Considering Mathematics Education Program Recruitment and Retention Through a Student-Centric Logic Model

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Abstract

The Mathematics Teacher Education Partnership (MTE-Partnership) in the *Guiding Principles for Secondary Mathematics Teacher Preparation Programs* (2012, 2014) and the Association of Mathematics Teacher Educators (AMTE) in the *Standards for Preparing Teachers of Mathematics* (2017) underscore the importance of mathematics education programs attending to recruitment and retention efforts to increase the number of applicants and completers, including those representing diverse communities. Local and regional partnership teams from the MTE-Partnership that contribute to the Program Recruitment and Retention Research Action Cluster (PR^2 RAC) engage in planning, implementing, analyzing and sharing program recruitment and retention strategies and approaches, along with results for the continued improvement across MTE-Partnership institutions. This paper discusses the use of a tool—a student-centric logic model—to guide and analyze secondary mathematics teacher education program recruitment and/or retention planning from the perspectives of potential students. Three PR^2 RAC institutions share student-centric logic-models for their programs, one undergraduate, one post-baccalaureate, and one Master of Arts in teaching, and discuss the recruitment and retention strategies they are planning, implementing, and analyzing.

Introduction

Throughout recent years, the United States has been faced with concerns about having an adequate number of well-prepared secondary mathematics teachers to meet demands (Banilower et. al., 2013; Ingersoll & Perda, 2010). In fact, Brainard (2007) reported that 30% of high school mathematics students in the U.S. were taught by teachers who did not major in the field in college or were not certified to teach mathematics. In 2010, the President's Council of Advisors on Science and Technology (PCAST) published an executive report highlighting the most important factor for STEM excellence in the U.S. was the need to recruit and prepare great STEM teachers; teachers "with both deep content knowledge in STEM subjects and mastery of the pedagogical skills required to teach these subjects well" (p. xi). At the same time, researchers and policy makers have emphasized the need for more racial and ethnic diversity in the teaching profession in ways that are more aligned with the students and population at large (D'Amico et al., 2017; U.S. Department of Education, 2016).

In an effort to increase the numbers of better-qualified and diverse secondary school mathematics teachers being recruited, retained, and graduating from institutions of higher education, the Program Recruitment and Retention Research Action Cluster (PR^2 RAC) was established as part of the larger MTE-Partnership (Martin et al., 2020). The PR^2 RAC is a consortium of institutions of higher education with secondary mathematics teacher education programs and their school partners (program teams) engaged in efforts to develop strategies and approaches for effective recruitment and program retention of secondary mathematics teacher education candidates. The work of the PR^2 RAC is grounded in improvement science (Byrk et al., 2015), including its evolution from the MATH RAC (Fernandez, 2020), and founded by the *Guiding Principles* (MTE-Partnership, 2012; 2014) and the AMTE Standards (2017). Both documents underscore the importance of mathematics teacher education programs attending to

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recruitment and retention efforts to increase the number of applicants and completers, including those representing diverse communities. For the PR^2 programs and their school partners, the diversity of candidates has been sought in ways that closely align with the demographics of the communities that the programs serve (McNamara, Franz, & Fernandez, 2020). Thus, the demographics of secondary mathematics teacher candidates sought can vary depending on where the programs are located, the needs of their communities, and the communities served by their institutions.

Student-Centric Logic Model for Program Recruitment and Retention

Logic models are graphical tools that can be used to map out program components and the processes that link them (McLaughlin & Jordan, 1999; Newton et al., 2013). Given the linkages presented among the components, a logic model can be used to present how a program will work to solve known problems. Such models can be used for program planning, implementation, and evaluation and should be revised periodically as changes in the context occur, lessons are learned, and obstacles are identified that lead to changes in program components.

