know, this is our 3D printing expert.' She was like, 'Yeah, I am. I can help you with whatever you need.'" (9–12, Librarian)
Learning standards	● "I teach seventh grade math and there's no other seventh grade teachers to collaborate with. I have students that come to seventh grade math already mastering seventh grade math and they're ready for more. And I think that's something, like if we're talking about goals and something like Khan Academy, there's not a cap to it. The kids are going to continue to go and grow." (7th grade, Math)
Guiding questions	● "We have Wonder Wednesdays where they ask whatever questions they want to, and I ask kids to research the answers." (2nd grade) ● "One thing I love about PBL is when the kids are developing the list of things like, 'This is what the question is. And this is the things I need to know.' I'm not telling them what they need to know they're developing the questions themselves of, like, okay, 'We need to learn how to do this. We need to learn how to do this.' They're developing their pathway. They are developing the questions for themselves." (K–6, Librarian)

In our sample, 51 teachers (82.3%) allowed for personalization of assessments in their classes. We designated an assessment as any assignment, test, or project that teachers used to measure student understanding. Our coding omitted assignments that were not graded or were graded based on participation or completion, which were coded as instructional activities. Similar to the personalization of learning objectives, teachers had different approaches to allowing students ownership of their assessments. Table 10 describes the themes that emerged for the ways teachers personalized assessments.

Table 10

Personalization of Assessments

Code occurrences: No. of interviews (overall instances)	Personalization of assessment	Thematic code description
26 (55)	Choice within assessments	Students choose the path of completing an assessment such as determining their role in a group project or determining which resources to use in completing an assessment.
25 (40)	Choice of topic	Students choose the topic of the assessment or project.
20 (32)	Choice of assessment type	Students choose (a) the type of assessment that they complete to demonstrate understanding or (b) the process of completing the assessment.
19 (31)	Flexibility of online assessment	Students choose when, where, and/or how long to complete an assessment due to online availability.
15 (31)	Choice to re-take assessment	Students can resubmit assessments.
7 (9)	Reflection on learning	Students choose to demonstrate what they have learned instead of testing over specific ideas, facts, etc.
3 (3)	Flexibility within submission window	Students choose when to submit an assessment within a specific window of time, allowing them to take an assessment when they are ready.

Teachers most commonly personalized assessments by offering students some choice within the assessments they would complete, the topic they were tested on, or the kind of assessment to be used. Many teachers used online assessments to give students options to complete the assessment where, when, or how quickly they liked. Many students were also allowed to retake an assessment, allowing them to personalize their goals for how well they

would do on an assessment and how quickly they would finish it. Table 11 presents examples of personalization within assessments.

Table 11

Examples of Personalizing Assessments

Personalization of assessment themes	Examples of practices (context)
Choice within assessments	● "Hall of History is something that we do every year with a poster of a famous person and I love to open it up to, 'Here's all the things you can do you. I'm not going to force you to make a poster. I'm not going to force you to do this, here are your options.' I think when you have more accessibility to it, then you get a product back that is so much better because kids can choose what they're good at." (5th grade) ● "I do a PowerPoint on fashion history. I set them up in a Google slides and they collaborate on that. Instead of having one student on a device typing it up or having a poster that four students are trying to work on, they're able to divide and conquer. They each have tasks. Sometimes I'll divide it up knowing that they have technology and access. I say, 'You do this, you do that. This person is in charge of this area, and these are the tasks that you guys need to divide up,' So, then each person has something to do." (9–12, Family and Consumer Science)
Choice of topic	● "The final project is, for some students, more of a passion project of 'I really want to create this app to do this and I'm going to start that process in this class.' But it's an assessment of the learning. It's a compilation of the learning and 'I'm going to make this cool thing, because that's what I'm going to do.'" (9–12, Coding) ● "I was just like, make a landscape. Go. The amount of landscapes I got were so different. I got schools. I got houses. I got bedrooms. I got fields. I got beaches. I mean, you name it. I got it. I got everything. They were able to do whatever they wanted to do." (4th grade, Special Education)
Choice of assessment type	● "When I give them opportunities to show products of their learning, I let them have control over how they want to show it. I give them some starting points like maybe try this, or this, or this, but come talk to me if you have another idea, which they do." (6th grade)

