

FOSTERING WELL PREPARED BEGINNING SECONDARY MATHEMATICS TEACHERS VIA THE PAIRED PLACEMENT CLINICAL RESIDENCY MODEL¹

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The clinical residency or student teaching experience has been dubbed as one of the most beneficial components of a teacher candidate's program. It is where teacher candidates learn how to orchestrate instruction, develop a student-centered classroom, reflect on their instruction, and collaborate with other professionals focusing on students' learning and well-being. We share the affordances and the outcomes of using the paired placement model with secondary mathematics teacher candidates. Qualitative analysis of teacher candidate data revealed that as a result of participating in the model teacher candidates become more student-centered, reflective, collaborative, and caring teachers.

The adoption of the Common Core State Standards for Mathematics (CCSSM) (National Governors Association [NGA] and Council of Chief State School Officers [CCSSO], 2010) and related college and career ready standards throughout the U.S. represented a significant shift in what it means to learn mathematics, emphasizing student sense-making, conceptual understanding, and communication of mathematical thinking, and a focus on not only learning mathematics content but also becoming proficient with mathematical practices. The National Council of Teachers of Mathematics' [NCTM] (2014) eight research-based Mathematics Teaching Practices (MTPs) delineate specific professional practices known to promote learning aligned with new college and career ready content standards: 1) Establish mathematics goals to focus learning; 2) Implement tasks that promote reasoning and problem solving; 3) Use and connect mathematical representations; 4) Facilitate meaningful mathematical discourse; 5) Pose purposeful questions; 6) Build procedural fluency from conceptual understanding; 7) Support productive struggle in learning mathematics; and 8) Elicit and use evidence of student thinking. Learning about the MTPs must be at the core of teacher preparation coursework and reflected in their clinical experiences; however, there are not enough mentor teachers at the secondary mathematics level prepared to foster the growth of teacher candidates due to a lack of proficiency with this new approach to teaching which is in alignment with the NCTM (2014) eight Mathematics Teaching Practices. Teacher preparation programs face significant challenges in providing secondary mathematics teacher candidates with quality clinical experiences that are in alignment with the new demands. Both experienced and novice teachers attest that clinical experiences (including student teaching) are powerful components of teacher preparation-- more influential on long-term practices than preparation program coursework (Wilson et al., 2001).

The aforementioned challenges and the need for teacher candidates to develop equitable teaching strategies motivated work that has been taking place among several universities since fall 2012 when a working group focusing on secondary mathematics clinical experiences was formed as part of the

¹ Funded by a grant from the National Science Foundation (DUE-1147987, 1726998, 1726362, & 1726853). Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

Mathematics Teacher Education Partnership (MTEP), an initiative organized under the auspices of the Association of Public and Land-grant Universities. The goal of MTEP is to build a national partnership that works collaboratively to redesign secondary mathematics teacher preparation programs (Martin & Strutchens, 2018). MTEP provides a coordinated research and development effort based on the Networked Improvement Community (NIC) design developed in consultation with the Carnegie Foundation for the Advancement of Teaching (Bryk et al., 2011). The essential characteristics of the NIC design begin with a focus on a well-specified common aim that addresses a problem with attributes that are well understood by the community. The community works together to develop interventions that have measurable outcomes, based on Plan-Do-Study-Act (PDSA) improvement cycles in which an intervention is planned, implemented, tested, and refined (Bryk, et al. 2015). Finally, the networked quality of the community allows acceleration of development, testing, and refinement of the interventions as well as testing them in varied contexts (Bryk, et al. 2015).

Members of the clinical experiences working group conducted an extensive literature review, which served as the basis for the formation of the Clinical Experience RAC (CERAC), a collaboration of 27 universities, with two serving as leads, which is engaged in exploring how to provide more effective clinical experiences for secondary mathematics teacher candidates following the NIC model. The leader of the CERAC is a faculty member in Auburn University's secondary mathematics education program, and Auburn University is the lead institution for an NSF Collaborative Award, entitled *Attaining Excellence in Secondary Mathematics Clinical Experiences with a Lens on Equity*. CERAC is answering the overall research question: How does a continuum of collaborative and student-focused clinical experiences, including co-planning/co-teaching and paired placement fieldwork models, impact pre-service teachers' equitable implementation of the Mathematics Teaching Practices (NCTM, 2014) across institutional contexts?

