Ten Key Questions University Leaders Should Ask about Quality Science and Mathematics Teacher Preparation: Implementation Strategies from The Analytic Framework

Charles R. Coble

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ABOUT THE AUTHOR

Charles R. Coble is the SMTI co-director, the co-founder and partner of The Third Mile Group and Teacher Preparation Analytics, and co-principal investigator of NSF grant #0831950. Coble has served as dean of education at East Carolina University, vice president for policy studies and programs at the Education Commission of the States, and vice president of university-school programs for the 16-campus University of North Carolina System. Coble holds an AA in Science from Mars Hill College and, from UNC Chapel Hill, a bachelor's degree in botany, a master's degree in science education, and a doctorate in curriculum and instruction. He maintains a current secondary science teaching license in North Carolina. For further information contact the author at ccoble@thirdmilegroup.com.

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Executive Summary

In 2008, the Association of Public and Land-grant Universities (APLU) launched the Science and Mathematics Teacher Imperative (SMTI) that is devoted to improving the quantity and quality of science and mathematics teacher preparation. Shortly into the work, the Executive Committee of SMTI asked for guidance in identifying and/or developing effective science and mathematics teacher preparation programs. In the absence of a resource that readily responded to their concern, the Co-Director of SMTI, Charles Coble, led an effort to create a tool called the *Analytic Framework: A Tool for Assessing Innovation and Quality Design in Science and Mathematics Teacher Preparation.* The Analytic Framework is an ordered classification of strategies along a continuum of teacher development from recruitment to preparation to induction to professional development (Coble, 2012; Coble et al., 2012). But, as the Analytic Framework grew in complexity, the SMTI Executive Committee began to ask: "*What are the most critical components or indicators of quality programs?*" Leaders want to know how they can assess quickly whether the teacher preparation programs on their campuses are of high quality and the most important levers to push to promote program improvement and quality on their campuses.

To address this challenge, Jennifer B. Presley and Charles Coble, co-principal investigators of the NSF grant of which this project was a part, undertook a structured interview process for identifying the key attributes of quality teacher preparation in science and mathematics. They recruited national teacher preparation experts, practicing teachers and thought leaders to participate in individual telephone interviews using a structured protocol designed by the PIs. Others participated in focus group interviews with six disciplinary or professional societies convened at various locations across the United States. They were all asked to share their vision of the ideal science and mathematics teacher education program and what the critical elements of such a program would look like. This process resulted in four thematic briefs and consensus1 statements that served as advanced organizers for a 1½ day colloquium to further hone in on attributes driving program quality. Out of the colloquium, Presley and Coble crafted a set of ten key questions that distill those findings. The full report, including the four briefs, is available in Presley and Coble, 2012. What was missing from that work, however, was any guidance about what constitutes appropriate action towards implementation. For this we turned to the Analytic Framework.

In this paper, the Ten Key Questions from the work of Presley and Coble are mapped to the current strategies contained in the Analytic Framework. This concordance provides campus and program leaders a more specific assessment of what their individual campuses

1 We define consensus as near, but not necessarily complete, unanimity.

and programs might do (and might already be doing) to provide a positive response to the key questions and build a plan to continually improve the quality of their science and mathematics teacher education program.

Next Steps

Four strands of work are needed to continue this quest for continuous quality improvement in teacher preparation using the knowledge gained in the development of the Analytic Framework (Coble, 2012; Coble et al., 2012), the four thematic briefs (Presley and Coble, 2012) and the Ten Key Questions, which we plan to disseminate widely:

1. Establish a database of science and mathematics teacher education programs built on the expanded use of the Analytic Framework, and analyze the accumulated assessment data to provide a foundation for program improvement.
2. Build a vetted portfolio of exemplary and promising practices that exemplify the goals, objectives and strategies of the Analytic Framework.
3. Seek additional strategies that augment those already identified here as mapping to the *Ten Key Questions*. Since the latter were developed through a process that was independent of the Analytic Framework, it is possible that upon deeper examination, additional approaches either can be identified as currently existing, or will be created to better address these program attributes.
4. Build criteria and metrics for assessing the degree to which the strategies are successfully being implemented within programs. This would help programs as they undertake their individual ongoing assessment for continuous improvement, but might also lead to the development of a national competition to recognize exemplary teacher preparation programs.