Figure 1 contains a Student-Centric Logic Model used by PR^2 program teams to guide and analyze program efforts for recruitment and retention from the perspectives of their potential students. The programs seek to recruit, retain, and graduate well-prepared secondary mathematics teacher candidates from diverse backgrounds aligned with the communities each program serves. This logic model consists of the following elements: Needs, Objectives, Input, Activities, Output, and Outcomes. The Needs element captures why students attend the institution in which the program being represented is housed. This helps program teams think deeply about the students they are seeking to recruit and retain in their programs. The Objectives element denotes what are the goals of students a program is seeking to recruit while attending the higher education institution. The Input element depicts aspects of the environment and community that potential program students are exposed to as part of their consideration of and attendance at the institution. This element includes Inputs encountered before applying and being admitted to the program, once admitted, and during the program. The Activities element describes ways to engage students through their Inputs that are aligned with their needs and objectives for attending the institution and engaging in the program. The Output element provides expected results from engaging the students in the Activities. Finally, the Outcomes element provides measurable items to assess the success of the Activities based on the Outputs. The PR^2 program teams investigate the Activities through the use of Plan-Do-Study-Act (PDSA) cycles central to networked improvement communities (NICs; Byrk et al., 2015). Fernandez (2020) provides examples of PDSA cycles used for program recruitment.

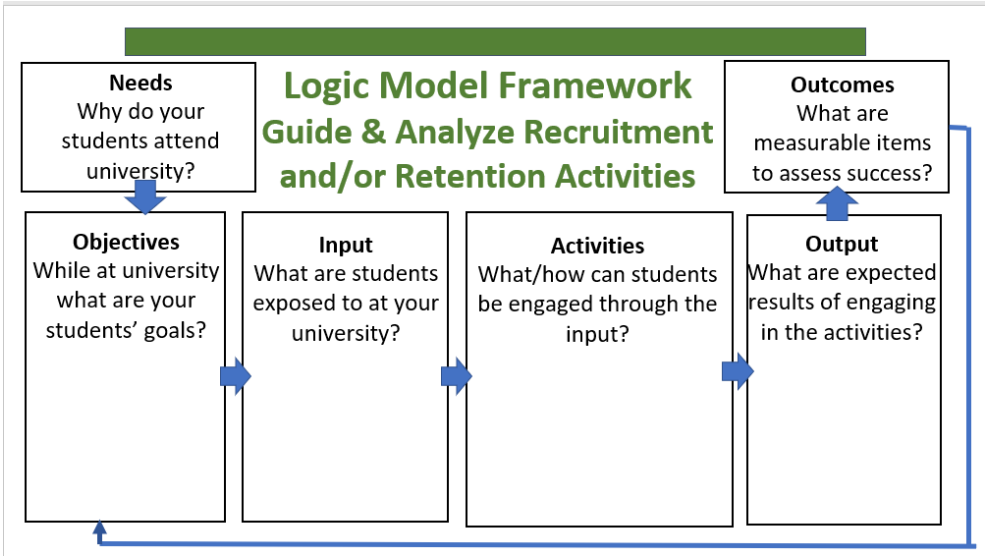

Figure 1. Student-centric logic model for Program Recruitment and Retention RAC.

Implementation of Student-Centric Logic Model for Program Recruitment and Retention

In this section, we discuss the use of the Student-Centric Logic Model (see Figure 1) across three secondary mathematics teacher education programs whose program teams were part of the PR^2 RAC. The institutions include the following: Florida International University (FIU), California State University-East Bay (CSUEB), and University of Hawai'i at Hilo. The programs discussed include a bachelor's, post-baccalaureate, and Master of Arts in Teaching, respectively.

Florida International University's FIUteach Program

Figure 2 provides the Student-Centric Logic Model describing FIU's FIUteach undergraduate program for students majoring in a mathematics or science discipline with an endorsement for teacher certification in Florida. FIUteach was aligned with the UTeach model (Brainard, 2007). When considering the *needs* of the students, the MTE-Partnership FIU team considered students who were attending FIU to pursue the completion of a four-year degree for future employment and opportunities that can support themselves and their families. The *objectives* that they have for attending include finding a major they like, feeling a sense of community while completing their degree, and feeling successful in the choices they make. While attending FIU, students' objectives were met through multiple *inputs* directly related to *activities* they engaged in. For instance, they were helped in deciding on a major through attendance at FIU orientations; talking with program faculty and advisors at orientations and in introductory mathematics classes; engaging with peers including peer advisors and STEMteach, a student organization for mathematics and science education students; taking classes; and seeing visuals with program information within their environment, such as emails to FIU-accepted STEM students, flyers, and posters. The inputs with related activities also overlapped in meeting students' other objectives. For example, students feeling a sense of community was met through student organizations such as STEMteach and engaging with program faculty and staff as well as other program students. Feeling successful in their program choices was met through success in their classes and communications with and support from program faculty and staff, as well as through STEMteach, which offered workshops for successful completion of state teacher certification exams and collaboration for academic success. The outputs provide descriptions of the expected results, and the *outcomes* consist of the results-related measures to assess success from the activities. Activities are investigated through PDSA cycles (Byrk et al., 2015; Fernandez, 2020).

