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Impact of Coaching, Co-Teaching, and Student Characteristics on Teacher Readiness

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Abstract
In this quasi-experimental study, we examine the effects of three different student teaching conditions—instructional coaching, co-teaching, and co-teaching and instructional coaching—on an elementary teacher candidate's readiness to teach in comparison to a traditional model of student teaching. 244 teacher candidates were randomly assigned to one of four models during their year-long student teaching experience and candidates and their cooperating teachers received training. The results of this study indicate candidate characteristics (race, gender, and academic ability/SAT score) and the treatment conditions contribute to a regression model that predicts a statistically significant amount of the variance in candidate readiness (edTPA score) even though, individually, the treatment conditions were not statistically significant predictors. Findings suggest teacher candidates who have been prepared under the three treatment conditions are similarly ready to teach to those who have been prepared under a traditional student teaching model. This is important because it gives teacher preparation programs a variety of options to meet the needs of their teacher candidates and program.

Key Words: Student teaching, co-teaching, instructional coaching, edTPA, teacher readiness

Introduction

Teacher preparation programs have been called to innovate through evidence-based change and program reforms (Peck, Gallucci, & Sloan, 2010). This call to action requires the use of reliable and valid measures in discerning the differential effects of various reforms and models associated with curriculum and clinical experiences (CAEP, 2014; Peck & McDonald, 2014). As faculty in a large teacher preparation program immersed in cycles of data driven program reform, questions arose regarding the effectiveness of the traditional student teaching experience. Subsequent examination

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of program practices revealed gaps in support and evaluative feedback during the student teaching experience (Cuthrell, Stapleton, Bullock, Lys, Smith, & Fogarty, 2014; Smith, Cuthrell, Stapleton, & Brinkley, 2013), leading us to identify and test alternative student teaching conditions. After reviewing emerging research in student teaching models (Bacharach, Heck, & Dahlberg, 2010; Ruys, Van Keer, & Aelterman, 2010; Strieker, Hubbard, Adams, & Cone, 2015), we chose to explore instructional coaching and co-teaching.

The goal of this quasi-experimental study was to determine whether varying the type of student teaching experience affects elementary teacher candidates' (TCs) readiness to teach. We examined the impact of three treatment conditions: (a) *instructional coaching,* in which coaches provided in-depth feedback and support to TCs; (b) *co-teaching*, in which clinical teachers (CTs) planned and taught with their TCs; and (c) a third condition, which provided a combination of these two approaches (i.e., instructional coaching and co-teaching). A fourth control condition, to which the treatment conditions were compared, was what we refer to as a *traditional* model of student teaching. To this aim, 244 elementary TCs were randomly assigned to the conditions (instructional coaching, co-teaching, instructional coaching and co-teaching, traditional), and the edTPA performance assessment was used to predict TCs' readiness to teach. Gender, race, and academic ability were included in the analysis to consider impact of participant characteristics.

We used SAT scores as a measure of academic ability. The SAT and the ACT are widely used in the United States to measure college readiness by testing high school students on writing, critical reading, and mathematics. SAT scores are strong predictors of first year college GPA (Mattern & Patterson, 2014) and moderately to strongly correlated to first-year college GPA and cumulative GPA (Shaw, 2015).

edTPA provides a measure of TCs' readiness to teach by assessing a cycle of teaching through tasks involving planning, teaching, and assessing (Pecheone & Whittaker, 2016). edTPA is a subject-specific, externally scored performance assessment for TCs that has been found to be both valid and reliable (SCALE, 2016). We chose edTPA as a measure of readiness in part due to the strong validity and reliability evidence, which can be accessed in SCALE annual reports. In addition to providing adequate validity evidence in the reports, SCALE has used Cohen's kappa to calculate internal consistency and inter-rater reliability, reporting near-perfect agreement among values in 2014 and 2015, reporting kappas on rubrics ranging from 0.83-0.96 (Landis & Koch, 1977; SCALE, 2016, p. 33). Each of the three required edTPA tasks (planning, teaching, assessing) has five corresponding rubrics constructed on a continuum associated with a TC's readiness to teach. A 5-point scale is used to measure readiness to teach: 1 indicates a more teacher-centered practice, 5 indicates more student-centered practice (SCALE, 2017). In this paper, we discuss findings yielded through a comparison of the four conditions and discuss their practical implications.

Theoretical Framework

This study is framed in situated theory of learning (Lave & Wenger, 1991), in which "teachers' knowledge is socially, culturally, and historically constructed" (Horn, 2010, p. 228) and social interaction facilitates learning (Werstch, 1991). Referred to as practice teaching, learning occurs by doing and the chance for *legitimate participation* (Lave & Wenger, 1991) within a community of practice. Through classroom interactions with a CT and students, TCs actively construct their knowledge of and skills in teaching, and develop their identity as a teacher (Alsup, 2006; Britzman, 2003; Danielewicz, 2014). TCs need opportunities to teach, receive feedback, reflect on the teaching episode, and then teach again in a cyclical fashion throughout student teaching and across the teacher preparation program (Darling-Hammond, 2010). Darling-Hammond (2010) called this process "practice in practice, with expert guidance" (p. 40).

