Merging Invitational Theory with Mathematics Education: A Workshop for Teachers

Anita N. Kitchens

Robert G. Wenta

Appalachian State University
Boone, NC, USA

Two faculty members in the department of mathematical sciences at a four-year university, with teacher-education experience, presented a workshop for in-service elementary and middle-school teachers. The intention was to address affective aspects of teaching including: teacher efficacy, learning styles, cognitive dissonance, relaxation, and beliefs as they influence behavior in order to motivate reflection and change. The goal of the workshop was to enhance the professional and personal development of the participants. The outline and implementation of the workshop were consistent with major tenets of Invitational Theory and with NCTM's 2000 Principles and Standards for School Mathematics. The intent of this paper is to suggest that educators reflect upon the teacher education program at their university and offer similar workshops.

Introduction

When it comes to mathematics, it seems to be a societal belief that some people "have it" and some people don't. Ask, at any social gathering, "Has anyone here:

- been embarrassed in math class and, as a result, given up?
- studied hard for a math test and failed with little hope for doing better?
- asked a question in math class and not understood the answer?"

If any of the above have ever happened to you, then you're considered to be a "have not." Socially, mathematics weakness is frequently joked about; but professionally, it is taken seriously. Professionally, teachers are not encouraged to speak up about these past experiences because it may demonstrate weakness. The authors of this piece offered a workshop in which the atmosphere encouraged K-8 teachers to feel welcomed and free to speak up. The workshop title was "Becoming a more powerful teacher: How to think, teach and believe in yourself". The underlying theme, based in cognitive restructuring (Kitchens & Hollar, in press; Meichenbaum, 1977) and perceptual psychology (Combs, Richards & Richards, 1976; Purkey & Schmidt, 1996), is consistent with the writings of many scholars who argue that life experiences are at the formation of beliefs that, in turn, dictate behavior (Bandura, 1986; Combs, 1982, Kitchens, 1995; Knowles, 2004; McEntire & Kitchens, 1984; Meichenbaum, 1977; Pajares, 1994). The topics of discussion included: the effects of beliefs on behavior, learning styles (an often-overlooked factor in mathematics difficulty), teacher efficacy, cognitive dissonance, guided imagery, and relaxation as applied to the personal reflection and self-development related to the participants' teaching. Activities included: an activity to demonstrate

learning-style differences, solving challenging mathematics problems chosen to create anxiety, and a guided imagery exercise preceded by muscle-relaxation.

The intentions of this paper include the following: to demonstrate that the workshop aligned with four dimensions and four assumptions in Purkey's foundation article on invitational theory (1992); to confirm that the ideals of the workshop were in agreement with those presented by the National Council for Teachers of Mathematics (NCTM) in the 2000 *Principles and Standards for School Mathematics (the Standards)*; and to propose a refined version of the workshop for in-service K-8 teachers that gives support for the application of invitational theory to the teaching of mathematics and to the professional development of teachers.

The Underlying Model and Theme of the Workshop

The underlying workshop theme was to make the participants more aware of the effect of their beliefs on behaviors and on their feelings of self-efficacy as teachers. The three components -- experiences, beliefs, and behaviors -- drive a *syndrome* that can be a success syndrome or a failure syndrome. The syndrome involves an acquired *belief,* affirmed as a result of a past *experience*, that dictates a resulting *behavior*. Then the behavior becomes another experience reinforcing the learned belief and generates a reinforced behavior: thus the syndrome. Change may be directed at any one of the three components: offer a positive *experience,* help the person to change a *belief*, or expect a different *behavior* (Kitchens, 1995; Kitchens & Hollar, in press). The workshop was intended to make teachers aware of the syndrome, and aware that beliefs are learned and can be unlearned (Beck, 1976; Combs, 1982; McEntire & Kitchens, 1984). The point was also made that often we think a particular happening (*experience)* causes our reaction of discomfort (*behavior*) but it is our choice of interpretation of that happening (*belief*) that causes the reaction of discomfort (*behavior*) (Kitchens, 1995; Meichenbaum, 1977; Young, 1974).

