ALTERNATIVE LICENSURE AT NEW MEXICO TECH

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New Mexico Institute of Mining and Technology (NMT), which is primarily an undergraduate science and engineering research institution, has a small alternative licensure program. Due to the nature of undergraduate requirements at NMT, the preservice teachers in the licensure program have extremely high content knowledge but little awareness of the average student's prospect for success in school. The goals of the licensure program are to promote understanding of the phrase "Science for All Americans", instill a disposition to use research-based practices in the classroom, and acquaint teacher candidates with the contemporary nature of schools and schooling. The primary sources of content for the licensure program are articles from the education literature and observations of local classrooms. The primary learning methods of the licensure program are critical discussions of educational research and classroom observations, creating standards-based lesson plans, and critiquing assessments (student work).

Introduction

A critical issue facing the United States (US) is a shortage of high-quality math and science teachers. Although indirect, the evidence for this shortage of high quality teachers are the consistently dismal average scores for US students on both national and international assessments. For example, only 27% of 8th grade students were deemed proficient on the National Assessment for Educational Progress (NAEP) for mathematics in 2003 [1]. About two-thirds of schools in the US did not make adequate yearly progress in 2004-5 [2]. On international measures, in 2000, US students' mathematics score on the Program for International Student Achievement (PISA) was 493, 7 points below the mean of 500; science PISA scores were 499, 1 point below the mean [3]. Another piece of evidence indicating the shortage of high-quality math and science teachers is the inability of some K-12 students to translate their knowledge into successful performance in post-secondary education. For example, low academic performance in the first year at private not-for-profit 4-year, public 4-year, and public 2-year institutions is correlated with higher attrition rates [4]. The ACT found that only 51% of tested high school seniors were prepared to read college texts [5]; they posit that reading ability correlates directly with achievement in college-level mathematics and science courses.

Although everyone seems to agree that high-quality teachers improve students' achievement both on standardized tests as well as performance in post-secondary adult life (e.g. [6-9]), there is little consensus on what characteristics make teachers highly-qualified deliverers of the type of teaching that leads to true student learning. There is a persistent question about the efficacy of subject matter preparation versus education courses. Using case study analyses and data from the 50 states, the 1993-94 Schools and Staffing Survey, and the NAEP data, Darling-Hammond finds little evidence for a high correlation between subject matter knowledge and student achievement [6]. She states, "It makes sense that knowledge of the material to be taught

is essential to good teaching, but also that returns to subject matter expertise would grow smaller beyond some minimal essential level which exceeds the demands of the curriculum being taught" (p. 7) [6]. In contrast, training in education showed a higher correlation with student achievement than subject matter training for both preservice and inservice teachers, with subject-specific education classes (such as math methods or science methods) appearing to be the most effective.

Alternative licensure programs face an interesting tension between subject matter preparation and education coursework. The definition of "highly qualified" embodied in the No Child Left Behind (NCLB) Act is that "highly qualified" rests solely in content area preparation. Teachers are classified as highly qualified or not based on the number of content area courses they have taken; no part of the Act requires teachers to take education classes, leaving that decision up to the states. Consequently, one justification for alternative programs is that they are a fast-track to get people with content area majors into the classroom without delaying their entry into teaching by making them take a lot of education classes. Unfortunately for proponents of NCLB, Darling-Hammond finds that education courses correlate more strongly with student achievement than subject matter knowledge [6]. The challenge for alternative programs is to give preservice teachers a sufficient knowledge of and skills in education in the least amount of time, where 'sufficient' has never been well-defined. One way of identifying 'sufficient' may lie in determining retention rates of teachers and K-12 student achievement and through post-training surveys of feelings of self-efficacy.

I am presenting this poster as a provider of alternative licensure in secondary math and science education in a unique setting. I am the only professor of education at a science and engineering college, New Mexico Institute of Mining and Technology in Socorro, NM (NMT). The teacher education program at NMT was established in the 1950s. From its inception, experimental psychologists (neuroscientists, not clinicians) have taught most of the courses. That is, the primary program instructors have been individuals with very little or no formal training in teacher education. Because of changes in state requirements, NMT decided to change its teacher education program from regular to alternative in 2001. Shortly thereafter, the administration created the first tenure-track position in education and I was hired to fill that position.

Primarily two types of students enroll in the NMT licensure program: undergraduates with an aptitude for science or math who are uninterested in pursuing a career in research and spouses of NMT professors. In order to graduate, NMT undergraduates must pass a year of calculus, chemistry, biology, and calculus-based physics. There are no non-majors courses. Consequently, the undergraduates in my program are extremely well-prepared in their content areas and have excellent study skills. Graduates of the program typically teach in the local school district. The district has 2000 students: 25% Anglo, 67% Hispanic, 4% Native American, 1% African American, and 2% Asian. Fifty-five percent of the students are on free or reduced lunch. Some students in the local schools do extremely well; for example, last year, one of the local high school students scored a perfect score on the ACT, one of 32 perfect scores nationwide. Unfortunately, most of the students in the local schools do not do so well. In 2005, only 45% of the high school students tested proficient in math and 38% tested proficient in reading on the New Mexico state assessments. Consequently, not only is there typically a large cultural difference between NMT-licensed teachers and the local student population but also a large gap in skills and motivation for success in schooling between these teachers and the local student population.