Personalization of assessment themes	Examples of practices (context)
	● "We had a girl who made up a song and sang the song. And she still showed mastery, but she was doing what she wanted to do. We had a guy who he wants to be a cartoonist. He did his projects like it looked like a frame for manga, and it was phenomenal. We highlighted the things that they like and they're interested in. I can tell you this kid, he's a C student and the time and energy that he spent on this project because he was interested in it and it tied into what he was interested in." (9-12, English)
Flexibility of online assessment	● "They do their corrections if they need to, based on individualized targeted feedback, which means each individual person gets to that question at different times, so [the assessment] almost has to be online because otherwise, I would have to stop and say, 'Okay now we're going to talk about something.' That just doesn't work organically. Putting it online allows them to maintain that self-paced aspect. Some kids will finish the quiz in five minutes. Some kids will finish the quiz in 30 minutes because it takes them that long to process each question and really be ready for it." (11–12, Special Education Science)
Choice to re-take assessment	● "They know all the scenarios at the beginning of the unit. Then they have a tracking sheet. You know, 'I've mastered this on this date and I got a two. And so I want to redo that.' They don't have a lot of choice in what, but they have all the choice over pacing. We will go over specific topics on a specific day, but then a student who isn't comfortable with a two or three and wants a higher score can at any point in the unit redo a mastery-check for trying to get a four." (8th grade, French)
Reflection on learning	● "I changed my online assignment to be where the students record their playing test, they listen to it themselves, fill out their own rubric, then get back to me with any feedback. They tell me what they learned. That was good. It saved me time and it put more of the responsibility on their shoulders." (7–12, Music)

Learning activities included ungraded assignments or other tasks that provided students with an opportunity to gain knowledge. This was the largest area of personalization with 13 emergent themes. Table 12 displays the number of teachers who implemented various strategies.

Table 12

Personalizing Instructional Activities

Code occurrences: No. of interviews (overall instances)	Personalization of instructional activities	Thematic code description
37 (102)	Online instruction	Students access instructional materials (i.e., mandatory materials created or used for
34 (73)	Multiple paths	Students select from various learning resources or activities.
30 (49)	Project-based learning	Students take more control over their learning process and final learning products.
28 (68)	Online resources	Students access online resources (i.e., non-mandatory materials used to enhance, review,
26 (51)	Online assignments	Students complete instructional activities not intended for assessment.
21 (45)	Task lists	Students work on a list of work or assignments that they can complete at their
19 (33)	Learning extension	Students extend their learning beyond the initially assigned activities.
19 (30)	Exploration activities	Students explore resources for a lesson or in response to their own interests and questions.
17 (46)	Educational software	Students use educational software or applications to learn, practice, and review
13 (23)	Submission window	Students are given a submission window for turning in work or completing activities.
11 (14)	Online communication	Students use online discussions, video calls, etc. to complete learning activities.
8 (10)	Future lesson availability	Students can work ahead after finishing an assigned lesson or activity.
3 (5)	Student created activities	Students create the learning activities they want to complete.

Many BPL practices relied on the online space to provide students with access to learning activities and materials that could be accessed anytime and anywhere based on students' readiness or preparation for learning. Many practices also required teachers to plan more instructional activities than might be used in non-blended classrooms. For example, creating multiple paths and having future lessons available involved providing more than a single activity for each class meeting. The practices in Table 11 were reported across all contexts, though we must note that none of the art teachers used the last three practices.

Personalization Across Dimensions

Personalization of students' goals, time, place, pace, and path for learning were widespread across contexts. All 62 teachers allowed for personalization of pace, 59 teachers for path, 54 for place, 49 for time, and 38 for goals. Table 13 separates these numbers across educational contexts.

Table 13

Comparison of Personalization Dimensions Across Contexts

Content area (No. of teachers)	No. of teachers personalizing across each dimension of personalization				
	Goals	Time	Place	Pace	Path
Elementary education (n = 15)	12	11	13	15	14
Science (n = 7)	4	5	5	7	7
Technology (n = 2)	2	2	2	2	2
Math (n = 6)	2	5	6	6	5
English (n = 6)	2	6	6	6	6
Foreign language (n = 5)	2	5	5	5	4
Social sciences (n = 6)	5	4	5	6	6
Arts (n = 5)	4	3	3	5	5
Other (n = 6)	3	4	5	6	6
Support staff (n = 4)	2	4	4	4	4
TOTAL	38	49	54	62	59

Our analysis showed that PL is widely practiced within BT. Four teachers (in arts, math, health, and science) personalized along two dimensions, six teachers personalized along three dimensions (in arts, two in elementary, science, and two in social sciences), 23 teachers

personalized four dimensions, and 29 teachers personalized across all five dimensions. Every other teacher group except arts teachers had some participants who allowed for PL across four or more dimensions.