Models of student teaching

To understand why these conditions were tested, we explore related literature focused on the varying approaches to student teaching: (1) a traditional model in student teaching, (2) instructional coaching in student teaching, and (3) co-teaching in student teaching.

Traditional model in student teaching

A triad consisting of a CT, TC, and university supervisor (US) is a widely accepted and utilized model in the United States (Boyd, Grossman, Lankford, Loeb, & Wyckoff, 2009; Greenberg et al., 2011). Because of its common use, we refer to this as the *traditional student teaching model.* In the traditional model, TCs first observe and then gradually assume instructional responsibilities with decreasing support from the CT and the university, culminating in the TC being solely responsible for the classroom for a predetermined number of days or hours. CTs help TCs understand the policies, practices, and culture of the school (Ambrosetti & Dekkers, 2010). They are mentors and coaches as the TCs become more independent in their teaching (Ambrosetti & Dekkers, 2010; Clarke, Triggs, & Nielsen, 2013).

The traditional model's ideal of a CT who models effective instruction, offers planning advice, and provides feedback related to practice teaching experiences is not always achieved, and the CT's role can become little more than providing a space for TCs to practice teaching (Hoffman et al., 2015). CTs are often given minimal preparation and support for providing TCs with feedback and mentoring (Clarke et al., 2013; Valencia, Martin, Place, & Grossman, 2009; Zeichner, 2010), and often receive little training to help TCs connect theory to practice (Arbaugh, Abell, Lannin, Volkmann, & Boone, 2007). The lack of support and training of the CTs can lead to inconsistent support and feedback for TCs. A deficiency in specific feedback can lead TCs to feel

frustrated (Bradbury & Koballa, 2008; Hoffman et al., 2015). Because feedback is an essential component of the learning process, the inconsistent quality of supervision found in the traditional model is a weakness of the student teaching experience (Wilson, 2006).

Adding to the complex student teaching situation is the role of the US. Supervisors provide a conceptual bridge between what TCs learn in their courses and what they see in the field (Boyd et al., 2009; Council of Chief State School Officers, 2012; Greenberg et al., 2011; National Council for the Accreditation of Teacher Education, 2010). While bridging the gap between theory and practice and maintaining a link between the university and public school system are important, the role of the US is not without issues. Unless there is a specific office or position dedicated to it, little time or effort is spent coordinating and monitoring field-based teacher experiences (Zeichner, 2010). Similar to CTs, USs receive little training (Borko & Mayfield, 1995; Hoffman et al., 2015) and are not necessarily familiar with university coursework and program requirements. Their lack of familiarity with the program, its requirements, and its courses makes USs more likely to evaluate TCs and coach them based on their past experiences (Valencia et al., 2009; Zeichner, 2010), often leading to a disconnect between important conceptual links in theory and practice.

Instructional coaching in student teaching

Sailors and Shanklin (2010) defined instructional coaching as "sustained classroom-based support from a qualified and knowledgeable individual who models research-based strategies and explores with teachers how to incorporate these practices using the teacher's own students" (p. 1). Scholars have found instructional coaching improves teacher instruction (Brady et al., 2009; Cantrell & Hughes, 2008; Zwart, Wubbels, Bolhuis, & Bergen, 2008) and increases student achievement (Bean, Draper, Hall, Vandermolen, & Zigmond, 2010; Biancarosa, Bryk, & Dexter, 2010; Lovett et al., 2008; Sailors & Price, 2010).

Though there are many models of instructional coaching, we focus on the model adopted by the school districts in our study, the Big Four Framework (Knight, 2008). Researchers Jim Knight and colleagues developed this instructional coaching model and validated the principles of partnership (Devine, Houssemand, & Meyers, 2013; Knight, 2009). Knight (2011) found effective teaching results when instructional coaches work in partnerships to accelerate teachers' professional learning.

In the research on instructional coaching with TCs, CTs are typically considered the coaches or mentors. A lack of training can lead CTs to feel unsure about their role as coaches (Bradbury & Koballa, 2008; Valencia et al., 2009). Untrained CTs tend to give feedback that is much more evaluative and directly focused on management, procedures, and pacing, but rarely content-specific (Valencia et al., 2009). Some indications suggest that, with training, CTs can improve their coaching interactions (Hoff-

man et al., 2015). Much of the research on coaching TCs focuses on types of interactions between the TCs and the coach (Hoffman et al., 2015). There is little research documenting the impact of coaching on TCs.

