

University of Kentucky
Department of Science, Technology, Engineering, and Mathematics Education
Master of Science in Science, Technology, Engineering, and Mathematics (STEM) Education
STEM PLUS⁺: Producing Teacher Leaders for Urban/Rural Schools

Continuous Assessment

The STEM PLUS⁺ Program utilizes a continuous assessment system designed to assess candidate proficiency and program effectiveness. Continuous assessment of candidates involves a development approach to educator preparation in which candidates are expected to progress toward mastery of standards as they practice and gain competence with increasingly complex pedagogical and professional tasks. The Mathematics Education and Science Education Program Faculties use candidate data to measure the progress of individual candidates throughout the program and then uses aggregated candidate data in the process of determining the effectiveness of the program. As the Kentucky P20 Data Collaborative launches this fall, candidate data in terms of effectiveness on student achievement will be collected and aggregated in order to provide another measure for effectiveness of the program. Selected data items collected on candidate proficiency and program effectiveness is also fed into the unit assessment system (UK-RADS). For example, all programs collect candidate data using the Continuous Assessment Record (CAR). The CAR is used at program admission, retention, and exit transition points to record candidate performance on the appropriate Kentucky-adopted educator proficiency standards, the UK Professional Education Unit Functional Skills and Dispositions, the UK Teacher Leader Standards, and the UK Professional Education Unit Technology Standards. In addition, data from the New Teacher Survey (as it becomes available) administered by the Kentucky Education Professional Standards Board are reviewed by the program faculties for new educators to help inform needs at the advanced level. These data are an essential element of the program evaluation component of the unit assessment system. Finally, a wide range of basic data items, e.g., grade point averages, admissions test scores, etc. are review by the program faculties and are also audited and monitored at the unit level, fed into the unit's comprehensive data system, and constitute important information for program development and unit operations.

The unit's continuous assessment model emphasizes the documentation of candidates' competencies for mathematics and/or science teaching by emphasizing the need for candidates to demonstrate the following:

- A. Attainment of standards and expectations for UK Educator Functional Skills and Dispositions

- B. Attainment of standards and expectations for the Kentucky Teacher Standards – Advanced Level
- C. Attainment of standards and expectations for the National Council of Teachers of Mathematics/NCATE Performance Standards for Mathematics Education and/or for the National Science Teachers Association/NCATE Performance Standards for Science Education
- D. Demonstration of content and pedagogical knowledge related to Senate Bill 1, especially the Kentucky Core Academic Standards (as they become available) and the College and Career Readiness Standards
- E. Demonstration of content and pedagogical knowledge related to Teacher Leadership as defined by the UK Teacher Leadership Standards

The standards sets and themes collectively reflect the STEM PLUS⁺ Program’s commitment to producing advanced teacher leaders who will operate as ethical professionals, lifelong learners, and leaders in their schools and communities, value and emphasize social diversity and educational equity, work to teach all students mathematics skills necessary for access to opportunities in modern, global, and technological society, and help their students use STEM Education productively in their daily lives to achieve personal goals and participate as active citizens within their communities. As such, the program’s plans for continuous assessment are well-aligned with the program’s conceptual frameworks. The frameworks emphasize the need to implement curriculum and instruction in ways that lead teacher leaders to capitalize on cultural and linguistic diversity as means for making academic activities relevant and useful for all students, to differentiate instruction so that the needs of individual students are addressed in classrooms, to approach science and mathematics learning as the acquisition of multiple skills for personal, civic, and working life, to teach for social justice and educational equity, and to view teaching as political work in the interest of positive and progressive social change and improvement.

Program Evaluation

Throughout the continuous assessment process, candidates are evaluated on how they are learning the content and the methods for being a successful teacher leader in their area(s) of certification. Through coursework, candidates are regularly assessed on content. They must demonstrate how they have learned content during their admissions interview to the program, in the instructional materials they generate during their program work and field experiences, and any other program activities they engage in. In addition to their own learning, candidates are expected to focus on the learning of the students they work with in their current jobs and in their field placements and to articulate ways in which they have helped such students achieve the knowledge outlined in the Kentucky Core Academic Standards and the Standards for College and Career Readiness.

