K-12 Blended Teaching Readiness

Phase 1
Instrument Development

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- Policy – Inform local, state, and national public education policy strategies that reinforce and support online and blended learning opportunities for the K-12 community;
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Executive Summary

Blended learning is on the rise in K-12 schools (Picciano & Seaman, 2009; Miron & Gulosino, 2016; Molnar, 2017). With this growth in demand for blended learning, there is a greater need to prepare teachers who can facilitate successful learning in these environments.

In order for educator preparation programs, districts, and schools to conduct effective professional development for future blended teachers, the unique competencies of blended teaching need to be identified. Additionally, organizations and teachers need to have an easy way to assess teacher readiness and be able to diagnose what knowledge and skills they should focus on first in order to have the greatest impact with their limited professional development time and resources.

In this manuscript, we report on Phase 1 of a project intended to create a scientifically validated, openly-available blended teaching readiness instrument that can be freely used by districts, schools, and individual teachers to assess core knowledge and skills needed for successful blended teaching. During Phase 1, we report on the following progress toward our goal:

- We report on the major patterns that we found in the existing competencies and identify limitations of the existing work.
- We used the literature and expertise of current researchers and practitioners in the field to develop an initial instrument for testing.
- We tested the instrument with over 200 teachers of various backgrounds in a large school district in the eastern United States.
- We used confirmatory factor analysis to test the fitness of two models using four common structural equation modeling (SEM) analyses and found good fit for one model and poor fit for a second model.
- We make recommendations for Phase 2 of the study which includes adding an additional section to the model that focuses on management of blended classrooms as well as pursuing the development and testing of a second shorter instrument focused on pedagogy for organizations and individuals not willing to invest time to complete the longer instrument.

Introduction

A few years ago, the Utah State Board of education updated teacher licensure requirements to include the need for coursework preparing teachers "to teach effectively in traditional, online-only, and blended classrooms" and "to facilitate student use of software for personalized learning" (Utah Administrative Code R277-504-4.C.3.c-f, n.d.). We also recognized national trends toward blended and personalized learning highlighted by reports and policy recommendations from iNACOL (Patrick, Worthen, Frost, & Gentz, 2016). Furthermore, we became aware of blended and personalized learning initiatives at the school district level (see FCPS, n.d.). This led us to search for what specific competencies teachers would need for these environments that are distinct from the skills they are already learning or have already developed for teaching in traditional classrooms. While most traditional educator preparation programs require coursework related to technology integration, they require very limited training related to online teaching (Archambault et al., 2014; Barbour et al., 2012; McAllister et al., 2016) and supply very limited data on blended teaching preparation for pre-service and in-service teachers. This report shares research that stemmed from the Phase 1 efforts of a *MVLRI* fellowship with the goal of developing an openly available instrument for identifying blended teaching readiness that could be used to inform professional development and training for both preservice and in-service K-12 teachers.

Growth in Blended Learning

Blended learning is the combination of both online and traditional classroom instruction (Graham, 2006; 2013). The past decade has seen significant growth in the adoption of blended and online learning across K-12, higher education, and corporate training sectors. Blended learning is quite difficult to track for three reasons: (1) there are many different models of blended learning; (2) often, blended learning is initiated by teachers without a formal school program; and (3) most schools do not collect data about blended learning implementation. Despite these limitations, several studies have tried to document the extent of blended learning growth in K-12 schools.

- A 2008 survey of U.S. school district administrators (N=808) reported that 41% were implementing blended learning at some level, with 21% planning to implement blended learning within three years (Picciano & Seaman, 2009).
- A 2016 report from the National Education Policy Center (NEPC) using publicly available data identified 87 full-time blended schools (45 charter and 41 district-run) enrolling over 26,000 students in 16 states (Miron & Gulosino, 2016).
- A 2017 NEPC report identified a 40% increase in student enrollments at full-time blended schools, from 10,490 to 36,605, between 2014 and 2015 (Molnar, 2017).

There is evidence that blended learning may even be more pervasive than current data indicate. For example, in a U.S. Department of Education sponsored meta-analysis intended to focus on the efficacy of online learning, the researchers found that almost half of the studies actually involved blended learning instead of fully-online learning because students had opportunities for face-to-face contact with instructors (Means et al., 2010; 2013). Other researchers have also noted that many district and state "online" programs are actually blended programs because students regularly meet with facilitators (also called mentors and learning coaches) who provide students

with face-to-face support in addition to the online support and instruction they receive from the course instructor. Although on-site facilitators are typically not content experts, researchers have found that they commonly assist students with content-related questions and instruction (Barbour & Hill, 2011; Freidhoff, Borup, Stimson, & DeBruler, 2015; Taylor et al., 2016; Watson, Murin, Vashaw, Gemin, & Rapp, 2011).

Need for Blended Learning Teachers

The rise in demand for K-12 blended learning brings with it the paired need for teachers who can teach effectively in this new context. Recently, researchers have discussed the importance of infusing blended teaching into preservice experiences (Archambault, DeBruler, and Friedhoff, 2014) and stressed the importance of modeling blended teaching principles in pre-service teachers' methods courses (Shand and Glassett Farrelly, 2017). We could find no existing studies that look at the state of pre-service teacher preparation for blended classrooms and only limited case studies examining blended learning professional development for in-service teachers (Acree, Gibson, Mangum, Wolf, Kellogg, & Branon, 2017; Moore, Robinson, Sheffield, & Phillips, 2017). Some limited data focusing primarily on teacher preparation and professional development for online teaching was found which might give some insight into what is happening with preparation for blended teaching. Rice and Dawley (2009) found that only 20.0-38.1% of K-12 online teachers received professional development prior to teaching online, with 28.3-38.1% receiving their training during their first year of teaching. Additionally, research found that only 3.5% of responding teacher preparation programs provided opportunities for field experience in online teaching (Archambault et al., 2016). While there are some advantages to learning on-the-job, we feel that a more concerted effort to identify blended teaching competencies, diagnose teacher readiness, and provide targeted professional development for blended teaching will strengthen outcomes for teachers and their students in blended learning classrooms.

Background

In order to begin thinking about the competencies required for blended teaching, we think it is helpful to consider different categories of learner interactions. The literature often identifies three categories of interactions: learner-teacher, learner-learner, and learner-content interactions (Anderson, 2008; Moore, 1989). Blended learning highlights the fact that these interactions can occur in a traditional face-to-face environment or can be mediated through the use of technological tools. Figure 1 is a matrix with a simplified representation of the range of interactions possible. Table 1 provides a brief explanation and examples of the kinds of interactions and teacher skills represented in each quadrant of the matrix.

- The left-half of the matrix represents learner-teacher and learner-learner interactions while the right-hand side represents learner interaction with content materials.
- The top-half of the matrix represents interactions that are mediated by digital tools while the bottom half of the matrix represents traditional interactions that are not technology-mediated.

The teaching skills represented in the different quadrants are important to understand because the different teaching modalities emphasize skills in the different quadrants, as will be explained in the following section.

Figure 1. Blended teaching matrix identifying categories of interactions.

