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To Blend or Not To Blend: Online-only and Blended Learning Environments

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To Blend or Not To Blend: Online and Blended Learning Environments in Undergraduate Teacher Education

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Increasing curricular demands and the desire to provide meaningful, engaging instruction have pressed teacher educators to review and revise their programs. Many have viewed the assets of online learning as a potential solution to meet the seemingly ever increasing state- and accreditation-mandated course content and competencies. Universities have explored the inclusion of Web based courses for students for several decades. According to Martyn (2003), over 90% of higher education institutions use some type of electronically enhanced learning or "e-learning" option. These options vary between courses that are offered completely "online" to those that include a blend of differing amounts of face-to-face and online contact time.

Research comparing student experiences with online-only and blended delivery has often concentrated on graduate students and nontraditional programs. However, the effectiveness of online and blended delivery depends on audience and subject matter (Saunders & Werner, 2002), suggesting that findings based on data from graduate and nontraditional programs may not hold true for undergraduate students in

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traditional teacher education programs. This study attempted to address this need in the literature by examining the work of undergraduate teacher candidates who participated in modules delivered in an online environment. Specifically, this study addresses students' comfort and perceived competence while working in online and blended learning environments, as well as the function of teamwork in an online space.

Review of Literature

The online environment experience brings benefits and challenges. Research has begun to identify and investigate the work and experiences of students in an online environment. This review of literature examines the research across three themes. First, the potential impact on student learning in a virtual environment is examined. Second, the students' level of comfort in the online experience is addressed. Third, knowing that social experiences nurture powerful learning opportunities, the nature of incorporation of teamwork in an online environment is explored. Finally, this review of literature looks at potential applications for blended student experiences that utilize time in an online environment as well as traditional face-to-face time to fully maximize student learning.

Impact on Student Learning

Multiple studies have documented that content understanding can be the same in the online environment as in the face-to-face environment (Aragon, Johnson, & Shaik, 2002; Meyer, 2003). Research, though predominately reported from data gathered from graduate students, has illustrated that students are able to understand and apply content studied in either environment. Students in an online space can engage with the content anywhere, anytime, and any place. This flexibility provides students the personalized time they need to read, think, process, and respond. In addition, Caverly and MacDonald (1999) found that "threaded discussion groups foster higher-level thinking and independence as students collect, evaluate, and create their own learning spaces" (p. 36).

Importance of Student Comfort

Many students who are uncomfortable speaking publicly in class find the online format favorable as it creates an environment in which they can "talk" in a lower pressure environment (Russell, 1999). Research documents that many students value the time provided through online classes to reflect and develop a response before responding over a face-to-face context with limited time to reflect and respond (Beeghly, 2005;

Harasim, 1990; Larson, 2002). However, other studies have documented that students may not feel as comfortable responding in the online context (Arnold, 2006; Staarman, 2003). Some do not like knowing that their thoughts are "out there" for anyone to find and read. Others do not feel their learning is supported by the delayed response and would rather have the direct and quick response of class members. Some students desire the face-to-face support from a professor to help them clarify and understand the content.

Possibilities for Teamwork in a Virtual Experience

In a virtual environment, online courses can and often do incorporate teamwork, group assignments, and common conversations through threaded discussions. These threaded discussion groups and team projects can build a sense of belonging (Aviv, 2000) and nurture positive interpersonal relationships, particularly when engaged in goal-oriented group work (Davis, 1997; Russell, 1999). In alignment with established pedagogical knowledge that students learn best through social interactions, online course work often incorporates social experiences through cooperative learning assignment experiences. Just as in face-to-face class discussions, some personalities may dominate in the online environment; however, the online environment provides ample opportunities and time for every person to participate rather than the limited time available in the classroom setting, thereby creating a more democratic environment (McDonald, 2002).