Co-teaching in student teaching

Although co-teaching has existed as a collaboration between special education and regular classroom teachers for several decades (Cook & Friend, 1995; Friend, Reising, & Cook, 1993; Reeve & Hallahan, 1994), its application in student teaching is a relatively new area of study (Bacharach et al., 2010; Goodnough, Osmond, Dibbon, Glassman, & Stevens, 2009; Roth & Tobin, 2005; Ruys et al., 2010; Smith, Tschida, & Fogarty, 2015). Research suggests co-teaching during clinical experiences positively impacts TC readiness to teach (Academy for Co-teaching and Collaboration, 2012; Bacharach et al., 2010; Tobin & Roth, 2006; Tschida, Smith, & Fogarty, 2015a, 2016b), increases self-efficacy in collaboration and teaching skills (Bullough et al., 2003; Goodnough et al., 2009; Kamens, 2007; Ruys et al., 2010; Tschida et al., 2015a), and enhances k-12 student learning (Bacharach et al., 2010; Heck, 2010; Smith et al., 2015).

While various models for co-teaching exist (Bacharach et al., 2010; Baeten & Simons, 2014; Roth & Tobin, 2002), faculty at this university chose to use the model that came out of the Academy for Co-Teaching and Collaboration at St. Cloud State University due to their research, training, and implementation (Bacharach et al., 2010; Heck, 2010). Co-teaching is defined as two or more teachers working together with groups of students and sharing the planning, organization, delivery, and assessment of instruction and physical space. The model uses seven co-teaching strategies to enhance instruction and allow for more differentiated teaching and learning (for more on these strategies, see Academy for Co-Teaching and Collaboration, 2012).

Co-teaching in student teaching allows for the collaboration between the CT and TC in all areas of planning, instruction, and assessment, and in delivering lessons together based on student needs (Smith, Stapleton, Cuthrell, Brinkley, & Covington, 2016; Sileo, 2005). Just having two teachers in the room, however, does not guarantee successful co-teaching; co-planning is essential (e.g., Cayton, Grady, Preston, & Sinicrope, 2016; Friend, 2008; Howard & Potts, 2009). Through co-planning and teaching together, the CT is better able to provide consistent feedback and mentoring, and TCs receive the support necessary to gain confidence and practice, developing both the teaching and reflective skills required for effective teaching (Bullough et al., 2003; Goodnough et al., 2009; Tschida et al., 2015a).

Research question

The goal of this quasi-experimental study was to determine how teacher readiness (as measured by edTPA scores) is affected by the model of preparation (tradi-

tional, instructional coaching, co-teaching, instructional coaching, and co-teaching) and TC characteristics (gender, race, academic ability). Thus, our research question was, "How well can we predict TC readiness based on student teaching conditions and TC characteristics?"

Methodology

Context and design

This study took place at a large public university located in a rural southeastern region of the United States. This university has an enrollment of approximately 28,000 and is one of the largest producers of teachers in the state. The majority of students enroll from the surrounding areas and approximately 50% qualify for financial aid. Of the total enrollment, 67% identify as White, 16% as Black, 6% as Hispanic, 3% as Asian, and 9% as unknown. We conducted the research over three semesters. The design involved assignment of TCs to three experimental conditions and the traditional condition (which served as a control) to study how well edTPA scores can be predicted by type of student teaching treatment after controlling for several candidate characteristics. Multiple regression was selected as the method for analysis because both continuous (SAT) and dichotomous (gender, race, treatment condition) factors were included as independent variables. Using regression over ANOVA allowed us to retain data in the continuous variables that would be lost if converted to categorical variables in ANOVA. Standard multiple regression was used for the analysis to account for the fact that some of the independent variables (race, gender, and SAT score) were related to the dependent variable (edTPA scores) and, therefore, control for these possible relationships while determining their ability to predict teacher readiness.

Treatment

All elementary TCs, regardless of condition, participated in a year-long student teaching experience with a CT in one grade level from k-6. The first semester of student teaching consisted of the TCs finishing classwork and attending their clinical placement at least one full day per week. The second semester of student teaching involved complete integration into a public-school classroom. All CTs who hosted TCs received an initial training that covered basic tenets of mentoring, expectations for CTs, and training on observation documents. CTs received a small stipend for their work with TCs over the course of two semesters. Each TC was assigned a US during his/her second semester who was responsible for evaluating the TC. In all conditions, USs completed four formal observations/evaluations developed by the institution's College of Education, worked with the CTs to complete the TC's final evaluation, and served as a liaison between the university teacher preparation program and the public school.

Traditional/control condition

The traditional student teaching experience involved a triad of participants: TC, CT, and US in the second semester of the year-long student teaching experience. In this model, the student teacher observed for a period of time and then slowly added responsibility of one content area a week until s/he was teaching independently all day with the CT offering feedback on instruction. After a predetermined number of weeks of independent teaching, the student teacher began reducing the content areas s/he was responsible for until they were no longer teaching.