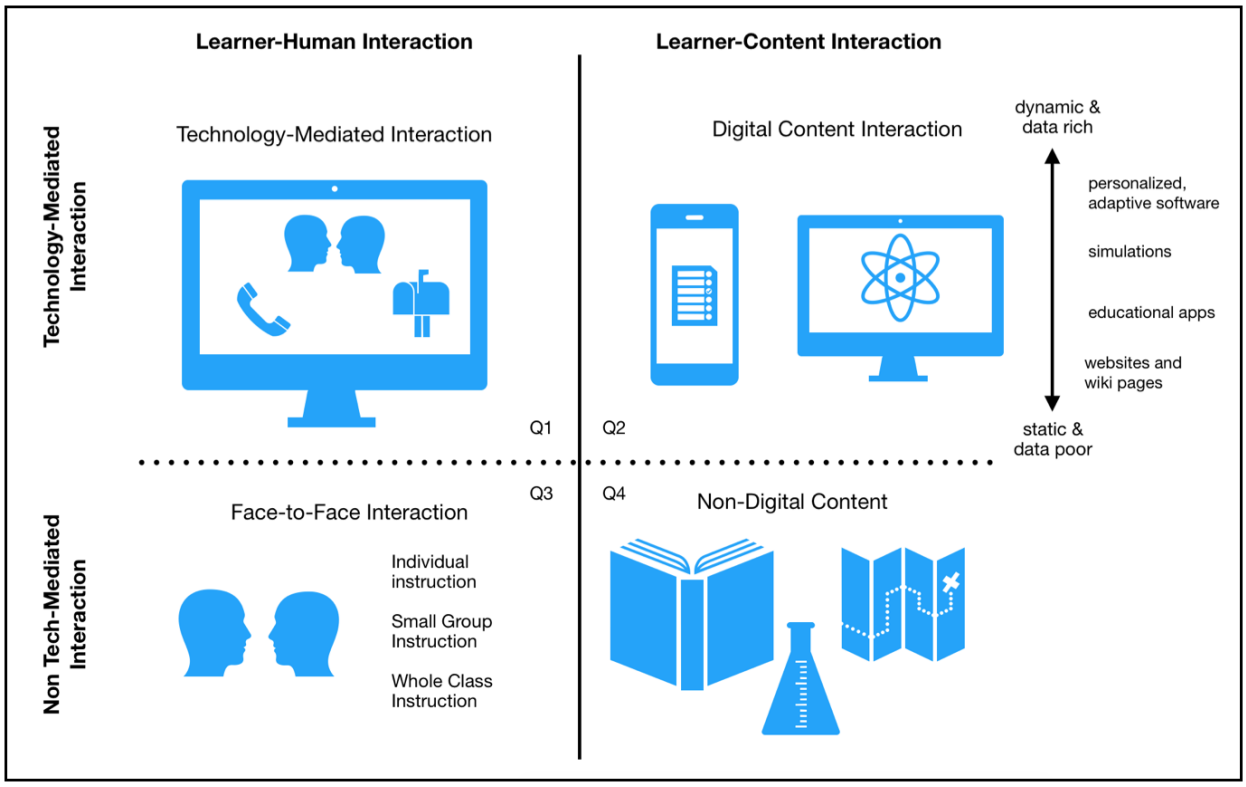


Table 1. Description of Interaction in Four Quadrants (see Figure 1)

Quadrant	Skills Required in Each Quadrant
Q1	This quadrant requires the skills for teachers to interact online with their students and to facilitate meaningful online interactions between/among students. Interactions in this space can happen either synchronously or asynchronously and at low or high fidelity (e.g., text-based vs. video).
Q2	This quadrant requires skills of working with digital tools and content. Digital content is increasingly dynamic and data rich. Thus teachers working in this quadrant need to strengthen their skills for working with real-time data generated by adaptive or personalized learning software.
Q3	This quadrant requires the skills for engaging in person-to-person teacher-student interactions as well as facilitating student-student interactions in whole class and small group settings.
Q4	This quadrant requires the ability to use and manage traditional classroom materials (e.g., books, physical manipulatives, lab equipment, etc.).

Blended Teaching vs. Technology Integration vs. Online Teaching

There are three common modalities for teaching: traditional face-to-face (F2F), online, and blended. Before the emergence of online and blended teaching, educational technology training focused on technology integration, which involves learning how to incorporate technology into classroom instruction. As shown in Table 2, traditional environments involved skills in Q3 and Q4 with a growing emphasis on Q2, having students engage with digital content. Online teaching which involved a physical separation between teacher and student involved communication skills in Q1 and engagement with both digital content (Q2) as well as non-digital content (Q4). Blended teaching combines the required skill-set of both the online and traditional teaching modalities, thus requiring skills across the entire matrix.

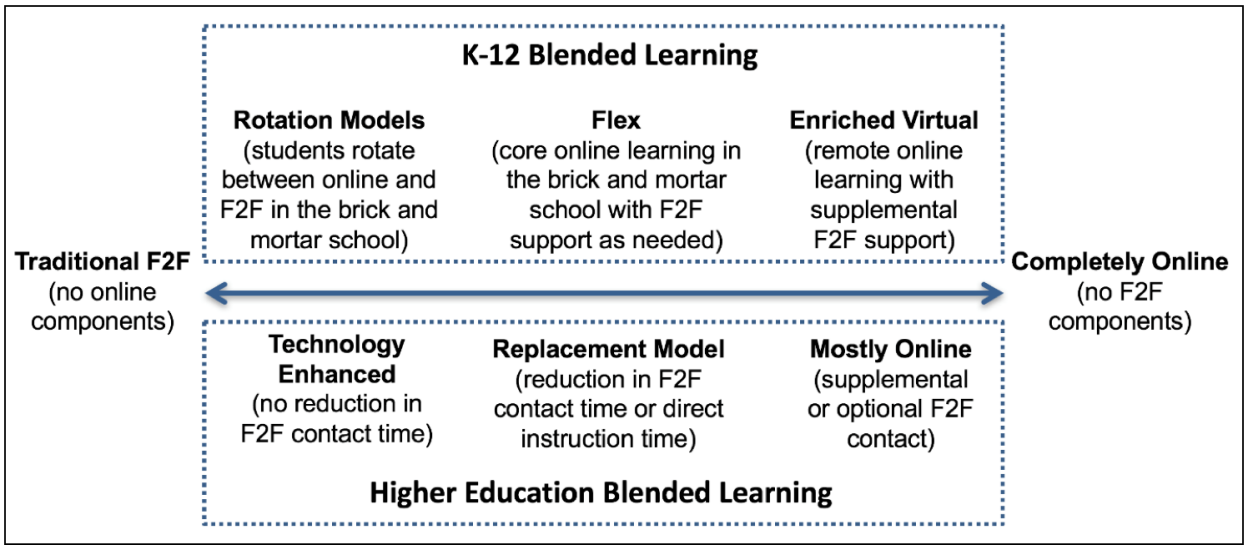
Table 2. Description of the General Teaching Skills Needed for Teaching in Three Modalities (see Figure 1)

Teaching Modality	Quadrant Skills	Description
Traditional teaching (w/ technology)	Q3+Q4+(Q2)	Traditional teaching has typically involved Q3+Q4. As classroom technologies have become more prevalent, tools for engaging with digital content (Q2) have become more available and more useful.
Online teaching	Q1+Q2+(Q4)	Online teaching primarily involves Q1+Q2. However, non-digital content (physical textbooks, science kits, etc.) often are used in an online teaching context.
Blended teaching	Q1+Q2+Q3+Q4	Blended teaching requires teachers to have skill sets in all four quadrants. Blending requires a combination of traditional and online teaching skills.

Different blended learning models may emphasize different types of interaction. Three of the most commonly identified K-12 blended learning models are *rotation models*, the *flex model*, and the *enriched virtual model* (see Figure 2)(Horn and Staker, 2014). The *rotation models* (where students rotate between online and F2F instruction in the brick and mortar school), emphasize online content interaction and not online interaction between teacher and student because the human interaction typically takes place F2F outside of the online rotation. A recent summary of K-12 blended learning programs by Broderson and Melluzzo (2017) confirmed the prevalence of this type of blend. These authors found in the studies they reviewed that "all communications between teachers and students were face-to-face (there was no online interaction)" (p. 5). The integration happened between Q2 (digital content interaction) and Q3 (face-to-face interaction) as student progress reports the teachers received from online software were used to inform their F2F instruction.

Alternatively, the *flex* and *enriched virtual* blended learning models have online learning at their core, thus a greater emphasis on the integration between Q1 (online human interaction) and Q3 (face-to-face interaction).

Figure 2. Spectrum of models of blended learning for K-12 and higher education.



Existing K-12 Blended Teaching Competencies and Limitations

Table 3 represents a list of sources in the existing literature that included K-12 blended teaching competencies. We included one professional development website in the list because of its robust framework related to competencies needed for blended teaching that were supported by video resources of teacher practice. An additional set of competencies called the IBSTPI Instructor Competencies (Klein, Spector, Grabowski, & de la Teja, 2004) could have been included in the list, but were ultimately not included because (1) they weren't specifically K-12 focused and (2) they spanned all three modalities and were not specific to blended teaching. However, the IBSTPI framework did inform our thinking and work.

Because the blended teaching domain is young and emerging, there is very limited research to guide our work. Many of the sources rely on exploratory and case analysis methods typical of emerging research (Graham, Henrie, & Gibbons, 2014).