STEM PLUS⁺ candidates are continually asked and expected to reflect on their own learning and the processes of teacher education and teacher leader development especially as it relates to teaching mathematics and/or science. Observation of candidates' work in the field entails the completion of an evaluation form. These evaluations help to inform the candidates' plan for professional development and growth. Candidates engage in frequent reflection in conjunction with instructional planning, instructional design, and classroom implementation/observation activities. In the context of their projects, instructional plans, field journals, etc., candidates are required to reflect on and articulate what they have learned from a given program experience or text, reflect on their improvement as teachers and future teacher leaders over time, and reflect on the nature of science and/or mathematics teaching and learning in diverse settings.

Candidates are expected to demonstrate their capacity for teacher leadership in their profession. During the admissions process and during retention assessment, candidates are required to reflect on their experiences with adolescents, experiences with professional development, and experiences in community service and/or engagement. Program activities are regularly framed in terms of their social and political contexts, and mathematics and science teaching is emphasized in terms of political activity toward community improvement and social equity. Candidates are expected to join and participate in professional organizations such as the Kentucky Council of Teachers of Mathematics and Kentucky Science Teachers Association, by attending and presenting at conferences, reading and submitting to professional journals, and seeking service opportunities especially within their school districts. Leadership behaviors are expected as a matter of course in learning how to operate as a teacher leader, and are defined through the UK Teacher Leadership Standards.

The STEM PLUS⁺ Program is founded on a solid body of research for the teaching of mathematics and science in public schools. Candidates are continually taught that curriculum and instructional methods used in their classrooms and schools should emerge based on a thorough understanding of disciplinary theories, research, and philosophy so they are able to make principled decisions about their work as professional educators and act as teacher leaders in advocating for sound and ethical practices in the contexts where they teach. These discussions begin during the application and interview process, when applicants are asked to describe the kinds of resources and methods they use in their current classrooms to teach mathematics and/or science or other STEM subjects. They are further required to explain how they used their knowledge of content, research, and theory to make their choices. On the Continuous Assessment Review form, candidates are assessed on Content Knowledge, which includes knowledge of research in the field. They are also assessed on "designs and plans instruction" which must be based on research and theory in order to be considered appropriate for implementation. Any instructional strategies and curricula implemented in the field classroom are required to reflect candidates' learning from content, STEM Education, and

leadership courses in the STEM PLUS⁺ Program. Evidence of candidates' principled and research/theory-based implementation of instructional practices and resources is collected through their action research and teacher leadership projects for review and assessment at the program mid-point and as an exit assessment at the conclusion of the program. In all cases, materials gathered for the Action Research and Teacher Leadership projects are organized to reflect candidates' attainment of all ten Kentucky Teacher Standards at the advanced level.

Assessment of Candidate Performance

Candidates are assessed at three transition points throughout their teacher leader program: admissions, mid-point, and exit. Data on candidate performance are collected at each of these transition points. Data sources for candidates enrolled in the teacher leader program include

- Basic skills test scores
- Grade Point Averages
- PRAXIS II test scores
- GRE test scores
- Ratings on the Kentucky Teacher Standards (Advanced), UK Unit Technology Standards, UK Functional Skills and Dispositions, and the UK Teacher Leader Standards

The program requires all candidates to complete a teacher leadership project and an action research project, which are assessed at the programs' mid-point and exit stage.