Instructional coaching condition

Though there are many models of instructional coaching, we focused on the Big Four Framework (Knight, 2008) adopted by the school districts in our study. In this condition, TCs followed the traditional model consisting of TC, CT, and US with the addition of an instructional coach. The coaches served as a bridge, connecting the university program and the local schools. In most cases, instructional coaches were previous employees of the school district and, thus, familiar with school materials, resources, policies, and procedures. Instructional coaches underwent multiple trainings, including 2 hours focused on how to engage in walkthrough observations, use of Jim Knight's (2008) Big Four Framework, and use of a modified TeachscapeTM observation instrument based on Charlotte Danielson's (2011) framework. Instructional coaches completed three walkthrough observations during the first semester and a minimum of two observations during the second semester. After conducting walkthrough observations, coaches held individual and group professional development sessions targeting needs identified in the walkthrough observations. These observations were in addition to those completed by the US on all TCs and were non-evaluative. The evaluations were used to give more frequent and targeted feedback and support beginning in the first semester of the student teaching experience. Instructional coaches were in the schools several times a week and spent the majority of their time interacting with TCs and CTs. Access to these non-evaluative coaches provided an additional level of support and feedback.

Co-teaching condition

While various models for co-teaching exist (Bacharach et al., 2010; Baeten & Simons, 2014), our program chose to use the model from the Academy for Co-Teaching and Collaboration at St. Cloud State University (Bacharach et al., 2010; Heck, 2010). Co-teaching is defined as two or more teachers working together with groups of students and sharing the planning, organization, delivery and assessment of instruction and physical space. The model uses seven co-teaching strategies to enhance instruction by allowing for more differentiated teaching and learning: (a) one teach, one observe; (b) one teach, one assist; (c) station teaching; (d)) parallel teaching; (e) supplemental

teaching; (f) alternative or differentiated teaching; (g) and team teaching (Academy for Co-Teaching and Collaboration, 2012). Participants of the co-teaching condition included the CT, TC, and US. In this model, TCs worked closely with their CT to plan, teach, and assess student learning from the beginning of the placement. As they collaborated, CTs were able to verbalize the thought processes behind their instructional decision making. As co-teachers, TCs had opportunities for feedback and reflection and were given a calendar that encouraged them to assume instructional responsibilities more quickly with the support of their CTs. These TCs still experienced a gradual increase of responsibility to independent teaching in which the TC took the lead on instructional decisions for a predetermined amount of time. TCs in this condition were assigned either a 1:1 or 2:1 co-teaching placement. The 1:1 placement had one TC paired with one CT, while the 2:1 placement placed two TCs with one CT. The primary difference between the two types of co-teaching placements is the additional opportunities that two TCs had to plan, teach, and reflect with not only their CT but also a peer. The same observation tools were used with co-teachers as in the traditional model. To monitor and assess the implementation of the co-teaching model, TCs were required to try all seven co-teaching strategies over the semester with at least three co-taught lessons per week. A single US was assigned to work with both TCs in 2:1 placements to ensure consistency in feedback and evaluation of teaching. CTs, TCs, USs, and program faculty who participated in a co-teaching placement received the same 5-hour co-teaching training focused on co-planning, co-instruction strategies, and relationship building during the first semester of student teaching.

Instructional coaching and co-teaching condition

In the instructional coaching and co-teaching condition, TCs participated in their 1:1 or 2:1 co-teaching placement with the additional support of an instructional coach. Coaches received the same co-teaching training as the CTs and TCs. Instructional coaches also used the same walkthrough observational tools as those in the instructional coaching only condition. See Table 1 for an overview of the differences between all four conditions.

Table 1.
Differences Across Conditions

	Traditional	Instructional coaching	Instructional coaching and co-teaching	Co-teaching
Clinical Teachers (CTs)				
General student teaching training	1 day	1 day	1 day	1 day
Co-teaching training	-	-	Foundations (once), pairs (each semester)	Foundations (once), pairs (each semester)
University Supervisors (US)				
General student teaching training	½ day/ semester, monthly meetings	½ day/ semester, monthly meetings	½ day/ semester, monthly meetings	½ day/ semester, monthly meetings
Co-teaching training	-	-	Foundations (once), pairs (once)	Foundations (once), pairs (once)
No of observations with progress reports	4	4	4	4
Number of final evaluations	1	1	1	1
Instructional Coaches (ICs)				
Training in Big Four Framework	-	6 days, monthly meetings	6 days, monthly meetings	-
Number of Teachscape walkthroughs	-	5/year	5/year	-

Participants

Each participant was enrolled in their final semester of student teaching. A sample size of 320 elementary TCs across three consecutive semesters (spring 2014, fall 2014, and spring 2015) was reduced to 244 participants (76.25% of our population during those three semesters) due to incomplete data from 76 TCs (see Table 2 for information about student characteristics). As is common in many elementary teacher preparation programs, the majority of the sample was female (n = 232, 95%). With only 12 males (5% of the sample) enrolled in the study, there is a large disparity between genders. This inequality aligns with national data on the elementary teacher workforce, which is known to be predominantly female (Goldring, Gray, & Bitterman, 2013). However, the percentage of males in the teacher preparation program of this study was lower than the national average of male elementary teachers in the US (approximately 10.7%; Goldring et al., 2013).

