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Achieving teacher education standards through a mathematics performance-based assessment: A case study of five Colorado preservice-teachers on field experience

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A range of factors has impinged on the provision of teacher education programs in the last decade. Largely emanating from governmental demands for increased accountability, these have included the setting of standards for student achievement, proof of program impact, and state and national testing. These legislative reforms and school district concerns initiated changes in field experience at a Western university and resulted in the introduction of performance-based assessments (PBA). During the final student teaching experience, preservice teachers were asked to teach mathematics to a group of students for a three-month period. Data analysis of pre and post tests revealed significant achievement gains for the elementary students. The preservice teachers' understanding of pedagogy and assessment evolved significantly as they experienced first-hand the impact of instructional choices on their students. Data analysis highlighted several main thematic connections including: (a) philosophy, attitudes and experiences, (b) knowledge, management and instruction, and (c) assessment and instruction.

Teacher education, standards, performance-based assessment, mathematics, elementary students

INTRODUCTION

As society becomes more complex, pressure for educational change comes from the business community, professional organisations, and, more recently, from government legislation (Becker and Jacob, 2000). Teacher education reform is inextricably interwoven with public school reform. One tool of reform has been the development of educational standards. Assessment of these standards has in turn led to state level tests in the United States.

> Because teacher preparation programs inherit much of their culture from the standards and practices shaping life in our public schools, the politics of high-stakes testing has become increasingly influential in the decision-making processes associated with curriculum and instruction in undergraduate teacher preparation programs. (Brawdy and Egan, 2001, p.438)

As a result of legislation like Senate Bill 99-154 in Colorado, teacher licensure requirements were changed and university education programs would be judged on the basis of the performance of their preservice teachers or teacher candidates (TCs), as they were referred to at many universities. All Colorado universities, including Mountain University (MU), were entwined in the new teacher licensure standards and the necessity to adjust teacher education programs.

Emphasis has always been given to effective teaching practices during the internships of preservice teachers at MU. In general, effective teaching practices were selected according to

impact on student learning (McEwan, 2002). One approach to assessing preservice teacher teaching performance was the use of performance-based assessments (PBA). PBA developers integrated current pedagogical research data, university and partner school needs, and the Colorado teacher standards.

BACKGROUND

Mathematics Education Reforms

Reforms in mathematics education have been under discussion for many years. Researchers reinforced the importance of real understanding of mathematics, by emphasising the need for students to make connections between ideas, facts, and procedures based on previous knowledge and newly established relationships (Hiebert and Carpenter**,** 1992). Acknowledging students' previous experiences and creating meaningful opportunities for new mathematical connections to develop could lead to more complex understanding. Consequently, students are more likely to remember what they have learned and to transfer the knowledge to new problems (Hiebert et al., 1992). Unfortunately many elementary preservice teachers feared mathematics and were concerned about their adequacy as teachers of this discipline (Battista, 1986).

Despite increasing pleas for changing practice in mathematics education, many teacher education programs failed to conform to the suggested reforms (Graham, Li, and Curran, 2000). This was further exacerbated by the mathematics anxiety displayed by numerous preservice teachers (Battista, 1986). Preservice teachers need to experience personally good mathematics teaching methods and be given time to process their experiences.

> Teacher education that is conducted in a setting that promotes investigation and inquiry into the problems of mathematics teaching seems to hold promise for assisting preservice teachers in becoming inquiring, reflective, mathematics teachers. (Mewborn, 1999, p.39)

The latter part of the twentieth century saw a shift from a purely scientific approach to teacher education to recognition of the art of teaching (Bryan, Abell, and Anderson, 1996). Studies indicated that preservice teachers, when exposed to reflective mathematics methodology in a supportive environment, could learn to manage learning environments effectively, develop sensitivity to students, and engage students in mathematics inquiry (Jaworski, 1992; Clock, 1999). Clock suggested that preservice teachers could learn effectively with small groups of students and needed to be given multiple opportunities to reflect on students' mathematical thinking.