Table 3. Blended Teaching Competency Documents Used in Analysis (Pulham & Graham, 2017 in review)

Document	Description
iNACOL Blended Learning Teacher Competency Framework (Powell, Rabbitt, & Kennedy, 2014)	This framework has four main categories: (a) mindsets, (b) qualities, (c) adaptive skills, and (d) technical skills. Twelve competencies are included.
Oliver's Framework for Blended Instruction (Oliver, 2014)	Framework domains include (a) professional responsibility, (b) instruction, (c) design, (d) technology, (e) preparation, and (f) curriculum.
Learning Accelerator Website (practices.learningaccelerator.org, 2017)	Framework involves (a) face-to-face learning, (b) technology, (c) integration, (d) real-time data, (e) personalized learning, and (f) mastery-based progression.
The Rise of K-12 Blended Learning (Staker, 2011)	This report compiles 40 case studies in K-12 blended learning from across the U.S., including type of blended institutional model, issues of cost effectiveness, and a few descriptions of necessary teacher skills.
Blended Learning in Grades 4-12: Leveraging the Power of Technology to Create Student-Centered Classrooms (Tucker, 2012)	This article shares practical advice and details from a blended teacher to other teachers who are implementing blended learning in their own classrooms. The major focus is on facilitating online discussion.
Preparing Teachers for Blended Environments (Oliver & Stallings, 2014)	This literature review compiles research-based evidence of effective blended learning practices, concluding that blended teachers must consider (a) class context, (b) pedagogical strategies, and (c) technology.
Implementing Online Learning Labs (Bakia et al., 2011)	This document reports Miami-Dade County's use of online learning labs after one year of implementation. Guidelines for online lab facilitators are included.
Go Blended! A Handbook for Blending Technology in Schools (Arney, 2015)	This handbook contains a three-part blended teaching readiness rubric: (a) instructional elements, (b) behavioral elements, and (c) data.

Note: Parks, Oliver, and Carson (2016) included a brief treatment of each of the competency domains, showing data from the validation of the Blended Practice Profile instrument, which is based on Oliver's Framework.

Pulham & Graham (2017 in review) did an analysis of the K-12 blended teaching competencies as well as a similar list of the existing K-12 online teaching competencies. Figures 3-6 are visual representations of the competency structures for several of the sources. In the analysis, we used open coding to analyze each competency and place them into organizing and global themes (Attride-Stirling, 2001). From the eight sources related to blended teaching competencies, we ended up with 767 basic codes that were organized into eight global themes and dozens of organizing themes shown in Figure 7. These existing competency structures and the Pulham &

Graham (2017 in review) analysis all informed our process as we sought to develop a parsimonious model for evaluating blended teaching readiness.

Figure 3. iNACOL blended teaching competency structure (Powell et al., 2014).

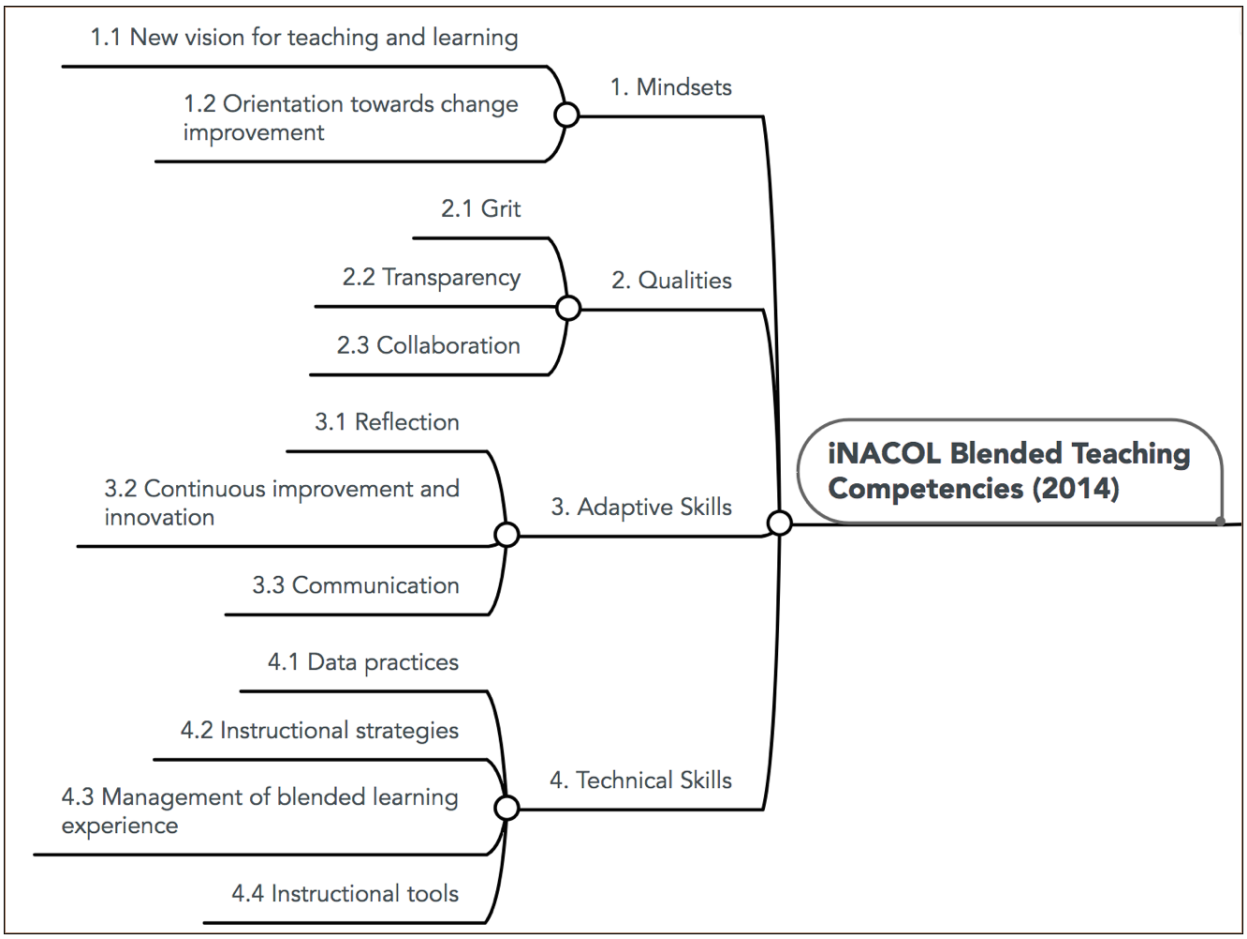


Figure 4. The Learning Accelerator blended teaching competency structure (practices.learningaccelerator.org).

