Teacher Preparation Program Abstracts

University of Northern Colorado, Greeley

STEM Preparation of Elementary Teachers at the University of Northern Colorado

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We focus on how pre-service elementary teachers are prepared in the areas of mathematics and science at the University of Northern Colorado. This undergraduate program consists of three mathematics content courses (9 credits), one mathematics methods course (3 credits), one mathematics field experience course (1 credit), three science content courses (10 credits), one science inquiry course (3 credits) and one science methods course (3 credit hours) totaling twenty-nine hours. Students choose an area of concentration including options in biology, chemistry/biochemistry, earth science, environmental studies, or mathematics totaling fifteen additional credit hours.

We will also present the Mathematics and Science Teaching for English Learners (MAST-EL) Grant project (U.S. Dept. Ed.) in which 30 pre-service elementary teachers have been prepared to deliver high quality mathematics and science instruction to K-5 English Learners in Colorado. The MAST-EL provides a model for integrated STEM preparation for culturally and linguistically diverse learners.

University of Northern Colorado's Pathways Towards Licensure in Secondary (7-12) Mathematics or Science

Robert J. Reinsvold (Biological Sciences), Wendy Adams (Physics and Astronomy), Rob Powers (Mathematical Sciences), & Bill Blubaugh (Mathematical Sciences)

Students interested in becoming secondary science or mathematics teachers can meet that goal via two pathways at the University of Northern Colorado. The first program is the Secondary Professional Teacher Education Program or Secondary PTEP. The students must complete on a content major in one of the four science areas (Biology, Chemistry, Physics, or Earth Sciences) or in Mathematics while also enrolling in the PTEP program. In this way the students have a rich content knowledge as well as the pedagogical knowledge to teach that content. Since the Colorado educator license with an endorsement in science requires content knowledge in all the science areas, all the science majors with secondary science emphases must also take additional science courses outside of major (e.g. Biology Teaching Candidates take additional coursework in Earth Science, Chemistry, and Physics along with their required major in Biology). The undergraduate degrees for these students require 40-45 credits within the major, 35-40 credits for PTEP, and 40 credits of the Liberal Arts Core. The Secondary PTEP program integrates courses on pedagogy with 84 hours of early field experience, 90 hours of advanced clinical experience, and a full 16 weeks (640 hrs) of student teaching. The PTEP program is spread over four semesters and often started during the sophomore year of the undergraduate. The teaching methods courses for science and mathematics are taught by science or mathematics educators that are members of the content faculties.

The second pathway towards licensure in secondary mathematics or science is the Secondary Post Baccalaureate Teacher Licensure Program. The Secondary Post Bac program focuses on empowering teacher candidates as school leaders for the purpose of improving student learning through the development of meaningful curriculum, authentic instruction, and performance-based assessment. Students in this program must have already completed at least a bachelor's degree in one of the natural science areas or mathematics before entering the Post-Bac Program. The program includes carefully constructed school-based field experiences where candidates connect theory and research while being supervised and coached in the practices characteristic of excellent teachers. Our licensure is founded upon a set of 12 program outcomes developed from the National Council for the Accreditation of Teacher Education (NCATE), Association for Childhood Education International (ACEI), and the Performance-Based Standards for Colorado Teachers.

Noyce Scholarship Program of Northern Colorado

Robert J. Reinsvold (PI, Biological Sciences), Lori Reinsvold (Coordinator, MAST Institute), Valerie Middleton (Co-PI, Teacher Education)

The NSF Noyce Scholarship Program of the University of Northern Colorado (NSF #1035333) began in September 2010. Our project had five goals: 1) increase the number of science and mathematics teachers graduating from the University of Northern Colorado; 2) increase the number of STEM professionals completing Colorado teaching licenses in science and mathematics; 3) increase the number of early STEM education experiences for students to encourage more to consider teaching of science or mathematics as a career; 4) provide ongoing mentoring and professional development support of science and mathematics teachers during their induction year at high-need schools; and 5) assess, disseminate, and sustain the best recruitment and retention practices.