Introduction

A•P•L•U launched its Science and Mathematics Teacher Imperative (SMTI) in 2008 in response to the call by the National Academies for more and better prepared secondary science and mathematics teachers, as described in *Rising Above the Gathering Storm* and *Rising Above the Gathering Storm, Revisited* (National Research Council, 2008, 2010b). University leaders wanted advice about leading practices in science and mathematics teacher preparation. However, a common source did not exist that identified effective strategies across institutions. Finding no comprehensive source, SMTI Co-Director Charles Coble developed the *Analytic Framework: A Tool for Assessing Innovation and Quality Design in Science and Mathematics Teacher Preparation* (Coble et al 2012). The Analytic Framework is an ordered classification of strategies along a continuum of teacher development from recruitment to preparation to induction to professional development, and including leadership and policy development. A detailed description of the Analytic Framework is provided later in this report. As the Framework grew in complexity, senior leaders from the A•P•L•U /SMTI Executive Committee asked, "*What are the most critical components or indicators of quality programs?*" Leaders want to know how they can assess quickly the teacher preparation programs on their campuses and the most important levers to push to promote program improvement and quality on their campuses.

In order to address this challenge, Jennifer B. Presley and Charles Coble chose not to undertake yet another review of research and reports. There are already a number of excellent analyses, and their findings have been integral to the development of the Analytic Framework (for example, Cochran-Smith and Zeichner, 2005; Cochran-Smith et al., 2008; National Research Council, 2010a; and Wilson et al., 2001). Instead, Presley and Coble conducted structured interviews across the nation to identify the key attributes of quality teacher preparation in science and mathematics. They recruited national teacher preparation experts, practicing teachers and thought leaders to participate in individual telephone interviews using a protocol designed by the PIs. Others participated in focus group interviews with six disciplinary or professional societies convened at various locations across the United States. The individuals and focus group participants were asked, as part of the protocol, to share their vision of the ideal science and mathematics teacher education program and what the critical elements of such a program would look like. This process resulted in four thematic briefs and consensus statements that served as advanced organizers for a 1½ day colloquium to further hone in on attributes driving program quality. Out of the colloquium, Presley and Coble crafted a set of ten key questions that capture the essence of those findings. The full methodology and report, including the four briefs, is available in Presley and Coble, 2012. What is missing from that work, however, is any guidance about what constitutes appropriate action towards implementation. For this we turned to the Analytic Framework.

Ten Key Questions University Leaders Should Ask With Implementation Strategies

The Ten Key Questions are mapped to strategies drawn from The Analytic Framework© (Coble, 2012; Coble et al., 2012). This provides campus and program leaders a more specific assessment of what their individual campuses and programs might do (and might already be doing) to provide a positive response to the key questions and build a plan to continually improve the quality of their science and mathematics teacher education program.

The Analytic Framework was designed to help its users delve deeply into programs to identify strategies that the literature and experts across the nation say are important to consider in designing quality programs. Every strategy listed in the Analytic Framework is in place at some institution (often in many programs) in the United States. The questions and strategies follow. [Key to notations below: I.A.1. = Goal 1, Objective A, Strategy 1.]

1. How do you as a leader convey a clear and strong message for the value of quality teacher preparation at your institution?

- **STRATEGY I.A.1: Mission & Strategy:** The institution's mission and strategic priorities are supportive of science and mathematics teacher preparation, as expressed by its academic policies and budget allocations.
- **STRATEGY I.A.2: Policy & Practice:** Institutional policies and practices, including financial allocations, are aligned to strengthen clinically based science and mathematics teacher preparation and development at the institution (e.g., mission, visibility, funding).
- **STRATEGY I A.5: Special Organizational Structures:** The institution and/or academic units have created special institutes, offices, or departments that have contributed to the success of science and mathematics teacher preparation and development programs.
- **STRATEGY I.B.2: Promotion & Tenure:** Faculty appointment, promotion, and tenure policies encourage science and mathematics faculty and education faculty involvement in science and mathematics teacher preparation and professional advancement programs (including research leading to improved programs and practices).

- **STRATEGY I.B.3: Incentives & Rewards:** Incentives and rewards (beyond tenure and promotion) are used successfully to encourage increased science and mathematics and education faculty engagement in teacher preparation, mentoring beginning teachers, and in professional advancement programs for in-service teachers of science and mathematics, particularly those in partnership schools.
- **STRATEGY I.C.3: External Advocacy:** Campus administration and/or faculty are active in advocating for policy changes (local, state, national) to strengthen teacher preparation generally and/or specifically for university-school partnerships and clinical practice, scholarships for teacher candidates, support for program completers, and professional advancement programs for in-service teachers of science and mathematics.
- **STRATEGY V.B.1: Leadership and Policy:** The institution and teacher preparation programs place a priority on extending the human and material capacity of the university to support the continuing development of science and mathematics teachers and the improvement of P-12 education, particularly cooperating teachers in partnership schools, as a strategy for improving the clinical preparation of teacher candidates.