Part of the teacher-education reform movement must involve a renewal of assessment processes. Clearly a changing preservice teacher education practice will necessitates an examination of assessment methods. Appropriate assessment of preservice teachers' readiness to begin teaching is an essential element of all programs.

Preservice Teacher Education Assessment

Traditional

Traditionally, assessment has been designed to compare how students performed relative to one another (Wolf and Reardon, 1996). According to Wilson (1995), teacher assessment has generally taken the form of multiple-choice tests and observational checklists. Licensure in most states has involved the successful completion of university courses and field experience, as well as some type of state-mandated competency tests. Assessments, such as the National Teacher Exam (NTE), tested content knowledge as well as pedagogical knowledge. Rich, Barikowski, and Boyd (1995) stated that while there was some evidence for content validity of the NTE, there was

virtually none in terms of predictive validity. In addition, traditional assessment tends to assume that a classroom is teacher-centered.

> Because we are broadening and changing our conceptions of teaching and learning we must rethink the questions that frame teacher assessment. (Wilson, 1995, p.194)

The aim of preservice teacher assessment is to determine whether a preservice teacher has the kind of professional knowledge, ability, and ethics needed to teach effectively (Brookhart and Loudman, 1995). Competency tests are insufficient to examine content, pedagogy, curricular knowledge, and interpersonal skills, as well as an ability to work with students.

Authentic

According to Schalock, Schalock, Cowart, and Myton (1993), it was rare for teacher licensure programs to assess on the basis of student performance, and yet this was clearly an important aspect of teaching. It was essential for preservice teacher evaluation to emphasise the use of knowledge (Yarbrough, 1995). In addition, Pasch (1995) alluded to the importance of developmental assessment over time. Preservice teachers were developing as professionals and needed to be assessed accordingly. Many programs looked to the use of PBAs that allowed preservice teachers to show what they could do in authentic situations.

> Student learning is the professional touchstone for both teachers and teacher educators, and the professional status of either will grow only when teachers are demonstrably able to nurture the kind and level of learning in students that is deemed essential for our nation at a particular point in time. (Schalock et al., 1993, p.108)

Impact of Preservice Teachers on Students

Mentoring of small groups

Studies have indicated that interventions by preservice teachers in small group tutoring could impact significantly on elementary students' reading levels (Hedrick, 1999). Mewborn (1999) found that small group tutoring in mathematics by preservice teachers could actually reveal information about elementary students' learning that was previously unknown by their classroom teachers. This was probably due to the individual attention given to students in the group over a sustained number of weeks. Students in Mewborn's study made gains in mathematics achievement.

CONCEPTUAL FRAMEWORK: PERFORMANCE BASED ASSESSMENTS

Structure of Performance-Based Assessments

Wilson (1995) indicated that preservice teacher assessment should have certain essential components. In particular, evidence of active student engagement and resultant achievement needed to be part of an effective assessment process. Teacher licensure demanded that preservice teachers demonstrated application of the knowledge learned in their university courses (Shalock et al., 1993). Many teacher education programs were moving to alternative assessment methods such as PBAs as a means to assess preservice teachers (Turner, 2002). PBAs allowed the development of preservice teachers over a period of time (Baron and Wolf, 1996).

According to Snyder, Elliott, Bhavnagri, and Boyer (1993-94), assessment should provide feedback to assist both the preservice teacher and the program as a whole. The use of PBAs promised to give important feedback to universities about their teacher education programs. In addition to assessment information, PBAs could assist in the development of effective teachers by allowing preservice teachers to align theory with practical experience.

According to Johnson, using performances in assessment implied a particular structure (1996). He described eight main parts of performance:

a) involved a complex goal and requires good judgment;

b) resulted in a whole that is more than the sum of the parts;

c) was personalised by the student;

d) allowed for refinement during the process, had known criteria, and gave many opportunities to demonstrate criteria;

e) did not involve so-called 'pat responses' and indicated mastery of criteria;

f) was judged according to impact, rather than the process used by the student;

g) required appropriate adjustments when errors occurred; and

h) resulted in student autonomy, where little assistance was required by completion

Rich et al. (1995) stated that while PBAs were promising, there were many measurement issues that remained unresolved. The reliability and validity of PBAs could be helped by using multiple sources of evidence. Some suggestions given by Rich et al. included the use of portfolios, reflective journals, and case studies. In order to satisfy these concerns and also maintain the integrity of the performance assessment, a lens for this study was based on Johnson's criteria with the addition of reflective journals that were kept by the participants.