Utilizing the Blended Design

Responding to the diverse needs and desires of students and the need for more time to cover increasing curricular demands, many higher education programs have developed online only and hybrid (using multiple online technologies) or blended learning online courses (Garrison & Kamuka, 2004). Simply defined, blending learning is "the thoughtful integration of classroom face-to-face learning experiences with online learning experiences" (p. 96). Blended learning is a mix of delivery methods that have been selected and fashioned to accommodate the various learning needs of a diverse audience in a variety of subjects.

The blended model can utilize "the best characteristics of online education and the interactivity that typically characterizes face-to-face classroom instruction" (Martyn, 2003, p.18). A blended environment can provide the opportunity for the continuation of discussions not completed during scheduled class time. In a similar but different manner, teachers can utilize class time to capitalize on key questions and conversations

that previously took place in the online environment (Mohr, Wiskstrom, Bernshausen, Mathis, & Patterson, 2003).

Content developers must work to find the right balance of time spent face-to-face and online (Ko & Rossen, 2008). This combination seems to vary and is dependent on the needs of the students and the content. Such flexibility can support different learning styles and different speeds of cognitive learning. The material of the course can be presented and reinforced in a variety of formats. This variety can also increase interest and engagement, supporting the process of more effective learning.

Research has illustrated that it is critical that the methods of delivery match the subject matter and audience (Meyer, 2003). However, finding one match for everyone is not possible. Instead a blend of approaches and methods is critical to "achieve maximum learning across a variety of learners. Only a blend of methods and approaches can produce the richness and achieve the desired learning outcomes" (Saunders &Werner, 2002). This statement illustrates the fact that poor instructional design and implementation (such as too much variety or lack of support) can negatively impact the learning experience. Poorly designed blended learning experience can potentially decrease effective learning compared with a single delivery method. As Garrison and Kamuka (2004) stated, "blended learning offers possibilities to create transformative environments that can effectively facilitate learning. It also represents a new challenge for higher education instructors to provide the necessary teaching presence in a blended environment" (p. 99).

A paucity of research exists regarding the utilization of blended learning course design in traditional pre-service education environments. Previously, the majority of research had examined courses utilized with nontraditional students and in graduate programs (Martyn, 2003). There is an increasing need to examine how blended courses can be utilized in traditional pre-service education programs to support the diverse learning needs of students and meet the growing curricular needs of universities. This study addressed this need by examining the perceptions of undergraduate teacher education students who used the same curriculum through different delivery methods. As will be further described, one class participated in a fully online model, and two classes participated in a blended design in which they received instruction with varying amounts of face-to-face instruction. Specifically, we investigated whether there were significant differences in teacher candidates' perceptions in the competencies they developed, their comfort using those competencies, the complexity of the content, and the effectiveness of group work to support student learning.

Methods

Quantitative research methodology was utilized to examine teacher candidates' perceptions of the ways that three university professors engaged their students in an online course entitled *Data for School Improvement*. This curriculum focused upon the utilization of value-added data in today's schools. This section will articulate the context, design, and procedures implemented to study the involved students and their professors.

Context

In 2007, the state of Ohio mandated that all teacher education programs incorporate outcomes related to value-added measures into their curricula. The work of Sanders & Horn (1994) found that value-added measures indicate whether school or district students have made an expected year's growth within a year's time. Though the idea behind value-added measures is simple, the reports generated from the data are often non-intuitive. Also, the topic is unfamiliar, and, once the surface of the topic is scratched, the concept becomes complex. Moreover, value-added measures are meant to be interpreted by educators in concert with an array of other types of data.

Teacher education faculty across the state wrestled with how to integrate such complex content into existing programs. In response to the mandate, the private Catholic-affiliated university in which this study was situated designed the course curriculum for *Data for School Improvement* as four online modules. The first author of this study was one of three faculty members who designed the curriculum. The curriculum designers represented the early childhood, middle childhood, and adolescent to young adult programs and worked closely with staff from the Institute of Technology Enhanced Learning housed in the School of Education at the university.