2. Does the selection process into teacher preparation programs attract candidates with demonstrated academic success and evidence that they have the skills and dispositions that will likely lead to their becoming good teachers?

- **STRATEGY II.A.1: Recruit Accomplished Candidates:** The program has developed practices and procedures to actively screen and recruit teacher candidates who are not only academically accomplished, but also demonstrate passion, persistence, high expectations, and success in working with learners and exhibit other characteristics that align with program expectations.
- **STRATEGY II.A.2: Recruit Diverse Candidates from Multiple Sources:** The program is resourceful in recruiting talented and diverse teacher candidates from a variety of sources such as: high school students; community college students; currently enrolled university students; mid-career adults, including teacher paraprofessionals; military retirees; and/or retirees from STEM-related businesses and industries.
- **STRATEGY II.A.3: Enforce High Program Admission Standards:** The institution and science and mathematics teacher preparation programs have set standards for program admission that require candidates, without exception, to demonstrate strong performance in college coursework, especially in science and mathematics content areas.

- **STRATEGY II.B.5: Monitor & Mentor for Student Success:** The program monitors the progress of all teacher candidates, from multiple pathways: high school students; community college students; currently enrolled university students; mid-career adults; paraprofessionals; and military and other retirees; and from underserved populations (Native Americans, Hispanics, African Americans, and others) - and mentor them through the academic pipeline from recruitment to program completion to beginning teaching.

3. Are there exit standards beyond minimum state requirements that ensure that the teacher education programs produce competent novice teachers?

- **STRATEGY III.D.2: Frequent Teacher Candidate Screening Practices:** The program ensures that teacher candidates can demonstrate through practices and instruments (developed with the input of P-12 educators) that they are on track toward acquisition of the knowledge, skills and dispositions necessary to work with colleagues and teach science and mathematics effectively to a wide range of diverse learners.
- **STRATEGY III.D.5: Aligned with National and International Assessments:** Both the disciplinary and pedagogical components of the science and mathematics teacher preparation programs ensure that teacher candidates have mastered the knowledge and critical thinking skills necessary to perform well themselves and to help their students perform well on NAEP, TIMSS, PISA, and other national and international science and mathematics assessments.
- **STRATEGY IV.B.2: Collecting and Using Beginning Teacher Data:** The program has established a feedback loop that seeks input from program completers, their principals and their mentors, using the information to respond to the needs of beginning teachers and as data for improving the programs to exceed expected minimum standards.

4. Do teacher preparation programs have a culture of evidence and accountability, one that tracks and assesses the progress of teacher candidates from entry to completion and as novice teachers, and uses those data to make appropriate interventions and program changes as warranted?

- **STRATEGY I.A.6: Accountability Infrastructure:** The institution has an infrastructure of people and technology that promotes comprehensive program assessment and accountability for candidate quality from entry to exit and into the beginning years of teaching with evidence of impact on P-12 student outcomes in science and mathematics.

- **STRATEGY II.B.5: Monitor & Mentor for Student Success:** The program monitors the progress of all teacher candidates, from multiple pathways: high school students; community college students; currently enrolled university students; mid-career adults; paraprofessionals; military and other retirees; and from underserved populations (Native Americans, Hispanics, African Americans, and others) - and mentor them through the academic pipeline from recruitment to program completion to beginning teaching.
- **STRATEGY IV.B.1: Tracking Retention & Effectiveness:** The program, in cooperation with local or state agencies, tracks the employment, retention, and effectiveness (including, if possible, student achievement data) of program completers.
- **STRATEGY IV.B.2: Collecting and Using Beginning Teacher Data:** The program has established a feedback loop that seeks input from program completers, their principals and their mentors, using the information to respond to the needs of beginning teachers and as data for improving the programs to exceed expected minimum standards.

5. Is teacher preparation clinically based all the way from early classroom exposure to more extensive, but still well supervised, student teaching?

