Journal of Online Learning Research (2021) **7**(1), 5-33

K-12 BLENDED TEACHING SKILLS AND ABILITIES: AN ANALYSIS OF BLENDED TEACHING ARTIFACTS

CECIL R. SHORT
Brigham Young University
cecil.r.short@gmail.com

CHARLES R. GRAHAM
Brigham Young University
charles.graham@byu.edu

EMILY SABEY
Brigham Young University
emily@sabey.org

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: Blended learning, teacher education, competencies, professional development

Winner of the 2021 Society for Information Technology and Teacher Education K-12 Online Learning SIG Promising Scholar Award

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 (Utah Administrative Code R277-504-5.C.c-d & R277-504-4.A.3.e-f, n.d.; Minnesota Senate Bill 273, 2012). 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 fairly 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 are able to 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 fairly 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.

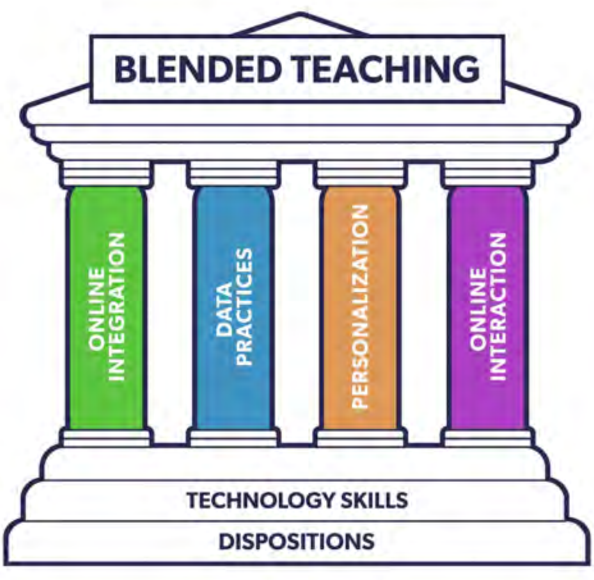

Figure 1. Visual representation of the competencies in the Blended Teaching Readiness (BTR) framework Note: This figure was created by Graham, Borup, Short et al., 2019).

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 (https://bit.ly/39Qzchm)
- A brief description of how teachers and students work together using technology to specifically personalize students' learning objectives (https://bit.ly/3gmJwi6)
- An implementation guide for scaling from a class-level blend to a school-wide blend or for choosing between the two BT systems (https://bit.ly/2VNTFee)

- 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 (https://bit.ly/37MyZZV)

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 (2019) and Pulham et al. (2019) 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

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 codes 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.

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 in order 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.

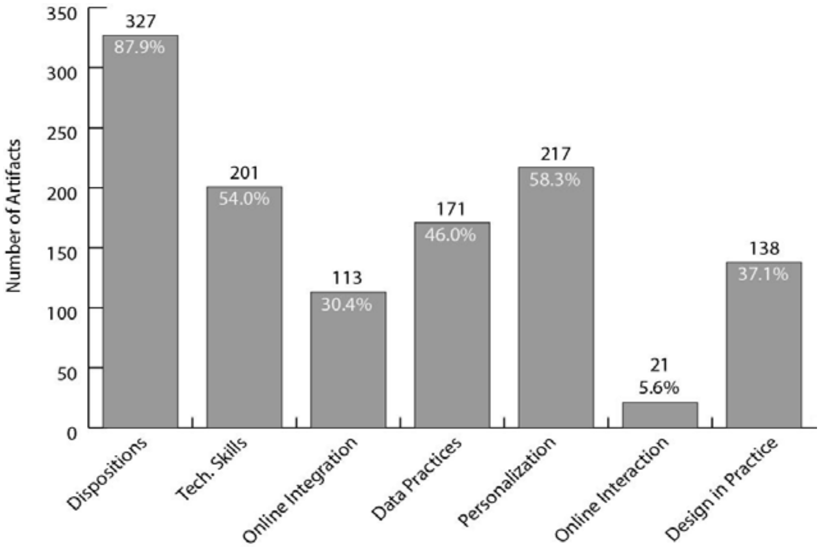

Figure 2. Prevalence of Code Categories Across the Sample of Artifacts.

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.