The licensure program, developed before I was hired, consists of 6 courses: Child and Adolescent Growth and Development; Concepts in Education; Classroom Management and Discipline; Assessing and Teaching Reading in the Content Areas; Methods and Practices of Secondary School Teaching; and Directed Teaching. Although the content of these courses needs to generally align with the titles, there are no constraints on what I can teach. I developed syllabi for five of these courses consistent with three primary activities of the entire program. The only course for which I haven't developed the syllabi is Assessing and Teaching Reading in the Content Area; an adjunct with a Master's degree in literature teaches this course. Since her tenure at Tech is two years longer than mine, I don't yet feel comfortable telling her what to teach and have consequently had no input into her syllabus.

The purpose of this report and conference poster is to identify and describe program activities and desired outcomes, illustrating these activities through examples from the courses. In part 1, I identify program activities. In part 2, I provide course information and indicate the correlation between course assignments and program activities. In part 3, I provide a sketch of some program graduates as well as some questions that arise from this paper.

Part 1: Conceptual foundations of the licensure program at New Mexico Tech

One of the most difficult aspects of creating a teacher education program is identifying which recommendations from the body of literature about teaching and teacher education are based on high quality research, are generalizable to my population of preservice teachers and local K-12 students, and are reasonable for a lone, tenure-track assistant education professor in an alternative licensure program to implement. Although I subscribe to and read major journals in both education and science and math education (for example, AERJ, RER, JRST, and JRME), only the infrequent meta-analyses seem appropriate to consider for my program design. Some of the reasons for excluding research articles include study populations that are too specific and different from my students, study populations that are too small, and a lack of substantiation for recommendations through replication studies. Consequently, the conceptual foundation of the licensure program at NMT is derived primarily from books about teacher education. An additional source of knowledge is from my own experience as a student, a scientist, a mid-life career-change teacher certified through an alternative pathway, and a graduate education student.

In creating a rationale for the design of instructional systems, Land and Hannifin [10] maintain that a correlation between educational theory, activities, and intended outcomes is crucial to developing a program. They caution that without establishing a clear connection between curriculum and objectives, educational systems often arise out of a collection of "things that work" but that may not work together, under closer examination. The unfortunate result is that meeting intended outcomes then becomes a matter of chance, rather than design. One such method of constructing the relationship between inputs, activities, and objectives is through the method of structured decomposition [11]. Alter and Egan [12] describe their version of structured decomposition, logic modeling, as a way of "identifying and explaining the assumptions about the cause and effect of a proposed change[-]process", i.e., a program. Stinchcomb [13] goes on to add that logic models "provide a clear link between theories of how programs will change and the practices of that program".

Logic modeling graphically shows hierarchical relationships between the inputs, constraints, activities, and intended outcomes of a program. The top of the hierarchy shows the one overlying activity of the program, the inputs and the outcomes. (Continuous inputs, termed

constraints, feed into the top of a box.) The NMT logic model is illustrated in figure 1. The conceptual foundation of the NMT logic model is conceptual change. Based in the family of constructivist theories of education, conceptual change theory requires instructional systems be designed in order to elicit and modify existing naïve or misconceptions the learner holds to make them more consistent with the commonly accepted body of knowledge [14]. At NMT, the goal is to uncover preservice teachers' novice beliefs about teaching, learning, and schooling, and make them more consistent with research-based beliefs about teaching, learning, and schooling. The major activities implemented to cause this change are reading and discussion of recent articles from peer-reviewed journals in science and math education; writing about experiences as students (and teachers) and evaluating them using the principles embodied in these articles; and, observations of and reflections on local classrooms.

The program at NMT is decomposed below; the logic model depicts the program activities, inputs, and outcomes. (Some duplicate aspects of the decomposition will be left out in order to minimize visual clutter.) There are many benefits to this strategy. This model explains the proposed mechanism of how and why the NMT program is able to bring about the desired change [11]. First, it provides a conceptual model to facilitate implementation through clear