To implement the program, the University of Northern Colorado partnered with 25 school districts, 19 of these are in rural communities where the need for science and mathematics teachers is very high. Most of the school districts also meet the high-need classification by having a high proportion of the students in poverty status (as measured by eligibility for free or reduced lunches). Each of these school districts is committed to collaborating with UNC during the early field experiences, student teaching, and consideration for employment of the Noyce Teachers.

Since Fall 2010, we selected 32 Noyce Scholars and 6 Noyce Post-Bac Scholars. Since the scholarship is restricted to teacher candidates in their last two years of their programs, we have found that some students have less than four semesters left when the annual cycle of scholarship selection occurs. As such, we have been able to offer scholarships to more individuals than originally proposed (32 compared to the proposed 22). The amount of scholarship per semester was the same, just distributed over more students. This will ultimately put more Noyce Teachers into high-need schools than our proposed goal.

Twelve Noyce Scholars have graduated, secured teaching licenses, and started teaching in high-need schools. One of the conditions of receiving the scholarship is the Noyce Scholar is required to teach in a high-need school for 2 years for each year of scholarship support. Two of the Scholars have successfully completed their obligation of teaching in high-need schools. Thus far, we have had no Scholar drop out of the program before meeting their teaching obligation. An additional two are graduating this Dec 2013 and will plan to start their teaching careers in Spring 2014. Evaluation data on teaching effectiveness of all these teacher candidates show on average proficient to advanced scores in pedagogical skills, diversity skills, professional skills, pedagogical content knowledge, and content knowledge.

Forty four Noyce Interns received early educational experiences through their internships; ten of these developed their commitments to teaching and later became Noyce Scholars. Thus far, we have had great success in recruiting excellent candidates as Noyce Scholars and Noyce Post-Bacs. Our challenge has been meeting our annual target goals for the number of Noyce Interns. With the help of the university marketing division, we plan to expand our recruitment efforts for Noyce Interns in the coming years.

The practices that are making an impact are: 1) the scholarships and internships are helping potential teachers to commit to teaching, and to commit to teaching where they are needed the most; 2) the support of Noyce Teachers during their induction year is critical for supporting them through potentially career-ending challenges; 3) creating a network for science and math teachers and teacher candidates has increase support from peers; 4) the lessons learned from the Noyce Program has influenced the redesign of our teacher preparation program by increasing early educational experiences; and 5) the Noyce Program has increased the awareness of the need for science and math teachers and established it as a priority for support from our dean, provost, and university president.

Adams State University, Alamosa

Adams State University Teacher Preparation Program

Matt Nehring, & Ed Crowther

The Adams State University teacher preparation program in STEM fields has been developed through close collaboration between the Teacher Education Department and the content-area departments. A highlight of the collaboration has been the development of Mathematics and Science emphases for students pursuing elementary licensure. We feel strongly that to improve STEM instruction within the K-12 system, teacher education programs must provide accessible and appropriate options for specialization in STEM fields beginning at the elementary education level. Without STEM-focused teachers in grades K-5, science and mathematics education at the secondary level will continue to face significant challenges.

Colorado Mesa University, Grand Junction

Colorado Mesa University, Center for Teacher Education
Jennifer Daniels

Math and Science Preparation program
The elementary licensure program candidates must have a major in Liberal Arts with an English, Mathematics or Social Science content area emphasis and preparing them as teachers for grades K-6. The secondary licensure program candidates may choose from majors in English, History, Mathematics, Spanish, and Science (Biology or Geoscience) and prepares them as teachers for grades 7-12. Content area coursework must be completed with a minimum GPA of 2.80.
Program requirements:
The elementary and secondary licensure programs provide teacher education candidates with broad content knowledge and prepare them as teachers for grades kindergarten through twelfth. A minimum of 60/75 credit hours of general education and content area coursework must be completed before a candidate may apply for admission to the Center for Teacher Education.