The personalization of goals was accomplished through a variety of strategies. Goals were personalized based on students' personal interests (n = 24), abilities (n = 12), and desire for a challenge (n = 7). Additionally, students could create SMART goals to direct their learning (n = 4), to establish deadlines for homework or projects (n = 3), and to decide which badges they wanted to attain (n = 20). These strategies often overlapped. For example, students working with a high school librarian in the school's maker space could choose to earn a series of badges in 3D printing, laser cutting, and textiles, enjoying the challenge of trying to earn all the badges. Similarly, a middle school social science teacher asked students to create two weekly goals based on their personal interests, both academic and non-academic, and students would set their own timelines for meeting such goals.

Personalization of time and place co-occurred 106 times (time was coded a total of 144 times, and place 173 times). Personalization of time included personalization of place in 73.6% of instances and personalization of place included personalization of time in 31.3% of instances. These two dimensions often co-occurred in allowing students access to learning materials and activities at home or another place outside of school. Personalization of time included 25 teachers who allowed students to work at home and 16 teachers who provided students with access to learning when absent; personalization of place included 26 teachers who allowed students to work at home and 18 teachers who provided students with access to learning when absent. Time was personalized by allowing students to have flexible class time (n = 9), a window of time within which to complete a set number of activities (n = 2), access to learning materials

before or after school (n = 2), or a selection of various in-person class meeting times (n = 2). Place was generally personalized as offering either on location or off location learning options. The on-location options included working in various places within the classroom (n = 18), working in groups (n = 16), or working in different locations around the school such as the hallway, library, or different classrooms (n = 7).

All 62 teachers mentioned some way of personalizing pace. The strategies most commonly offered were (a) providing students with access to media-based instructions so they could review, slow down, or speed up instruction as they wanted (n = 29), (b) allowing students to follow task lists to continue working after completing an assigned task (n = 27), (c) providing students with online activities to work on at their own leisure (n = 24), (d) providing extension opportunities for students to learn more about a subject after completing a required assignment (n = 23), and (e) allowing students to submit assignments within a due date window (n = 21). Less common practices included (a) using educational software to allow student to progress when ready (n = 16), (b) allowing students to retake assessments (n = 16), (c) allowing students to work ahead in the curriculum (n = 14), and (d) enabling students to take on independent projects paced according to their own goals (n = 12). Educational software was disproportionally used by elementary teachers, who made up 8 of the 16 using this affordance. The other eight teachers were spread across contexts — three math teachers, two foreign language teachers, two English teachers, and one support staff member. The least common practices for personalizing pace included the use of online presentations that students could revisit or progress through at their own pace (n = 9), the use of online assessments that provided flexible completion times (n = 8), the opportunity to review assessment content before retesting (n = 3), and the ability to work through content at their own pace after missing class (n = 3).

Only three teachers did not allow for personalization of path. Strategies for personalizing path are listed in Table 14; they were spread fairly evenly among educational contexts. Slight discrepancies included nine teachers using task lists coming mostly from science (n = 6), with elementary teachers (n = 3) and support staff (n = 1) making up the other four. The only teachers who used educational software to personalize path were elementary teachers, which may hint at a shortage of available educational software for other contexts.