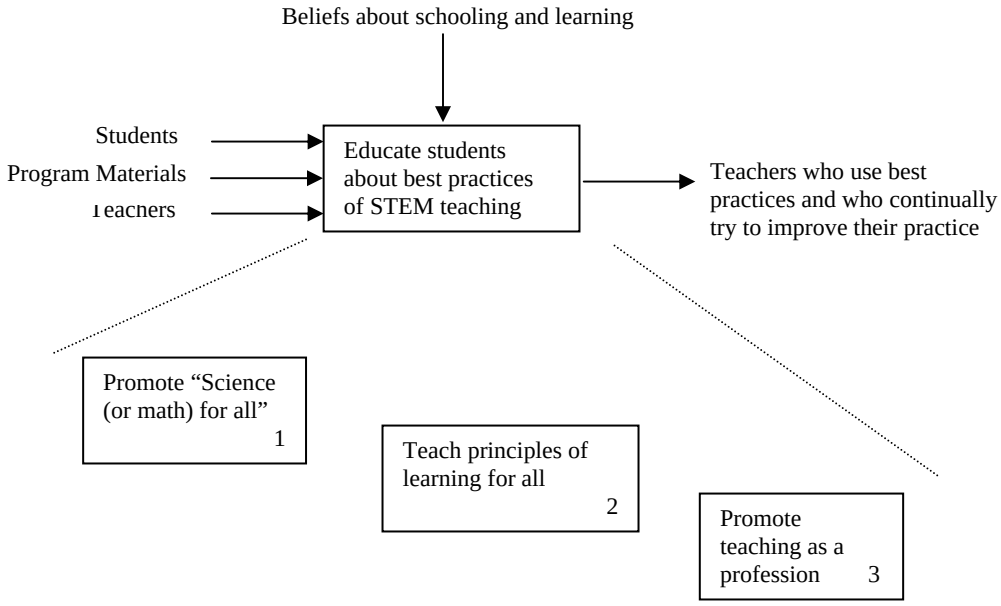

Figure 1: Logic Model of the Licensure Program at New Mexico Tech

communication of program activities and goals [13, 15, 16]. Second, it is a visual organizer of resources, activities, and program objectives [13, 16-18]. Finally, it provides a "mechanism and conceptual basis for measuring program impacts" [13, 18, 19].

Activity One: What does "Science (or math) for all Americans" mean to you and how will you operationalize this meaning in your teaching?

The desired outcome of this activity is to prompt preservice teachers to develop a personal justification for teaching their content equally well to all students—why *is* science or math required for all students, regardless of whether or not they are going to pursue a math- or science-based career?

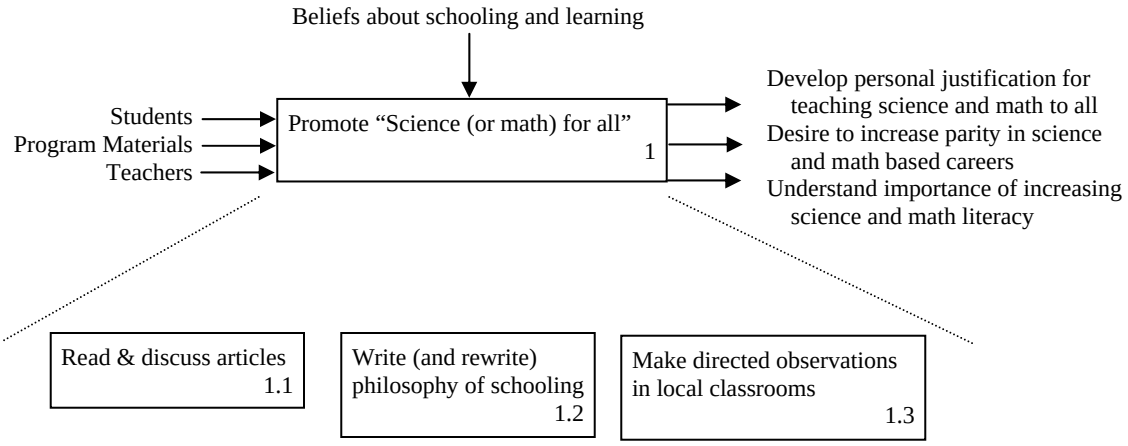

Figure 2: Logic Model of Activity One: What does "Science (or math" for all Americans mean to you?

Desired outcome 1: Success in promoting "Science for all" lies in leading NMT teacher candidates to consider how they learn versus how other people learn; the fact that they are successful students at NMT puts them in a minority of students who are very school friendly. NMT teacher candidates need to understand that very few of the students they will teach will have the same motivations, abilities, and knowledge skills they do. These candidates need to appreciate the effect their pedagogical decisions will have on the achievement of students in their classes.

Desired outcome 2: Promoting equity in science- and math- based careers means increasing the parity between white males and groups historically underrepresented in these fields; the pipeline begins with equal access to high-quality education.

Desired outcome 3: Very few people become scientists or mathematicians so it is essential for candidates to decide how to make subject matter meaningful and relevant for all. One primary goal of instruction is to increase the scientific and mathematical literacy of students, while also giving a good knowledge foundation to those students who will choose science- or math- based careers.

Activity Two: What does effective teaching and learning in science look like and sound like?

The desired outcome of this activity is to teach teachers how to teach their content equally well to all students. The primary content of the alternative licensure program at NMT is research-based, peer-reviewed journal articles. Teacher candidates learn about how knowledge claims in education are established. There are three goals behind this activity:

Desired outcome 1: Inoculating candidates against the conservative nature of schools, which turn novices versed in research-based methods for teaching into veterans who teach how they were taught, not how they were taught to teach [20], requires giving teacher candidates evidential support for effective methods. Hopefully they will be more likely to retain the dispositions acquired during their licensure and use high-quality instruction in their classroom practice if they understand why certain methods are more successful for a particular population of students than other methods.