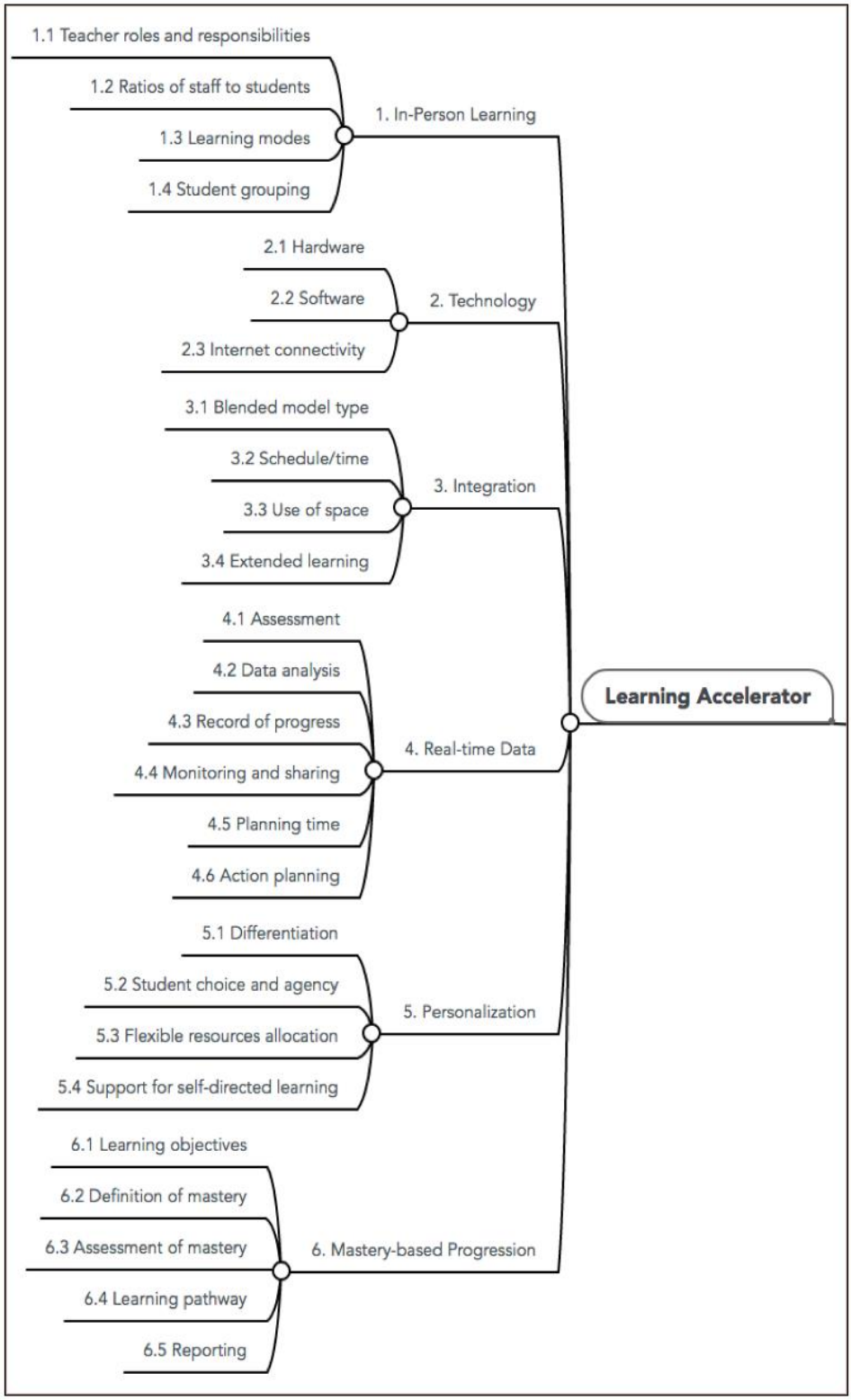


Figure 5. Oliver's Blended Profile competency structure (Oliver, 2014).

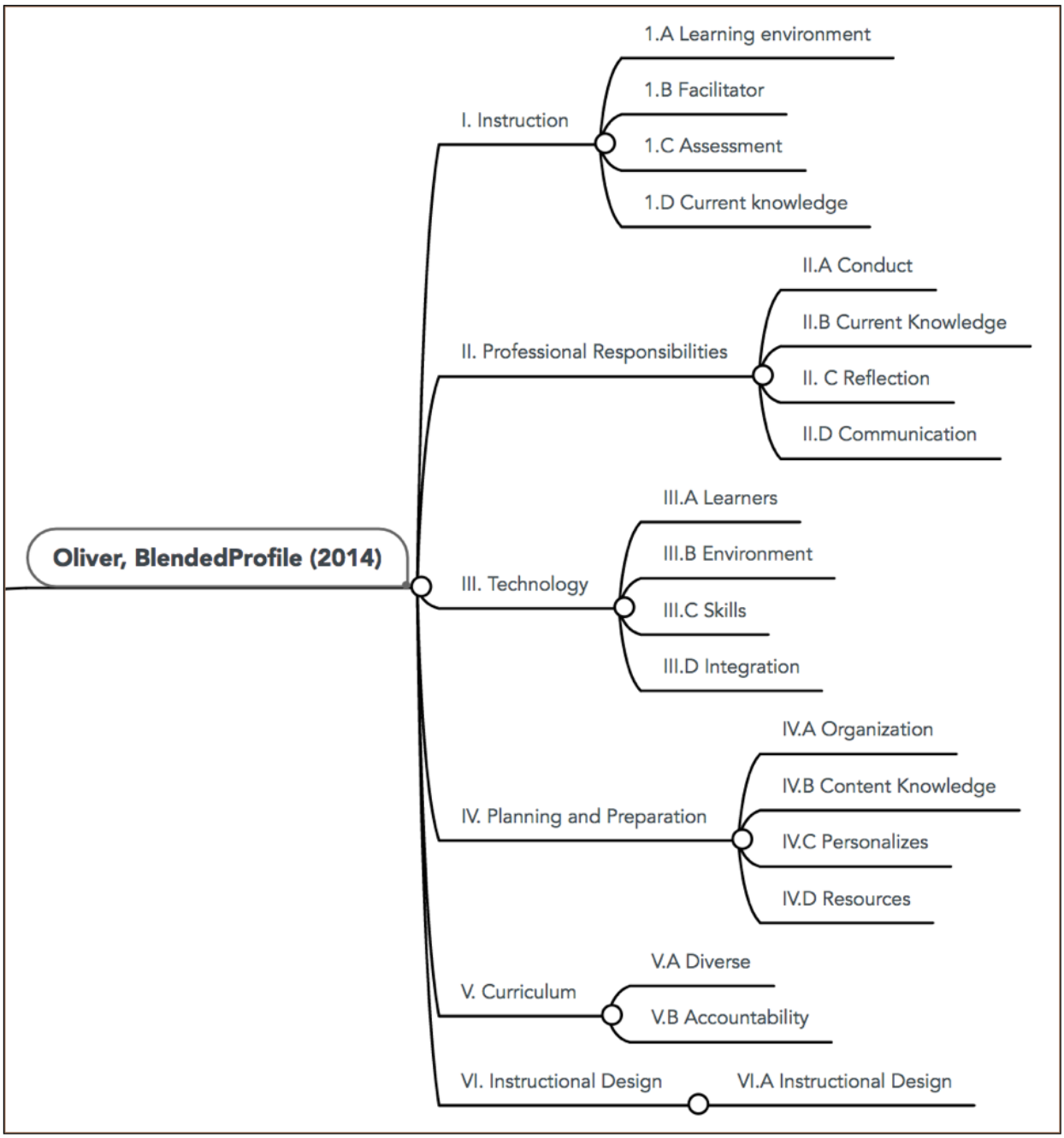


Figure 6. IBSTPI instructor competency structure (Klein, Spector, et al., 2004).