- **STRATEGY III.C.1: Intensive Well-Supervised Clinical Experience:** The program provides teacher candidates with early, sequential and increasingly intensive clinical experience in both laboratory settings and embedded experiences in partnership schools, in which:
  a) Teacher candidates learn and demonstrate good practice in managing the complexity of teaching science and mathematics to diverse learners;
  b) Teacher candidates demonstrate growth in teaching through cycles of well supervised practice, reflective analysis and feedback over an extended period of time in school settings; and
  c) Supervision of teacher candidate's clinical experiences is a partnership between master teachers and knowledgeable university faculty.
- **STRATEGY III.C.2: Diverse Clinical/Field Placements:** The program provides teacher candidates with early and continuing field placements and guided supervision with master teachers in partnering schools that are experiencing success with historically diverse populations in successful or improving schools, and where candidates learn and demonstrate their comfort and capacity to work in schools and communities with high numbers of minority and at-risk learners.

- **STRATEGY III.C.3: Placements in Non-Traditional Schools:** The program provides teacher candidates with opportunities to study and demonstrate their ability to teach in alternative schools, such as small schools, charter schools, magnet schools or science and mathematics or technology oriented schools.
- **STRATEGY III.C.4: Informal Learning Settings:** The program provide teacher candidates guidance in how to use informal learning opportunities, such as those provided by STEM centers, museums, parks or other out-of-school settings, to support P-12 science and mathematics learning objectives.

6. Do teacher preparation programs blend courses in disciplinary content and pedagogical content knowledge so that students acquire deep content knowledge and the knowledge to transmit core disciplinary concepts in an age-appropriate way?

- **STRATEGY III.A.1: Disciplinary Knowledge:** The program ensures that teacher candidates fulfill the disciplinary major requirements for those seeking high school licensure and at least a minor for those seeking middle grades licensure.
- **STRATEGY III.A.2: Knowledge for Teaching:** The program ensures that teacher candidates possess the science and mathematical knowledge, skills and dispositions necessary for teaching the secondary science and mathematics curriculum, including the conceptual areas embedded within the NRC Science Framework, the Next Generation Science Standards and/or the Common Core State Standards and the Standards for Mathematical Practice.
- **STRATEGY III.A.3: Disciplinary Research and Applied Learning:** The program offers opportunities for teacher candidates and (other students) to engage in inquiry, research and/or applied applications in the science and mathematics disciplines.
- **STRATEGY III.B.1: Lesson Design:** The program ensures that teacher candidates can design coherent, scaffold classroom curricula and content-rich, developmentally appropriate, and engaging science or mathematics lessons.
- **STRATEGY III.B.2: Teachers-in-Residence:** The teacher education program engages teachers-in-residence — those with strong disciplinary backgrounds and evidence of exemplary understanding of teaching, as essential colleagues in teacher preparation. (Teacher Residency models, characterized by embedding teacher candidates within district schools, are the hallmark of this strategy.)
- **STRATEGY III.B.3: Differentiation of Instructional Strategies:** The program ensures that teacher candidates are able to understand students' knowledge of science and mathematics and design instruction using different instructional strategies and managing classroom discourse that actively engages, motivates and meets the needs of the full range of students with different preconceptions and levels of understanding in their classes.

7. Do programs have vigorous university-school partnerships that demonstrate a shared responsibility for teacher preparation and development with the public schools in which most teacher candidates are placed for clinical experiences and student teaching?

- **STRATEGY I.C.1: Partnerships with P-12 Schools, Business and Community:** Institutional and program policies and practices support formal external partnerships as an essential strategy for assessing needs and designing and delivering student/problems-centered science and mathematics teacher preparation and development programs.
- **STRATEGY III.C.1: Intensive Well-Supervised Clinical Experience:** The program provides teacher candidates with early, sequential and increasingly intensive clinical experience in both laboratory settings and embedded experiences in partnership schools, in which:
  a) Teacher candidates learn and demonstrate good practice in managing the complexity of teaching science and mathematics to diverse learners;
  b) Teacher candidates demonstrate growth in teaching through cycles of well supervised practice, reflective analysis and feedback over an extended period of time in school settings; and
  c) Supervision of teacher candidate's clinical experiences is a partnership between master teachers and knowledgeable university faculty.
- **STRATEGY III.C.2: Diverse Clinical/Field Placements:** The program provides teacher candidates with early and continuing field placements and guided supervision with master teachers in partnering schools that are experiencing success with historically diverse populations in successful or improving schools, and where candidates learn and demonstrate their comfort and capacity to work in schools and communities with high numbers of minority and at-risk learners.
- **STRATEGY III.C.5: Professional Communities:** The program ensures that teacher candidates engage in a pattern of active professional involvement and collaboration, such as in university-school learning communities, local student-led chapters of state and national professional organizations, and awareness of and participation in school or university initiatives designed to improve science or mathematics teaching and to learn the ethics and mores of the teaching profession.
- **STRATEGY V.A.1: Partnerships with P-12 School & Districts:** Structures (such as consortia, alliances, P-20 councils, partnerships, or other mechanisms) exist to engage P-12 science and mathematics educators in the collaborative design and delivery of professional development, advanced studies and provide teacher leadership opportunities, especially teachers who support pre-service candidates' clinical and field experiences.