Design of online curriculum. The course was designed to utilize an integrated set of four online modules. The online format allowed consistency in the content to be conveyed and simultaneously allowed flexibility of use by several licensure programs, a variety of courses, and multiple instructors. Throughout the curriculum, teacher education candidates explored several types of data. The first module introduced the four categories of data for school improvement and required teacher candidates to examine demographic data from the United States Census for a particular community. In the second module, candidates learned more about student learning data and analyzed State Report Card data

from one of the community's schools. The third module explained value-added measures and compared them to the types of student learning data presented in module two. This module drew on the *Battelle for Kids'* value-added training materials for higher education faculty (Seidel et al., 2007) which were reorganized, edited, and supplemented by the faculty. Candidates completed the module by interpreting the school's value-added reports and diagnostic reports. The final module was a culminating activity in which candidates wrote a school improvement plan, and noted the limitations of the data they had and what data they would like to collect.

Each module had a similar format. Each began with an introduction that reviewed the previous module and provided an overview of the module's objectives, content, and tasks. Next, the content was explained using examples of realistic data. Each module had both individual and team tasks, which when complete, were posted to a team message board. This structure ensured individual accountability as well as promoted collaborative discussions of the data and the implications that could be drawn from it. For example, in the third module, teacher candidates individually summarized a school's value-added report and value-added diagnostic report. After posting summaries to the team message board, each teacher candidate, as a participant in a threaded discussion, commented on the other team members' postings. The team leader then drafted a team synthesis, which was revised with feedback from the team and then posted as the team's final assignment.

Pilot of curriculum. The *Data for School Improvement* curriculum was piloted in four undergraduate courses in the fall of 2007. As intended, instructors used the curriculum flexibly. One instructor created in-class lectures based on the content of the curriculum, but did not utilize the tasks, team structures, or otherwise engage with the online technology. The teacher candidates in this class worked through examples of the materials as a class, not using the online or team aspects of the curriculum. The remaining three classes represented a range of implementations from completely online to blends of online with in-class support. Data from these classes were included in the current study.

Participants

Participants included 80 undergraduate teacher candidates who were enrolled in one of three courses using the Data for School Improvement curriculum. The three classes represented three different curriculum delivery methods. In the first class teacher candidates engaged in the curriculum online only. The second and third class represented different

blends of online and in-class support. The *Data for School Improvement* curriculum was the only online portion of any of the three courses.

Teacher candidates in this study had access and previous experiences with technology and participating in an online environment. The university's Learning and Teaching Center, or LTC, is a $2.9 million 18,500 square foot incubator for innovation in teaching and learning. The LTC serves as the symbolic center of the university's Learning Village Project that has resulted in the wiring (voice, video, and data) of the entire campus including resident halls and 250 university-owned houses. Beginning in the fall of 2000, all first-year students were required to purchase a computer meeting university specifications to insure compatibility and accessibility. These collective efforts resulted in the university being named by *Yahoo! Internet Life* magazine (May, 2000) the "#1 Most Wired Catholic University" in the nation and the "#1 Most Wired University" in Ohio. In addition, most teacher candidates participated in online discussions via the content management system WebCT in their freshman year Introduction to Education course. Teacher candidates in the study also had experience with team projects throughout their programs. Thus, the collegial problem-solving methods called for in this study's course curriculum were not new.

The first comparison group consisted of 33 participants from the Middle Childhood Program's fourth-year reading methods course taught by the second author. The course is part of the senior year methods block of required courses. Though she had originally planned for teacher candidates to use the module in an online only format, the instructor discovered that her teacher candidates needed support to navigate the modules, understand the role of the team leader, and clarify some points about value-added measures. The week before each module was due, the instructor provided an overview of the upcoming module and the next week asked teacher candidates to discuss what they learned and why it is important. She prompted them with questions such as "What were the key ideas?" "What will you take away from this?" "Why do we care?" and "What will this mean for your classroom?" The instructor also set aside 2 hours of in-class time for candidates to work on the modules with their teams.