This study was designed to examine the effect of an elementary mathematics PBA on preservice teacher and elementary student learning. Two main research questions addressed in this article.

- What do teacher candidates learn about pedagogy and assessment from the PBA?
- How are teacher candidate attitudes towards teaching mathematics affected by developing and implementing the lessons from the PBA assignment?

METHODS

Participants and Location

The preservice teachers who participated in this study were in their final internship in a partner school that they had worked in throughout their teacher education program. This particular PBA was only one part of their overall internship. The study was conducted at Mountain View School with five preservice teachers and 24 elementary students in Grades 2 and 5. The school was an alternative public urban school of choice available to students from pre-kindergarten through to twelfth grade and drawn from throughout the district. Parents, students, and teachers chose the school because of the emphasis on self-directed learning and active participation in the learning process in and out of the school setting. Students were organised in multi-aged groups based on interests, needs, and developmental levels. The Early Learning Center (ELC) catered for students in Grades K-2. Students in Grades 3-5 were members of the intermediate area (IA).

Structure

During this study, preservice teachers took total responsibility for the mathematics instruction of between four and seven elementary students. The preservice teachers worked with their groups of students on a daily basis for three months. In addition to mathematics, preservice teachers taught all subject areas to the whole class and this included a two-week solo block.

The following lists details the PBA requirements for each of the preservice teachers:

- administer CSAP-like tests to elementary students;
- grade the tests with clinical teachers;
- select students for the group with clinical teachers and the site coordinator;
- interview students;
- examine examples of students' work;
- write case studies of each student's mathematical strengths and weaknesses;
- determine individual and group goals;
- design instruction for the group;
- administer instruction;
- conduct ongoing assessment of students' achievement;
- administer CSAP-like tests after three months of instruction;
- grade tests;
- reinterview each student;
- write summaries of each student's progress during the three months; and
- write a summary of the PBA experience.

Interviews, on educational philosophy, pedagogical beliefs, and knowledge of student's learning were conducted with each preservice teacher at the beginning and end of the study. Throughout the instructional period, preservice teachers conducted ongoing assessment of student progress. Preservice teachers met in focus groups with their peers to express any concerns, discuss group progress, and seek advice concerning instructional queries preservice teachers also kept daily journals concerning all aspects of their individual mathematics groups. The journals included lesson plans, work samples, ongoing student progress information, student problems, and preservice teacher reflections.

Data

Both quantitative data, in the form of pretests and posttests for the elementary students, and qualitative data, in the form of interviews, focus groups, journals, observations, and artefacts were collected during the study. Test data were analysed and interpreted with the additional qualitative data concerning student achievement. Codes arose partly from the literature review and partly from emergent themes following an initial reading of all documents. Each document was then examined on the basis of the selected codes and coded accordingly.

Following this initial analysis, I used the model function to display visually the codes and their connections. This allowed me to see more clearly any relationships between the data. Documents were recoded as new codes emerged and were examined both vertically across all of the teacher candidates and horizontally for individual teacher candidates. Fontena and Frey (1994), who advised researchers to interpret both individual instances and an aggregation of instances, espoused this method. I conducted searches for relationships using groups of codes and participants. This led to some conclusions that could be generalised from the analysis.

In general, analysis was used both to filter and funnel data. Context and relevance determined the importance given to individual pieces of data. Each stage of analysis led to an aggregation of themes into main categories and ultimately allowed the research questions to be answered. In order to allow the reader to interpret the data, a quasi-statistical method was used to count the number of times particular themes were mentioned (Ratcliff, 2003).

RESULTS

Preservice Teacher Experiences

Each of the five preservice teacher participants had unique experiences over the three-month study. A summary of what each individual learned during the study is presented at the beginning of this results section.