Program Continuous Monitoring Checkpoints

Checkpoint 1: Admission into the STEM PLUS⁺ program

- Application materials including an essay
- Interview with Program Faculty members
- Evaluation and consensus selection by full Program Faculty and members of STEM Education Department

Checkpoint 2: Retention (halfway through program)

- Semi-annual evaluation by the advisor to include GPA review, class attendance, reliability, professional/ethical conduct, assertiveness, teacher leader potential, and other areas
- Mid-point review of Action Research Project and Teacher Leadership Project

Checkpoint 3: Exit

- Evaluation of innovation residency experience by innovation mentor and advisor

- Completed Action Research Project including presentation to committee and additional stakeholders, especially the P12 community
- Completed Teacher Leadership Project including presentation to committee and additional stakeholders, especially the P12 community
- Evaluation of GPA

Continuous Assessment Checkpoint 1: Admissions Data

Admission screening includes thorough reviews by the respective program faculties of each applicant's undergraduate coursework, grades, professional experience, additional experiences with adolescents, and writing ability. In addition, each applicant is evaluated via an interview with Program Faculty members, including a member of the P12 community, using a protocol designed to assess the applicant's knowledge, skills, and dispositions for the teaching of science and/or mathematics to diverse students. In addition to these individual interviews, applicants are required to submit an essay describing how they are (a) currently utilizing the characteristics of highly effective teaching and learning in their classrooms and (b) areas within the characteristics they feel they can improve upon through the STEM PLUS⁺ program. The Characteristics of Highly Effective Teaching and Learning include:

- Learning Climate: a safe environment supported by the teacher in which high, clear expectations and positive relationships are fostered; active learning is promoted
- Classroom Assessment and Reflection: the teacher and student collaboratively gather information and reflect on learning through a systematic process that informs instruction
- Instructional Rigor and Student Engagement: a teacher supports and encourages a student's commitment to initiate and complete complex, inquiry-based learning requiring creative and critical thinking with attention to problem solving
- Instructional Relevance: a teacher's ability to facilitate learning experiences that are meaningful to students and prepare them for their futures
- Knowledge of Content: a teacher's understanding and application of the current theories, principles, concepts and skills of a discipline

At the time of the interview, applicants are evaluated according to the following criteria:

- Grade Point Average
- Graduate Record Examination Scores
- Review of Characteristics of Highly Effective Teaching & Learning Writing Sample
- Completion of a grade level appropriate science or mathematics content question
- Verbal communication skills
- Quality of references

- Commitment to teaching
- Commitment to STEM Education – especially their respective certification area(s)
- Awareness of and value for social diversity
- Experiences with diverse adolescents
- Classroom/Professional teaching experience
- Experiences in multicultural contexts

Each applicant is given a rating based on his/her performance and application materials; this rating is intended to reflect the applicant's potential for successful completion of the STEM PLUS⁺ Program as well as his/her potential to become a teacher leader. After admissions interviews have concluded, the full Program Faculty reviews each applicant's materials; Program Faculty members who had direct contact with the applicants respond to questions and make recommendations in order to clarify rankings. Applicants are rank-ordered for admission based on the consensus of the Program Faculty. A maximum of thirty (30) candidates are admitted to the program each year. Applicants are informed whether they have been admitted, denied, or placed on a rank-ordered stand-by list. Applicants placed on stand-by may be admitted to the program if an admitted student declines, defers, or is otherwise unable to enroll. In cases where an admitted applicant declines or defers enrollment, the first applicant listed on the stand-by list is offered admission. This process continues until the stand-by candidate list has been exhausted. Applicants who are denied admission may re-apply to the program or appeal the Program Faculty's admissions decision by following university procedures.

Continuous Assessment Checkpoint 2: Mid-point Retention Data

Once admitted to the STEM PLUS⁺ Program, candidates immediately begin taking coursework. Candidates take the required SEM 610: Teacher Leadership in STEM Education course their second semester into the program and through that course immediately begin work on their action research project and generate ideas for the innovation residency and teacher leadership project. Materials for the action research project and teacher leadership project are gathered throughout the program and focus the reflection of the individual candidate's learning and growth over time. Artifacts for the action research project and teacher leadership project may include, but are not limited to:

- Formal course papers
- Instructional units
- Field observation journals
- Reading Reflections
- Literature Reviews
- Candidate Self-Assessments

- Analysis of student achievement data

Retention action research and teacher leadership project artifacts and materials are collected in an online digital framework for the display and collection of a candidate's work. These materials are reviewed with the candidate by the candidate's advisor at the midpoint of their program.