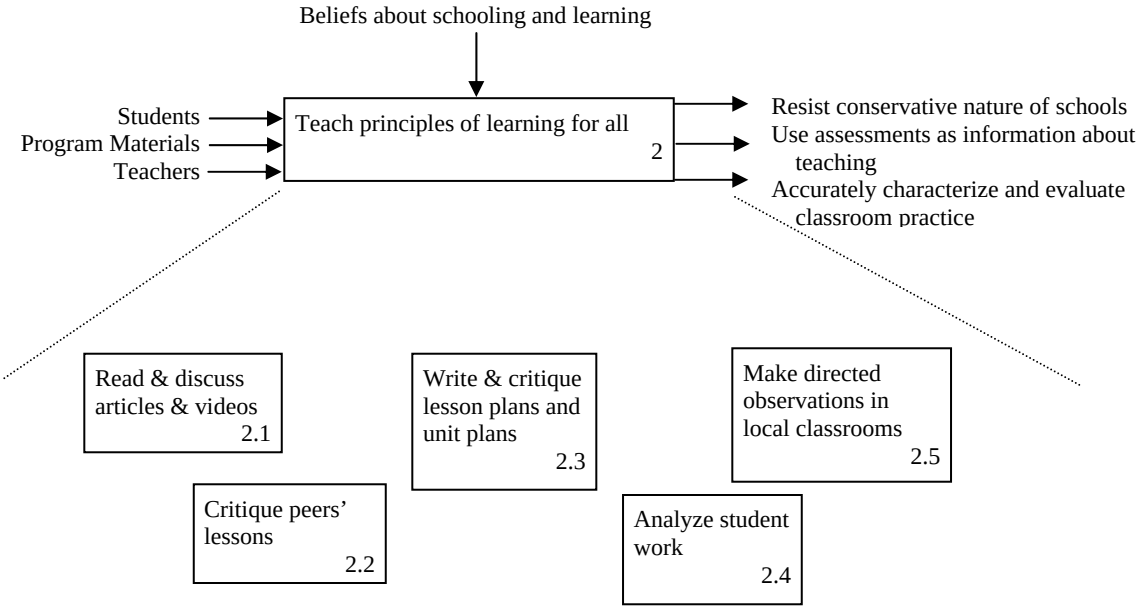

Figure 3: Logic Model of Activity Two: What does effective teaching and learning in science look like and sound like?

Desired outcome 2: Developing a propensity to use evidence, i.e., high-quality classroom assessments, in making classroom decisions leads teachers away from the myth of natural teaching [21]. Teachers need to know how to establish whether or not their own teaching is effective.

Desired outcome 3: Increasing critical observation skills of classroom practices gives teachers the skills to be able continually improve their practice and be skilled practitioners in any setting. Teachers need to be able to do informed reflection on classroom interactions. They need to be able to identify subtle nuances in student responses to instruction and the classroom environment in order to refine their skills.

Activity Three: Is teaching a profession? How will you contribute to making it a profession?

The field of teaching includes many superficial signs of being a profession, including degree accreditation, licensing exams, continuing training requirements, and professional societies [21]. However, none of these are *really* required in order to teach during teacher shortages, when school districts will hire anyone with a college degree, or financially advance in the profession, since raises are based on seniority rather than performance. Teachers do not have to belong to practitioner societies, participate in high quality professional development, or ever change their practice. As presently constituted, teaching is a pseudo profession. In many school districts, teachers receive no support to implement research-based practices from their administration, little encouragement from their colleagues, and often outright hostility from parents and students. The desired outcome of this activity is not to scare teachers out of teaching but to warn them about the realities of some school situations and give them tools for coping with, overcoming, and hopefully improving the profession of teaching both locally and nationally.

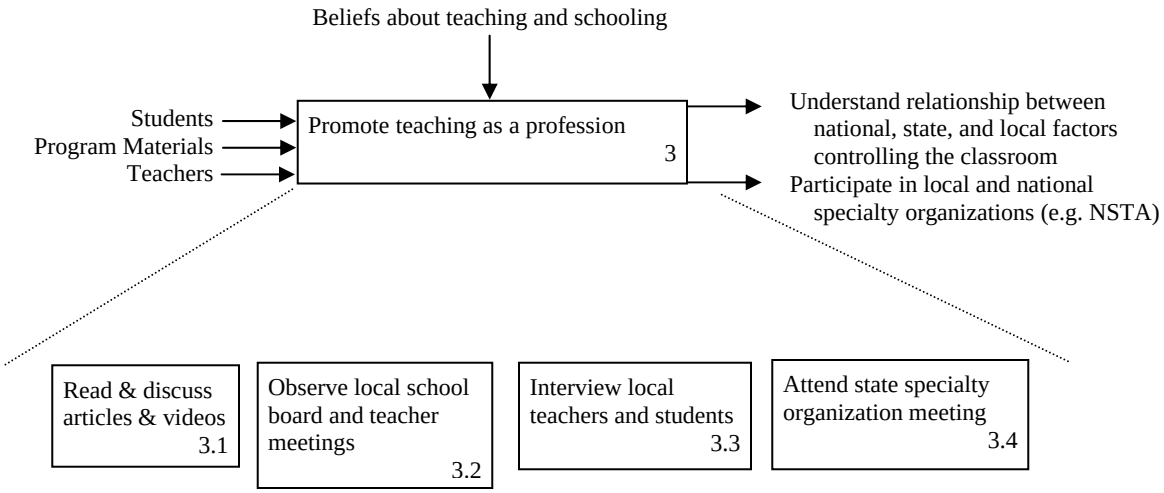

Figure 4: Logic Model of Activity Three: Is teaching a profession? How will you contribute to making it a profession?