Bethany

Although Bethany had always enjoyed mathematics, she was not confident about teaching it. The three month teaching experience gave her the opportunity to explore different strategies and to use a variety of manipulatives in a relatively "*safe environment*". She developed confidence in her ability to teach mathematics effectively:

> *I have learned a lot about how to teach math because I had a really hard time…how to know where to get started, and once I got started, each day knowing where to go from there. So that's been a really nice thing for me.*

In addition, Bethany's knowledge that children were at many different levels and had individual needs was reinforced. Over time, she began to see assessment and instruction as inextricably linked. Assessment of all kinds began to drive her instructional decisions.

Bob

Bob expressed appreciation for the teaching experience. He believed that he learned many things during the three months. He stated that it was important to determine what students' strengths were and then "*play to them*". For example, he made wooden boxes because he observed the connection between hands-on learning and interest level within his group. He also observed:

> *I learned to let go of the control when the kids were doing things, like cutting wood, and just keeping a watchful eye on them.*

Bob found that three of his group responded well to direct instruction for building skills, while the other one preferred manipulatives. After trying some peer instruction, he concluded that it was difficult for young children to teach one another. Given that Bob noted the session became a "*free for all*" it might be more of a management and structural problem than an inappropriate instructional method. He noted that he tried several activities that were unsuccessful and he would not use them again.

Jill

Jill discussed the importance of discerning students' strengths and weaknesses. She explained that every student had different learning styles and needs and, therefore, as a teacher she needed to "*tackle math from a wide variety of angles*". Furthermore, she explained that students learnt mathematics most effectively when they connected with it.

In conclusion, she wrote the following:

> *I would say that I have grown a lot as an instructor during this math PBA. I learned about getting to know your students and their unique strengths and weaknesses, different learning styles, planning, instructing and assessing. I will take all of this knowledge and experience with me in the future when I will be teaching my own classroom!*

Mary

Like all of the TCs, Mary learned many specific things about pedagogy, assessment, and management. She indicated that one of the most effective teaching strategies for the group was peer teaching. After starting with direct instruction, Mary discovered that only one or two students responded well, but saw the positive impact on all group members when using peer teaching. She found that those teaching had to think through the concepts more completely and they used language and techniques that made sense to their fellow students.

Mary discovered the importance of making the goals and outcomes clear to the students. Initially, she did not always explain at the beginning of lessons why activities were chosen, and felt that the students did not gain as much as they could have. When she began to explain expected outcomes and her reasons for choosing activities, the students responded very positively. They appeared to appreciate being "let in on the secret".

Mary practised and learned much about using assessment effectively in teaching. She said that with experience, she became better able to recognise when students did or did not understand concepts. It also became clear that the students were often far more capable than they first appeared. In summary, Mary said the following:

> *The most important thing I have learned is to be constantly assessing kids as you go through a series of lessons. If you don't, you might think it all makes sense but you get to the end and do an assessment and find they didn't understand something at the beginning, and also to provide feedback.*

Susan

As an extension to getting to know her students well, Susan indicated that she had learned to record anecdotal observations and informal conversations. For example, when a student understood better using visual aids, she made a note of this. She also made notes concerning students' attitudes and the circumstances involved.

> *To wrap up the day to day journal for the Math PBA, I'd like to share one revelation I had recently about teaching math, especially to a large group of students. I think that when you use one resource (such as Quest) for too many consecutive days, the types of activities (although fun and innovative at first) become a little mundane and ordinary. Quest is an amazing resource and I would use it as a primary resource for kids as a first year teacher. However, every few days, I think we should take a Marilyn Burns, or collaborative exploration to rejuvenate the atmosphere of learning. It makes such a difference in the ability and willingness for kids to be self-directed with free reign over their progress, and then it may be time to "bring them back in" for some direct instruction. It's kind of similar or an analogy to what you eat for breakfast. If you eat the same thing too many days in a row, you may burn out on it. You may need to switch up a bagel for a donut or vice versa.*

She also discovered that, given the opportunity, students were capable of making good choices for themselves. For example, when given a choice of playing a math game or doing their workbooks, students chose appropriately according to their needs at that time. In general, Susan observed extremely positive results in terms of attitude and willingness to learn when students were part of the decision-making process.

