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Glenn Nelson
University of Northern Iowa

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Iowa will require, by 2014, that all elementary education pre-service teachers have "pre-student teaching clinical experience in teaching mathematics".

Providing Preservice Teachers With Worthwhile Field-Based Experiences In Mathematics

Glenn Nelson, University of Northern Iowa

Providing preservice teachers with worthwhile field-based experiences is recognized as an important component in their development as good teachers. Because mathematics instruction in general has moved from a teacher-directed, procedurally-focused process to a more student-centered, conceptually-oriented approach, preservice mathematics education classes – especially methods courses - should reflect this shift as well. Field-based opportunities can be instances for preservice teachers to personally experience such a shift to real-world relevance.

The implementation of such an experience requires some thoughtful planning. There are a number of important questions an instructor must address in order to produce optimal results. This article attempts to raise some of those questions, look at some possible solutions, and share how one such program has chosen to resolve each issue.

The author, collaborating with dozens of different classroom teachers, has provided field experiences in mathematics for over five thousand preservice elementary education students over a span of thirty-five years, trying a number of different approaches.

WHY PROVIDE SUCH AN EXPERIENCE AT ALL?

This is certainly a valid concern. After all, many teacher education programs are already short of important content; why choose to devote already scarce class time to add an additional component? Another concern, it must be admitted, is finding time in an already very busy professional life to take on another labor-intensive responsibility.

The author's experience is that a field experience has the potential to motivate preservice teachers to work very hard. This allows them to learn much content in a limited time, in part because they must immediately apply it in a real world setting. There is little that pushes a preservice teacher to study, say, how to meaningfully introduce fractions with a region model, than knowing that a student will be waiting next

week, to learn this important idea from the preservice teacher. The result is much preservice teacher attentiveness and willingness to work hard in the classroom portion of the course. Comparisons with other sections of the same mathematics content and methods courses, which do not include a field experience, indicate that much the same content is able to be covered well, even when up to half of the class sessions are in the field.

Such preservice teacher motivation and learning through application is often sufficient reward for college instructors who choose to take on this increased responsibility. End-of-semester evaluations by preservice teachers invariably identify the incorporated field experience as an enormous factor in their satisfaction with the course.

HOW DOES ONE GET STARTED IN BUILDING A FIELD EXPERIENCE INTO A COURSE?

The most critical need is for a classroom teacher who models the kinds of good instruction the college instructor wants her/his preservice teachers to develop. This classroom teacher will have a substantial influence on how the preservice teachers begin their teaching of the subject. Hopefully the college instructor knows something of this teacher, or her/his reputation already. If the college instructor has had an opportunity to observe the classroom teacher, this is ideal. Sometimes one can get a lead from colleagues who know of this teacher's capabilities. And, perhaps, the college instructor may even have helped develop this teacher from when she/he was an undergraduate or graduate student.

Another important need is the ability of both the college instructor and the classroom teacher to get along personally, communicate clearly and respect each other professionally. There will be many times, both in preplanning and in the real classroom, when challenges and different needs will arise. The ability of both parties to be flexible, empathetic and willing to accommodate makes for a smoother experience for all. Since it is more likely that the college instructor will have been a classroom teacher than vice-versa, the major responsibility to understand and adapt to the other's position will be the college instructor's. (It is also worth keeping in mind that the classroom teacher and her/his students may not have to participate if she/he so chooses; it is the college instructor who is beholden to the teacher, to make this field experience happen!)

The author has been fortunate to have worked with many teachers who have possessed these aforementioned characteristics. Even then, however, accommodations may have to be made. For example, if the classroom teacher is uneasy about presenting a certain lesson to be observed by the preservice teachers, the college instructor can help co-plan the lesson, or teach it herself/himself while the classroom teacher and the preservice teachers observe.