The second comparison group consisted of 27 participants who were teacher candidates in the junior-level general pedagogy course taught by the first author. All of the teacher candidate's in this course were either in the Adolescent to Young Adult program or seeking K-12 licensure (e.g., foreign language, art, religion). These teacher candidates completed the curriculum and tasks mainly, but not exclusively, online. These teacher candidates were given a general introduction to the topics and naviga-

tion of the online modules and assigned to teams. Because several teams had difficulty with interpreting value-added data, the instructor spent one class period, 75 minutes, on this topic. Though additional class time was not devoted to discussion of the curriculum, the teams sat together twice face-to-face to facilitate informal conversations and coordination of teamwork, and the instructor provided a few minutes at the end of classes for team members to check in with each other and coordinate group work. In addition to the tasks embedded in the curriculum, skills in data interpretation was also assessed on the final exam.

Finally, the third comparison group consisted of 20 teacher candidates who completed the curriculum as part of their fourth-year methods block which included a reading methods course, a subject area methods course, and part time field experience. Like the candidates in the second group, these candidates were in the Adolescent to Young Adult program or a k-12 program. The first author provided these participants with a general introduction to the topics, format, and navigation of the online modules, assigned to teams, and then the students completed the modules without further face-to-face instruction. The teams consisted of teacher candidates from various content areas (e.g., social studies, math, etc.) and no attempt was made to have teacher candidates meet face-to-face during the semester. However, all but one of the candidates in the third comparison group were also in a face-to-face class during the semester with at least one other team member.

Materials

A survey was constructed to tap participants' perceptions of the complexity of the curriculum content, their learning of the curriculum content, their comfort using what they learned, and the effectiveness of teams. The survey included 19 Likert-type items with a 5-point scale ranging from *strongly disagree* to *strongly agree* with a midpoint of *neither disagree nor agree.* An open-ended item, "Approximately how many hours did it take you to complete all four modules?", served as an estimate of the perceived effort required by the curriculum. An additional four Likert-type items which did not support the constructs and three open-ended items were not included in the current study.

Procedure

Surveys were administered to each of the first two groups by course instructors in class at the end of the semester. Because they did not meet face to face, surveys were administered to the third group in their required readings methods course by the course instructor. Participants

were told that their responses would be used in aggregate and the faculty would use the data to refine the use of the curriculum. Furthermore, participants were assured that their responses would have no bearing on their grade in the course. To this end, the surveys did not ask participants for any identifying information.

Results

The first step in analyzing the 19 Likert items was to create scales based on five a priori dimensions of curriculum complexity, learning of content, comfort using content, and team effectiveness (see Table 1). Cronbach's coefficient alphas were computed to obtain internal consistency estimates of reliability and were found to be above the acceptable level of .7 for each of the scales (see Table 1). The first scale assessed teacher candidates' perceptions of the complexity of the curriculum and consisted of four Likert items. Each Likert item referenced one of the curriculum's four modules and asked participants to respond to the statement that the module "was too complex for me to learn in an online-only format." The second scale included six items to assess teacher candidates' reported learning. Three of these items asked about a specific type of data, while the remaining three evaluated teacher candidates' perceived understanding and ability to synthesize several types of data. The third scale included three items to assess teacher candidates' feelings of competence and comfort using data. The fourth scale, perceived team effectiveness, was measured with four items.

Correlation coefficients were computed among the delivery methods, hours to complete the curriculum, and the four scales described above. The results of the correlational analysis presented in Table 2 show that 9 out of the 15 correlations were statistically significant. Of particular note, the delivery method was not correlated with the reported hours to complete the curriculum or the perceived complexity of the curriculum suggesting that on average the teacher candidates who experienced the three delivery methods (full blended, partial blended, and online only) were similar in their perceptions of the curriculum's difficulty and the level of effort it required.