- The Biology secondary program offers coursework in the foundational sciences including Biology, Chemistry, Physics and Geology, students choose 10 hours of upper level Biology course work, in consultation with their advisor.

- The Geosciences secondary program includes basic chemistry, physics, and biology. Students have access to department equipment that includes research petrographic microscopes, binocular microscopes, a computer-assisted x-ray diffractometer, scanning electron microscopes, GPS units, short- and long-period seismometers, and a magnetometer.

- The mathematics secondary program develops problem-solving and critical thinking skills and is an introduction to the logical and historical development of mathematical ideas.

Highlight any unique aspects and/or strengths of programs
The Colorado Mesa University Center for Teacher Education works closely with the school districts throughout western Colorado. We offer a variety of methods for teacher licensure: traditional degree plans and non-traditional, intensive programs for candidates who already hold a bachelor's degree. Using 21st century tools, we prepare our graduates to employ emerging technologies and best practices to lead in elementary, middle school, and high school classrooms. Cutting-edge technology is used in our newly developed smart classroom, to educate tomorrow's classroom leaders in curriculum, state standards, classroom management, and education research.

Colorado State University, Fort Collins

Colorado State University Teacher Preparation Programs
Meena Balgopal

Colorado State University's School of Teacher Education and Principal Preparation (STEPP) prepares around 50 graduates each year in the following secondary STEM licensure areas: science, integrated technology (computing science), technology education (engineering), mathematics, and agricultural education. In addition, the Early Childhood Education (ECE) program integrates STEM content and pedagogy in its curriculum graduating around 30 students each year to teach in PK-3rd grade classrooms. The teacher licensure program follows a Professional Development School model and places students in local PK-12 classrooms early and often throughout the program. CSU students spend three semesters (observing, co-teaching, and reflecting) in authentic classrooms prior to student teaching. Moreover, CSU's Noyce program recruits academically strong and professionally committed STEM majors to pursue teaching in high-needs communities (e.g., rural, inner-city). All students (undergraduate, post-bachelor, and Masters plus licensure) have many opportunities to engage in service learning and outreach activities across campus and in the community. Math education students are peer mentors in the mathematics department. program. Science methods students engage in service learning teaching in STEM elementary schools and at STEM nights in local districts, sometimes collaborating with

ECE students to create age-appropriate, engaging inquiry-activities. Students also volunteer in the following programs; El Centro's Triunfo tutoring program for high-needs elementary-middle school students; Math, Science, Tech Day; Colorado Science and Engineering Fair, Little Shop of Physics Open House, Ag Day, and many others.

Metropolitan State University of Denver

STEM Teacher Preparation in an Urban Land Grant Institution

Janelle Johnson, Equity Assistance Center Region VIII; Angela Powers, Department of Secondary,K-12, & Educational Technology; Mark Koester and Clark Dollard, Department of Mathematical and Computer Sciences

The diverse student body of Metropolitan State University of Denver makes it a unique place for STEM teacher education: first-generation-college students and those eligible for Pell grants are each 31 %; Latino enrollment is 19.2 %; and resident Coloradans make up 96.6 % of all students, with 41% of students attending part-time.

Teacher education programs at MSU Denver provide a curriculum that recognizes the multicultural composition of the local urban population, the global understandings necessary in an interconnected world, the relationship between formal education and maintaining a democratic society, the importance of existing knowledge about learning and teaching, and the role of technology in instruction.

MSU Denver currently offers STEM concentration options within preparation programs for both elementary (Math, Biology) and secondary (Math, Biology, Chemistry, Environmental Science, Physics) teacher education candidates. In addition, all elementary candidates take three math and two science courses, and an integrated math/science teaching methods course with a field experience.