Candidates who have met or exceeded program expectations are retained in the program. Candidates who are judged to have failed program expectations are required to meet with their advisor and the Mathematics and/or Science Education Program Faculty Chair in order to develop an improvement plan and contract for meeting program expectations. In such cases, the candidate works closely with the Program Chair and advisor to develop additional goals for improvement based on reasonable deadlines and clear assessment criteria that are dependent on the particular needs of the candidate. Assuming the candidate meets all expectations by the agreed upon deadline, he/she is retained in the program. In cases where the candidate fails to meet the conditions of his/her agreed upon improvement plan, the candidate may be dismissed from the program.

Continuous Assessment Review (CAR) Form

Data for continuous assessment in the STEM PLUS⁺ program is recorded at the admission, retention, and exit stages using a Continuous Assessment Review (CAR) form. Using the CAR form, candidates are assessed on graduated scales for each Kentucky Teacher Standard (Advanced), Unit Functional Skills and Disposition Standard, UK Teacher Leadership Standards, and Unit Technology Standard. For each standard set, candidates are assigned a composite score, and these composites are used to determine the overall ratings as follows:

1. Demonstrating no or very limited progress (experience) with the program
2. Demonstrating progress, but the Program Faculty has concerns (memo required)
3. Demonstrating progress
4. Demonstrating progress with innovation and creativity

Based on these ratings, candidates are assigned a continuing status code as follows:

1. Good Standing
2. Probation
3. Suspended
4. Denied
5. Completed (has met all standards)

Continuous Assessment Checkpoint 3: Exit Data

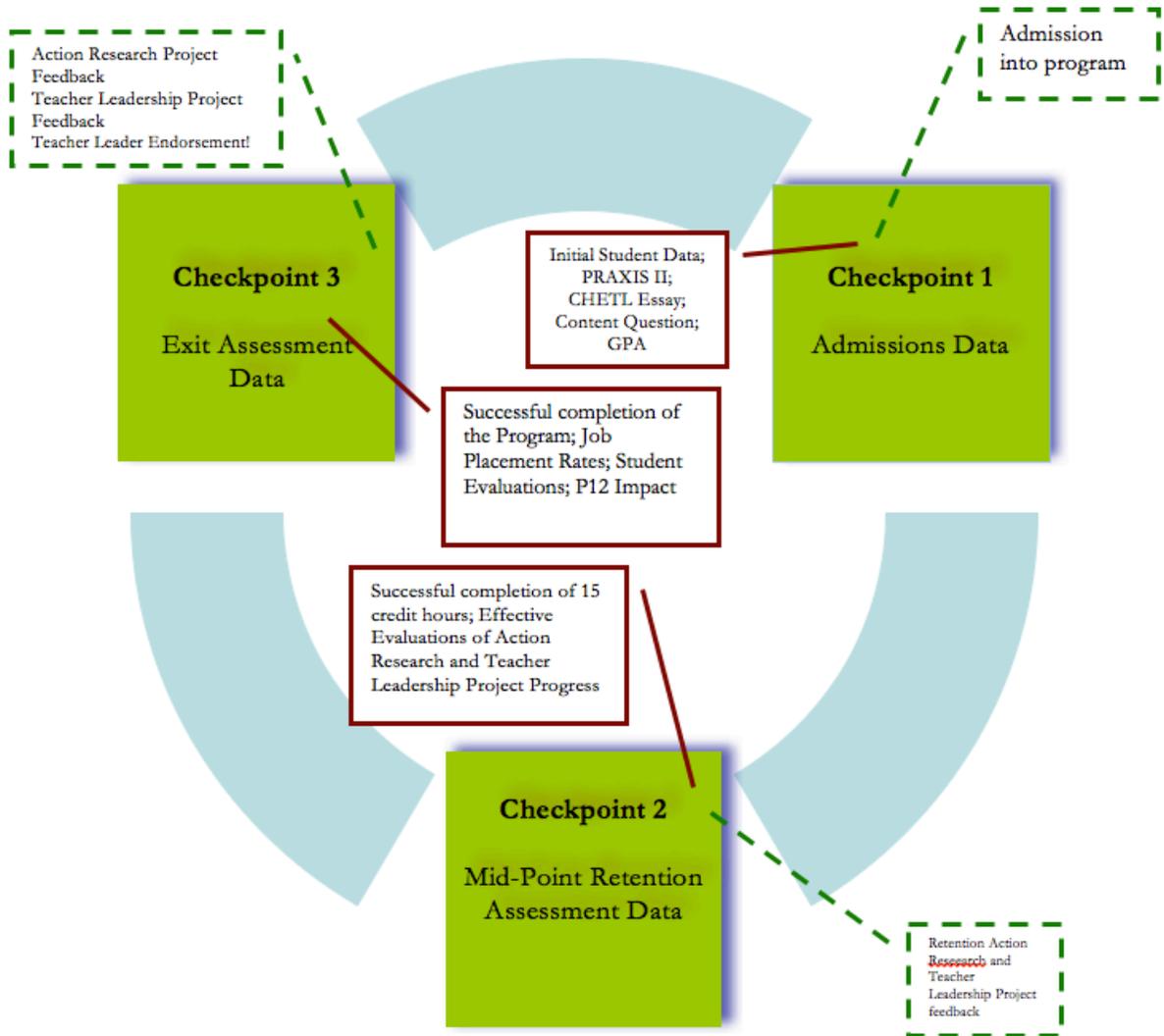
Once candidates have passed the midpoint retention phase of the program, they enter their final phase of the program. During this time, candidates work to refine their skills as future teacher leaders and complete their teacher leadership project and their action research project.