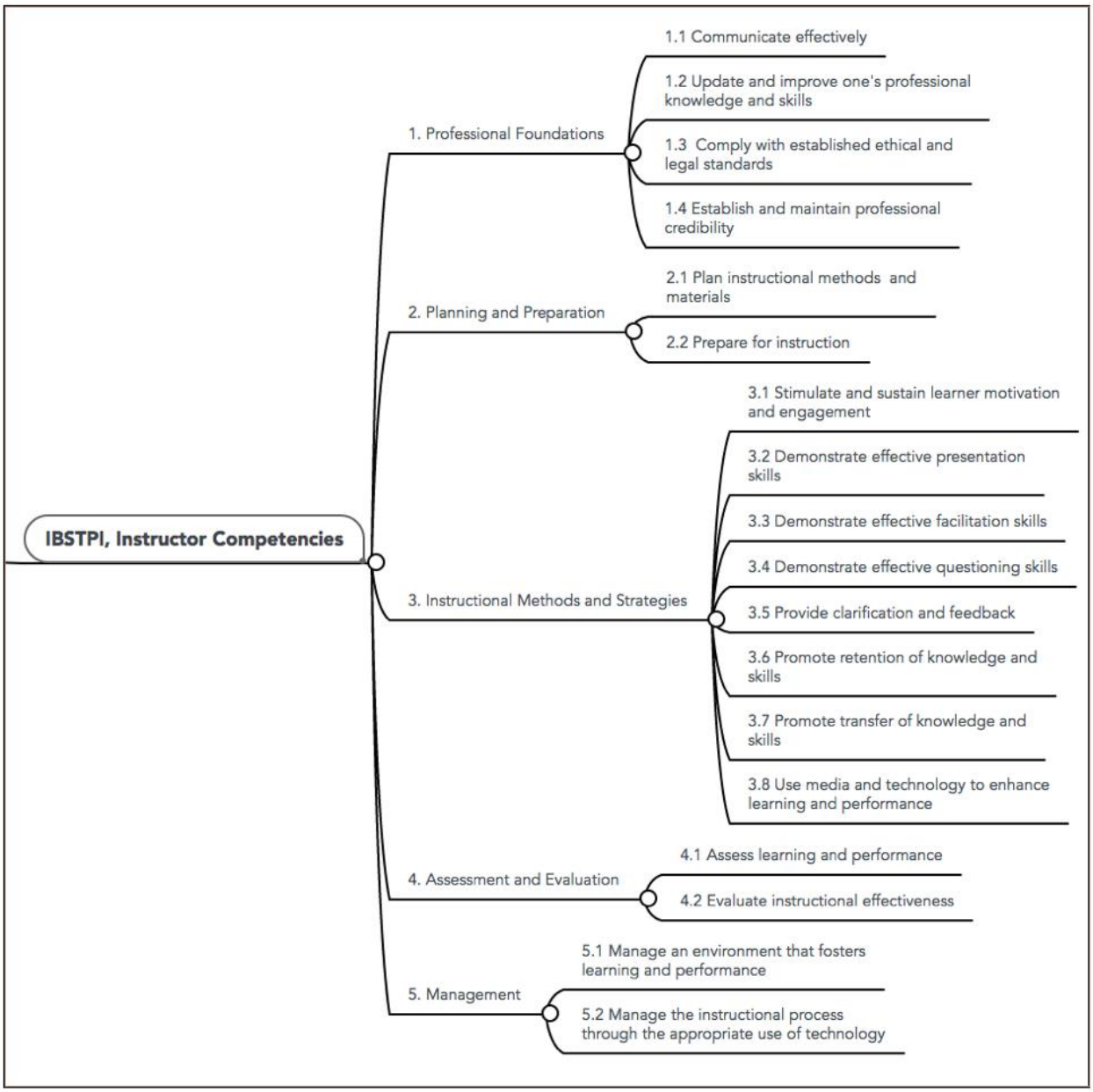


Figure 7. Visual representation of codes from blended teaching competency documents, with global themes ordered by rank of frequency.

Note: The number in parenthesis after the organizing theme is the number of references (or basic codes) organized within that theme (Pulham & Graham, 2017 in review).

Methods

Instrument Development

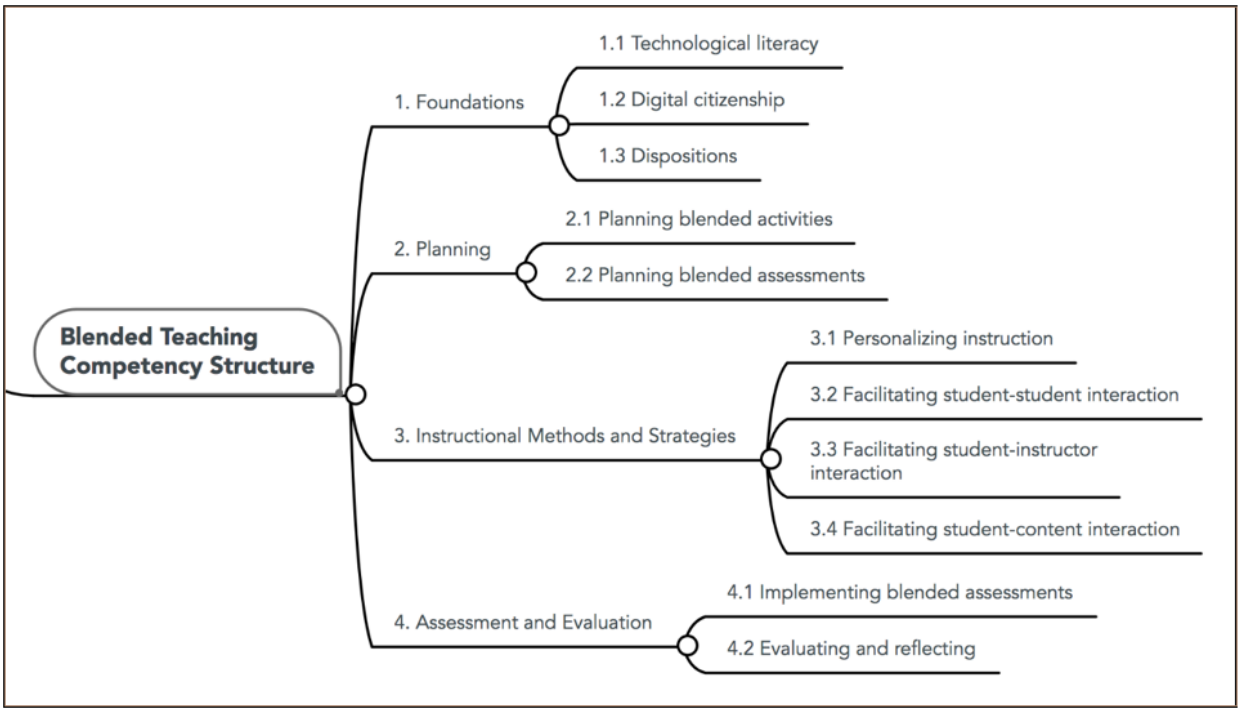
Following the steps below, we developed the initial blended teaching readiness instrument:

1. Reviewed existing frameworks – This consisted of the extensive analysis outlined previously, along with familiarizing ourselves with the existing frameworks and reviewing the competency items.

2. Developed a competency structure – In this step, we tried to find a middle ground between comprehensiveness and parsimony (Whetten, 1989). This was a creative and subjective process informed by the literature in which we ultimately chose a process-oriented competency structure.
3. Developed items for constructs – In this step, we developed five to six items for each of the 11 first-order constructs in the model.
4. Solicited external expert feedback – In this step, we sought feedback from four expert reviewers who are top scholars and leaders in the area of K-12 online and blended learning. We made adjustments to items based on their feedback.
5. Solicited district administrator feedback – In this step, we received several rounds of feedback from a large school district's blended and personalized learning instructional service team. We made adjustments to items based on their feedback.
6. Solicited practicing teacher feedback – Finally, we held interviews with four current teachers at elementary, middle, and high school levels who followed a "think aloud" protocol to react to each item in the instrument in order to identify confusing language or jargon. Several minor changes were made to make items easier to understand.

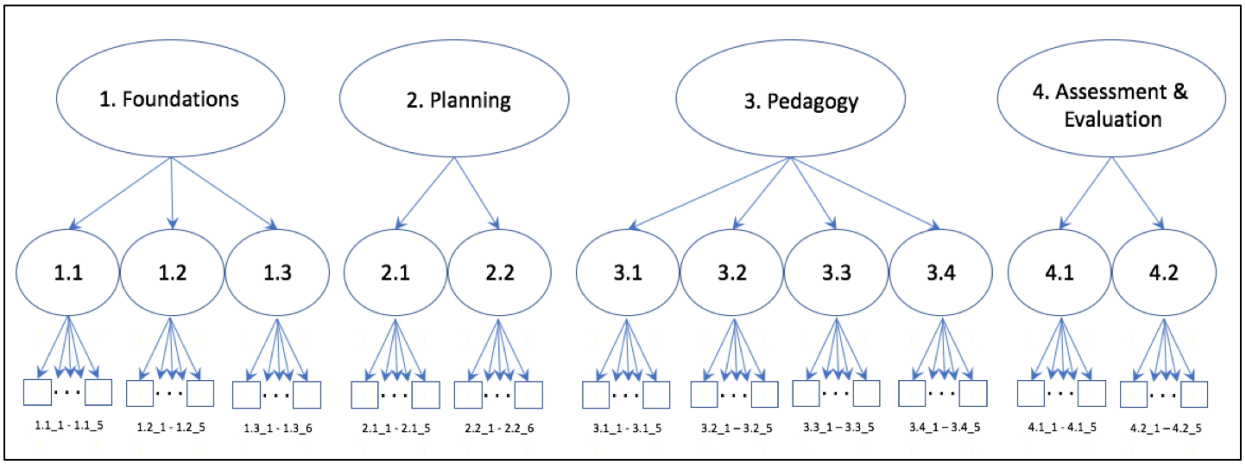
After finishing this process, we had a solid first draft. This instrument had four second-order constructs: (1) Foundations, (2) Planning, (3) Instructional Methods & Strategies, and (4) Assessment & Evaluation (see Figure 8). Additionally, the initial draft included 11 first-order constructs supported by 57 items (see Appendix A for a copy of the instrument).

Figure 8. Visual representation of our blended teaching competency structure.