Since behavior is the only component of the syndrome that is apparent, sharing conversations of beliefs and past experiences was the leaders' way of teaching participants about the syndrome and eliciting change. The syndrome served as a model and becoming aware of the syndrome and considering change was the underlying theme of the workshop. This suggested that changing a behavior in students or in oneself, uncovering the belief and possibly the experience at the formation of that belief, might be the first step. The intent of the workshop was to help participants break their own negative syndrome, if it existed, and to give suggestions and demonstrate how to detect and address it in their own students.

Evidence of Invitational Theory (IT) in the Workshop

Four Dimensions of IT-- Personally Inviting with Oneself and with Others, Professionally Inviting with Oneself and with Others.

At the workshop, the two *personally inviting* dimensions of IT were introduced and expressed through the personal approach of the leaders. Regarding *Personally Inviting with Oneself*, the

leaders encouraged the participants to "…view themselves as able, valuable, responsible…be open to experience …and seek to reinvent and respirit themselves" (Purkey, 2000, 59-62). Part of this encouragement includes getting past images that many students and teachers have of themselves, or ideas that perpetuate negative self-talk in their own minds (Purkey, 2000). Purkey also summarizes the downside of some teachers' perspectives of themselves by noting that "Teachers who say to themselves that they are unable, inadequate, and not responsible are in a poor position to teach anything to anyone" (p. 58). However, Stanley (1992), in her essay, *Inviting Things To Do in the Privacy of Your Own Mind*, said "Being intentionally inviting with ourselves means we know we will not always know 'the answer,' and that we don't have to" (p. 224). This attitude relaxes the pressure to perform and enables students and teachers to learn. In both students and teachers, the act of being *Personally Inviting with Oneself* allows the development of a sense of "unselfconscious confidence" (Purkey, 2000, p. 40). At the workshop, being *Personally Inviting with Others* suggested a tone of camaraderie and mutual respect, which involved listening and being supportive of others. In the words of Purkey, "…without this, invitational theory could not exist" (p. 13). The leaders encouraged the participants to take back to their classrooms the feeling of *invitation* that they experienced in the workshop.

Professionally Inviting with Oneself supported the workshop leaders' encouragement of reflection, introspection, and growth in self-efficacy recognizing the possible need for change. Change could involve a change of beliefs about themselves and/or about their students that could result in a new class atmosphere and presence. A discussion on teacher efficacy reminded participants of the benefits of continued change toward positively believing in oneself. The leaders shared research-supported evidence of the positive results of making such changes (Ross, 1995). The final dimension, *Professionally Inviting with Others*, reinforced the idea of treating people as individuals without labels. "It also requires honesty and the ability to accept less-than-perfect behavior of human beings" (Purkey, 1992, p. 14).

Four Assumptions of IT-- Trust, Respect, Optimism, and Intentionality (Purkey, 1992)

Trust

The workshop leaders' grounding belief was that an atmosphere of *trust* and *respect* was vital. The workshop was to be a safe and supportive place to share covert feelings without judgment (Purkey, 1970). The workshop leaders modeled *trust* (Purkey & Novak, 1996) by sharing (in the first 15 minutes of the workshop) personal beliefs and examples from their lives of how their *beliefs* have initiated *behaviors*. They wanted each person to be introspective and uncover personal beliefs, fears, and concerns, and have the courage to share these feelings with others. This sharing reinforced the underlying theme of addressing the syndrome:

Experiences⇒Beliefs⇒Behaviors.

As feelings were shared, participants were to listen and reflect upon others' reactions to their concerns and beliefs, developing a group-trust.

Respect.

"An indispensable element in any human encounter is shared responsibility based on mutual respect" (Purkey, 1992, p. 8). This puts into action the idea of being P*ersonally Inviting with Others*. The workshop leaders demonstrated *respect* (Purkey & Schmidt, 1996) by sharing the following supportive beliefs about teachers in the school setting:

- Each person is different and brings value and talent to a school.
- No one should feel inferior for any reason, particularly in mathematics, for not possessing the talent of another. Rather, teachers should feel valued and comfortable with self and with the mathematics they know.
- All teachers could benefit from focusing on their strengths while continuing to learn mathematics and growing in an awareness of the affective component in teaching.

Optimism.