- **STRATEGY V.B.1: Leadership and Policy:** The institution and teacher preparation programs place a priority on extending the human and material capacity of the university to support the continuing development of science and mathematics teachers and the improvement of P-12 education, particularly cooperating teachers in partnership schools, as a strategy for improving the clinical preparation of teacher candidates.

8. Are master teachers and teachers-in-residence, those with strong disciplinary backgrounds and evidence of exemplary understanding of teaching, engaged as essential colleagues in teacher preparation?

- **STRATEGY III.C.1: Intensive Well-Supervised Clinical Experience:** The program provides teacher candidates with early, sequential and increasingly intensive clinical experience in both laboratory settings and embedded experiences in partnership schools, in which:
  a) Teacher candidates learn and demonstrate good practice in managing the complexity of teaching science-and mathematics to diverse learners;
  b) Teacher candidates demonstrate growth in teaching through cycles of well supervised practice, reflective analysis and feedback over an extended period of time in school settings; and
  c) Supervision of teacher candidate's clinical experiences is a partnership between master teachers and knowledgeable university faculty.
- **STRATEGY III.C.2: Diverse Clinical/Field Placements:** The program provides teacher candidates with early and continuing field placements and guided supervision with master teachers in partnering schools that are experiencing success with historically diverse populations in successful or improving schools, and where candidates learn and demonstrate their comfort and capacity to work in schools and communities with high numbers of minority and at-risk learners.
- **STRATEGY III.B.2: Teachers-in-Residence:** The program engages teachers-in-residence, those with strong disciplinary backgrounds and evidence of exemplary understanding of teaching, as essential colleagues in teacher preparation.

9. Do the teacher education programs ensure that co-operating classroom teachers who are assigned student teachers are master teachers or are teachers under the supervision of a master teacher in the school or district?

- **STRATEGY III.C.1: Intensive Well-Supervised Clinical Experience:** The program provides teacher candidates with early, sequential and increasingly intensive clinical experience in both laboratory settings and embedded experiences in partnership schools, in which:
  a) Teacher candidates learn and demonstrate good practice in managing the complexity of teaching science and mathematics to diverse learners;
  b) Teacher candidates demonstrate growth in teaching through cycles of well supervised practice, reflective analysis and feedback over an extended period of time in school settings; and
  c) Supervision of teacher candidate's clinical experiences is a partnership between master teachers and knowledgeable university faculty.

10. Do the teacher education programs include formal support to their novice teachers through an induction period as a part of their formal program?