Even though the grant was funded in 2017, the secondary mathematics education program at Auburn University has been implementing the paired placement model for the required semester-long clinical residency since 2014 as a part of the original CERAC work. In the paired placement model, a pair of student teachers works daily with an experienced mathematics mentor/coach who is devoted full time to helping the student teachers address the craft of teaching, plan lessons jointly, and teach those same lessons while actively observing, reflecting, and revising (Leatham & Peterson, 2010). Mau (2013) reported that paired interns: 1) engaged in more frequent and varied communication; 2) increased their willingness to take pedagogical risks; 3) improved their levels of reflection; 4) found methods for collaboration and cooperation in the teaching action; 5) found ways to increase K–12 student learning; 6) had better classroom management; and 7) found strategies to handle tensions in perspective and performance. Over the past nine years we have been using PDSA cycles to improve the implementation of the model at Auburn University in tandem with a subset of other members of the CERAC who have been implementing the model at their institutions. In this report, we address the specific research question: How did the implementation of the paired placement model impact secondary mathematics teacher candidates during their clinical residency at Auburn University?

To investigate this question, we analyzed data collected from several sources from teacher candidates (TCs) in cohorts who participated in the paired placement model. Together these cohorts totaled 26 pairs, with the first cohort having completed their clinical residency in Spring 2014 and the most recent ones having completed their clinical residency in Spring 2023. The data included TCs' journals,

transcriptions of focus group meetings, PDSA cycle questionnaires, observation protocol data, and university assessment data, which are described as follows. Each TC wrote in a *journal* each day of their paired placement clinical residency. *Focus group meetings* were conducted to understand the individuals' experiences with and perceptions of the paired placement at the conclusion of their clinical residency. These focus group meetings included the pairs of TCs, mentor teachers, and university supervisors. Each meeting was recorded and transcribed for analysis. Before the midterm of the clinical residency, the TCs, mentor teacher, and university supervisors completed a *PDSA cycle questionnaire* regarding the implementation of the paired placement such as its strengths and weaknesses. These questions were used to improve the paired placement model, but they also highlighted the students' priorities in their placements. To gain better understanding of their instructional practice, each pair was observed several times during the semester using the *Mathematics Classroom Protocol for Practices* (MCOP2; Gleason et al., 2015). The MCOP2 is designed to assess the alignment of instructional practice to national standards such as the Standards for Mathematical Practices (NGA & CCSSO, 2010). Finally, throughout the internship, the pairs were evaluated by their university supervisor and mentor teacher using required *university instructional assessments*. Collectively, these data sources were analyzed to provide a broader picture of the paired placement.

ANALYSIS

To understand and gain insight into the TC's experiences in the paired placement internship model, we utilized open coding (Corbin & Strauss, 2014). The initial focus of the analysis was the TCs' journals since, they provided the most detailed data source. The researchers began with *a priori* themes drawn from the literature describing perceived strengths of the paired placement internship model. Each researcher independently coded three to four TCs' journals using the *a priori* themes, while simultaneously identifying emerging themes. Throughout the coding process, the researchers met frequently to develop and revise shared definitions of the themes and worked toward satisfactory inter-rater reliability. The final themes related to the paired placement model's impact on the teacher candidates include: growth related to the Mathematics Teaching Practices (NCTM, 2014), equity awareness, reflective of the teaching practices, collaborative with others, importance of feedback, and emphasis on learners.

FINDINGS AND CONCLUSION

The data analysis suggests that the paired placement model had a significant impact on the teacher candidates involved in the model, indicative of them becoming well-prepared beginning teachers. They showed significant growth in their awareness, appreciation, and use of the Mathematics Teaching Practices (NCTM, 2014) in creating a discourse-rich classroom. They developed an awareness of critical issues related to equity, including a commitment to providing instruction that is attentive to the needs of all students. They demonstrated self-awareness of both their strengths and weaknesses as teachers, along with a commitment to continuously improving their practice. They developed a deep appreciation for the power of collaboration, given that it is a core characteristic of the paired placement model, and often expressed the desire to continue to develop collaborations with their colleagues as they began their teaching careers. Teacher candidates learned to value the importance of receiving and giving constructive feedback as a part of the reflective process. Finally, their primary focus for reflection was on the learners they were teaching, rather than on themselves.

These attributes can be traced back to the design of the paired placement model. In contrast to the experiences a teacher candidate often faces in a single placement clinical residency, where the focus may be more on the individual growth of the teacher candidate, the paired placement model foregrounds interactions of the pair of teacher candidates with their mentor teacher. In fact, this trio could be considered a mini-professional learning community (PLC) which has the goal of improving instructional practice to better meet the needs of the students. The mentor teachers selected to participate in the model are expected to have had extensive experiences with the Mathematics Teaching Practices (NCTM, 2014) and issues related to equitable instruction, both of which are central in the Auburn University secondary mathematics education coursework; indeed, nearly all are either graduates of the program or have been involved in professional development provided by program faculty. Thus, the members of the mini-PLC have a clear shared vision that guides their work (Fulton et al., 2010). In conclusion, the evidence clearly show tht the paired placement model supports the development of well-prepared beginning teachers who will continue to grow as they begin their careers. We will continue to explore our rich data set in to further elucidate factors that support its success.

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