"No one can choose a beneficial direction in life without hope that change for the better is possible (Purkey, 1992, p. 9). If you know you can't do something, you won't be able to do it. If you can reverse the "I can't" (an old *belief*), by understanding how the "I can't" came about (the *experience*), then you initiate a new way of thinking, a new *belief*, a hope, an optimistic attitude that then motivates a positive action (a new *behavior).* In the workshop, we discussed that learning styles can give hope that something other than ability could be at the root of a difficulty with mathematics. It was also noted and discussed, however, that this new hope can also be a source of cognitive dissonance in that the new belief may be in opposition to old beliefs. Dissonance is often necessary and even essential for change to occur (Bruning et al., 2004; Festinger, 1957).

Optimism was demonstrated with a sincere belief that all participants could grow in understanding (Purkey & Stanley, 1991) that teaching and learning mathematics is more than a cognitive exercise but an affective one as well. Such optimistic confidence contributes toward the belief that all can grow through self-reflection (Purkey & Schmidt, 1996). The leaders made it clear that all students can do the mathematics required, and if students are not successful, then an investigation into study skills, learning styles, or beliefs should be considered. Bruning et al. (2004) suggest that "…high academic achievement is attainable by virtually all students, provided they develop a belief system that encourages them to use their existing skills and to cultivate more advanced thinking skills" (pp. 160-161).

Intentionality.

The leaders summarized *intentionality* as teachers knowing *what* they're doing, *why* they're doing it, and being selective with *how* they do it. It involves pedagogical decisions as well as affective encounters with students (e.g. dialogue and body language). At the workshop, every presentation and activity (referred to below as "selections") began with a statement of *intentionality.*

Selection #1: Draw the Model: Experience⇒Belief⇒Behavior on blackboard.
Intent #1: Allow leaders to refer to it often and emphasize its importance.

Selection #2: Discuss Teacher Efficacy.

Intent #2: Make teachers aware that their efficacy influences student and teacher performance, self-confidence, and classroom presence.

Selection #3: Discuss learning styles: The Myers-Briggs Type Inventory and left-brain/right-brain theory.
Intent #3: Point out that difficulty in mathematics may be something other than inability. Give students hope for success.

Selection #4: Lead an exercise suggesting left/right-brain preference (Kitchens, 2003).
Intent #4: Experience personal preferences and relate to school learning.
Raise awareness of differences in preferences among the participants.
Suggest that this exercise be done in their own classroom.

Selection #5: Discuss the topics: cognitive dissonance and relaxation.
Intent #5: Realize importance of personal change.

Selection #6: Present six mathematics problems to arouse anxiety, or the awareness of anxiety.
Intent #6: Share fears and beliefs (affective). Share approaches (cognitive).
Feel the anxiety and learn a coping strategy.

Selection #7: Lead guided imagery (with relaxation) exercise.
Intent #7: Provide the opportunity to reduce anxiety and change beliefs.

Selection #8: Ask for written participant feedback and requests.
Intent #8: Monitor participants' ongoing evaluation and level of engagement.

Selection #9: Present mathematics concepts requested by participants.
Intent #9: Meet cognitive needs and discuss dissonance.

Selection #10: Provide comfortable setting with nutritious snacks.
Intent #10: Emphasize the need to take care of self.

Selection #11*:* Discuss: *Notable Failures…* (Larson, 1973).
Intent #11: Exemplify that prominent individuals have been seen as failures by their superiors and yet have become influential in society.

Selection #12: Assign Friday-night homework and lead Saturday-morning discussion.
Intent #12: Encourage reflection and review of presented theory.

Selection #13: Ask "What can you take to your school?" and request written response.
Intent #13: Reflect on specific applications of the workshop in the classroom.

The leaders conducted the workshop in line with the general view of IT that abiding by the four assumptions of *trust, respect, optimism, and intentionality*, would establish an atmosphere that would encourage participants to be the best that they could be (Van Hoose & Strahan, 1992).

Mathematics Education Consistencies with IT

NCTM Principles and Standards consistent with invitational dimensions.