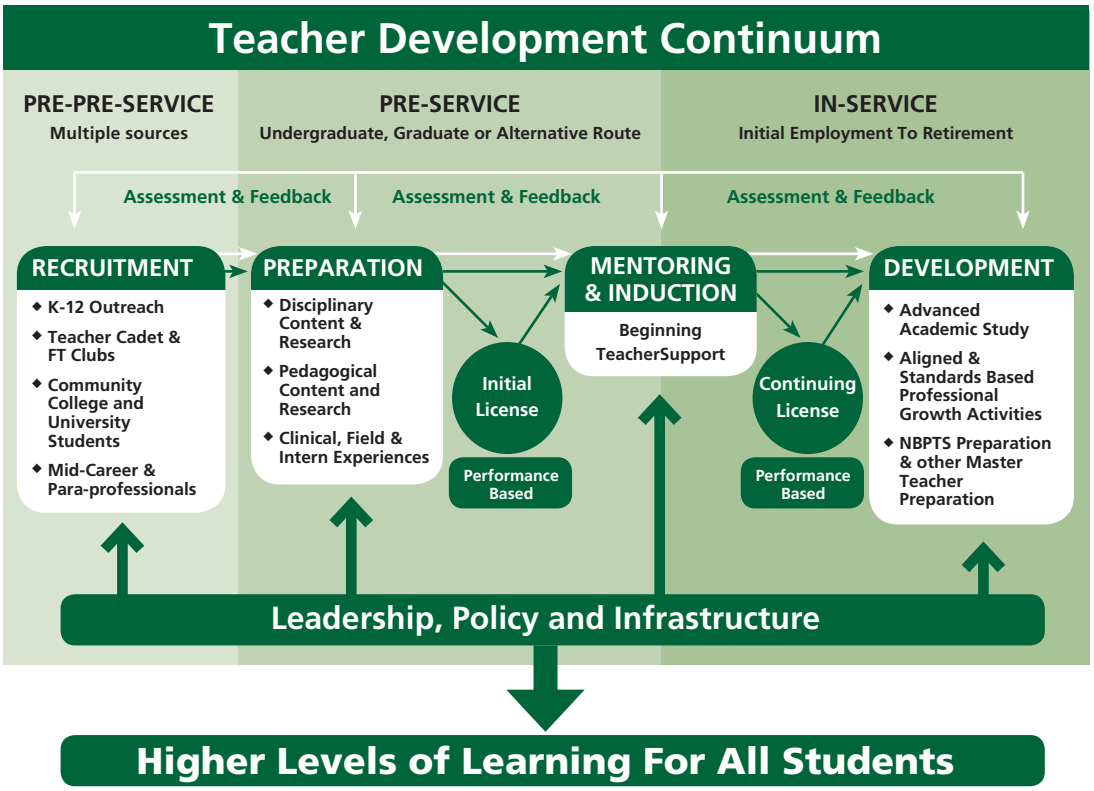
- **STRATEGY IV.A.1: Beginning Teachers Seek Support:** Program completers are provided strategies on how to be active in seeking out on-line and face-to-face support from their program, from experienced teachers, from peers and from professional associations.
- **STRATEGY IV.A.2: Extending Support to Beginning Teachers:** The program provides mentoring and support mechanisms to recent program completers.

Background on the Analytic Framework

With grant support from the Carnegie Corporation of New York and the National Science Foundation, the Analytic Framework was built from the knowledge gained from experts, advisors, focus groups, campus visits and literature reviews. The resulting product, the Analytic Framework, is an assessment tool that allows educators and policymakers to build more coherent and effective programs. The second significant use of the tool is to serve as a platform for identifying promising and exemplary practices.

The conceptual backbone of the Analytic Framework was inspired by the 2000 National Research Council publication, *Educating Teachers of Science, Mathematics and Technology: New Practices for a New Millennium* (National Research Council, 2000). The NRC publication identifies the continuum of teacher development as extending from recruitment, preparation, induction and development. The Analytic Framework embraces this model for teacher preparation, and extends the continuum to include the role of leadership and policy as critical components of the enterprise, as shown in Figure 1.

Figure 1. Teacher Development Continuum



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The Analytic Framework is structured around 5 Components and goals, 13 objectives and 56 strategies (Coble et al., 2012). Each of the five components contributes in essential ways to the development of more reliably effective teachers of science and mathematics. Beyond the extensive development process described in Coble, 2012, experts were engaged to conduct crosswalks[2] of the Analytic Framework with the NCATE (CAEP) Unit and SPA Standards, the Report of the NCATE Blue Ribbon Panel on Clinical Preparation and Partnerships for Improved Student Learning (NCATE, 2010), the revised InTASC Standards (2012) and the NCTQ Standards (2012).[3] The general structure of the Analytic Framework is shown below.

The General Structure of the Analytic Framework

Component I: Leadership, Policy and Infrastructure

Goal I: Promote and Sustain a Strong Institutional Commitment to the Preparation and Development of Highly Capable Teachers of Science and Mathematics

Objective I.A	Institutional Policies, Practices and Infrastructure Ensure a Strong Institutional Commitment to the Preparation and Continuing Professional Development of Highly Capable Teachers of Science and Mathematics.
Objective I.B	Institutional Policies and Practices Provide Encouragement, Support, and Rewards for Shared Disciplinary and Pedagogical Faculty Leadership in Science and Mathematics Teacher Preparation
Objective I.C	The Institution and Programs Pursue Partnerships and External Financial and Policy Support for Science and Mathematics Teacher Preparation and Development

Component II: Recruitment, Selection and Admission

Goal II: Recruit High Quality and Diverse Candidates into Science and Mathematics Teacher Preparation

Objective II.A	Institutional and Program Policies and Practice Ensure that Science and Mathematics Teacher Preparation Is Highly Selective, Admitting Teacher Candidates Who are Academically Successful and Who Have the Passion and Determination to Succeed in Teaching
Objective II.B	The Program has Developed and Sustained an Infrastructure to Recruit and Retain Diverse Teacher Candidates Matched to Assessed Needs for Science and Mathematics Teachers in the Region or State

2 The crosswalk documents are available upon request from the author.

3 National Council for Accreditation of Teacher Education (NCATE); Council for the Accreditation of Educator Preparation (CAEP); Specialized Professional Associations (SPAs), see www.ncate.org for more information. The Interstate Teacher Assessment and Support Consortium (InTASC), see www.ccsso.org for more information. The National Center for Teacher Quality (NCTQ), see www.nctq.org for more information.