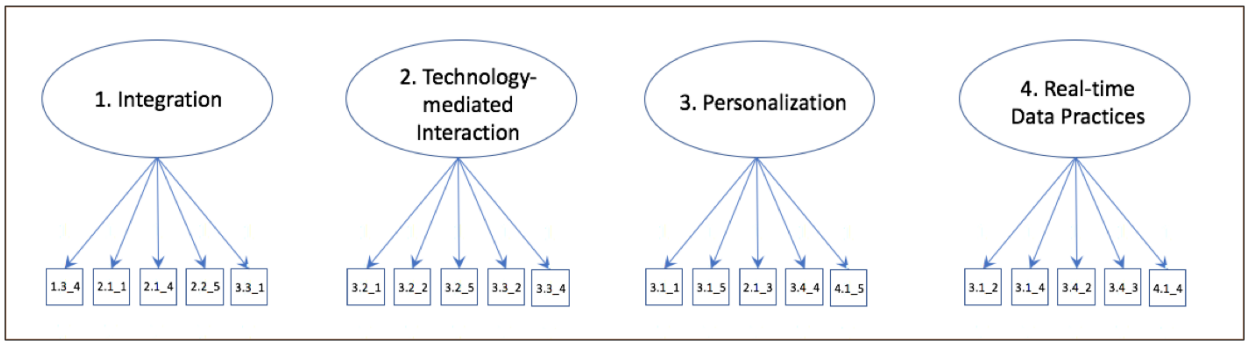
We also decided to try and adapt some of the items from the original instrument into a second, simplified version of the instrument that would be quicker to administer. We wanted to see if we could test a second, simpler model with no additional data collection. For the second model we chose constructs influenced heavily by the Learning Accelerator framework (see Figure 4). In particular, we felt that the concepts of *integration*, *personalization*, *real-time data practices*, and *mastery-based progression* represented a well-articulated set of skills central to a blended teaching pedagogy. We added a fifth construct that we called *technology mediated-interaction*, which we felt was missing from their model, likely due to the focus on blended learning *rotation models* (see Background section of this report). We identified what we felt were the five best items from the process model for each of the constructs. We were successful with all of the concepts except *mastery-based progression*, which we had to drop from our simplified model because we couldn't identify enough items. The final two structural models that we tested are represented in Figures 9 and 10.

Figure 9. Initial process-oriented structural model of K-12 blended teaching readiness for empirical testing.



Note: See all items in Appendix Table A1.

Figure 10. Simplified structural model for empirical testing.



Note: See all items in Appendix Table A1.

Data Collection

The participants for this research were 218 in-service teachers in a district in the eastern United States, with broad representation across teaching levels and subject areas. The majority of participants had little to no blended teaching experience. All participants took the survey, and a handful of teachers participated in walk-through feedback to ensure terminology and items in the survey were clear. Table 4 represents the demographic profile of the sample.

Table 4. Demographic Data for Participants (N=218)

Demographic Variable	Number of Teachers
Total number of participants	218
Level taught	
Grades PK-6	149
Grades 7-12	70
Secondary subjects taught	

Science	21
Language arts	21
Special education	11
Social studies	8
Math	7
World languages	5
Career and technical education	4
Health and physical education	2
Performing and fine arts	2
Other	7
Years of PK-12 teaching experience	
1-5	61
6-10	52
11-15	42
16-20	29
21+	34
Years of blended teaching experience	
1-5	91
6-10	13
11-15	5
16-20	1
Years of online teaching experience	
1-5	4
6-10	1

Data Analysis

We ran a confirmatory factor analysis (CFA) on both of the two theoretical structures as represented in Figures 9 and 10. The models were tested in Mplus using established cutoffs for four different fit statistics (RMSEA < .08, CFI > .9, TLI > .9, SRMR < .08; Wang & Wang, 2012). Each fit statistic makes slightly different assumptions about the structural models; achieving the cutoff levels for more fit statistics indicates a stronger model.

Results

Initial Model Fit

The initial model, based on Figure 9, fit the data surprisingly well (CFI=0.898, TLI=0.893, RMSEA=0.061, SRMR=0.05, χ2= 2743.260, df = 1522), considering its complexity. After considering theoretical issues and examining the communalities of the items, we determined that two items could be deleted (1.3.6 and 2.2.2), with the additional advantage of having each sub-factor with exactly five items. The resulting model met the criteria for all the fit indices (CFI=0.905, TLI=0.900, RMSEA=0.060, SRMR=0.049, χ2= 2512.429, df = 1413). The unstandardized factor loadings, the standard errors, the standardized factor loadings, and the communalities of all items in this model are found in Table A1 in the Appendix. All the standardized factor loadings were relatively high (>.7) and statistically significant. Additionally, all the communalities of the items were relatively

high (>.6) with the exception of a few items (1.3.3, 1.3.4, 1.2.5) which may be candidates for revision.

Simplified Model Fit

The simplified model (Figure 10) did not fit the data well (CFI=0.841, TLI=0.828, RMSEA=0.099, SRMR=0.055, χ2= 1,421.290, df= 458). A variety of modifications, based on modification indices and theoretical considerations, were employed; but the absolute fit indices (CFI, etc.) did not significantly improve.

Table 5 is a summary of the four fit statistics that were run on the three different models. The end recommendation is to use the initial model with four super factors (Figure 9) excluding two of the items (1.3.6 and 2.2.2) as mentioned above.

Table 5. Fit statistics for the various blended teaching readiness models tested.

Variable		CFI > 0.9	TLI > 0.9	RMSEA < 0.08	SRMR < 0.08
Initial Model (57 items)					
	Value	0.898	0.893	0.061	0.050
	Fit	Poor	Poor	Good	Good
Initial Model (55 items-two items removed)					
	Value	0.905	0.900	0.060	0.049
	Fit	Good	Good	Good	Good
Simplified Model (20 items)					
	Value	0.841	0.828	0.099	0.055
	Fit	Poor	Poor	Poor	Good

Discussion

As researchers, we were actually surprised at how well the data fit the initial model in our first round of instrument testing. We were also disappointed that the simplified model did not have good fit statistics. We learned a lot in the process. Below are several of our conceptual insights.

- **Measurement Instrument Validation Work Is Needed** – We learned that there is limited formal research work related to blended teaching competencies and that no clarity or consensus exists regarding the distinctive skills needed for blended teaching. We learned that only two of the existing frameworks are supported by current measurement practices (Oliver, 2014; Klein et al. 2004). A close analysis of both of these instruments shows that many of the items are not specific to a blended teaching environment. Additionally, the Oliver instrument is proprietary and not available for teachers and administrators to use openly and freely under a creative commons license.
- **Blended Teaching in K-12 vs. Higher Education** – Some significant differences exist between predominant models of blended learning used in K-12 and higher education contexts (see Figure 2). The predominant model in higher education is the *replacement model* while *rotation models* seem to dominate in the K-12 sector. Rotation models are closer in kind to technology-rich classrooms than to online learning environments and therefore would prioritize a different set of skills. For example, skills related to working with personalized learning software and real-time data practices (see Q2 in Figure 1) may need to be prioritized over skills for online teacher-student interaction (see Q1 in Figure 1). However, we anticipate that in the longer term, as *flex* and *enriched virtual* models become more prevalent, blended teachers will need to be skilled in both areas.
- **Blended vs. Online Teaching Competencies** – In addition to analyzing blended learning competencies, we also analyzed online teaching competencies (Pulham & Graham, 2017 in review). We discovered that while there were some areas of overlap, there were also significant differences in the competencies emphasized in the two areas. For example, while both emphasized the ability to enable flexibility and personalization as top themes, competencies related to mastery-based learning, reviewing student progress, and student grouping were high priorities for blended teaching but ranked much lower on the online teaching list.
- **Personalized Learning** – The ability to provide a flexible and personalized learning experience for students was ranked as a top theme for both online and blended competencies (Pulham & Graham, 2017 in review; Graham, Borup, Pulham, & Larsen, 2017 in review). However, we feel that our understanding of this concept within the field is still evolving fairly rapidly (Enyed, 2014; Patrick, Kennedy, & Powell, 2013), particularly in terms of how personalized learning differs from the traditional concept of differentiated instruction or from response to intervention (RtI). In our competency structure, items relating to personalization were not grouped together, but rather viewed as part of several other constructs. In the simplified version of the instrument, we made *personalization* one of the top-level constructs (see Figure 10). Because the term *personalized learning* is emerging, we were not able to pursue it more specifically in our current model. However, we present some of our early thinking about the concept of personalized learning in Figure 11, attempting to separate what is being

personalized (columns) from the agent making decisions about the personalization (rows). The dimension of what is being personalized is taken partially from the most prevalent definition of blended learning in the K-12 space (Horn & Staker, 2014). We consider this a productive way to begin thinking about the role of the teacher and distinguishing it from the role of the software in facilitating personalized learning.