Part 2: The licensure program at New Mexico Tech

As stated previously, the licensure program currently consists of six classes: Child and Adolescent Growth and Development, Concepts in Education, Classroom Management and Discipline, Assessing and Teaching Reading in the Content Area, Methods and Practices of Secondary Teaching, and Directed Teaching. In creating the content for these courses, I had an empty slate: although syllabi existed, these were developed by people without advanced training in education so I felt more comfortable either adapting syllabi from courses I had taken or developing new syllabi out of my knowledge of the research base in teacher education. The content of these courses is described below; references to program activities mentioned in part 1 are made by referring to the numbers on the logic model diagrams.

Although not mentioned explicitly, students can take all but the last two courses in any order; Methods and Directed Teaching must be taken as the final two courses in the program. During the first course, students purchase several textbooks that are used as references throughout the program as students complete assignments: Kagan's Cooperative Learning, Wiggins & McTighe's Understanding by Design, and Angelo & Cross's Classroom Assessment Techniques. (I'm still looking for a general reference on classroom management.) The course is administered entirely through webct. All classes take place in a computer lab; the computer monitors sit below desk level and are viewed through a window in the table so students have flat surfaces to work on.

Note: The content of the Reading course is not included because I don't teach it and I don't know anything about teaching reading. The adjunct who does assures me that her content is consistent with the general principles delineated in the program.

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Child & Adolescent Growth and Development
Course anchor: Creating curriculum for your course is like baking; you need to decide what your product is in order to make good instructional decisions based on an educational theory.

On the first day of class I do the following demonstration.
Materials on the front table:

Bread machine
Water
Vegetable Oil
Eggs
Cake Mix

"Last night I told him my husband that I was going to make some bread but I was out of ingredients so he needed to go to the store to buy ingredients for me. Here is what he bought."
Put cake mix ingredients into the bread machine and turn it on. "Do you think it will work?" Continue with various questions such as, "After class I'm going to go home and make something, do you think I should knead? Should I use flour?" Etc. Eventually, students will keep saying, "It depends on what you want to make."

Students fill in the following table:

Material or Procedure	Bread	Layer Cake	Sugar Cookies
Flour			
Sugar			
Type of pan			
Grease the pan?			
Etc.			

Reference Land & Hannifin [10]: a correlation between educational theory, activities and intended outcomes is crucial to developing a program. They caution that without establishing a clear connection between curriculum and objectives, educational systems often arise out of a collection of "things that work" but that may not work together, under closer examination.
"In this course, we will identify products of several different education theories and the components that lead to successfully producing the desired education outcome. For each theory, we will identify the desired educational outcome and the materials and procedures that lead to that educational outcome. Only then can we make good decisions about whether or not to have students work in groups, do projects on their own, show evidence of meeting standards by completing worksheets, etc. In other words, depending on your desired outcome, you shouldn't be trying to knead with layer cake ingredients."

The analogy of appropriate materials for the desired outcome is reinforced throughout the course as students discuss readings and complete course assignments.

Course readings [1.1, 2.1]: Students read articles by B. F. Skinner, Robert Gagne, George Miller, Howard Gardner, and Lev Vygotsky. They read articles about Piaget. They read some practitioner articles for and against incorporating constructivist practices in the classroom. They read some articles about the intersection between culture and development (classroom success)

and gender and development. They read articles on measuring development and some of the inherent difficulties with that, such as stereotype threat (Steele & Aronson). They also watch some excerpts from the “A Private Universe” series of videos. Students discuss all of these articles and videos.
Peer assessment: In order to make sure that students read assignments in a timely fashion, they evaluate each other three times through the semester using the format given in appendix 2.

Course assignments:
[1.2] Students write their philosophy of schooling at the beginning of every course; the first one acts as a baseline for their philosophy. All subsequent versions give me an indication of how their philosophy is being influenced by their education courses.
[2.3] Students pick one of the New Mexico secondary math or science standards and create one lesson that is consistent with a behaviorist orientation to learning, a second lesson on the same standard that is consistent with a cognitivist orientation to learning (Piaget or Miller), and a third lesson that is consistent with a constructivist orientation to learning. Each lesson plan must have the format given in appendix 1 which was adapted from McTighe and Wiggins [22]. Arrows go from each standard to the assessment, so students can see exactly where they are assessing each standard. Arrows also go from instructional events to assessments so students can see exactly where they are teaching the necessary content for each assessment. Students must provide all supporting material for the lesson and an outline of the unit that would contain the lesson. Finally students write a short justification of why the lesson is consistent with the particular theory.
[1][2] Students complete unit exams and a final exam.

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Concepts in Education
Course anchor: “The myth of natural teaching.” During the second class period, we dissect the book chapter, “Beyond natural teaching” [21]. Each subsequent course topic is linked back to issues raised by Murray in order to confront misconceptions about teaching.

Course topics taught by me [1.1][2.1]: Bloom’s taxonomy, Maslow’s hierarchy; teacher education; examples of teaching methods; examples of assessment methods.