Finally, a one-way multivariate analysis of variance (MANOVA) was performed to determine possible differences on the five dependent variables between the three types of curriculum delivery methods (full blended, partial blended, and online only) after checking that the required assumptions were met. The dependent variables included the number of hours reported to complete the curriculum, and the four scales described previously. The multivariate test was significant for the main effect of

Table 1:
Scale Items and Cronbach's Coefficient Alphas

Measure followed by excerpts from participant commentary	Coefficient
Complexity	.838
The information in first module was too complex for me to learn in an online only format.	
The information in second module was too complex for me to learn in an online only format.	
The information in third module was too complex for me to learn in an online only format.	
The information in fourth module was too complex for me to learn in an online only format.	
Learned Content	.723
I have a better understanding of the types of data that can be analyzed for school improvement.	
I am better able to synthesize two or more types of data to identify strengths and areas for school improvement.	
I am more able to analyze demographic data.	
I know how to explain the student achievement data provided on the Ohio School Report Cards to parents or other teachers.	
I know how to explain the student achievement data provided on Ohio Value-added Reports to parents or other teachers.	
I am better able to analyze whether my (future) school or district is providing a quality education for all students.	
Comfort with content	.737
I feel comfortable using data to compare performance of different groups of students.	
I feel comfortable using data to compare performance of one group over time.	
I feel competent analyzing data for school improvement.	
Team effectiveness	.803
As needed, members of my team asked each other for help and supported each others' learning of the content	
My team was able to plan, organize, and coordinate work on the tasks.	
Overall, my team's work was of high quality. Working with my team to complete the modules helped me better understand the content of the modules.	

Table 2:
Descriptive Statistics and Intercorrelations between Variables (n=80)

	M	SD	1	2	3	4	5
1. Delivery method			--				
2. Hours to complete	6.34	2.89	.09	--			
3. Complexity	12.98	3.68	.01	.23*	--		
4. Learned content	20.81	3.29	-.29*	.09	-.33**	--	
5. Comfort with content	10.84	2.08	-.33**	.00	-.37**	.70**	--
6. Team effectiveness	14.88	3.70	-.41**	.40	-.15	.31**	.35**

* p < 0.05
** p < 0.01

Delivery Method, Wilks's A = .70, $F(10,146)$ = 2.82, p < .01. The multivariate n^2 based on Wilks's A was strong, .16. The means and standard deviations on the dependent variables for the three groups are reported in Table 3.

Follow-up univariate F tests revealed significant effects on Learned Content, $F(2, 78)$ = .4.96, p = .009, Comfort with content, $F(2, 78)$ = 7.23, p = .001, and Team Effectiveness, $F(2, 78)$ = 7.93, p = .001. However, there was not a statistically significant Delivery Method effect on teacher candidates' report of the number of hours to complete the curriculum, $F(2, 78)$ = .29, p = .75, or on perceived complexity of the curriculum, $F(2, 78)$ = .06, , p = .94 (see Table 3). Least significant difference (LSD) post-hoc analysis revealed significant differences between the online only group and both blended delivery groups on Learned Content, Comfort with Content, and Team Effectiveness. No statistically significant differences were found between the full and partial blended delivery groups. Figure 1 graphically illustrates these findings. To create a common metric for the graph, the four scales were divided by their respective number of items.