Of the sample, 219 identified as White (89.8%), 13 as Black (5.3%), and 12 who

we aggregated into a single category ("other") if they identified with one of the following groups: Hispanic or Latino, Native American, Asian, or one or more races (4.9%). Due to the imbalance between White candidates and those who identified as another race, we coded participant race dichotomously. Thus, the non-White category was further aggregated and includes multiple designations (i.e., Black, Hispanic or Latino, Asian, Native American, two or more races, or unknown). The number of TCs who identified with a minority group in this study (11.3%) is lower than the percentage of practicing teachers who identify with a minority group at the national level (18%; Putman, Hansen, Walsh, & Quintero, 2016).

Table 2.
Participants by Treatment Condition, Race, Gender, and SAT score

	Traditional (n = 114)	Instructional coaching (n = 42)	Instructional coaching and co-teaching (n = 49)	Co-teaching (n = 39)	% of total (n = 244)
Race					
White	102	37	43	37	89.8
African American/Black	7	2	3	1	5.3
Other	5	2	3	2	4.9
Gender					
Female	109	37	47	39	95.0
Male	5	5	2	0	5.0
SAT score					
M	1009.65	1001.19	1009.80	1028.72	
SD	97.76	86.34	102.62	76.78	

Student characteristics were used as independent variables based on previous studies indicating that these factors have differential effects on the dependent variable, edTPA score. Data published in the Stanford Center for Assessment, Learning, and Equity (SCALE, 2015) Administrative Report indicate differences in performance of some subgroups on edTPA, including that Black TCs were found to perform significantly lower than other candidates [White ($p < .01$), American Indian ($p < .03$), Asian or Pacific Islander ($p < .01$), Hispanic ($p < .01$)] and males performed significantly lower than females ($p < .01$). Past research has also shown that prior ability, which can be measured by tests like the SAT, can affect teacher readiness (Bastian & Henry, 2015). This readiness carries over into their performance as teachers, as indicated by correlations between teacher readiness and students' performance in specific content areas (Boyd, Lankford, Loeb, Rockoff, & Wyckoff, 2007; Ferguson & Ladd, 1996; Greenwald, Hedges, & Laine, 1996). For example, Boyd et al. (2007) found a significant positive relationship between math SAT scores earned in high school by future

teachers, and higher performance in their math students. When Bastian, Henry, Pan, and Lys (2016) examined graduates' edTPA scores, they found increased scores on edTPA were predictors of higher principal ratings for new teachers. Additionally, their study determined every 1-point increase by TCs on the Planning and Instruction task corresponded to a 1.4 increase in their students' state exam scores. This prior study suggests examining factors that improve edTPA scores is a worthy endeavor for teacher preparation. These findings indicate the need to determine the unique contribution of these variables on our ability to predict teacher readiness to perform well in their profession.

Sampling procedures, sample size, and power

According to Tabachnick and Fidell's (2001) guidelines for running multiple regression analyses, a sample size of 98 is recommended based on the six indicators used in our study ($N > 50 + 8m$, where m is the number of indicators). It should be noted that, although there are four predictor variables in the study (student teaching condition, gender, race, and SAT score), the dummy coding (explained in the Findings section) creates three distinct variables for the student teaching condition in which the participant's condition is coded as a 1 and all other conditions are coded as zero, therefore resulting in six indicators entered into the regression model. Stevens' (1996) recommendation of 15 subjects per predictor for social science research suggests a sample of 90 participants. For a more precise measure including the number of predictors used in this study, we completed an *a priori* calculation using G*Power (Faul, Erdfelder, Lang, & Buchner, 2007), which yielded a recommended sample size of 146. These guidelines determined the minimum number of participants needed for the study. Thus, our sample of 244 participants is adequate.

We studied four student teaching conditions (traditional, instructional coaching, instructional coaching and co-teaching, and co-teaching). Due to small cell sizes, participants randomly assigned into either the 1:1 co-teaching model or the 2:1 co-teaching model were collapsed into a single category for each condition. We understand some nuance was lost by collapsing these conditions in this way; however, this decision was made in an effort to maintain at least 20 observations per independent variable such that we would achieve sufficient power in our analysis for generalization of findings (Hair, Anderson, Tatham, & Black, 1998). Candidates were randomly assigned to the conditions, though not all conditions were available during each of the semesters in this study. In the spring 2014 semester, there were three possible placement options: placement in a setting (a) considered traditional in which they neither received instructional coaching nor co-taught, (b) where they received instructional coaching, and (c) where they both co-taught and received instructional coaching. External funding for instructional coaching stopped at the end of spring 2014 semester; therefore, no instructional coaching was offered in the other two semesters. In the fall

of 2014, all TCs were placed into the traditional model. In the spring 2015 semester, candidates were once again randomly assigned to either the traditional condition or the co-teaching condition. See Table 3 for assignments to each student teaching condition by semester.