As with midpoint retention, candidates are informed about their progress and status toward graduation regularly through meetings with their advisors and meetings with the STEM Education Innovation Lab.

Candidate and Program Feedback Chart

Green = Candidate Feedback

Red = Program Feedback



Collection of P12 Impact Data

The STEM PLUS⁺ Program is keenly aware of the importance of the issues of P12 teacher quality enhancement, promotion of increased achievement for P12 students, and closing the achievement gaps between P12 student populations. Although professional education programs cannot directly affect changes in these P12 environment realities, the STEM PLUS⁺

Program is committed to developing future teacher leaders who will help address these issues. The program develops candidate research capability and studies the extent to which pedagogical activities affect P12 learning. Coursework requires candidates to plan, implement, and assess engaging instructional lessons and units. Candidates analyze the results of their efforts, with increasingly sophisticated tools as their experience with research methods grows. Candidates also gain experience and facility in utilizing the results of standardized (summative and interim) assessments (as reported by P12 school faculties) to understand student needs and to interpret student performance behaviors. In addition, the program plans to work with graduates of the program to collect aggregated summary performance data from the Commonwealth Accountability system (as defined by Senate Bill 1), particularly subject-specific summary data. Specifically, the STEM PLUS⁺ Program will collect student achievement data on summative and interim standardized assessments from their candidates throughout their program.

Capstone Experience

Each STEM PLUS⁺ candidate must complete a capstone project, which includes an action research project completed over the course of the program, a teacher leadership project completed over the course of the program, and an innovation residency project. These three projects combined provide summative assessment information for the program and candidate. Candidate must defend the report of the capstone project during formal oral examinations conducted by three-member committees of graduate faculty approved by the Dean of the Graduate School. Each committee must include at least one tenure-track member of the STEM Education Faculty. Because the oral defense of the capstone project also serves as the oral examination for the award of the MEd degree, P12 practitioners may participate only as ex officio, non-voting members of the committees.