Table 14

Strategies for Personalizing Path

No. of teachers	Personalization strategy	Examples from interviews
31	Topic choice	English students choose the topic of an essay based on the prompt "What's a problem in the school?"
24	Tool or medium choice	Theatre students can perform live in class or live online from home.
22	Resource choice	Math students can choose to watch a recorded lecture or listen to the lecture in-person.
21	Choice boards	Music students are given 20 assignment options to choose from, each with its own point value; they must complete 60 points worth of activities.
18	Guided questions	History students are asked to present and explain what happened during the Cold War from the Western perspective, and then given freedom to explore different ideas.
16	Instructional media	Elementary students can choose to learn from a video, from a NearPod presentation, or from the teacher.
15	Assessment choice	Coding students choose a final project that can display what they learned in the class.
13	Extension activities	Elementary students are given a list of enrichment activities they can choose to complete upon finishing an assignment.
13	Creative assignments	Science students are tasked with creating ideas for preventing oil spills; they must research their ideas.
11	Lesson choice	Elementary students are given a list of videos to use for review before taking a test. They can look at all of the videos or only the videos they want to use.
10	Task lists	Science students are given a list of tasks to complete, but they can choose the sequence.
7	Optional learning	History students can choose to attend an after school online session to learn more about a class topic.

No. of teachers	Personalization strategy	Examples from interviews
5	Goal-based paths	Elementary students choose how to complete a project based on goals they set with the teacher.
4	Remediation choices	English students can choose to read something below grade level if they need remediation.
3	Educational software	Elementary students choose which software to use during a free learning time, or which activity to complete within a given software.

Personalization of Instructional Elements Across Personalization Dimensions

Our final analysis related to the research question about differences in BPL across contexts. Tables 15, 16, and 17 break down BPL practices along the variables of educational contexts, instructional elements, and personalization dimensions. These tables demonstrate all three elements of instruction can be personalized along all five dimensions of personalization. Table 15 illustrates the personalization of learning objectives across PL dimensions according to each context. Learning objectives were mostly personalized according to students' goals or path.

Table 15

Personalization Dimensions Within Learning Objectives Across Contexts

Content area (No. of teachers)	No. of teachers personalizing across each dimension of personalization				
	Goals	Time	Place	Pace	Path
Elementary education (n = 15)	7	1	2	2	2
Science (n = 7)	1	-	-	1	1
Technology (n = 2)	2	1	1	2	2
Math (n = 6)	1	-	-	-	
English (n = 6)	1	-	-	-	-
Foreign language (n = 5)	1	-	-	-	1
Social sciences (n = 6)	2	-	-	-	3
Arts (n = 5)	3	1	1	1	4
Other (n = 6)	1	-	-	-	-
Support staff (n = 4)	2	1	1	1	2
TOTAL	21	4	5	7	15

Personalization of learning objectives was more prevalent in content areas such as the arts and technology that may not have mandatory state or national learning standards. For example, teachers in the areas of technology (i.e., coding), arts, and support staff (librarians or

instructional coaches) do not have to prepare students for state-mandated tests and may have more room to allow students to control the course's learning objectives.

Learning objectives personalized along the dimension of goals allowed students to choose their own learning objectives related to the class or to goals within a set learning objective. Students chose from a set list of topics or chose to work ahead on more advanced learning objectives. Personalization of time and place included providing students with opportunities to explore their own learning goals outside the classroom. Personalization of pace enabled students to determine how quickly they would work toward meeting a learning objective, allowing them to pursue fewer or more learning objectives or to undertake easier or more difficult learning objectives than their classmates based on ability and perseverance. Finally, personalization of path allowed students to choose topics to study within a set learning objective, such as choosing from various events or figures to learn about during a Civil War unit.

Table 16 displays the dimensions used to personalize assessments across contexts. Personalization of assessments across contexts was a fairly prevalent practice. We were surprised that path was the most personalized dimension of assessments. Personalization of assessments across the dimensions of goals, time, and place was less common.

Table 16

Personalization Dimensions Within Assessments Across Contexts

Content area (No. of teachers)	No. of teachers personalizing across each dimension of personalization				
	Goals	Time	Place	Pace	Path
Elementary education (n = 15)	2	1	2	2	10
Science (n = 7)	1	3	2	7	5
Technology (n = 2)	1	1	1	1	2
Math (n = 6)	2	1	1	2	4
English (n = 6)	-	3	2	4	5
Foreign language (n = 5)	1	1	-	4	3
Social sciences (n = 6)	-	3	3	3	5
Arts (n = 5)	2	2	2	2	2
Other (n = 6)	1	1	1	3	5
Support staff (n = 4)	-	2	2	1	3
TOTAL	10	18	16	29	44

Personalization of goals and assessments allowed students to select the assessment difficulty or assessment questions, as well as choose how well students wanted to do on an assessment. For example, some math assessments had questions with tiered difficulties, and students could choose whether they wanted to try to answer the more difficult questions.