- **Mastery- and Competency-Based Approaches** – This showed up as a major theme in the competency analyses and didn't have strong representation in our model and consequently had to be removed from the simplified model because of a lack of available items (Pulham & Graham, 2017 in review; Graham, Borup, Pulham, & Larsen, 2017 in review). We viewed mastery-based approaches as a strategy supporting personalization. It may be worth revisiting this idea in the future.
- **Management Skills in Blended Environments** – After we had already begun data collection, we came to the realization that there were some basic skills relating to managing a blended classroom that were different from purely technical skills or planning skills. We determined that a fifth category, called Management, with sub-categories of "managing the learning environment" and "managing learning routines" should be added and tested in the next iteration of the instrument. Figure 12 shows a representation of the new structure and Table 6 provides some possible items that could fit in this category.

Figure 11. Early thinking about the dimensions and actors involved in facilitating personalized learning.

Dimension where personalization can occur

Who controls or makes the personalization decisions

	Time (WHEN instruction takes place)	**Place** (WHERE instruction takes place)	**Pace** (How quickly a student progresses through the instruction)	**Path** (HOW a student progresses through the possible instructional sequences)	**Methods** (WHAT instructional strategies are chosen)	**Feedback** (WHO the feedback comes from)
Teacher						
Student						
Software						

Figure 12. Visual representation of the blended teaching competency structure.

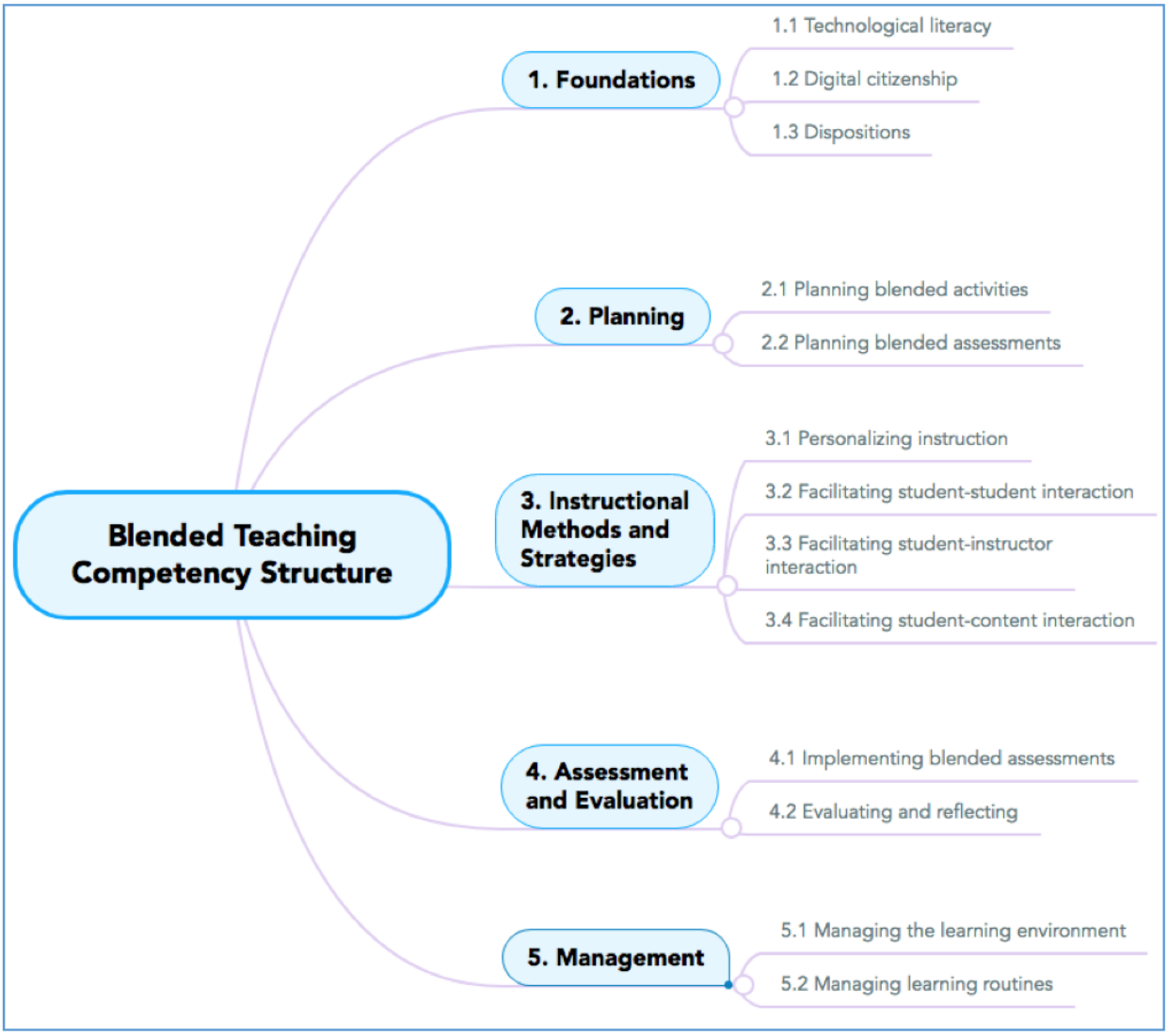


Table 6. Possible Items for a Management Construct in the K-12 Blended Teaching Readiness Instrument

Sub construct	Items
5.1 Managing the Learning Environment	5.1.1 Manage students' use of digital devices in the classroom to maximize on-task behavior. 5.1.2 Manage student data from digital and traditional sources. 5.1.3 Organize the classroom space to enable smooth transitions between online and traditional activities. 5.1.4 Rearrange the classroom space regularly to support the planned digital and traditional classroom-based activities. 5.1.5 Ensure stakeholders (e.g., students, parents, and counselors) have appropriate access to resources (e.g., performance data, learning materials, and contact information).

5.2 Managing Learning Routines	5.2.1 Establish classroom routines for using digital devices in addition to traditional materials. 5.2.2 Provide clear guidance/procedures for moving back and forth between online and face-to-face learning activities. 5.2.3 Manage a classroom where students have flexibility in how they pursue mastery individually. 5.2.4 Establish high expectations for students to stay on-task when using technology. 5.2.5 Intervene constructively to resolve disruptive behavior, both online and in class.

Future Instrument Development – Phase 2

Our ultimate goal for the K-12 Blended Teaching Readiness Instrument is to ensure that it has been scientifically validated and is openly available for use by districts, schools, and individual teachers interested in evaluating their blended teaching readiness. Below are some specific goals that we will be working on.

- **Management Items** – We feel it is important to add management items to the instrument (see Figure 12). The draft items in Table 6 will need to go through a process similar to the initial draft instrument to make sure items are sound before testing the entire model for statistical fitness.
- **Limited Embedded Resources** – Ultimately, we envision the readiness instrument being used to help drive professional development training for teachers. We would like to have some linked resources embedded within the instrument so that once teachers have completed the survey, they can opt to receive an email with their scores for each section and some curated resources related to their areas of greatest deficiency.
- **Preservice vs. In-Service Context** – Once we have completed validation efforts with an in-service teacher population, we would like to test the instrument's use with a preservice teacher population. An additional population that might be considered is teachers who primarily teach in fully online settings.
- **Simplified Model Focused on Blended Pedagogy** – We would still like to pursue the development of a simplified instrument. The more comprehensive instrument is process-oriented, and, ultimately, it is likely to have 65 items, 13 first-order constructs, and five second-order constructs. We realize that this might work in a context where the teachers are already committed to a professional development program and are willing to take a diagnostic survey of that length; however, there are many teachers for whom a shorter instrument, more focused directly on core blended teaching pedagogical practices might be a more practical approach. Rather than use items from the longer more comprehensive survey like we tried unsuccessfully in Phase 1, we would like to develop specific items for a simplified instrument that has only first-order constructs and 20-25 items max.