MSU Denver's teacher preparation is supplemented by the Center for Urban Education (CUE), which supports and promotes the most effective teachers for high-need urban schools, as well as providing both paid and volunteer tutoring and service opportunities in schools.

MSU Denver's Title III grant is helping the University form a School of Education. The increased visibility and status of the teacher preparation programs will contribute to improved retention and completion rates, and to the enrollment of more students from under-represented groups.

Regis University, Denver

Regis University STEM Teacher Preparation Programs

Dr. Todd D. Fantz , College for Professional Studies; Dr. Kevin Pyatt, College for Professional Studies; Dr. Karla Esser, Regis College

Regis University, based in Denver, Colorado, is a private, co-educational institution founded on the Jesuit mission of a values-centered education that shapes intelligent decision-making and strengthens commitment to community service. It is divided into three colleges: Regis College, The Rueckert-Hartman College for Health Professions, and the College for Professional Studies. Regis University offers multiple programs that lead to teacher licensure in mathematics or science through both online and on-campus formats.

Regis College provides degrees for traditional-age high school graduates and transfer students. Regis College offers a teacher education licensure program in mathematics or science in conjunction with a BA or BS degree in the subject area of licensure. Students completing the program at Regis will also have completed requirements for a minor in Secondary Education. Regis College also offers a MA degree in Education: Graduate Teacher Licensure. The Graduate Teacher Licensure (GTL) program targets students who earned bachelor's degrees within the past five years, although it is open to anyone with a qualifying degree.

The College of Professional Studies (CPS) is focused on adult education. CPS offers a Masters of Education degree with Initial Licensure in mathematics or science education. Available both online and on-campus, the M.Ed. with emphasis and initial teacher licensure in Secondary Education is designed for those who would like to become licensed in the state of Colorado or Wyoming. The teacher education programs are nationally approved through the Teacher Education Accreditation Council (TEAC).

University of Colorado Boulder

Sociocultural Perspectives on STEM Secondary Teacher Preparation

Victoria Hand, Ph.D.

Recent theories of learning suggest that focusing solely on cognitive elements of STEM teaching and learning does not capture the complexity of the processes involved in STEM teaching and learning. As an early member of the UTeach consortium, CU Boulder was instrumental in revitalizing dated models of STEM teacher preparation to address sociocultural and critical perspectives. The design of our STEM teacher preparation at the secondary level focused on centering candidates' experiences on the practices and contexts of their future work, and on STEM learning as a form of participation in sociocultural communities.

CUTeach is designed to provide maximum exposure of candidates to STEM content, school classrooms and teaching experiences. All of the courses are content-specific either for math, science, engineering subject matter, or for STEM generally. Courses were developed in collaboration with A&S and School of Education faculty, and often co-taught by faculty teams. Candidates develop and teach lessons at local school sites with hand picked mentor teachers throughout their coursework. Candidates also mentor middle and high school students from non-dominant ethnic, racial and linguistic backgrounds through the AVID program. Master teachers cultivate strong partnerships with local schools and districts to deepen candidates' experiences. Field experiences are also enhanced by analysis of video cases of classroom teaching. Candidates utilize research-based frameworks to strengthen noticing skills around student thinking, aspects of inquiry-based learning environments, formative assessment opportunities and culturally relevant pedagogy.

An overarching theme of the program is that STEM teaching is never neutral, and that teachers need to be aware of multiple and overlapping contexts shaping educational processes and outcomes. Readings and class discussions support critical perspectives on assumptions, labels, and processes, that privilege or marginalize groups of students in STEM education. Relatedly, candidates are treated as future teacher-leaders who will develop professional communities that work towards educational change and equity.

Teaching and Learning Biology @ UC Boulder: an novel approach to Teacher Preparation and Molecular Biology Education

Mike Klymkowsky & Erin Furtak; Molecular, Cellular, and Developmental Biology and the School of Education

A critical component of learning is the opportunity to test and strengthen one's thinking about a particular subject. In many undergraduate curricula, there are few opportunities for such a Socratic synthesis. At CU Teach Boulder, an early member of the UTeach consortium, we have developed a series of courses to replace the original "Research Methods" course requirement. These Teaching and Learning courses are designed to provoke students to consider the factual knowledge and conceptual foundations of their particular disciplines.