However, it is desirable that the regular classroom teacher models at least some of the teaching. Preservice teachers read from their text about certain methodology, they view edited videos of how some teacher, far, far away has taught a topic, but there is something about watching a real teacher presenting a model lesson, in front of their eyes, right in their own community, that has an authenticity that is really believable. While the college instructor can also model some lessons, there may be an expectation that such lessons might be “easier” for the content specialist than the regular classroom teacher. It is really beneficial to have the regular classroom teacher provide most of the modeling.

Another obligation of the college instructor is to check his/her preservice teachers' eligibility to take a course with a field experience. In order to participate they must meet all the institution's standards required for such work in public schools, such as child abuse reporter training, criminal background check, etc. And the college instructor must adhere to any protocols of the school, the district and the college in arranging the experience.

HOW MIGHT THE FIELD EXPERIENCES BE SCHEDULED, IN GENERAL?

It is may be preferable if the whole class has these field experiences during regularly scheduled class times. Although these could be done outside of the regular class meeting times, scheduling instructor visits, especially if preservice teachers are in many different field placements at many different times, becomes a real challenge. However, it is certainly possible to have several different settings, at several different times and still have quality results.

Even when meeting at the same, regularly scheduled class time, a question is, do the preservice teachers all meet in the same classroom, or are they in different classrooms, hopefully in the same building? Utilizing several rooms/teachers allows for some flexibility in grade placements. For example, preservice teachers with an interest

in younger grades might be able to work in a lower grades setting. But dividing one class of preservice teachers among several/many classrooms results in their having several/many students to teach.

The author has tried to have one class of preservice teachers matched with only one public school classroom, if possible. For one thing, it makes arranging the placement easier, as there is only one contact person, that classroom teacher, with whom to co-ordinate. For another, it lessens the amount of energy that a preservice teacher needs to devote to classroom management. With only a few preservice teachers to cover an entire class, as is often the case if one class of preservice teachers is spread among many public school classrooms, management becomes a significant demand. However, if the preservice teachers are working in one classroom, and the number of preservice teachers is somewhat comparable to the number of students in the class, many match-ups will be one-on-one, greatly lessening management concerns and thus permitting more attention to be paid to an individual student's thinking, learning style, personality, etc. It is also true that it's easier for the college instructor to observe the teaching of the classroom teacher and preservice teachers if they are not widely dispersed.

Another consideration is providing the preservice teachers with multiple settings at differing times throughout the term, perhaps at several different grade levels. While the upside is seeing a variety of students at different levels of development, the downside is getting the opportunity in one semester/term to really understand how one student thinks. One may think about it this way: Would you rather meet one person multiple times, or multiple people once each? In the former, one probably gets to know one person well; in the latter, one gets to know a greater number of people, but each at a more superficial level.

Ideally a combination of these spread over the preservice teachers' college careers - where each preservice teacher gets to teach a student for one semester/term in one course, then another student at a different level for a field experience in another subsequent course - would be very beneficial.

Other procedural issues that need to be considered are accommodating for preservice teachers' travel time and school sign-in procedures, storage of their belongings and teaching materials, seating provisions for preservice teachers so they can readily observe their students, etc.

WHAT HAPPENS AFTER IDENTIFYING A CLASSROOM TEACHER WHO WOULD BE A GOOD COLLEAGUE, AND SEEING IF SCHEDULES COULD MATCH?

Since a field experience in the classroom of the teacher will be a change from the usual routine, and involve additional responsibility for her/him, the college instructor may need to articulate some of the benefits of this collaboration. While the preservice teachers will undoubtedly profit from this experience, they are not the only benefactors – the public school students stand to gain academically as well. The trade-off of many young students being taught by one capable classroom teacher is that each student is receiving one-on-one attention, albeit from a less experienced teacher.

The author has tracked student achievement in mathematics for upper elementary students who have received over 10 percent of their instruction in a given year from preservice teachers in a one-on-one setting. The achievement gains made by these students in that year were better than anticipated, when compared to year-by-year mathematics growth over their previous years. Of course much of that gain should be attributable to the competence of the regular classroom teacher, but at least there seems to be no adverse effects from being taught math by a preservice teacher in a one-on-one situation such as this. Such a positive effect on their students' achievement is often a very persuasive point when convincing a classroom teacher to provide a field experience site. In addition, regular contact with the college instructor, who is a subject matter specialist, is often helpful to the classroom teacher. Finally, providing such modeling and experience to entering professionals is often very rewarding to teachers, many of whom can recall such experiences being provided to them early in their careers.