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Appendix A - Constructs and Items for Instrument

Table A1. Confirmatory Factor Analysis Results for Initial Model (see Figures 5 & 6) (n =218 teachers)

Item	λ	S.E.	Std. λ[a]	Comm.[b]
1.1 Technical Literacy				
1.1.1: Master new digital technologies on your own.	1.000	NA	0.852	0.725
1.1.2: Successfully troubleshoot unfamiliar technological issues that you and students encounter.	1.031**	0.047	0.877	0.770
1.1.3: Use the tools commonly found in a learning management system (e.g., gradebook, announcements, content pages, quizzes, discussion boards).	0.990**	0.078	0.799	0.638
1.1.4: Use content-specific educational software outside of the learning management system (e.g., math/literacy/science educational software, educational games).	1.007**	0.078	0.813	0.661
1.1.5: Find quality digital content resources relevant to student learning needs (e.g., media resources, lesson plans, etc.).	0.903**	0.073	0.815	0.665
1.2 Digital Citizenship				
1.2.1: Model the legal use of instructional materials (e.g. copyright, fair use, creative commons).	1.000	NA	0.845	0.714
1.2.2: Ensure student digital privacy (e.g., technology use agreements for sharing student data, protection of online data and identities).	1.102**	0.043	0.928	0.860
1.2.3: Model digital safety for students (e.g., ensure password protection, protect against cyberbullying, detect scams, use content filters and virus software, etc.).	0.981**	0.057	0.877	0.770
1.2.4: Ensure academic honesty in a digital learning environment (e.g., prevent cheating, check for plagiarism, etc.).	1.012**	0.063	0.842	0.709
1.2.5: Ensure access to digital learning activities for all students (e.g., low socioeconomic status, English language learners, special education, gifted, etc.).	0.904**	0.065	0.745	0.555

1.3 Dispositions				
1.3.1: I believe students perform better when they have some control over the pace of their learning.	1.000	NA	0.669	0.447
1.3.2: I believe individual student access to devices in the classroom should enable students to take greater ownership of their learning.	1.479**	0.172	0.837	0.700
1.3.3: I believe online technologies allow students and teachers to do things that would be difficult or impossible in the traditional classroom.	1.371**	0.179	0.786	0.617
1.3.4: I believe it is important for teachers to explore new teaching strategies that blend face-to-face and online learning.	1.275**	0.163	0.757	0.572
1.3.5: I believe individual student access to devices in classrooms enables development of important life skills (e.g., creativity, collaboration, critical thinking, communication).	1.573**	0.162	0.855	0.731
2.1 Planning Blended Activities				
2.1.1: Create activities that combine online and face-to-face components to help students develop important life skills (e.g., creativity, critical thinking, communication, and collaboration).	1.000	NA	0.877	0.769
2.1.2: Sequence activities in the learning management system in an easy-to-follow format.	1.032**	0.044	0.905	0.819
2.1.3: Strategically combine online and face-to-face activities that enable student ownership of their learning (e.g., flexibility in when, where and how they learn).	1.006**	0.041	0.892	0.797
2.1.4: Incorporate existing digital and traditional educational materials into learning activities.	0.911**	0.059	0.853	0.728
2.1.5: Create new digital learning materials when relevant content is not available.	1.069**	0.060	0.844	0.712
2.2 Planning Blended Assessments				
2.2.1: Create performance-based assessments that require students to use technology in ways that demonstrate important life skills (creativity, critical thinking, communication, collaboration).	1.000	NA	0.879	0.773

2.2.3: Create formative assessments to measure students' learning progress (e.g., polls, online surveys).	1.007**	0.042	0.882	0.778
2.2.4: Incorporate appropriate media into assessments (e.g., video, audio, images).	.0988**	0.048	0.838	0.703
2.2.5: Determine when to use computer-administered vs paper-based assessments.	0.911**	0.051	0.834	0.695
2.2.6: Create an approach to assessment that allows for student choice in how they demonstrate mastery of learning objectives.	0.983**	0.044	0.848	0.720
3.1 Personalizing Instruction				
3.1.1: Use data collected online to customize students' learning experience.	1.000	NA	0.839	0.705
3.1.2: Use data collected online to determine which groups or individual students need additional instructional support.	1.009**	0.049	0.841	0.708
3.1.3: Answer students' course related questions online (in addition to face-to-face).	1.155**	0.090	0.820	0.673
3.1.4: Use student performance data to provide timely help with misconceptions.	1.102**	0.054	0.895	0.801
3.1.5: Address any limitations of educational software through individual or small group instruction.	1.095**	0.085	0.831	0.690
3.2 Facilitating Student-Student Interaction				
3.2.1: Facilitate students' small group discussions online (in addition to face-to-face discussion).	1.000	NA	0.913	0.833
3.2.2: Facilitate students' small group collaboration on projects online (in addition to face-to-face collaboration).	1.041**	0.030	0.945	0.893
3.2.3: Foster a sense of belonging for all students in the online learning community (in addition to the face-to-face classroom).	1.054**	0.043	0.924	0.853
3.2.4: Monitor students' online interactions with each other to ensure quality participation.	1.056**	0.043	0.927	0.860
3.2.5: Create opportunities for students to teach each other inside and outside of class using technology.	0.965**	0.046	0.876	0.768

3.3 Facilitating Teacher-Student Interaction				
3.3.1: Determine when it is most effective to interact with students online versus in-person.	1.000	NA	0.873	0.762
3.3.2: Strengthen caring relationships with students via computer-mediated communication.	1.047**	0.038	0.896	0.803
3.3.3: Convey your personality in text-based communication with students.	1.062**	0.068	0.874	0.764
3.3.4: Ensure students are comfortable communicating with you online.	1.101**	0.061	0.930	0.866
3.3.5: Promptly respond to student inquiries online (in addition to face-to-face).	1.014**	0.069	0.829	0.687
3.4 Facilitating Student-Content Interactions				
3.4.1: Ensure that students can navigate digital educational materials.	1.000	NA	0.837	0.701
3.4.2: Use the learning management system to monitor student activity with online educational materials to determine if they are on-task.	1.204**	0.078	0.849	0.721
3.4.3: Use data to monitor student progress in subject-specific software programs.	1.220**	0.084	0.873	0.762
3.4.4: Help students to select online and traditional educational materials that are relevant to them.	1.149**	0.070	0.860	0.740
3.4.5: Encourage student persistence with independent online learning activities (in addition to face-to-face activities).	1.242**	0.074	0.912	0.831
4.1 Implementing Blended Assessments				
4.1.1: Administer performance-based assessments online (in addition to face-to-face assessments).	1.000	NA	0.851	0.724
4.1.2: Use online tools to provide students with opportunities for reflective self-assessment.	1.098**	0.041	0.905	0.820
4.1.3: Use online and traditional grading rubrics to clearly identify individual student performance gaps.	1.005**	0.048	0.883	0.779
4.1.4: Use data from online and traditional assessments to identify patterns in group and whole class learning gaps.	0.951**	0.065	0.851	0.724

4.1.5: Help students use online and traditional assessment data to guide their own learning progress.	1.125**	0.055	0.933	0.870
4.2 Evaluating and Reflecting				
4.2.1: Use student performance data to evaluate the effectiveness of teachers' online instruction.	1.000	NA	0.953	0.908
4.2.2: Use student performance data to evaluate the effectiveness of digital educational materials and assessments.	0.998**	0.023	0.970	0.941
4.2.3: Use student performance data to evaluate the effectiveness of how digital and face-to-face activities and assessments were blended together.	1.001**	0.032	0.957	0.916
4.2.4: Provide students with multiple opportunities to provide input about the effectiveness of the online and face-to-face teaching strategies.	1.000**	0.038	0.920	0.846
4.2.5: Collaborate with other teachers to evaluate the effectiveness of units that blend online and face-to-face instruction.	0.961**	0.041	0.874	0.764
Superfactor 1. Foundations				
Technical Literacy	1.000	NA	0.854	0.730
Digital Citizenship	0.946**	0.117	0.724	0.524
Dispositions	0.343**	0.068	0.486	0.237
Superfactor 2. Planning				
Planning Blended Activities	1.000	NA	0.938	0.879
Planning Blended Assessments	1.036**	0.065	0.931	0.868
Superfactor 3. Instructional Methods & Strategies				
Personalizing Instruction	1.000	NA	0.907	0.823
Facilitating Student-Student Interaction	1.219**	0.114	0.899	0.808
Facilitating Teacher-Student Interaction	1.149**	0.111	0.891	0.793
Facilitating Student Content Interaction	0.984**	0.087	0.952	0.905
Superfactor 4. Assessment & Evaluation				

Implementing Blended Assessment	1.000	NA	0.957	0.916
Evaluating and Reflecting	1.133**	0.064	0.931	0.866

Omitted Items

1.3.6: (Dispositions) Given adequate resources and administrative support, I would be likely to implement blended learning instruction.

2.2.2: (Planning Blended Assessments) Create rubrics in a learning management system that clearly communicate assessment criteria.

** $p < .01$. [a]Standardized factor loadings based on Mplus 8.0 output. [b]Communalities

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