Elementary Student Growth

Academic Achievement

The most important measurement of teacher effectiveness is impact on students. While achievement is the main focus, students' attitudes and dispositions should also be considered. What follows, is a brief discussion of changes in students during the study.

Positive changes in test scores were evident for all elementary students, as presented in Table 1. The mean increase in test scores was 28 per cent. The standard deviation of 16 was quite high, as increases actually varied from seven per cent up to 55 per cent. This difference, however, did not diminish the results, as in all cases students displayed an increase in test scores.

The relatively high variance was basically an indication of the heterogeneity of the students as well as a result of the small number of students (24) in the study. The real significance of the data is seen in the individual progress made by each of the students. Clearly, the group experience impacted positively on each student's mathematics test achievement.

Table 1. Total Test Scores, Variance and Standard Deviation

Test Categories	Mean	Variance	Standard Deviation
Pretest	51	435	21
Posttest	79	204	14
Change	28	247	16

Affective Growth

While there were many notable improvements in attitudes, the small group experience was not a panacea for change in all students. Given the many years of negativity, it would be unreasonable to expect a total reversal of attitudes in a few months. Complex factors worked together to influence attitudes and behaviour and it was impossible to separate them from one another. Despite an improvement in performance, some students remained unenthusiastic about mathematics activities.

Many students expressed a renewed interest and confidence in doing mathematics. A strong majority of students (92 per cent) displayed a definite improvement in attitude and confidence level. All of the younger students developed enthusiasm for mathematics during the course of the group experience. Bob (TC) wrote in his journal as follows:

> *By the end of our time, it was hard to contain their excitement. Do we have math group today? Some days I got to answer that question five or six times, interesting because there were only four kids in the group.*

Back in the Class

As the study effectively finished when the groups disbanded, limited data was gathered about classroom re-entry. During the final focus group and latter journal entries, TCs made some observations about students' behaviour in the larger classroom groups. In addition, clinical teachers remarked on students' behaviour within the main class groups.

One observation centred on students' participation in classroom activities. Prior to the study most of the students endeavoured to be invisible, never volunteering answers. Following the group experience, numerous instances of student initiative in answering questions and in seeking visible roles were evident.

Students actually offered assistance to others in the class. Furthermore, their overall demeanour was significantly more positive. Many of the students showed a greater willingness to tackle difficult problems and to approach unknown situations.

Preservice Teacher Development

Attitudes, Philosophy and Experience

While the TCs' journeys were varied, the richness of the events made the pilgrimage invaluable for all. Prior to the study, the TCs were full of expectation and eager to learn more about teaching. Entwined with this was a reticence about taking total responsibility for a group of students.

In many ways, attitude and philosophy lay at the heart of the experience. In general, TCs began with instructional perspectives based on an evolving philosophy. Background experiences, university methodology, and classroom observation had influenced their pedagogical beliefs. Patterns emerged from the journals and interviews of a changing emphasis from rote learning and the basics to strong consideration of individual needs with a hands-on approach.

Initially, TCs spoke about the general need for differentiation and generally included visual, auditory, and kinaesthetic needs. Manipulatives, drill and practice, and basic skills were discussed in broad terms. Details were sparse and actual examples rare.

As the study progressed, TCs gained awareness of different factors that affected instructional choice. Bethany began to use modelling after seeing how effective it was. In addition, student choice of strategy encouraged self-advocacy and gave Bethany useful information concerning individual preferences. Finally, Bethany included hands-on activities with clear real world connections. She found that increased student engagement and better understanding resulted from this combination of instructional methods.

Jill worked very reflectively and continually autopsied her lessons. Through her search for the optimum instructional methods, Jill became adamant about the necessity for knowledge of each student's needs, learning preferences, and interests. As part of this process, she discovered her personal preference for hands-on learning and commented that "*math actually made sense*".