Table 3.
Participants by Treatment Condition and Semester

Semester	Traditional (n = 114)	Instructional coaching (n = 42)	Instructional coaching and co-teaching (n = 49)	Co-teaching (n = 39)	% of total (n = 244)
Spring 2014	22	42	49	0	46.3
Fall 2014	49	0	0	0	20.1
Spring 2015	43	0	0	39	33.6

We ran Pearson chi-square and ANOVA tests to examine whether the groups differed from one another significantly in race, gender, and SAT scores. We used Pearson chi-square tests to examine differences by indicator for each of the treatment conditions. We found that students from minority groups were distributed proportionately (X^2[18, N = 244] = 15.832, p = .60), and the number of males randomly assigned to each treatment condition was proportionate and could be expected randomly ($X2$[3, N = 244] = 6.85, p = .08). We conducted a one-way between-groups ANOVA on the means for gender. Levene's test for homogeneity of variance indicated that the variances were significantly different, violating this assumption, F = 2.749, p < .000. For this reason, we determined gender should be used as a control variable (see Table 1). To examine SAT scores across all four conditions, we conducted a between-groups ANOVA, which suggested there were no significant differences among any of the groups, F(3, 342) = 1.030, p = .38. Results suggest the treatment groups do not differ from one another significantly in race, gender, or SAT scores.

Because data were yielded from candidates in the traditional condition across three semesters, we sought to determine whether or not they could be compiled and analyzed as one group in the model. We used a one-way between-groups ANOVA to analyze SAT scores across groups and found that means of each group—including spring 2014 (M = 45.09, SD = 5.935), fall 2014 (M = 46.31, SD = 5.738), and spring 2015 (M = 44.93, SD = 7.426)—did not differ statistically, F(2, 110) = .587, p = .558. In turn, data from the three semesters of control participants were combined to form the traditional group, which represents the traditional student teaching experience.

Measures

We collected data on TC characteristics (race, gender, and academic ability [SAT scores]) and TC readiness (as measured by the performance assessment, edTPA). Race

and gender were obtained through candidates' self-reports and a data request for the college's teacher education database. SAT scores were imported from each candidate's university admission file and the teacher education database. Of the 244 candidates, 133 had ACT scores and 111 had SAT scores on file. Because a considerable number of students had taken the ACT instead of the SAT, we used a method for converting ACT scores to SAT in which a composite ACT English and ACT Math score average is obtained and then converted to an SAT score (conversion tables provided by College Board, 2009).

Findings

The dependent variable was candidate readiness, as measured by the edTPA. Table 4 includes the total edTPA scores by treatment condition. Prior to the analysis, we created dummy codes for each of the dichotomous independent variables (student teaching condition, gender, race) to allow for bivariate comparison within the model (Fox, 1991). We entered the indicator variables into the equation simultaneously to run the standard multiple regression in SPSS. Table 5 shows the correlation coefficients for the variables in the model. The correlation effect sizes among all variables were low (Cohen, 1988).

Table 4.
Total Scores on edTPA by Treatment Condition

Treatment	*n*	*M*	*SD*
Traditional (control)	114	45.37	6.71
Instructional coaching	42	47.10	6.71
Instructional Coaching and Co-teaching	49	46.59	4.65
Co-teaching	39	45.08	5.29

Table 5.
Correlations Among Independent Variables and Teacher Readiness Variable (edTPA)

	edTPA score	Race	Gender	SAT score	Instructional coaching	Co-teaching
Race	-.043	-				
Gender	-.174**	.111	-			
SAT score	.151*	-.029	-.110	-		
Co-teaching	-.050	-.040	-.101	.070	-	
Instructional coaching	.087	-.007	.151*	-.041	-.199**	-
Instructional coaching and co-teaching	.059	.033	-.019	-.008	-.225**	.222**

Note.
** $p < .01$
* $p < .05$

The sample multiple correlation coefficient was .27, indicating that approximately 7% (R square = .071) of the variance of the readiness index in the sample can be accounted for by the linear combination of predictors. Cohen's (1998) guidelines for interpreting R values indicate that values between .01 to .29 are considered a small effect. However, results indicate candidate characteristics and treatment condition accounted for a statistically significant amount of the readiness variability, F (6, 237) = 3.01, $p < .01$.

Table 6 includes the unstandardized regression coefficients and measure of standard error, the standardized regression coefficients, *t* values, and significance estimates. The unstandardized coefficients indicate the relative contributions of each of the variables in the model. We also present indices to indicate the relative strength of the individual predictors in Table 5. Two of the six independent variables were statistically significant predictors in the regression model including gender, which had the strongest unique contribution (β = -.178, $p < .01$), and SAT scores (β = .139, $p < .05$). The instructional coaching condition, however, narrowly missed statistical significance, $p < .054$ (β = .130). Race, the co-teaching condition, and instructional coaching and co-teaching condition were not statistically significant predictor variables.

Table 6.
Results of Standardized Multiple Regression Using Six Variables

Source	*B*	*SE*	B	*t*	*p*
(Constant)	36.791	4.059		9.063	.000
Gender	-5.051	1.822	-.178	-2.772	.006
Race	-0.455	1.276	-.023	-0.357	.722
SAT score	0.009	0.004	.139	2.208	.028
Instructional Coaching	2.134	1.102	.130	1.937	.054
Co-teaching	-0.579	1.107	-.035	-0.522	.602
Instructional Coaching and Co-teaching	1.215	1.025	.079	1.185	.237
R^2	.071				

Analysis of the unstandardized *B* coefficients (Table 6) of student characteristics suggests that participants' edTPA scores (readiness) varied in the following ways depending upon their variable scores: Minority participants could be expected to score 0.455 points lower on the edTPA than White participants, although this was not statistically significant. Males could be expected to score 5.051 points lower on the edTPA than female participants. In addition, every 1-point increase in a candidate's SAT scores yields a 0.009-point increase in the corresponding candidate's edTPA score.