As an example, we describe here "Teaching and Learning Biology" a course cross listed in MCD Biology (MCDB 4811/5811) and in the School of Education (EDUC 4811/6811). The course is typically taken by a range of MCDB seniors, not just those interested in a career in education, as well practicing teachers. For MCDB undergraduates it serves as a capstone course prior to graduation as well as a required component of the CU Teach certification process.

The course focuses on an analysis of what ideas are critical to consolidate, correct, and extend for a student's ability to approach biological problems generically. In addition, students read and discuss papers on how student understanding is measured. The core of the course is the development by the students of a short ~10 minute engaging, scientifically accurate, and didactically effective video together with a written project description. The process involves an initial "pitch", group review and critique, preliminary storyboard, further feedback, and then final project, which includes a clear characterization of the target audience and assessment questions to help determine whether the core ideas presented were recognized and understood by the audience.

The end result, based on the quality of the videos produced and classroom discussion, is a deeper understanding of the disciplinary complexity of even the simplest biological system together with the production of compelling examples of the student's abilities to extract, package, and transmit complex ideas in digestible chunks.

University of Colorado Denver

University of Colorado Denver Teacher Preparation Programs

Robert (Bud) Talbot, Assistant Professor, Science Education; Geeta Verma, Associate Professor, Science Education; Heather Johnson, Assistant Professor, Mathematics Education; Ron Tzur, Professor, Mathematics Education; Bryan Wee, Assistant Professor (Joint appointment between SEHD and CLAS), Science Education and Environmental Science;. Diana White, Assistant Professor, Mathematics

The teacher preparation program in the STEM fields at the University of Colorado Denver is a collaborative effort between the School of Education and Human Development (SEHD) and College of Liberal Arts and Sciences (CLAS) and is a part of the Urban Community Teacher Education (UCTE) program. The UCTE program is committed to contributing to the mission of SEHD by developing educators who are culturally responsive, collaborate closely with families and communities, and have the knowledge and skills to create engaging and inclusive classroom communities where all students can achieve and grow. Our STEM teacher education program is focused on preparing science and mathematics teachers (elementary and secondary) to meet the needs of diverse student populations. It focuses on developing mathematics and science teachers' pedagogical content knowledge through course offerings in SEHD and CLAS. Simultaneously, we engage our teachers in meaningful and robust conversations for them to be able to teach mathematics and science in culturally responsive and socially just ways. In partnership with the CLAS, we obtained funding to develop two pipeline programs into our teacher licensure: the Learning Assistant (LA) program in science, and the NSF Noyce Scholarship program in science and math.

Western State Colorado University, Gunnison

Math and Science Preparation at Western State Colorado University

Heidi Keck, Holly Brunkal, Dale Orth, Edith Cranor-Buck, Christopher Benedetti, Gaye Jenkins

At Western State Colorado University, the math and science preparation of elementary school teachers contains courses specifically designed for these students. This is in contrast to other areas across the campus. The preparation of secondary school teachers does not presently include such specialized or interdisciplinary courses. The science curriculum for elementary teachers (previously contained in our IDLA degree) was revamped in 2006. The previous collection of introductory science courses in several areas was redesigned to a set of three 4 credit interdisciplinary lecture/lab courses and a 1 credit seminar. The courses are often team taught and a major focus is helping students see that science is indeed fun and something they can do in their future classrooms. The sequence for mathematics preparation includes two courses of content presented using problem solving and exploration and a third course that examines the development of mathematical thinking with problems tied to the Common Core Standards. We will share course descriptions and goals for the sequences used at Western to prepare future elementary teachers.