Students across contexts were also able to retake assessments (allowing for personalization of pace) until they were satisfied with their score. This practice also enabled personalization of goals, as students could choose whether their grade on a first assessment attempt earned their desired grade. Personalization of time and place for assessments allowed students to choose when and where they completed assessments, which included completing assessments either at school or away from school. Personalization of pace provided choices of how long to spend on assessments as well as how many times to retake them. When path was personalized students could choose which assessments they would use to demonstrate understanding (e.g., traditional test, presentation, video, or essay) or choose between questions or topics within an assessment method (e.g., choosing between test questions or essay topics).

The most commonly personalized aspect of instruction was learning activities. Pace was the most common way of personalizing learning activities (n = 60), followed by path (n = 57), time (n = 40), and place (n = 40); the dimension of goals was the least personalized (n = 24). Table 17 displays the dimensions that were used to personalize learning activities across contexts.

Table 17

Personalization Dimensions Within Learning Activities Across Contexts

Content area (No. of teachers)	No. of teachers personalizing across each dimension of personalization				
	Goals	Time	Place	Pace	Path
Elementary education (n = 15)	6	9	8	15	14
Science (n = 7)	3	5	5	7	7
Technology (n = 2)	2	2	2	2	2
Math (n = 6)	1	5	5	6	4
English (n = 6)	2	2	2	6	6
Foreign language (n = 5)	1	5	5	5	4
Social sciences (n = 6)	2	2	2	5	6
Arts (n = 5)	3	3	3	5	5
Other (n = 6)	2	4	4	5	5
Support staff (n = 4)	2	3	4	4	4
TOTAL	24	40	40	60	57

Personalization of goals within learning activities allowed students to choose the difficulty level of activities based on their goals; for example, choosing a more difficult reading level in English using Newsela, or creating a plan for progressing through science learning activities by mapping out when, where, and how to complete chosen activities. When time and

place were personalized, students were provided access to learning materials and activities so they could work when and where convenient. Personalization of pace provided a set timeline or due date window for students to progress through learning activities. Personalization of path enabled students to choose which activities, assignments, projects, or resources they would use to meet course objectives.

Problem-based learning and project-based learning were also mentioned by teachers; such practices often spanned multiple elements of instructions and dimensions of personalization. For example, a social studies class was assigned an environmental entrepreneurship project as part of a human environment unit; students chose their topic, their entrepreneurial product, their presentation style, and how to use their class time (i.e., completing research, planning group assignments, or building their prototype). Most groups worked on their projects both at school and at home. This project-based learning included personalization of learning objectives, assessments, and learning activities across the dimensions of goals, time, place, pace, and path.

Discussion

Our findings suggest that teachers across K–12 contexts offer personalization to students within all five personalization dimensions as proposed by Graham et al. (2019). Subtle differences were found between contexts regarding how these dimensions were personalized. However, opportunities were apparent for personalizing all three elements of instruction (objectives, assessments, and activities) along all five dimensions of PL (time, place, pace, path, and goals). The competencies suggested by Graham et al. (2019) for personalization seemed to cover the extent to which teachers used BPL. They created BPL plans for their classes, and then personalized their learning objectives, assessments, and learning activities.

Our findings also suggest that learning activities may be the element of instruction that teachers personalized most often, while learning objectives were personalized least often. This aligns with findings from Short et al. (2021) that the personalization of learning activities was the most prevalent BPL practice within a sample of BT artifacts. In contrast with Short et al. (2021), however, we found that personalization of assessments was more prevalent than personalization of learning objectives. This difference could be due to the specific scope of each research project, as this study asked specifically about PL practices, whereas Short et al. (2021) was analyzing general BT practices.