B coefficients (Table 6) also provide information about how randomized block assignment to each condition impacted TC readiness in this sample. Non-significant B coefficients for the treatment conditions indicates that these trends may not be generalizable beyond the study population. The instructional coaching condition yielded a

2.134-point increase in candidates' edTPA scores, indicating an increase in readiness. The co-teaching condition resulted in a 0.579-point loss in edTPA score, suggesting a decrease in readiness. Finally, those randomly assigned to the instructional coaching and co-teaching condition experienced a 1.215-point score increase on edTPA over those not assigned to the condition, indicating an increase in teaching readiness.

Table 7.
ANOVA Table for Standard Multiple Regression

	SS	*df*	*MS*	*F*	*p*
Regression	650.20	6	108.34	3.01	.007
Residual	8532.52	237	36.01		
Total	9182.537	244			

Discussion

The results of this study indicate candidate characteristics and the treatment conditions contribute to a regression model that predicts a statistically significant amount of the variance in candidate readiness even though, individually, the treatment conditions were not statistically significant predictors. This research suggests TCs who have been prepared under the three treatment conditions explored in this study are similarly ready to teach to those who have been prepared under traditional conditions. This finding is important because it gives teacher preparation programs different options to meet the needs of their TCs and their program. Even though co-teaching was not significantly associated with improved readiness, as measured by the edTPA in this sample, our research indicates that it does not hurt teacher candidate readiness either, and this model can be beneficial to our partner schools, clinical teachers, and the university. Qualitative data yielded from other aspects of the co-teaching work suggest co-teaching candidates yield higher degrees of collaboration as a result of their experience and have increased self-efficacy regarding differentiation and classroom management than peers who did not co-teach (Smith et al., 2016; Tschida et al., 2015a, 2015b). One benefit for universities is that 2:1 co-teaching allows institutions to place more CTs in fewer classrooms, which can be beneficial in light of the dwindling number of willing CTs that many programs experience. Co-teaching placements can be more appealing to CTs because of the higher level of support they provide to the TC, like additional modelling and mentorship, and emphasis on co-planning. Similarly, instructional coaching offers a more supportive model that invites an instructional coach into the circle of support, which hesitant CTs may find more attractive than the traditional student teaching model.

We found that TC characteristics were more significant predictors than the conditions that were part of the experimental design of this study. In particular, SAT/ACT scores significantly predicted teacher readiness. Prior literature aligns with the notion

that prior achievement (e.g., GPA, SAT/ACT scores) is significantly associated with teacher effectiveness (D'Agostino & Powers, 2009; Henry et al., 2013), a correlate of teacher readiness. Past research has also shown that prior ability, which can be measured by tests like the SAT, can affect teacher readiness, as measured by the edTPA (Bastian & Henry, 2015). Others have noted that teacher academic ability, as measured by assessments such as the SAT and ACT, has been associated with their performance as teachers, as indicated by their students' performance in specific content areas (Boyd et al., 2007; Ferguson & Ladd, 1996; Greenwald et al., 1996). These findings indicate the need to determine the unique contribution these variables might have on our ability to predict teacher readiness to perform well in their profession.

Instructional coaching treatment

Of the treatment conditions, instructional coaching was nearly a statistically significant predictor of candidates' edTPA scores and warrants further study with a larger sample size to explore its influence. Adding the fourth person to the traditional student teaching triad with the specific role of supporting and coaching the TC may hold promise. TCs with instructional coaches had access to an individual who was familiar with the school and curriculum. Instructional coaches observed their assigned TCs' teaching and gave suggestions for improving instruction. Then, coaches designed professional development seminars based on the specific needs of the TCs they observed. TCs were able to call on their coach all hours of the day and night for support without fear of negatively impacting their evaluations. The TCs often felt the coach was "in their corner" and it appeared to help them relax.

Instructional coaching and co-teaching treatment

One of the reasons why the instructional coaching and co-teaching treatment may have approached significance is the opportunity for participation within a community of practice. TCs received support both from their CT and their instructional coach. Being able to co-teach with their CT offered the TC support as they began teaching with a gradual release of responsibilities. Having an instructional coach to ask questions without fear of it impacting their evaluation gave the TC a level of support well beyond the other treatments. Within this treatment, both gender and SAT scores were identified as statistically significant predictors of candidate readiness. With both variables equally distributed across the conditions of the study, these findings indicate a need for further exploration of additional support to TCs who enter the program with lower test scores.

