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Impact & Effectiveness of Developmental Relationships



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Mentoring STEM Majors into Careers in Teaching

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ABSTRACT

Talented Teachers in Training for Texas (T4) is a National Science Foundation funded program aimed at recruiting and training outstanding STEM high school teachers while pursuing a better understanding of methods that increase recruitment and foster persistence in the field of STEM teaching. T4 is unique in that it has a five year cohort model – scholars begin receiving financial support and mentoring starting in their junior year at university and support continues through their third year in the high school classroom. While in college, T4 Scholars meet with university faculty and teaching mentors biweekly to discuss aspects of teaching, examine content and explore challenges for new teachers. Key to this experience is continuity in mentorship. Rather than have a different mentor for advising, for classroom observations, for student teaching, and for classroom induction, T4 fosters sustained relationships which transcend a variety of academic experiences. While scholars meet with a variety of practitioners, from novice teachers, to veterans, to administrators, the focus is on becoming a supportive, sustained academic community. Regular classroom observation and reflection is an integral part of the program, as are local, regional, and national conferences.

CONTENT

Establishing a sufficient teacher pool, that is both excellent in STEM and pedagogy is a central focus of the STEM educational community and has been for years (Watt, Richardson, & Pietsch, 2007). In his 2011 State of the Union Address, President Obama committed the federal government to train 100,000 new STEM educators. While training new teachers contributes to a solution, PCAST's Report to the President stated that the problem lies at least as much in *retaining* teachers as in *training* them. "If recent trends continue, about 25,000 mathematics and science teachers can be expected to leave the profession annually" (2010). Less than a third of them will retire, while nearly two-thirds cite job dissatisfaction as their reason for leaving. Clearly in order to reverse this trend, aspiring STEM teachers must be invited into a supportive, sustained academic community if they are going to succeed in the classroom and persist at a high rate.

The Robert Noyce Scholarship Program was first authorized by the National Science Foundation in 2002 (nsfnoyce.org 2013) to meet the demand for STEM teachers and stimulate innovation in teacher recruitment, preparation, and support for high-need, diverse school settings. To date, the Noyce Scholarship Program has supported the certification of approximately 6,800 teachers (Prival 2013). Talented Teachers for Training in Texas (T4) (NSF 1136416), a Noyce Scholarship program, was conceptualized to offer attractive entry points to STEM majors to consider high school teaching, and to target a limited number of those majors, called T4 Scholars, for authentic induction into the STEM teaching community. This specialized approach to targeted STEM educator recruitment and mentoring was intended by design to be fundamentally different from the standard teacher preparation program offered within our university and based on evidence-based research on the effects of support mentoring within the *content* areas and throughout the induction phase for novice STEM teachers who enter high needs classrooms.

By design, T4 is unique in that it is based upon a five-year cohort model. T4 scholars begin receiving financial support and mentoring during their junior and senior year at the university and mentoring support continues within a cohesive, integrated framework through their third year in the high school classroom. Thus, the onset of sustained mentoring occurs at the beginning of their junior year when T4 Scholars meet with university faculty and teaching mentors biweekly to discuss aspects of teaching, examine content and explore challenges for new teachers. Key to this sustained induction experience is continuity in mentorship. Rather than assigning different mentors for advising, for classroom observations, for student teaching during teacher education and later within their classroom induction, T4 fosters sustained relationships with STEM university faculty and an experienced classroom mentor, MOM, which transcends across the academic continuum of induction experiences. While scholars meet with a variety of practitioners, from novice teachers, to veterans, to administrators, the focus is on becoming a supportive, sustained authentic community of learners. Regular classroom observation and reflection is an integral part of the program, as are participation in professional STEM-related conferences at the local, regional, and national levels.

The focus of this article is to discuss unique aspects of the mentoring model as grounded by evidence-based practice in a growing literature base on teacher retention within the last decade (NCTAF, 2005; Sid Richardson Foundation, 2012; Smith & Ingersoll, 2004; Spradlin & Prendergast, 2006). Treating the T4 Program as a case study in STEM pre-service teacher mentoring, we begin with a discussion of the standard certification and teacher induction approach within our university and contrast it with the T4 program model. We then outline the sequence of cohesive, sustained mentoring experiences that T4 Scholars receive through the program and into induction. Within this section, we focus on peer mentoring and the use of a cadre of experienced classroom mentors within the content areas. Finally, we discuss our vision and longitudinal plan to support and study teacher satisfaction, effectiveness, and retention during and beyond the critical three-year period of induction. Maintaining continuity in mentoring once T4 Scholars are placed within high need districts is at the core of this vision.