Component III: Content, Pedagogy and Clinical Practice **Goal III:** Prepare Quality Teachers with Demonstrated Capability to Improve Student Success in Science and Mathematics	
Objective III.A	The Program Ensures that Teacher Candidates Have the Disciplinary Knowledge and Understanding of Science and Mathematics to Promote Student Success
Objective III.B	The Program Ensures Students Have the Pedagogical Knowledge and Skills to implement Educational Practices Found to be Effective in Improving Student Success in Science and Mathematics
Objective III.C	The Program Embeds Sequential and Diverse Clinical Experiences in Partnership Schools that Ensure Teacher Candidates Develop and Demonstrate Proficiency in Improving Student Interest and Success in Science and Mathematics
Objective III.D	The Program Ensures Alignment with Local, State and National Education Policies and Meets or Exceeds International Standards to Produce Teacher Candidates with Demonstrated Capacity to Teach to High Standards
Component IV: Beginning Teacher Support **Goal IV:** Support and Learn from Program Completers as Beginning Science and Mathematics Teachers	
Objective IV.A	The Program Provides Mentoring and Support for Recent Science and Mathematics Program Completers
Objective IV.B	The Program Tracks and Assesses the Effectiveness of Program Completers and Beginning Teachers
Component V: Teacher and School Development **Goal V:** Provide Continuing Learning Opportunities and Advanced Studies for Science and Mathematics Teachers	
Objective V.A	The Program Partners with Schools and Community to Assess, Plan and Implement Professional Advancement Options for Science and Mathematics Teachers
Objective V.B	The Program Promotes and Sustains Professional Development Programs for Graduates and Other Science and Mathematics Teachers

The Analytic Framework provides a two-scale rating system: first, how *valued* the objective and strategy under each goal is perceived to be; and second, how effectively *implemented* the objective or strategy is perceived to be in their program. Both scales provide five response options: Uncertain, Strongly Disagree, Disagree, Agree and Strongly Agree. Assessing programs on both perceived value and perceived level of implementation allows for a deeper discussion and analysis of the *current* program and the *desired* program.[4]

4 The online Analytic Framework survey requires approximately 60 minutes to complete in its entirety. Results can be made available individually and summarized across all respondents for use in helping achieve consensus on program strengths and areas of needed improvement. Contact ccoble@thirdmilegroup.com for more information.

Underlying the Analytic Framework is the understanding that no one person possesses all of the knowledge about a particular program; people involved in the same program can and do have different perceptions about the same program. Thus, the authors of the Analytic Framework encourage people with different roles and responsibilities (including P-12 partners) associated with a program to complete the assessment. The individual and summative responses are data that can be used to seek consensus about *what is valued* and *what is implemented* in a program. A complete description of the development of the Analytic Framework is available in Coble, 2012. A PDF of the Analytic Framework can be found at http://www.aplu.org/document.doc?id=4106.

In response to the request of SMTI institutional leaders, there have been two major applications of the Analytic Framework:

- The first is as a tool for supporting program improvement, to identify strengths and areas of needed improvement within and across science and mathematics teacher preparation programs.
- A second major use of the Analytic Framework has been to guide a pilot process to identify promising and exemplary practices. Twenty five (25) institutions that were members of a collaborative supported by NSF award #0831950 had an opportunity to use the Analytic Framework to identify and submit selected strategies for consideration as a promising practice by A•P•L•U. A description of the process and results can be found at http://www.aplu.org/page.aspx?pid=2311.

Next Steps

Mapping the Analytic Framework to the Ten Key Questions revealed that all five components and goals of the Analytic Framework are embedded at different places within the Ten Key Questions, as are all 13 of the objectives. In total, 28 of the 56 Strategies, or 50%, are directly linked to the Ten Key Questions. However, as users begin to utilize these tools to improve program quality, other strategies will likely be identified or developed – and we encourage users to communicate suggestions for additions or improvements to the Analytic Framework to the author or APLU/SMTI staff.