The findings of this study also comprise a foundation for a new framework for describing and designing PL opportunities. As previously explained, many definitions of PL are broad terms that cover any "tailoring" of instruction based on students' needs, interests, goals, etc. (Fisher, 2019; Knowledge Works, 2019; Morin, 2021; U.S. Department of Education, 2010, 2017). These definitions follow Cuban's (2018) claim that PL falls along a continuum from teacher-centered to student-centered practices. Other definitions, however, focus specifically on either enabling student ownership of learning (Bill & Melinda Gates Foundation et al., 2014; National Center for Learning Disabilities, 2015; Patrick et al., 2013) or requiring student ownership of learning (Gross & DeArmond, 2018; LEAP Innovations, 2021) as part of PL. Our findings demonstrate that teachers, across contexts, can enable students to take ownership of their own learning objectives, assessments, or learning activities by adapting the goals, time, place, pace, and/or path of their learning.

The adoption of a broad definition of a specific phenomenon creates a communication problem for researchers and educators interested in that phenomenon. The umbrella definitions for PL over the last decade present such a problem. Educators or researchers cannot say they are

interested in or practice PL without clarifying their approach to PL by specifying how students have control over the goals, time, place, pace, and/or path of their learning objectives, assessments, and/or learning activities. This approach to PL is similar to the approach taken by Moore (1993) in explaining transactional distance and the degrees of autonomous learning consisting of learner autonomy across learning goals, evaluation, and execution. Figure 1 and Figure 2 illustrate elements of instruction that can be personalized along various personalization dimensions. This personalized learning design framework can help educators plan PL by illustrating the ways in which personalization can happen within each instructional element of backward design and guide evaluators in understanding the ways in which educators personalize learning.

Figure 1

Elements of Backward Design

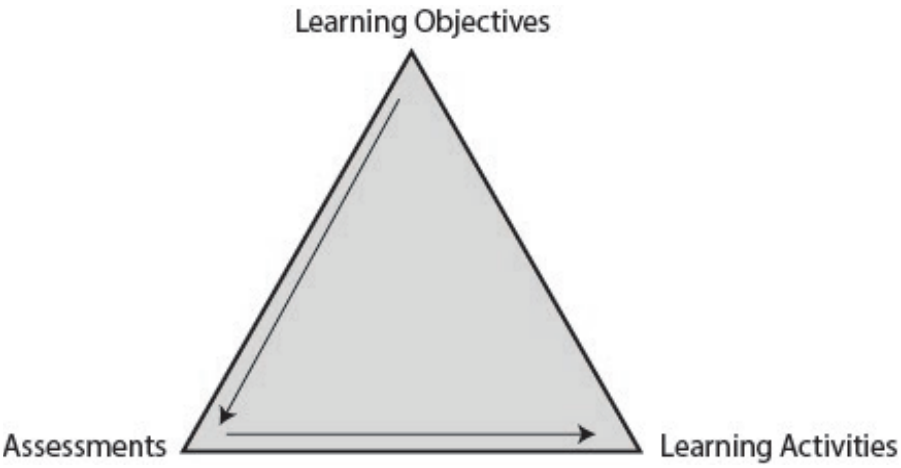

Figure 2

Dimensions of Personalized Learning

A significant contribution of this PL design framework is the addition of the personalization dimension of goals. Previous definitions of PL mentioned providing students with ownership over time, place, pace, and path (see Table 1, and Horn & Staker, 2011), but Graham et al. (2019) were original in adding goals. This study has provided concrete examples of personalizing students' time, place, pace, path, and goals, detailing what such personalization looks like across various instructional elements and educational contexts.

Iterations of the personalized learning design framework may identify various levels of PL within each dimension. For example, the lowest level could represent no personalization of instruction. At the next level educators surrender some ownership of instruction by providing students with differentiated instructional elements. This may be an important step for implementing PL, as differentiation for one student could become personalization for another student (as is the idea behind Universal Design for Learning). The penultimate level would represent teachers enabling students to make choices over the goals, time, place, pace, and/or path of their learning within limited options, such as using a choice board, creating a due date window, or allowing students to select among assessment methods or tools. At the ultimate level

of personalization, teachers give students complete ownership of their learning allowing them to create their own goals, time, place, pace, and/or path for learning. This framework could have design and evaluation implications for K–12 PL, extending to corporate and higher education settings, in efforts to promote life-long learners through increasing student ownership and agency.