When ready, preservice teachers can be intentionally matched to the classroom students. The preservice teachers can complete a short survey, each indicating his/her degree of comfort with the subject area and with learners of the age/grade level, as well as her/his willingness to accept a more challenging assignment. Then the college instructor and the classroom teacher can make suitable pairings.

Almost every classroom student is eager for “her/his own teacher” who is a college student. Even an initially reluctant student soon warms to her/his college teacher partner. Parents and family members are usually willing to accept some preservice teacher instruction for their child, especially if the potential advantages are

made known. One very well received idea has been to have the preservice teachers meet the families of the public school students at a “back-to-school night” somewhat early in the term. Having the classroom student share with her/his family members a mathematical problem-solving game or activity learned from her/his preservice teacher is a good way to help alleviate family concerns. This exposure also helps family members put a face with the preservice teacher, who will often be talked about at home after each class visit throughout the term.

WHAT ACTIVITIES MIGHT OCCUR WITHIN THE TIME OF THE VISIT?

Often both collaborators – the classroom teacher and the college instructor - are restricted by their teaching schedules. A whole class of college students does not have much flexibility in its schedule, which is often set a semester in advance. Likewise, there may be little wiggle room in the classroom teacher’s schedule, what with specials and/or changing classes. Compromise and accommodation are needed.

One of the most ideal schedules that the author and his collaborating teachers have found is if both can create a concurrent double period. This allows much to be accomplished in one visit - a lesson of regular length can be taught by the classroom teacher and observed by the preservice teachers and the college instructor; following that, the preservice teachers can each teach a lesson to her/his student and be observed by the classroom teacher and college instructor. If the classroom teacher then has time to debrief with the preservice teachers, while the students go to their next class, this is ideal. Such a schedule will unlikely occur the first few times that the field experience is implemented, but, when the program is proven successful, and the school administrators become sold on its value, and the college instructor can have some say in determining her/his class meeting time, then eventually a more ideal schedule can result.

But, if the observation of the classroom teacher and the preservice teachers’ instruction cannot be done in the same period, this could be done during two separate visits.

WHAT KINDS OF EXPERIENCES SHOULD THE FIELD-BASED COMPONENT OF THE COURSE PROVIDE?

Again, compromise is required. Classroom teachers are under significant pressures to cover specific content, while preservice teachers are more likely focused

on methodology. The author's program tries to accommodate both. Our methods course begins by focusing initially on more general methodology - such as teaching in a problem-based manner, utilizing real-world contexts (that often incorporate other subjects), incorporating technology, employing on-going assessment, etc. Then, the latter part of the college course addresses how to apply such methodology to teach specific content. Therefore, early in the term especially, the classroom teacher is often able to teach her/his regular content, while highlighting a particular methodology. This has not been particularly troubling for teachers who utilize a style consistent with the recommendations of responsible professional organizations such as the National Council of Teachers of Mathematics. As the term progresses, the preservice teacher begins to apply this methodology to mathematical content specific to her/his student's and classroom teacher's needs.

Currently, the author begins by devoting approximately the first eight of the preservice teachers' total of fourteen visits to teaching certain types of lessons – such as a student-centered lesson, a problem-solving lesson, one that integrates mathematics and another content area, etc.

About the last six lessons that the preservice teachers deliver focus on a specific piece of mathematical content which the classroom teacher and the methods instructor determine. Often it is a mini-unit on a topic where the students possess a wide range of understandings (such as rational numbers or flexible computational procedures), and/or a topic that lends itself well to individual, hands-on learning (such as measurement or data). Specifically-designed, carefully-focused lessons are then planned and delivered to individuals or small groups of students utilizing a variety of teaching techniques. Usually these lessons are independent of the regular content the classroom teacher is presenting. This allows the preservice teachers to plan and teach content in a coherent sequence (albeit maybe twice a week), unencumbered by whatever else the classroom teacher is presenting. The classroom students are able to handle the learning of these two different content strands surprisingly well.