Depending on additional funding, four strands of work are needed to continue this quest for continuous quality improvement in teacher preparation using the knowledge gained in the development of the Analytic Framework (Coble, 2012; Coble et al., 2012), the four thematic briefs (Presley and Coble, 2012) and the Ten Key Questions, which we plan to disseminate widely:

1. Establish a database of science and mathematics teacher education programs built on the expanded use of the Analytic Framework, and analyze the accumulated assessment data to provide a foundation for program improvement.
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4. Build criteria and metrics for assessing the degree to which the strategies are successfully being implemented within programs. This would help programs as they undertake their individual ongoing assessment for continuous improvement, but might also lead to the development of a national competition to recognize exemplary teacher preparation programs.

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APPENDIX A. AUTHORS AND ADVISORS OF THE ANALYTIC FRAMEWORK

Authors: Charles R. Coble with Lizanne DeStefano, Fox Family Distinguished Professor of Education, University of Illinois; Nancy Shapiro, Associate Vice Chancellor, University System of Maryland; Jennifer Frank, Project Evaluation, Office of Academic Affairs, University System of Maryland; and Michael Allen, Allen Education, Washington, DC.

Advisory Committee for the Analytic Framework: *Deborah L. Ball,* Dean, School of Education, University of Michigan; *Cynthia Bauerle,* Senior Program Officer, PreCollege and Undergraduate Science Education, Howard Hughes Medical Institute; *Carlos Contreras,* US Education Director, Intel Corporation; *Daniel Goroff,* Program Director, Alfred P. Sloan Foundation; *David Imig,* Professor of the Practice, College of Education, University of Maryland; *Jim Lewis,* Professor of Mathematics, University of Nebraska-Lincoln; *Deborah Lowe Vandell,* Professor and Chair, Department of Education, University of California, Irvine; *Lynne Weisenbach,* Vice Chancellor for Educator Preparation and Innovation, Board of Regents of the University System of Georgia; *Stamatis Vokos,* Professor of Physics, Seattle Pacific University; *Suzanne Wilson,* Chair Department of Teacher Education, College of Education, Michigan State University

The following individuals provided substantive critiques and helpful suggestions during the four years of developing the Analytic Framework: *Debra Ambrosetti, Josh Anderson, David Andrews, Deborah L. Ball, Cynthia Bauerle, Camilla Benbow, Marty Bonsangue, Jana Bouwma-Gearhart, Valerie Brown-Schilds, Jennifer Bruckner, Bonnie Brunckhorst, Herb Brunckhorst, Tony Bryk, Tom Carroll, Jim Cibulka, Marta Civil, Angelo Collins, Jane Coggshall, Carlos Contreras, Vikki Costa, Amy Cox-Peterson, Ed Crowe, Linda Darling-Hammond, Melissa Dodson, Francis Eberle, Roy Edelfelt, Mark Ellis, Susan Elrod, Mary Lou Fulton, Eugene Garcia, Cynthia Gautreau, Barbara Gonzalez, Daniel Goroff, Gene Hall, Victoria Hammer, Jim Hamos, Joseph Heppert, Ted Hodapp, Dan Howard-Greene, George Hynd, Karen Ivers, Gladis Kersaint, Tom Koballa, Bob Koch, Steve Koziol, Sabrina Laine, Frances Lawrenz, Marsha Levine, Jim Lewis, Michael Loverude, Gary Martin, Jim Middlelton, Dennis Minchella, David Monk, Sidney Moon, Margaret Mohr-Schroeder, Cherilynn Morrow, Mary Nakhleh, Valerie Otero, Michael Padilla, Tracy Le Quey Parker, Susan Parry, Sue Parsons, Monica Plisch, Janet Prado, Jennifer Presley, Kristen Shand Heidi Ramirez, Mary Ann Rankin, James Raths, Jr., Kacy Redd, Barbara Reys, Jeff Roberts, Sharon Robinson, Chris Roe, Maryann Santos de Barona, William Schmidt, Kay Shallenkamp, Sam Silverstein, Linda Slakey, Sam Stern, Gay Stewart, Marilyn Strutchen, Megan Tommerup, Catherine Walker, Mary Walker, Lynne Weisenbach, Gerald Wheeler, Jennifer Wilhelm, Jennie Whitcomb, Suzanne Wilson, Donna Wiseman and John Yopp.*

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1307 New York Avenue, N.W. | Suite 400
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