The FIU team has studied the outcomes of activities proposed. For example, the team found through surveys collected in program introductory STEM education classes and through the program website that students enrolling in these classes to trial teaching primarily heard of the program and introductory course through flyers shared by program faculty and staff including advisors at university orientations and through emails sent before their orientations. On the other hand, few reported hearing of the program through flyers physically mailed to their homes. At a point when the FIU team observed that students were leaving the program because they were not successfully completing the three required state certification exams (General Knowledge, Subject Area, and Professional Knowledge), the team added to the Logic Model, having the STEMteach student organization, along with a program faculty member, share materials and offer workshops for successful completion of the exams. The program tracked student completion of the exams as they proceeded through program classes and found an increase in numbers of students successfully completing the exams and, in turn, an increase in the number of program completers.

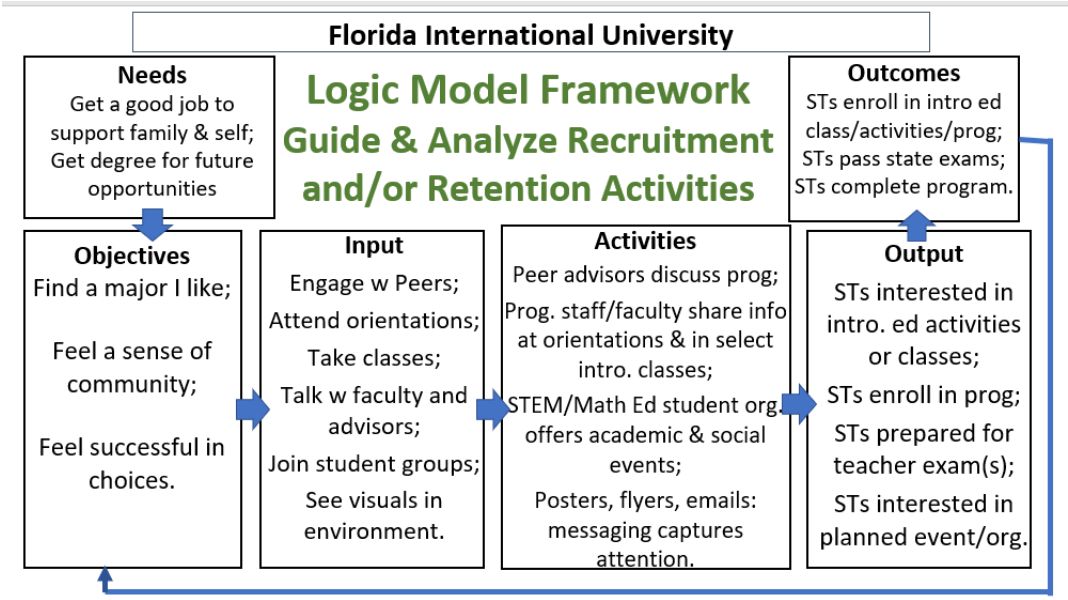

Figure 2. FIU's logic model for its undergraduate Program Recruitment and Retention.