“Standard” Pre-Service and In-Service Teacher Induction Contrasted with the T4 Project

Our university’s content and pre-service pedagogy training is traditional in nature. Like many American universities, a science or mathematics major planning to become certified in to teach at the secondary level follows the following typical trajectory:

- Receive academic advising from someone within a STEM discipline, usually a faculty member who does not have a teaching background
- Take STEM courses in major field of study
- Take five education courses and one educational psychology course prior to student teaching, which includes approximately 30 – 40 hours of observation
- Participate in student teaching in the high school classroom with an online pedagogy component offered by a university supervisor who visits the classroom and debriefs with the student teacher
- Apply for a teaching position and quickly be hired
- Discover whatever type of mentoring program their school district has after arriving at their district

Every one of these six steps adds value, but they are typically disconnected: Major courses rarely discuss teaching and educational courses are typically discipline independent. Observation hours are virtually never discussed with academic advisors. Student teaching mentors are met the first

day of student teaching and said good-bye to at the end of the semester. Job applications may be discussed with academic advisors or master teachers, but no system exists to ensure STEM teacher candidates are applying to jobs that suit their needs and skill set. Any semblance of university mentoring ends before students enter their first full-time employment and any attempt at district mentoring begins after.

The fundamental premise of T4's mentoring model is that by connecting university mentoring with pre-service teacher induction experiences and induction mentoring in the classroom, the T4 Scholars will experience greater connection with their teaching peers, receive better support as new teachers in the classroom, experience more immediate success in the classroom, and be more likely to stay in the teaching profession (Sid Richardson Foundation, 2012). Even more optimistically, we believe that if T4 Scholars experience cohesive mentoring themselves, they will be more equipped to offer the kind of mentoring needed among at-risk youth in high need school settings.

The T4 project purports to achieve these goals in essentially two ways: 1) Build a team of researchers, academics and teachers that are committed to a particular group of teachers for a five-year period; 2) Craft a plan for integrating the components of the standard induction process that includes extensive opportunities for sense-making and engagement in a community of teachers (NCTAF, 2005). This extensive plan is outlined in the sections below.

Sequencing and Connecting Pre-Service Mentoring Experiences

We summarize the T4 project's overall mentoring strategy as "Inviting scholars into an authentic, sustained learning community." Pragmatically, the sequence of cohort mentoring activities breaks down as follows:

- Recruit and prepare cohorts of STEM majors willing to commit to at least 4 years of teaching in a high-need school district.
- Meet biweekly as a group. (The following activities were part of our bi-weekly meetings.)
 - Start with get-to-know-you activities and academic advising.
 - Meet veteran teachers, hear what inspired them, and ask questions.
 - Meet school administrator, hear what administration is looking for, and ask questions.
 - Meet a first year teacher, hear first-hand about the transition, and ask questions.
 - Observe classroom teachers.
 - Eat together, sometimes in mentors'/advisors' homes.
- Attend STEM-related professional conferences together.
 - Discuss experiences with peers and classroom teachers.
- Identify a master teacher in STEM to serve as a mentor across several semesters and who will invest in students prior to student teacher, be involved in where they are placed for their observations, oversee their student teaching, and continue a mentoring relationship after they enter the classroom.
- Encourage peer-to-peer interaction (reaching out to other future teachers if possible).
- Track each student's academic progress, supporting strong learning within the STEM major and education minor and attempting to preemptively identify particular obstacles in course work.

With our first cohort of T4 Scholars, we spent the first semester bringing the teaching community to them – experienced teachers, an administrator, and a new teacher. In their second semester, we

asked Scholars to attend 5 different classes in as many different school settings as possible – large district, small district, high level, low level, etc. Pedagogical analysis was discussed and a reflective framework was discussed with the mentor teacher.

Although the cohort has outstanding buy-in and typically has great follow-through, less than a quarter of Scholars successfully completed the assignment. We modified the scholars' third semester so that they were asked to work with a single master teacher. This pairing allows them more familiarity in entering a high school classroom setting and more accountability in coming regularly. Visits are structured so that Scholars will be able to observe outcomes-based lesson planning at the beginning of a semester, observe how that lesson content plan extends over the semester, and how bench-marking assessments and examinations finish the accountability cycle in our high-stakes, test-driven schools. The fourth semester in our strategy is full-time student teaching with university supervision provided by the same mentor with whom Scholars have been developing rapport for over a year.

Master Teachers As STEM Content Mentors

One of the assets our university possesses is a cadre of well-prepared master teachers who are outstanding in STEM teaching. This cadre has evolved from two graduate programs active at our institution. These programs are the Robert Noyce Master Teaching Fellows program (NSF0934878) and a Math Science Partnership (MSP) cohort of teacher leaders (P16EQ-MST2-08-1). The programs were established with funding from the National Science Foundation, and a state-funded Math, Science & Technology Teacher Preparation Academy for high school teachers.

At a T4 teacher recruiting activity, a group of these master teachers recommended the pairing of T4 Scholars and master teachers for a semester with the focus of objective-based lesson planning. The concern raised was that often the pre-service teacher curriculum is extremely strong in sound pedagogy but less focused on meeting standards. The master teachers' goal was to help pre-service teachers think through how to accomplish both goals simultaneously, first seeing it in the lesson planning, then in the implementation.