One practical consideration of these results would be to utilize this condition for the TCs most in need of support. Because this is a more costly model of preparation than the other options here, it may warrant further study to determine how instructional coaching paired with co-teaching might be utilized for TCs with lower scores upon

program entry, or whose performance in the program have indicated a need for greater support. This additional support may prove beneficial in retention and overall preparation for the profession. Using these variables to predict TCs' successful completion of the edTPA can lead to programmatic enhancements.

Co-teaching treatment

Interestingly, even with the variables accounted for in the regression model, over 90% of the variance in edTPA scores is left unexplained. Many factors in both candidates' internal characteristics and those surrounding the student teaching experience could contribute to the variance. One possible factor could be the relationship between the CT and the TC. In extensive literature reviews, Ambrosetti and Dekkers (2010) and Clarke et al. (2013) found the relationship between the CT and the TC often impacts the overall student teaching experience. In some studies, programs have sought to match CTs with TCs based on personality traits to mitigate such tensions in the relationships that can negatively impact the experience (e.g., Ambrosetti & Drekkers, 2010; Clarke et al., 2013). In particular, this may factor into co-teaching placements in which candidates are working closely with their CTs. In this vein, we wonder if there could have been greater gains in edTPA performance of TCs if we were better able to (a) pair TCs with one another in the 2:1 co-teaching setting or (b) pair CTs with TCs in the 1:1 co-teaching setting. Additionally, analyzing the co-teaching conditions (1:1 and 2:1) separately in the future, when we have sufficient sample size, could further illuminate how each approach contributes differently to teacher readiness.

Additionally, although we had established that a minimum of two co-taught lessons per week would constitute the standard of implementation for co-teaching in the study, we did not specifically measure treatment fidelity in this study. Co-teachers were asked to self-report that they taught at least two lessons per week, but adherence to the co-teaching model and implementation has been found to vary. Findings by Guise, Habib, Thiessen, and Robbins (2017) indicate that cooperating teachers often have differing ideas about what co-teaching constitutes and therefore vary greatly in their implementation. It is likely also true that there was a continuum of what co-teaching looked like in this study and likely diluted implementation in some cases. The practical consideration for this model involves continuous opportunities for professional development that allows for greater fidelity of implementation.

Limitations

As with most studies, there are some limitations. First, the different conditions took place over three semesters with the traditional condition occurring every semester. Another limitation is in the co-teaching data. For this study, data from those in the 1:1 model were compiled with data from those in the 2:1 model and analyzed as "co-teaching" if they received only co-teaching experience or "instructional coaching with

co-teaching" if they received instructional coaching but also co-taught.

There are several potential validity threats. The first potential threat to the internal validity of this study is selection. To control for any possible bias, the total population of elementary education candidates were used in the study and randomly assigned to one of four treatment conditions. Although specific intervening variables were not identified, a threat may be the chance for some event or difference to have occurred during one of the semesters that would have significantly impacted that semester's data.

There are also threats to the external validity of the study. Because this study was conducted at only one university, the results may be limited to students attending this university. Additionally, gender and race data were not generally representative of the national population for elementary TCs (Goldring et al., 2013; Putman et al., 2016).

Finally, although the results of this research indicate TCs participating in the instructional coaching, instructional coaching and co-teaching, and co-teaching conditions scored as well as those in the traditional student teaching condition, the treatment conditions can be expensive; sustainability is a consideration. Originally funded through a United States federal grant, the instructional coaching and co-teaching conditions required additional personnel and extensive training over a large rural geographic area. Once the grant ended, faculty within the program looked for ways to restructure the year-long student teaching experience to seamlessly incorporate instructional coaching and co-teaching. Co-teaching was perhaps slightly more self-sustaining than instructional coaching because the condition (a) provided a compelling case for hosting a TC and (b) reduced the number of clinical placements needed for student teaching by half, allowing teacher preparation programs to place TCs in the classrooms of the most effective CTs.

Conclusion

Based on the literature and a needs assessment from the program, four conditions were designed as unique student teaching experiences with the possibility of contributing to candidate readiness. The edTPA provided a reliable and valid way to compare the different conditions implemented in programs and is a predictor of future teacher success. Although the treatment conditions were not statistically significant predictors, our findings are important because they provide teacher preparation programs with different options to meet the needs of their TCs that may also assuage concerns programs often experience with increasingly hesitant CTs and dwindling available classrooms for placements. This study also demonstrates other factors play an important role in TC readiness. Internal characteristics of TCs seemed to be more significant predictors of readiness than the conditions that were part of the experimental design of this study. Internal characteristics play an integral role in the success of TCs, several of which contribute significantly and could warrant program support for some candidates. As

program faculty, we have begun to examine the impact of noncognitive factors (e.g., motivation) on our TCs (Chittum, Cuthrell, Stapleton, Tschida, & Fogarty, 2018) and believe these can be used to predict teacher readiness. Understanding the relative contributions of these predictors can help programs make decisions about the use of innovations to support candidates toward success and consider the question, how do teacher preparation programs accommodate the individual differences of TCs, so everyone has the chance to succeed? We posit that programs must consider the impact of both internal candidate characteristics and external program needs when adapting and implementing innovations such as those presented in this study.

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