Susan noted the influence of student engagement on achieving success. She purposefully selected concrete activities such as games with real world connections. Over time, her students became more invested in mathematics and showed improved understanding.

Without doubt, the most significant shift was towards an emphasis on individualisation. Although some TCs had mentioned individual needs in their first interview, explanations lacked any substance. By completion of the study, TCs used more accurate and specific language in relation to pedagogy. Examples to verify their beliefs were given and it was clear that TCs understood the connections between theoretical pedagogical philosophies and actual students.

Use of Assessment

Assessment was arguably vital to all instruction and was been divided into two categories for this analysis: informal and formal. In addition, a count was made of the number of connections made between assessment and instruction. Table 2 compares assessment choices made by the ELC and IA groups.

Table 2. ELC and IA Assessment Comparison

Group Level	Formal	Informal	Instructional Connection
ELC	(3) 27%	(8) 73%	6
IA	(10) 21%	(37) 79%	16

Informal assessment dominated all groups. TCs used observation, student workbooks, discussion, and questions to determine a myriad of information concerning student understanding and progress. All TCs valued the details gained daily through informal data in their groups. They

spoke positively about the valuable anecdotal information gained from observations, conversations, and student work.

Formal assessment, though used less often, provided solid evidence about students' understanding and was also affirming for the students themselves.

> *Susan wrote: I graded the multiplication tests last night. I am pleased to say that each and every student increased their scores, some very substantially. Jane (her clinical teacher) was right, kids just need to identify the numbers that are hard (usually 7s, 8s,and 9s) and memorise them. Kids are extremely psyched to graph their improvement. I'm so glad that the folders have encouraged them to take ownership and pride in their improvement.*

In the final focus group and interviews, all TCs discussed the importance of assessment. Data analysis revealed that Bob and Bethany were using informal assessment more than they specifically recognised. There seemed to be a tendency to avoid too much discussion of assessment in the lower grades; possibly because of the negative connections associated with over testing. In reality, all TCs (including Bob and Bethany) used multiple forms of assessment, much of which involved informal observations and discussions with their students.

When asked what he had learned during the PBA, Bob observed that assessment can take many different forms that it does not have to be a standard pencil and paper test. He was excited at being able to recognise students' understanding from various informal means:

> *It was exciting to see the light bulbs turn on when they could explain a concept to me. For me, I learned again to let go of the control when the kids were doing things, like cutting wood, and just keeping a watchful eye on them.*

Bethany described the varied forms of assessment she used:

> *I was constantly assessing after I became more comfortable about what I was doing. Sometimes we were doing little hands-on projects and we would switch and use the white board, they would love and do some little problems like number sense. For example, like with the boxes, I wanted to see where they were after we did the number sense thing, let them fill in the boxes with the numbers that would come in next, and they would make up the rules and I was constantly assessing where they have gotten from the last time we had done that…that was informal…also always talking to them observing.*

Mary responded as follows:

> *The most important thing I have learned is to be constantly assessing kids as you go through a series of lessons. If you don't, you might think it all makes sense but you get to the end and do an assessment and find they didn't understand something at the beginning, and also to provide feedback.*

Management

Management issues frequently dominate a preservice teacher's time. The TCs in this study were no exception to this observation. Early journal entries and focus group discussions often centred on behavioural issues. Data indicated that management concerns were more significant at the beginning of the study and became more minor with time.

During the first focus group, doubts about management emerged. Bob spoke about some problems he was experiencing and added

> *I am concentrating on keeping the kids engaged for the 25 minutes that I get them.*

Susan wrote this during late March:

> *I made the mistake of modelling a real life basketball tournament with real life teams, and there are many avid sports fans, and as we ploughed down through the tree diagram and called on certain attentive individuals to determine the winners of matches, it began to sound a lot like a Denver Nuggets game in our classroom. Cheers, screams, paper throwing, etc. Next time, I will definitely use teams that are invented so no one really cares who makes it to the final". She further stated: "It was difficult to get class started because of a high energy level. But after moving a couple of individuals around, things quickly settled down.*

Concern over management issues declined for various reasons. First, over time, student confidence and, consequently, attitudes significantly improved. Second, TCs' knowledge of student needs resulted in more appropriate instructional choices and, consequently, a higher level of engagement. Finally, TCs developed better behaviour management skills and were able to deal with situations more effectively.