California State University-East Bay's Single Subject Credential Program

The CSUEB program is a one-year post-baccalaureate program similar to others across the California State University System. Much of the recruitment into the CSUEB program comes from their undergraduate students, who may or may not have already identified that they want to be teachers. Looking at CSUEB's Student-Centric Logic Model (see Figure 3), students attending the institution are seeking to satisfy the need to find a university considered to be a good value, that is nearby, and that can support their opportunity to find employment. Many of their students come from the local community. Students seeking additional opportunities beyond their bachelor's degree have Objectives to receive preliminary credentials and opportunities for local employment, including getting hired as a local teacher. Given the post-baccalaureate nature of the program, the Inputs are considered starting while potential students are undergraduates. These include students participating in university events such as those aimed at mathematics and science students interested in teaching, students connecting with peers with similar goals, students viewing flyers and electronic announcements about events, and students interacting with instructors that may nominate them as potential teachers for program events. One such event is "A Celebration of Teaching" during which attendees network and hear from current teachers, administrators, and others connected to the teaching profession. A Celebration of Teaching is supported across the state by the CSU Chancellor's Office. With respect to the Activities in the model, the Chancellor's Office provides financial support in addition to that of the institution and program. For example, the Chancellor's Office supports CSU EduCorps (https://www2.calstate.edu/educorps) and its' Teacher Toolkit (http://diversitytools.csu-eppsp.org/) for recruitment and retention of diverse students in becoming well-prepared teachers across the state. The Chancellor's Office also provides funding for scholarships in addition to the National Science Foundation's Robert Noyce Teacher Scholarships the program offers to support students completing their undergraduate degree in mathematics and the post-baccalaureate program to earn their teaching credential. Additionally, the students complete field experiences in local schools, which support their future employment in the local schools, meeting their Needs and Objectives for finding employment in the local community. The Activities also included helping students prepare for teaching prerequisite requirements, such as subject matter competency exams, field experiences, and navigating the teaching credential application process. As for the Outputs from the Activities, the students were expected to complete all requirements to be accepted into the program, enroll in the program, and obtain their preliminary credential and a position in the field. The Outcomes measured included the numbers of

candidates successfully completing program coursework and passing the licensure exam, obtaining of their teaching credential, and acquisition of a teaching position in the field.

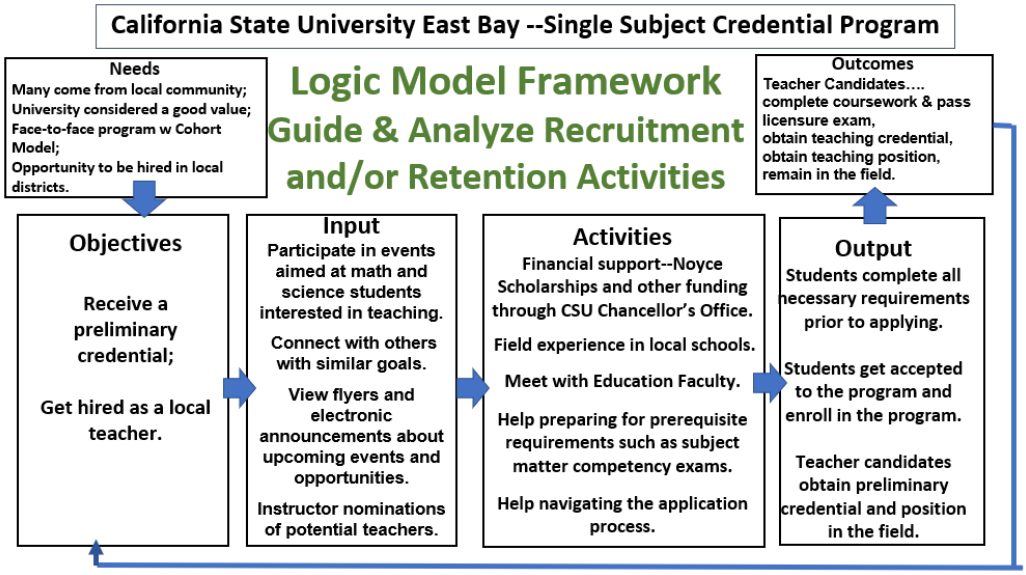

Figure 3. CSUEB's logic model for its post-baccalaureate's Program Recruitment and Retention.

University of Hawai'i at Hilo's Master of Arts in Teaching (MAT)