HOW MIGHT PRESERVICE TEACHERS BE ASSESSED ON THEIR FIELD EXPERIENCE PARTICIPATION?

There are several different ways. The field experience could be separate from the college in-class portion of the class - it could be ungraded, or assigned a pass/fail grade, or graded.

The only portion evaluated and graded could be the final mini-unit, at term's end, since that is the culminating experience.

Although it is time-consuming for the instructor, the author has assessed all preservice teachers' lessons, very soon after each experience. This gives the preservice teachers timely feedback on a regular basis and encourages continual growth. The best eleven of the fourteen reflections constitute 44 of the total of 100 points the preservice teacher can earn in the course, and this distribution reflects the fact that approximately half of the course takes place in the field experience setting.

Each reflection on each preservice teacher's visit is worth a maximum of four points. Although there are some variations, usually each reflection contains:

- comments, stated professionally, over the observation of the teacher and/or student(s) during the modeling of the lesson taught by the classroom teacher,
- an overview of the plan of the lesson to be taught by the preservice teacher, including a rationale for the activity(ies) chosen,
- an example of student thinking, and
- mention of something significant learned from the day's experience.

Much can be learned by watching and reflecting upon a good teacher's performance, noting not only the delivery of the content, but also the things done to create a positive climate for learning. Summaries of the preservice teachers' reflections on the model lessons can be provided to the cooperating classroom teacher. Often these are complimentary. When several reflections question a teacher action, and this was not brought up during debriefing, the college instructor can ask the classroom teacher to specifically address this during the next debriefing, so that the classroom teacher's reasoning can be shared.

Having to provide a rationale for the day's lesson can help a preservice teacher devise a plan based on her/his student's needs rather than teacher convenience.

The ability of a preservice teacher to include an example of student thinking can indicate the presence of several important teaching qualities. Is the preservice teacher asking good questions? Is he/she listening carefully to the student's answers? Does the preservice teacher value information her/his student can provide? Can the preservice teacher interpret the student's response and use this information to adjust instruction, if not during the current lesson, then in a subsequent lesson?

Although rather open-ended, asking each preservice teacher to close his/her reflection by stating something of significance to him/her about the day's experience often yields significant insight into what is of value/concern to that preservice teacher. This in turn helps the college instructor to note at what point each preservice teacher is in her/his professional development.

The preservice teacher gets to count the best eleven scores over her/his reflection – the best five of the first eight, and the final six which are over the mini-unit. Because this may be a different reflection format for many preservice teachers, the initial write-ups sometimes score low; allowing several of them to not be counted seems beneficial.

While input from the regular classroom teacher is always welcomed, the author, in his program, has chosen not to require that the classroom teacher do a formal evaluation of the preservice teachers.

ARE THERE ANY PHASES THAT SEEM TO OCCUR DURING THE SEQUENCE OF FIELD EXPERIENCES?

Based on many years of observation, there seem to be several stages through which the preservice teachers pass, if they have a sufficient number of these experiences in a term. In a series of fourteen visits, these stages could be categorized as: honeymoon, trial, adaptation, and realization.

The honeymoon phase often lasts for two to four visits. Here the student and the preservice teacher are appreciative of each other and try to make a good first impression.

As each gets to know each other better, a trial period is experienced. In this phase each gets to check out each other's commitment to significant learning and meaningful teaching. The classroom student may push to find what behaviors are acceptable and not acceptable to the preservice teacher. The preservice teacher begins learning to develop reasonable expectations. She/he also begins to transition from presenting activities that initially may have been chosen because they seemed "fun", to tasks selected because they address an area of student need.