Towards the end of the study, TCs were more apt to mention specific strategies used during the day. For example, Susan recorded

> *Generally, kids stayed on task but I had to use proximity and moving around to reinforce this to keep kids moving in a productive direction.*

After becoming more confident with behaviour management, TCs began to focus on other management areas and in particular time management. They soon discovered that activities took longer than planned. In addition, there were frustrations caused by extra school commitments that affected group members.

All TCs agreed that while planning was extremely important, so too was flexibility. Plans were often altered due to last minute responsibilities such as Colorado state-wide test supervision, school activities like community service, and individual interests such as music. In addition, individual needs as diagnosed by students' response to activities and through discussion in the groups, dictated frequent changes in instructional plans.

Implications

Benefits for Schools

Given the increasing demands for accountability in schools, it is important that preservice teachers contribute positively to schools during field experience. The cost of field experience is significant in terms of finance, time, and effort, particularly in a Professional Development School setting. Field experience must be mutually beneficial for the universities and schools.

Results of this study clearly show that preservice teachers can positively influence the achievement and attitudes of elementary school students. A number of these students were at risk for continued low achievement in mathematics. Progress made during the three-month study has the potential to improve students' mathematics performance for years to come.

Multiplication of this individual effect flows through to school test results. Schools unable to show improvement in test scores are threatened with loss of funding and closure. Any program that contributes to improved test scores is given full support in schools.

Although it is imperative that field experience is first and foremost for the development of preservice teachers, benefits to schools and their students cannot be ignored. Preservice teachers have always contributed to schools but supportive data has rarely been collected to provide

substantive evidence. It appears to be wise for teacher education programs to collect data more systematically concerning preservice teacher impact on schools during field experience.

Benefits for Teacher Education

The introduction of teacher standards needs to be viewed positively. Each of the requirements is clearly important and an appropriate skill for a beginning teacher. Firsthand experience with crucial aspects of teaching have allowed TCs to develop a more mature and realistic knowledge of pedagogy.

PBAs have the potential to provide valuable information to teacher educators by giving evidence of proficiency in teacher standards. This holistic approach fulfils the dual roles of both instructing and assessing preservice teachers. Observing performance in an authentic setting gives additional credence to the preservice teachers' knowledge and skills.

As preservice teachers observe first hand the impact of using particular teaching methods, they naturally incorporate the most effective methods into their teaching. It is not necessarily an abandonment of beliefs but rather a change in emphasis or modification of mathematics pedagogical philosophies. In general, preservice teachers conclude that a balanced approach with particular attention to individual needs is the most effective practice.

During the PBA, TCs were able to experiment safely with different aspects of pedagogy. Control of the small groups allowed TCs to implement varied instructional and assessment strategies. Adjustments were continually made according to the effectiveness of the chosen strategies. Having the ability to change goals and instructional methods provided TCs with what might be called a teaching laboratory.

In addition, TCs developed management skills without constant scrutiny of supervision. Differentiating for students based on individual learning and behaviour needs presented TCs with a microcosm of their future classes. As a result, they became more confident and well-prepared for their teaching careers.

Participation in a highly open-ended and extended teaching activity, such as the elementary mathematics performance based assessment (PBA), is quite empowering. The lessons learned about pedagogy through the PBA planted seeds that would continue to grow and develop. The pedagogical cycle of reflection engaged in by the TCs should encourage life long learning and development as teachers.

CONCLUSION

In order to ensure proficiency of standards and to maintain the integrity of teacher education programs, PBAs should be increasingly used. PBAs had both formative and summative assessment components. As a result, teacher educators were able to track performance and give feedback over time.

Although PBAs were quite time-consuming, they could be designed to incorporate multiple standards and experiences for preservice teachers. As responsibility for action is transferred to the preservice teachers, PBAs were an ideal bridge between teacher education and becoming certified teachers.

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