Course topics taught by students [1.1][3.1]: History and current structure of schooling in the US; national and state school funding; do teachers matter?; the standards-based movement and curriculum alignment; recent learning & motivation theories; historical and current reform movements; standardized testing; No Child Left Behind; textbooks and curriculum; legal issues of teaching: code of ethics, contracts, rights and responsibilities of teachers, professional organizations.

Course readings: Drawn from current articles and books and include Sanders and Horn, Coleman, Kozol, Education Trust, etc.

Course assignments:
[1.2] Philosophy of schooling

[2.3] Teams of students plan and teach specified topics. The lesson must include preassigned homework and formative and summative assessments. Readings for the lessons must be taken from contemporary sources and must include at least two different and opposing points of view. I give some suggestions for articles for each topic but students must find additional sources from education research databases. Students use the lesson plan format given in appendix 1 with standards chosen from the NM secondary licensure standards for beginning teachers.
[2.2] Students are evaluated on the quality of their peer critiques; they are given a rubric to use and I score the quality of comments they give to their peers using the rubric.
[2.3][2.4] After scoring the assignments they created and their fellow students completed, students write a reflection on the lesson they gave including suggestions for improvement.
[2.5] Students make two observations in local schools during the semester in which they choose one of the course topics and reflect on how this topic is manifested in contemporary classrooms. They must reference course readings and discussion in this reflection in order to receive full credit.

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Classroom Management and Discipline
Course anchor: On the first day of class we discuss the following quote:

> The Latin root of *discipline* and *disciple* means student. To be a student is to be disciplined—not necessarily in the militaristic style, but rather by adopting the demeanor and practices of one who studies well. If we accept this definition, then, it means teaching students not only what to learn, but how to learn it, and how to mature with that learning. It's not an add-on to the curriculum, it *is* the curriculum. Robert Frost said that education is the ability to listen to almost anything without losing your temper or your self-confidence. According to Helen Keller, the highest result of education is tolerance. Note the discipline angle of both of these—how learning transcends content and skills. We won't be successful teachers if we see discipline as an imposition, something we have to step aside and handle before we continue on the road to scholarly endeavor[23].
>
> After this discussion, students complete a STAR-Legacy cycle [24] on "What is classroom management?" Each class day ends with students writing a short reflection on how their understanding of classroom management has changed that day.

Course readings: Students read Cooperative Discipline (Albert), Classroom Management for Secondary Teachers, 7th Ed. (Emmer, Evertson, and Worsham), and Beyond Discipline: From Compliance to Community (Kohn). Students also read articles relating to each type of classroom management.

Course assignments:
[1.2] Philosophy of schooling
[2.1][3.1] Daily reflective log. In addition, in order to make sure that students are doing the assigned prereading, students are evaluated by their peers using the rubric in appendix 2.
[1.3][2.5] Students make two sets of observations in the local school system. Each set includes one observation in a classroom at each level, Kindergarten through 12th grade. For the first set, students write a narrative of what they see. For the second set, the class creates an observation

rubric during one of the class meetings; the rubric is based on people's observations during the first set of observations. Students turn in both sets of observations, a reflection that integrates course reading and discussion, and an assessment of the observation rubric.
[1.3][3.3] Students interview one of the teachers they observed and one of the students in a classroom they observed.
[3.2] Students attend a local school board meeting and write a reflection about it.
[3.2] Students attend one of the teacher meetings at either the middle school or high school and write a reflection about it.
[2.1] Students write a web-based management plan.
[2.3] For the final exam, students watch a movie illustrating one teacher's responses to an out-of-control class. They analyze the teacher's responses using the principles learned throughout the semester.

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Methods and Practices of Secondary Schooling
Course anchor: The first two class periods are devoted to modeling a complete math unit from introduction to final exam.

Course readings: From Understanding by Design, Classroom Assessment Techniques, and Cooperative Learning.

Course topics: State standards, unit anatomy, essential questions, lesson anatomy, what is technology?, assessment, managing paperwork. In addition, various teaching methods for math and science are modeled every week.

Course assignment:
[1][2][3] Students organize the standards for a content area and grade level into units for an entire year. The purpose of this assignment is to get students in the mindset of implementing standards-based curriculum rather than textbook-driven curriculum. They must justify their sequencing.
[2.3] Using the sequencing structure created in the first assignment, students create a complete unit that they must use in student teaching the following semester: they know their placements and must coordinate topics with the supervising classroom teacher. Each lesson must use the format given in appendix 1. Students must include all supporting material. The unit must incorporate technology. The unit must include accommodations.
[2.3] Students teach one part of two different lessons from their units (occurs on separate occasions). They are evaluated each time by their peers and must reflect on the evaluations they received.
[2.4] Students review proposed assignments for one of their peers' units and evaluate the relationship between instructional activities and assessments.

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Directed Teaching
In addition to student teaching for 10 weeks, students attend a weekly seminar.

Seminar topics: The first part of each class is devoted to problem-solving based on what I observed or what student teachers request. The second part of the class is spent looking at student work [2.2][2.4]. Student teachers bring in assignments that their students have completed and the class evaluates them. Student teachers also discuss the nature of the teaching that preceded the assignment and how they felt the class responded to the assignment.