Discussion

This article explores differences in undergraduate teacher candidates' experiences with a curriculum unit presented through online only and blended models. This was critical to examine in today's climate in which

Table 3:
Perceptions of Curriculum and Learning by Delivery Method

Dependent variable	Full blended (n = 33)		Partial blended (n = 27)		Online only (n = 20)		*F*	Post hoc comparisons
	M	*SD*	*M*	*SD*	*M*	*SD*		
Hours to Complete	6.09	2.08	6.37	3.10	6.72	3.75	.29	
Complexity	13.03	3.67	12.78	3.42	13.15	4.17	.06	
Learned Content	21.46	2.59	21.44	3.38	18.90	3.60	4.96**	FH, PH > OO
Comfort with Content	11.27	1.75	11.33	1.66	9.45	2.32	7.23**	FH, PH > OO
Team Effectiveness	16.30	2.73	14.96	3.71	12.45	3.99	7.93**	FH, PH > OO

Note: FH = Full Blended, PH = Partial Blended, OO = Online Only (N =80)

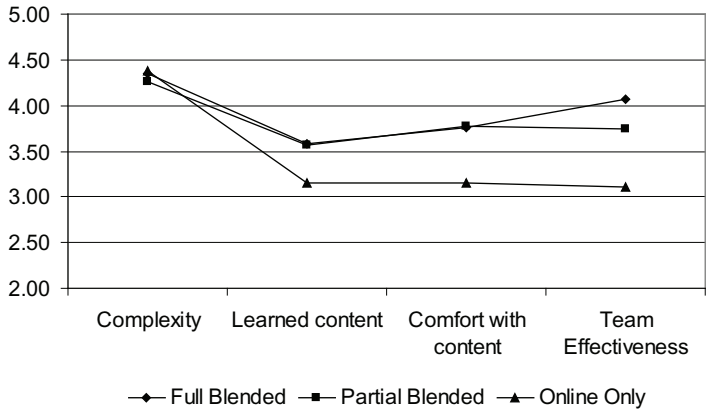
** $p < 0.01$

teacher education programs are under pressure to utilize instructional time in the most effective ways possible. The design of online learning experiences is one way in which universities can continue to maximize learning time and provide important content to teacher education candidates. The curriculum unit studied in this article was developed in direct response to a state mandate to add content to the teacher education program regarding value-added education. The online unit engaged teacher candidates in practically interpreting and analyzing several types of data that are available for educators engaged in school improvement.

Teacher candidates in both blended models reported significantly higher levels of learning than those in the online only group. Though they reported lower levels of learning, the online only group did not perceive the content to be more complex. In addition, the groups did not differ significantly in the time they took to complete the curriculum suggesting that the online-only group felt they learned less despite a similar amount of effort. Interestingly, though the two blended groups differed in the amount of face-to-face class time devoted to discussing or clarifying points in the curriculum, yet they were similar in their reported levels of content learned. This suggests that having a face-to-face component was important for teacher candidates to feel competent with the content of the course. Teacher candidates who worked completely alone in the online space may have felt more isolated and alone while engaging and working through the curriculum of the course.

The hope is that these future teacher candidates will be able to transfer what they have learned and practiced in the modules to their professional lives as educators. Research shows that transfer is more

Figure 1.
Means of the Scaled Scores for Perceived Complexity of Content, Learned Content, Comfort with Content, and Team Effectiveness



likely when teacher candidates feel self-efficacious, comfortable with the content and competent in using it (Pugh & Bergin, 2006). Teacher candidates in the blended classes reported significantly greater feelings of competence and comfort in putting what they learned into practice.

In this study, it is possible that the face-to-face interaction with the instructor and other teacher candidates supported confidence and comprehension of the material. One student in the middle school course experienced a direct connection with the university course content when she participated in a professional development day within her school district focused upon examining value-added data for her school and her cooperating teacher's classroom. The student came back to her university class and spontaneously self-reported her feelings of confidence and competence regarding what had previously been difficult material to comprehend. The student articulated her excitement at having the opportunity to utilize her knowledge and her appreciation of having had the experience with the online content before her field-based professional development opportunity.

Quality online course experiences incorporate group work. In these social experiences, teacher candidates interact and learn from each other as well as from the curriculum and the instructor (Ko & Rossen, 2008). Teacher candidates in both blended delivery models were significantly more likely to perceive their team as functioning successfully than teacher candidates in the fully online model. Fully online courses can build a

teamwork foundation with a preliminary module setting expectations for interactions and contributions. Expending time on team building may be stressful for a single curriculum unit; however, knowing the value of socially engaged learning, incorporating time for this component may prove highly fruitful.