Next, in the adaptation stage, the student adjusts to the expectations, demands, and presentations of the preservice teacher, while the preservice teacher becomes more familiar with her/his student's thinking, interests and learning style(s). Also at this time the preservice teacher usually transitions from a teacher-directed style to one

which begins to place more emphasis on developing students' conceptual understanding and sense making.

The realization stage is usually attained during the culminating six-lesson mini-unit, which the preservice teacher planned, and is revising and teaching. Oftentimes, the classroom teacher is willing to let each preservice teacher assess his/her student's understanding of the material taught during the mini-unit and have that become a part of the classroom student's grade/assessment for that term. Given this assessment opportunity, the preservice teacher reports how many of the predetermined points his/her student earned and also provides a rationale for that score.

Preservice teachers enjoy the opportunity to not only create a unit, but to actually teach it to a real students and assess the effectiveness of their teaching. At this point, the preservice teacher has usually progressed through a continuum that consists of:

1. accepting that teaching in a manner consistent with responsible reform recommendations, which they have read and talked about, seems sensible,
2. observing a real classroom teacher make mathematics enjoyable, understandable, and attainable for her/his students,
3. realizing that with a conscientious effort, she/he, the preservice teacher, can also teach in this manner, presenting material in a way that allows students to become excited about learning, make sense of the mathematics being studied, and take ownership of their learning.

This third stage is a very significant accomplishment for many preservice teachers who initially may have had numerous doubts about their ability to teach mathematics meaningfully.

During one semester, the author was required to give student assessments over a mathematics methods course with a field experience, before the mini-unit was taught by the preservice teachers. Wondering if teaching the unit and assessing the students over the unit would have any impact on the preservice teachers' perceptions of self and the effectiveness of the methods course, it was arranged to again give the same student assessment instrument to these preservice teachers after the unit was taught. The second of the two student assessments, the one given after the teaching of the mini-unit, was noticeably more positive than the first. The supposition is that the preservice teachers' successful presentation of the their mini-units further deepened their belief that this method of teaching for understanding was worthwhile and attainable by them.

IS THERE ANY INDICATION THAT A METHODS COURSE WITH A FIELD EXPERIENCE HAS ANY LONGER-TERM EFFECTS?

Conversations, over a long period of time with many former students, indicate that this self-confidence, developed during the methods course which incorporated an extensive field experience, is often carried over to student teaching, through beginning teaching, and throughout their professional lives. Such results may be seen as evidence that the efforts of the college instructor and the cooperating classroom teacher in providing such a field-based experience are beneficial for their students as they continue their careers as teachers.

Web Bytes

www.iowamath.org

Iowa Council of Teachers of Mathematics offers information about the organization as well as links to resources for teachers. Information about grant opportunities and deadlines to apply can also be found here.

nlvm.usu.edu

National Library of Virtual Manipulatives contains a grid of options for each of the 5 strands of the core math/ NCTM strands, separated into grades spans. There are several overlapping options, between strands and grade spans, so it is easy to find what you are looking for, even if you are not exactly sure where to search. The activities include a virtual balance for solving equations, probability activities, pattern blocks, 3-D shapes, graphers, and a variety of fraction tools.

Visualfractions.com

This site contains interactive tutorials (videos), visual models and explanations that model fraction operations and converting mixed numbers to improper fractions for example. Users can choose between circles, bars and line to visualize the fractions. This site is helpful for grades 4 -8 (fraction introduction), and for older kids as a review. This site is fraction specific.

Mathplayground.com

Contains a wide variety of math games and worksheets; organized by grades, and math topics. You can also use virtual manipulatives or flashcards. Under each grade is a list of skills organized by type - probability, algebra, and activities that are sorted by skill and grade level.

Coolmath4kids.com

This site contains a wide variety of math games for pre-algebra level students and beyond. Students can investigate tessellations, fractals, polyhedral, and other topics. Choices include tutorials, games, art, and a link to coolmath.com, a very similar site with lots of overlap and some additional content.

www.nctm.org

National Council of Teachers of Mathematics has an enormous amount of resources for teachers to use in planning lessons, from classroom aides to Washington legislation.