Hilo is a small town on the Big Island of Hawai'i and the University Hawai'i at Hilo and at Mānoa on the island of O'ahu are both part of the University of Hawai'i (UH) System and compose the MTE-Partnership Hui (a Hui is a club). These universities collaborate for the increased recruitment, retention, and graduation of well-prepared teachers with diverse backgrounds aligned with their communities. Figure 4 maps the Student-Centric Logic Model for the UH-Hilo MAT. With respect to Needs, their potential students are seeking a supportive educational environment, preparing them well for future employment without leaving town. Their Objectives include completing the necessary licensure requirements for employment and obtaining a local position. Several Inputs were identified that potential program students are exposed to as they consider selection and then attendance at UH-Hilo to meet their Objectives. Potential students engage with other interested students in courses including prerequisite undergraduate courses that can be completed as part of their undergraduate programs and count toward the MAT. They also have opportunities to talk with peer advisors and faculty. Additionally, they are exposed to program information in the community such as seeing flyers around campus and broader advertising. In regards to Activities aligned with the Inputs students engage in, the UH System has collaborated with local news media on mediums targeting teacher recruitment. UH-Hilo was able to collaborate with its local news media to create informational vehicles about the MAT for teacher recruitment containing program voices, including interviews with students that the program is able to post on its website. Also, the program participates in advertising through School of Education program open houses and program application workshops. The program faculty advise interested students explaining the flow of the program, as well as scholarship opportunities available from state funding such as Grow-Your-Own-Initiatives, and campus funding sought by the program through the institution's financial aid office. Such funding supports students' objectives and needs to get licensed while engaging in a supportive education without leaving town. Other Activities include providing students with extensive field experiences prior to applying for licensure, along with extensive mentoring in the field to support students in successfully completing the program and obtaining a position in a local district. The extensive field experiences and mentoring in the field have been found to be important for retention. As for Outputs, the program outlined the following: students completing all necessary requirements prior to applying, students getting accepted to

and enrolling in the program, and students remaining in the program and in the field. The related Outcomes measuring these results include the numbers of students from diverse backgrounds aligned with the community demographics completing the program and teacher candidates remaining in the profession.

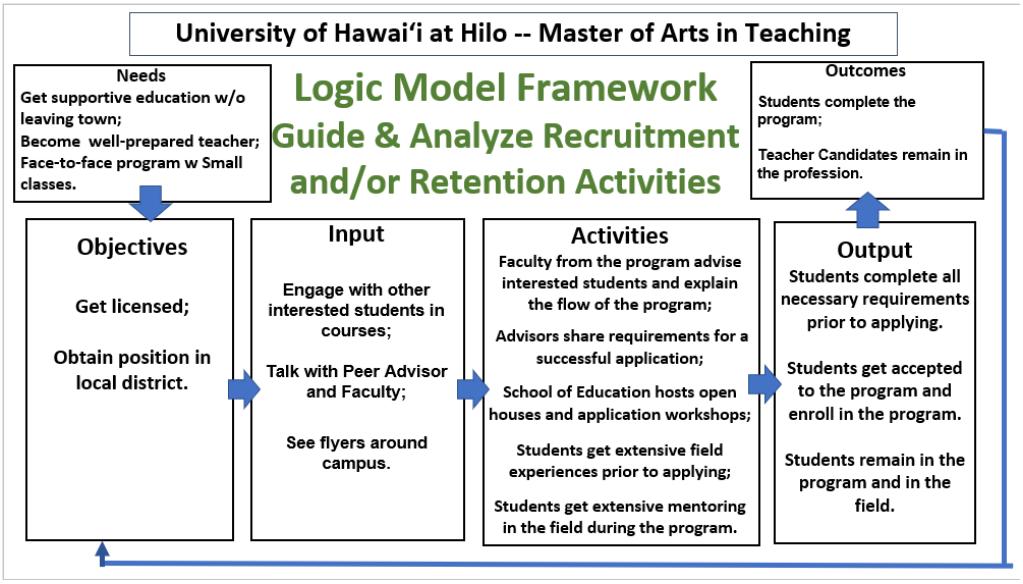

Figure 4. UH-Hilo's logic model for their Master of Arts in Teaching's Program Recruitment and Retention.

Concluding Remarks

The completed and presented Student-Centric Logic Models for Program Recruitment and Retention of potential students into secondary mathematics teacher preparation represent three types of programs, a bachelor's degree, a post-baccalaureate program, and a Master of Arts in Teaching, across three different communities. One important observation is that the three logic models target program recruitment and retention in accord with the specific location and community served by their institutions and programs, drawing on local opportunities, resources, and collaborations both in and out of the institutions for support in recruiting (Fernandez, 2020) and retaining students. Institutions and programs are not uniform, and the diversity sought among teacher candidates varies depending on where the programs are located as well as the communities served, as suggested by McNamara, Franz, and Fernandez (2020). Through the use of the logic model—including reviewing the components for recruiting and retaining potential students and related outcomes—program faculty and staff, most advantageously in teams, can reflect on possible gaps, challenges, or areas in need of focus at their institutions and for their programs, contributing to continual improvement.

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