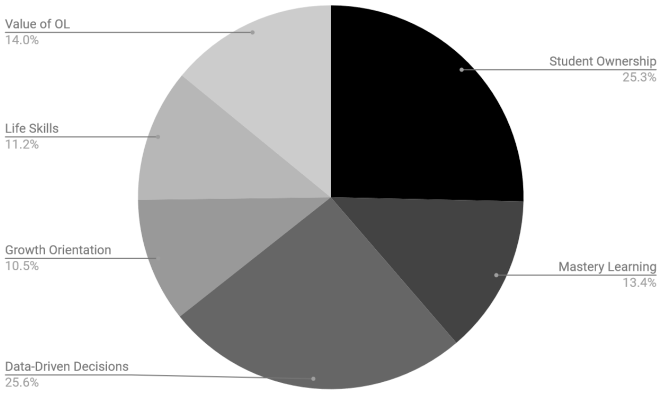

Figure 3. Prevalence of Codes within Dispositions.

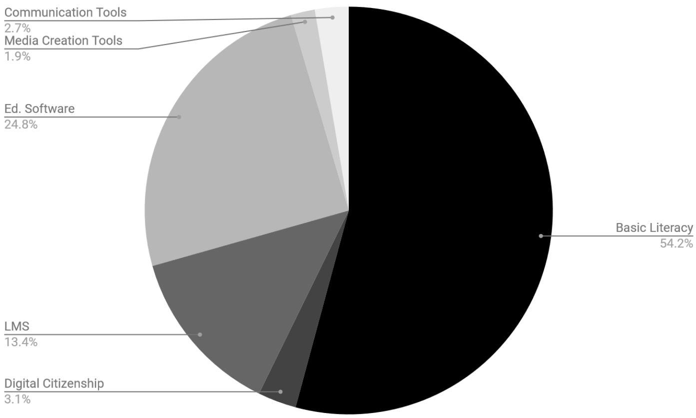

Figure 4. Prevalence of Codes within Technology Skills.

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.

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 Additional 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	58	56	52	-	17	27	5	25
(OLI)	(51.3)	(96.6)	(89.7)		(29.3)	(46.6)	(8.6)	(43.1)
Data practices	72	71	34	6	-	34	2	11
(DP)	(42.1)	(98.6)	(47.2)	(8.3)		(47.2)	(2.8)	(15.3)
Personalization	131	128	60	24	61	-	8	25
(pers)	(60.4)	(97.7)	(45.8)	(18.3)	(46.6)		(6.1)	(19.1)
Online interaction	4	4	4	2	3	2	-	2
(OLR)	(19)	(100)	(100)	(50)	(75)	(50)		(50)
Design in practice	75	68	51	23	18	23	2	-
(DiP)	(54.3)	(90.7)	(68)	(30.7)	(24)	(30.7)	(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 in order to support personalization, such integrations may not be necessary for personalization. Additionally, design in practice was somewhat frequently related to online integration and also 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.

Table 5, *Continued*

Rank	No. of occurrences	Competency area	Competency
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.

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 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 regards 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

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.

Note. BT = blended teaching.

Data Practices

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

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 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.). 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 in order 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 are able to 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. Revise: BT = blended teaching, 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 em ergent 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 BT 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. BT = blended teaching

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 disposition codes in our analysis suggests that the dispositions theorized by Graham, Borup, Short et al. (2019), which expanded upon the BTR instrument from Graham, Borup, Pulham et al. (2019), are foundational 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; however, the distribution of dispositions was less extreme than other areas of our analysis, ranging from 10.5% to 25.3%. This result 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 the sample, respectively, and were the most prevalent competency areas in the sample. There is clearly a connection between the high prevalence of these competency areas and the high valuing of dispositions of student ownership and data-driven decisions.

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

Future research in this area could focus on the role of dispositions in preparing teachers for BT. As our analysis showed, experienced blended teachers demonstrated specific dispositions as part of their practices, but discerning whether these dispositions were in place prior to implementing their BT practices was outside the scope of this research. Understanding how dispositions can impact teachers' implementation of BT practices could prove useful for districts seeking to identify teachers to pilot BT as well as for PD providers or teacher educators planning to prepare teachers for BT. Additionally, further research could seek to identify the role of dispositions in helping teachers to successfully 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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