Course assignments:
[2.3] Students complete 150 hours of classroom teaching.
[2.3] Students write a reflection on how they would revise the unit they created in Methods based on their experience incorporating it in the classroom and their peers response to student work generated during the unit.
[1.3][2.5] Students videotape one of their lessons; they capture and narrate good and bad teaching moments.
[3] Students keep a time log of everything they and/or their supervising teacher do in a day for two weeks. They categorize these activities and then reflect on how a teacher spends their time.
[1.3][2.5] Students identify 3 students they will observe throughout the 10 weeks—a "good" student, a "transparent" student, and a "bad" student. Throughout the 10 weeks, they try to determine their learning styles, report how they and the classroom teacher interacted with them and how other students interacted with them. Students try to ascertain content & pedagogy that seemed to increase their engagement and achievement and content & pedagogy that seemed to decrease their engagement & achievement.
[1.2] Philosophy of schooling—written several weeks after the end of student teaching.

Part 3: Program Graduates

So far, there have only been four program graduates; none of which are a product solely of these education classes. Their characteristics are summarized in Table 1.

Table 1: Characteristics of Graduates from the NMT Alternative Licensure Program

Teacher characteristics	Number of courses from "old" program	Number of courses from "new" program	Placement	Current situation
Bill—early retiree from a career in science-based management	2	3	Reservation school (math)	Quit after one year; now works in administration for NMT
Kimmie—mother returning to work	2	4	Local middle school (science)	Same placement; head of science at local middle school
Mai-li—mother returning to work	3	3	Local middle school (math)	Same placement
Aten—mother returning to work	4	2	Local high school (biology)	Same placement

Bill taught high school math at a reservation school and got excellent reviews from his principal. Although he followed the prescribed curriculum in terms of content, he implemented a lot of inquiry-based strategies. Over the course of his first year, he became frustrated with the management of the school. When a job opened at NMT, he decided to apply for it.

Kimmie teaches science at the local middle school. Her first year reviews were so excellent that she was put in charge of coordinating science at her school. The district curriculum supervisor has purchased a lot of technology and classroom supplies to support Kimmie in her attempts to implement inquiry-based teaching. She is very involved in student activities and is the coach of the Science Olympiad team.

Mai-li teaches advanced math at the middle school for two class periods and does tutoring with students who are struggling during the other class periods. She uses very traditional strategies for her advanced math classes, consistent with her experiences as a student in China. She told me that the parents of her students, who are also *all* native Asian, expect her to teach this way. However, she uses a variety of strategies when tutoring her low-achieving students. She has received excellent reviews for her teaching.

Aten has struggled as a teacher. The largest problem seems to stem from a very wide cultural gap between her and her students that she seems unable to bridge. She has a very high content knowledge, having trained as a doctor in the Middle East. She seems unable to understand how to motivate her students to be interested in learning biology. The only courses she took under the new format were Methods and Directed Teaching so she missed a lot of content about equity in science education that may have given her some tools to help her solve some of her classroom dilemmas. She has tried to implement inquiry-based instruction and has been successful the few times she tried. However, these attempts were all carefully scripted by me; she seems unable to think of how to adapt her instruction to inquiry-based teaching on her own.

There are many questions that arise from this paper; a few are:

1) How can I judge the effectiveness of the NMT program since it is too small to realistically complete a control-group study? What are some valid & reliable indicators of success?
2) Considering the high quality of students in my program, how could institutions similar to NMT be recruited into developing programs for science teacher licensure?
3) How can students at a place like NMT be better supported in pursuing teaching as a full-time profession rather than a more lucrative one in science?

Bio

Barbara Austin is an assistant professor of science and math education at New Mexico Tech; she is the director of the teacher licensure program.