Conclusion

Personalization of instruction has been perceived as a range of practices enabling teachers to tailor instruction to students' abilities, interests, and needs, ranging from teacher-centered to student-centered practices. However, educators who want to increase student ownership and agency need to provide instruction that allows students some control over the goals, time, place, pace, and path of their learning. Findings of this study relate to the ways K–12 teachers across contexts allowed students to have some control over their classes' learning objectives, assessments, and learning activities. These findings have provided the foundation for a new framework for PL that can allow for educators and researchers to have a shared language for PL that more accurately describes personalization within a given context than previous descriptions of PL. Future research could seek to uncover the affordances and constraints of BPL, particularly regarding personalization of various elements of instruction, as well as dispositions and technology skills needed for BPL, detailed implementation and management practices related to BPL, and applications of the personalized learning design framework.

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APPENDIX

Institutional Review Board Approval Letter

Memorandum

To: Charles Graham
Department: BYU - EDUC - Instructional Psychology & Technology
From: Sandee Aina, MPA, HRPP Manager
Wayne Larsen, MAcc, IRB Administrator
Bob Ridge, PhD, IRB Chair
Date: March 26, 2020
IRB#: IRB2020-127
Title: K-12 Blended Teaching Within the Content Disciplines

Brigham Young University's IRB has approved the research study referenced in the subject heading as exempt level, Category 2. This category does not require an annual continuing review. Each year near the anniversary of the approval date, you will receive an email reminding you of your obligations as a researcher and to check on the status of the study. You will receive this email each year until you close the study.

The study is approved as of 03/26/2020. Please reference your assigned IRB identification number in any correspondence with the IRB.

Continued approval is conditional upon your compliance with the following requirements:

1. A copy of the approved informed consent statement can be found in iRIS. No other consent statement should be used. Each research subject must be provided with a copy or a way to access the consent statement.
2. Any modifications to the approved protocol must be submitted, reviewed, and approved by the IRB before modifications are incorporated in the study.
3. All recruiting tools must be submitted and approved by the IRB prior to use.
4. Instructions to access approved documents, submit modfications, report adverse events, can be found on the IRB website, iRIS guide: http://orca.byu.edu/irb/iRIS/story_html5.html
5. All non-serious unanticipated problems should be reported to the IRB within 2 weeks of the first awareness of the problem by the PI. Prompt reporting is important, as unanticipated problems often require some modification of study procedures, protocols, and/or informed consent processes. Such modifications require the review and approval of the IRB. Please refer to the IRB website for more information.

DISSERTATION CONCLUSION

This dissertation characterized peer-reviewed research related to preparing teachers for K–12 blended teaching and connected research-based competencies to concrete practices to understand the skills and abilities K–12 teachers need to implement blended teaching. Such connections provided insight into preparing K–12 teachers for implementing blended teaching along the dimensions of online integration, data practices, personalization, online integration, and blended teaching implementation, with specific attention paid to personalization due to a national mandate from the U.S. Department of Education. Based on the findings of this study, the competencies from Graham et al. (2019) represent the skills and abilities that K–12 teacher need to blend online and in-person instruction. More research is needed to determine whether the online interaction competencies from Graham et al. (2019) are sufficient for K–12 blended teacher preparation.

This dissertation's literature review characterized the current the state of research based on articles' impact, methods, and research focuses. More importantly, it provided a foundation for future research focused on an in-depth thematic analysis about what is known and unknown in peer-reviewed research about preparing K–12 teachers for blended teaching. One area that current research focused on was competencies to guide the preparation of teachers for blended teaching. These articles focused on the development of competencies based on prior research and theories, teachers' practices, and blended teaching implementation. However, there was no research that attempted to connect research-based competencies for blended teaching to blended teaching practices.

To address this gap from the first article and provide teachers and teacher educators with a better understanding of the skills and abilities that K–12 teachers need for blended teaching, the

second and third articles of this dissertation provided insight into how research-based competencies related to examples of blended teaching practices. Both articles supported the competencies from Graham et al. (2019) by connecting them to concrete blended teaching practices. The third article also laid the foundation for a theoretical framework for personalized learning that can guide future instructional design and blended teaching practices.

Due to the COVID-19 pandemic, there may be an increased need to understand blended teaching practices and how to prepare K–12 teachers to implement them. There is still much to uncover concerning the ways in which K–12 blended teachers implement various blended teaching pedagogies across various grade levels, content areas, and geographical locations. However, I believe that the findings presented in this dissertation provide valuable insights to guide such endeavors, moving the field forward.

DISSERTATION REFERENCE

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