Both blended groups reported a higher satisfaction with the way their teams functioned than the online only group. In one of the blended design groups, teacher candidates physically sat together when in their face-to-face classroom. This may have supported teacher candidates as they potentially could have utilized the time for their online work and had the opportunity at least once a week to communicate together, clarify work, and encourage those who had fallen behind. The instructor of the fully blended design incorporated time for explicit instruction regarding how teams should work together and the role of the group leader for each module.

The researchers considered whether the differences that were found between the groups could be attributed to preexisting differences in the groups' prior knowledge and comfort with the curriculum content. While measures comparing teacher candidates' prior knowledge were not collected, teacher candidates did report the number of hours it took to complete the curriculum and how complex they perceived the curriculum content to be. The online only and blended groups were not significantly different on these measures of effort and difficulty. This suggests that the online group was able to negotiate the content as easily as the blended groups. In addition, teacher candidates in the online only group, like those in the blended groups, were assigned to teams with teacher candidates from various content areas majors with the assumption that students with different content area backgrounds would support the team process in different ways. For example, a mathematics or science background may support others in conceptual understanding of value-added measures while those with language art could take the lead on writing. It is also important to note that teacher candidates were previously comfortable with technology and with utilizing the WebCT environment. This ubiquitous experience of all participating teacher candidates provided a foundation for all teacher candidates' comfort level utilizing the technology.

Conclusion

The blending of face-to-face and online environments provided a reciprocal structure for student learning. The face-to-face environment supported team development, commitment and accountability to team

members, and the processing of content with the instructor and class members. The online space supported the face-to-face environment by giving teacher candidates time to think, process, and have online conversations outside of scheduled class time. Individual accountability was provided within the online environment as each individual was required to be engaged and to contribute within each module. This level of individual participation would not necessarily have been possible within the time constraints of a face-to-face course.

We propose that the blended environment provided a forum in which additional connections and bridges were built as the teacher candidates (and the instructors) worked through the material together. In this space, the teacher candidates asked questions of each other and of the instructors. It provided a delivery method for reassurance of their comprehension of the material which in turn supported their self-efficacy. In class, face-to-face time allowed for a deeper level of comprehension to be developed through interactions in which the teacher candidates synthesized the material, brought ideas together, generated links to larger issues and topics, and discussed application in the real world.

The blended design provided an optimal opportunity for professors and teacher candidates. It offered a flexible option for teacher education by providing opportunities for discussion both in a face-to-face and an online space. The blended design also provided the opportunity to use time in a flexible way inside and outside of class walls.

However, with the opportunity to utilize online content comes a danger of an increased workload for teacher candidates and professors. Professors could be tempted to add additional content and create an overwhelming curriculum for the teacher candidates. The utilization of an online technology space also necessitates that the professor and teacher candidates have familiarity and comfort level with a technology based delivery system such as WebCT or Blackboard. Finally, it is critical for professors to be well versed in how to teach successfully in an online space as well as how to facilitate teamwork in an online environment (Ko & Rossen, 2008). Despite these cautions, this study illustrated the ways in which a blended design can meet the needs of differing teacher candidates at different times.

Though this study had several limitations, including a small sample size, potential bias via the inclusion of the researchers as the professors involved in course delivery, the inherent limitations from participants' self-reported data, and an unusual data set in which all participants were highly familiar with technology, there remains strong implications that can be drawn from this data regarding possibilities for future research. First, we suggest that similar studies be conducted with larger

numbers of teacher candidates. Next, we suggest that similar studies be conducted without the researchers as the instructors and/or with participants who have mixed abilities with regard to online technology. Finally, this study should also be repeated with online experiences in varying curricular content.

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