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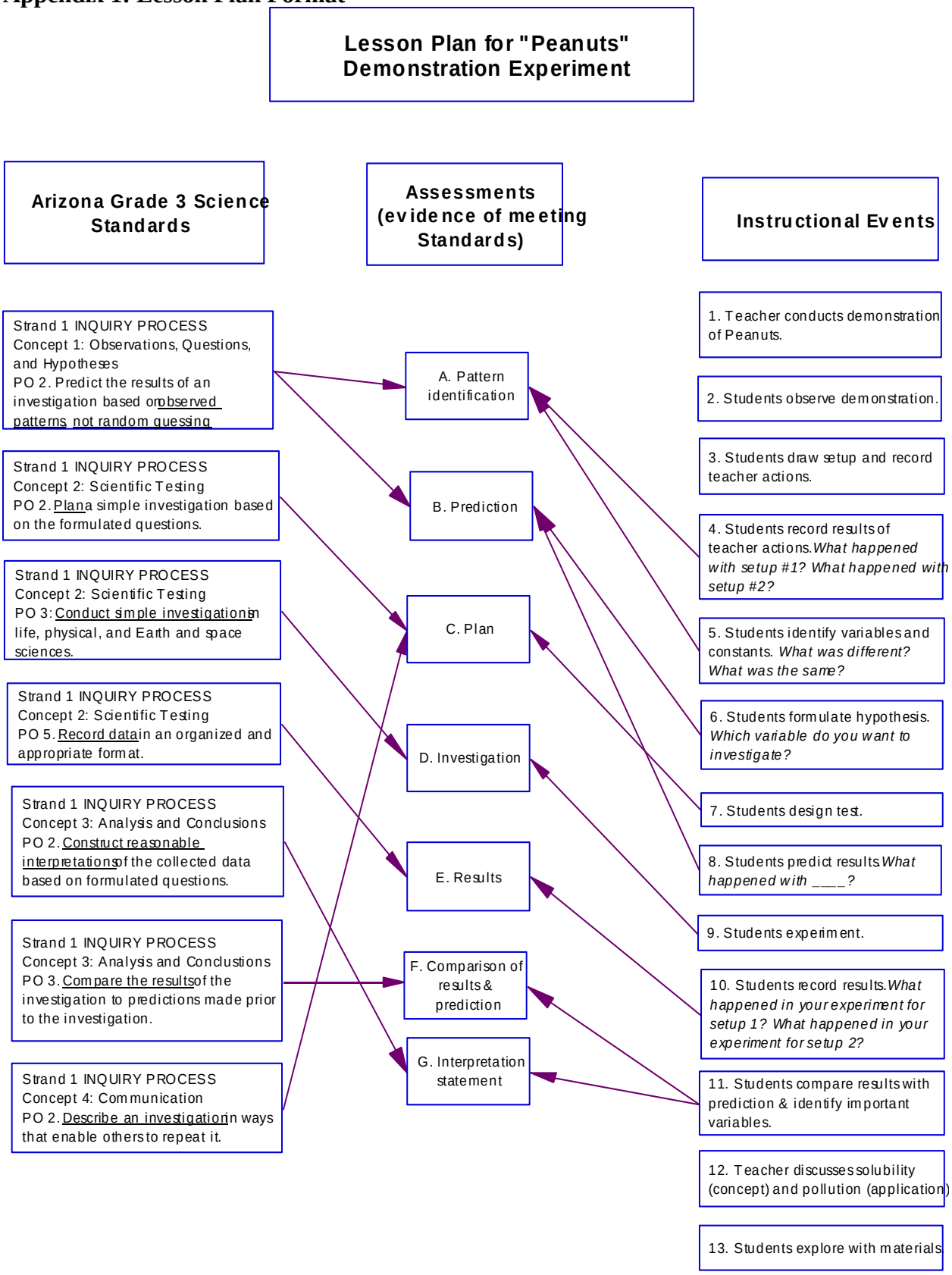
Appendix 1: Lesson Plan Format



Appendix 2: Peer Assessment Form

Peer Assessment Survey
Educ 323: Child and Adolescent Growth and Development
New Mexico Tech May 2, 2005

I have worked with **Joseph Cotton** this semester
_____ No or I am Joseph Cotton (skip to next person)

_____ Yes (Answer all three questions)

1. **Reading**
   If I had to participate in a debate that served as **50%** of my course grade over an article I HAD NOT read and I had my choice of team members:
   a. _____ I would definitely want her/him on my team because s/he usually reads and tries to comprehend class readings, finding insights, applications, and relevance to teaching in the modern classroom.
   b. _____ S/he isn't my first choice as a team member because s/he doesn't always read every article thoroughly, but I would consider her/him as an alternate if my first choice wasn't available because s/he might have read this particular article.
   c. _____ I wouldn't want s/he on my team because s/he usually only skims the readings.
   d. _____ Chances are low that s/he read the article so s/he wouldn't be much help in a debate.
2. **Participation/Discussion**
   If I had to participate in a debate that served as **50%** of my course grade over an article I HAD read and I had my choice of team members:
   a. _____ I would definitely want her/him on my team because I know s/he would listen to my opinion in addition to offering an in-depth thoughtful one of her/his own.
   b. _____ S/he isn't my first choice as a team member but I would consider s/he as an alternate because s/he sometimes offers insightful views.
   c. _____ Although I've worked with her/him, s/he hasn't talked often enough for me to form an opinion about whether or not s/he would be a good team member.
   d. _____ S/he would not be a good team member because s/he doesn't have anything informative to say.
3. **Perspective**
   If I had to participate in a debate that served as **50%** of my course grade and I had my choice of judges:
   a. _____ I would definitely want her/him as a judge because I know that s/he would judge the debate based on the quality of argumentation rather than whether or not s/he agrees with a particular side.
   b. _____ S/he would be an acceptable judge because s/he usually considers all views; however, s/he has difficulty going beyond predictable ideas.
   c. _____ S/he would not make a good judge because s/he is too accommodating of all views without seriously considering their true merit.
   d. _____ S/he would be unacceptable as a judge because s/he would choose the side s/he agrees with as the winner, regardless of the quality of argumentation.

I have worked with **Emily Latella** this semester
_____ No or I am Emily Latella (skip to next person)

_____ Yes (Answer same three questions as previous)

1. **Reading**	2. **Participation/Discussion**	3. **Perspective**
a. _____	a. _____	a. _____
b. _____	b. _____	b. _____
c. _____	c. _____	c. _____
d. _____	d. _____	d. _____