The beauty of having such an outstanding group of teachers in our STEM teaching community, which represent over a dozen school districts ranging in size from a few hundred to many thousand students, is that they offer sound insight into how to prepare future teachers and they generate access to the districts that our pre-service teachers need to be in (Odell, 2006). They shape the content and exemplars used in our bi-weekly meetings as well as instill in Scholars the foundational elements of inquiry-based teaching and learning within an outcomes-based educational system. For over a decade, our university has invested in these teachers' professional development and these are the STEM master teachers we want our Scholars working with and observing.

T4 Scholars as Peer Mentors

T4 particularly targets students from diverse backgrounds and recruits community college transfer students and those students not originally intending to teach. About half of the T4 Scholars entered college not intending to teach and without any family member in the teaching profession. On the other hand, one of our T4 Scholars is the daughter of a school superintendent and a 20-year veteran of public school teaching. Thus, she is intricately familiar with all sorts of aspects of the teaching profession, understands the culture of in-services and conferences, and will be a teacher-leader from the day she sets foot in the high school classroom. One of the key strategies of

the T4 project is to allow students to share their experiences with one another, employing a highly individualized approach with regards to what it means to be an educator.

As the T4 Scholars become more comfortable with each other, it is interesting to hear them honing their ideas of teaching, discipline, and job application together. They have also begun to recreate together, study together, and to draw others outside the program into their STEM teaching circle. Interestingly, when identifying out second T4 Scholar cohort, the majority of scholarship finalists had spoken to a T4 Scholar about what the program entailed.

T4 Scholars have taken an active role in our teacher recruitment activities, from speaking to their peers about their experiences in the T4 Program and expressing their contagious enthusiasm about going into STEM teaching to actually sitting in on each finalist interview. In case of point, the Scholars have undertaken the formation of a student club for future STEM Teachers – Pi Delta Tau, which stands for Passion Driven Teaching. The goal is to spend time together pursuing teaching-related activities and also to invite future teachers who are currently not associated with the T4 Program into community with them. From a teacher recruitment perspective, having a student led club that reaches out to students considering a career in STEM teaching is a gold mine.

Cohesive In-Service Induction Through T4 Mentors

Identifying a veteran STEM teacher to invest in each cohort is central to the T4 model. Cohort One affectionately calls their cohort mentor MOM (Mentor of Math... and Science). MOM is an outstanding STEM teacher with over 20 years of classroom and professional experience in teacher development. She provides support to T4 Scholars during the pre-service induction period and will maintain contact with them once they are placed in a high need secondary classroom. Most importantly, MOM is invested in these students – she checks in on them, calls them out when they are not performing as they should, and communicates caring support to each Scholar.

Once this cohort enters the classroom, having a mentor that is not school district-based gives Scholars an advocate. If their first teaching assignment does not go smoothly and they must move schools, they know they are not losing their mentor and advocate. This relationship also provides a safe sounding board with clear allegiance to the Scholar first and not primarily to the district, which contrasts with the traditional district-based mentoring approach.

Realistically, however, new teachers often describe most success when mentored daily, even hourly, by an experienced veteran and that is only going to happen with a mentor who also teaches in the same district. (See for instance, Cochran-Smith 2012.) These are supremely valuable connections. After years of working with Alabama's statewide new teacher mentoring program, Dr. André Green has refined the process as follows: He waits until a new teacher begins teaching in a district, works with the new teacher to identify someone who the new teacher believes would be a good fit as a mentor, then invites that person into mentoring training at the university campus.

This model was refined in the University of South Alabama's Noyce Scholarship program Pathways to Mathematics. Once in-district mentor teachers are identified, they are invited to campus for three to four mentoring workshops throughout the year, they are provided a \$500 per semester stipend, and they are included in an online discussion thread that feeds them weekly questions to ask their novice teacher. The T4 Project plans to utilize this model, even bringing in

the Alabama team initially to train mentors since our state does not have a standardized, research-based new teacher mentoring program.

Conclusion

Training and supporting outstanding STEM teachers to invest in the next generation is a much-needed, and perplexing, endeavor. The T4 project has undertaken the challenge by forming a team of university faculty, practicing master STEM teachers, and teaching mentors with the intention of forming a cohesive pathway for STEM majors interested in committing to an authentic teaching community. The T4 mentoring model centers on creating mentoring relationships that will last and likely transform into educational partnerships over time. From advising and sustaining relationships formed in pre-service training to peer mentoring, T4 has fostered a sound, cohort-based model that includes mentoring across the continuum of pre-service and in-service teacher induction. T4 focuses on connecting those relationships into a cohesive solid foundation. We believe a sustained, well-structured induction experience into the teaching community is the best foundation to build STEM teachers who will spend a lifetime investing in the next generation of learners.

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