Documents presented by the National Research Council (NRC) and NCTM address the concept of disposition. This affective concern clearly aligns with the dimension *Personally Inviting with Oneself* (Novak & Purkey, 2001; Purkey, 1992; Purkey & Schmidt, 1996; Purkey & Stanley, 1991). "Just as students must develop a productive disposition toward mathematics,…so too must teachers develop a similar productive disposition" (NRC, 2001, p. 384). In the 1991 document, *Professional Standards for Teaching Mathematics*, the NCTM suggested that among the "…persistent obstacles to making significant changes in mathematics teaching and learning in schools…are the beliefs and dispositions that both students and teachers bring to the mathematics classroom" (NCTM, 1989, pp. 1-2). In his foundation text, *Self-concept and School Achievement*, Purkey (1970) states "most investigators agree that the underachieving student sees himself as less capable, less worthy, and less adequate than his more successful peers" (p. 22). Successful teachers work from the first day of class to create an inviting classroom (Moskowitz & Hayman, 1976; Purkey & Stanley, 1991). Furthermore, "(d)isposition refers not simply to attitudes, but to a tendency to think and to act in positive ways" (NCTM, 1991, p. 233), reflecting *optimism, respect* and *intentionality*.

The dimension, *Personally Inviting with Others*, claims the need for all of our students to be welcomed in their classrooms (NCTM, 2000; Purkey & Stanley, 1991). In particular, "equity requires accommodating differences to help everyone learn…" (NCTM, 2000, p. 13). Also, in their pre-*Standards* writings, Purkey and Novak (1988) used phrases, "treating students equitably" and "using terminology that is equally understandable by all" (p. 30), that are similarly stated in the *Standards* (NCTM, 2000).

The *Standards* also reinforce the dimension *Professionally Inviting with Oneself* with the idea that "… (teacher) opportunities to reflect on and refine instructional practices are essential" (NCTM, 2000, p. 19). Combs (1982) goes a step further and suggests that teachers' beliefs about self are key to the teaching process. The National Research Council reiterates this concept by noting that "many successful programs of teacher education and professional development engage teachers in reflection" (NRC, 2001, p. 383).

Collaboration, an essential component of teaching (NCTM, 2000; NRC 2001), aligns with *Professionally Inviting with Others*. It encourages teachers to "examine teaching practices with colleagues" (p. 370), which requires a *trust* and *respect* for fellow teachers. Also in the *Standards*, teachers are encouraged "…to collaborate with their colleagues and to create their own learning opportunities" (p. 373). In the workshop, teachers were encouraged to allow other teachers into what many might normally be considered their private space so that teaching techniques and other ideas could be shared and realized together.

NCTM Principles and Standards consistent with invitational assumptions.

The *Principles and Standards* give clear support for *trust* and *respect.* "The educational environment must be characterized by trust and respect for the teachers and by patience as they work to develop, analyze, and refine their practice" (NCTM, 2000, p. 370). Also, an underlying respect for students is strongly implied in various writings (NCTM, 2000; Purkey, 2006; Purkey & Schmidt, 1996). Goals are stated in other mathematics education writings to encourage our students to "…think of themselves as capable of engaging in independent thinking and of exercising control over their own learning…" (NRC, 2001, p. 146).

Statements are made throughout the *Standards* that echo the vision of *optimism* and *intentionality*. "*Principles and Standards* is provided as a catalyst for the continued improvement of mathematics education" (NCTM, 2000, p. 380). Phrases, including "…high-quality instruction…", "…enhanced preparation for teachers…," and "…increased opportunities…," proclaim an optimistic perspective that permeates IT.

The *intentionality* is also spelled out in several ways. For teachers, "(t)his document is intended to…set forth a comprehensive and coherent set of goals…; guide the development of…; serve as a resource for…; stimulate ideas and ongoing conversation…" (NCTM, 2000, p. 6). In *Standard #2,* entitled "The teacher's role in discourse," the importance of orchestrating discourse with *intentionality* (NCTM, 1991) is demonstrated. Also, in its closing remarks the intentionally optimistic tone of the *Standards* is expressed and encapsulated in the sentiment that the task will be difficult, "…but it can be done…We owe our children nothing less" (NCTM, 2000, p. 380).

The Pilot Workshop

Pilot Description

Two presentations of the same 10-hour workshop were offered entitled "Becoming a more powerful teacher: How to think, teach and believe in yourself." The first, in September of 2004, was offered for K-5 teachers, the second, in January of 2006, for K-8 teachers. The ten hours included four hours on Friday beginning at 5 p.m. and six hours on Saturday beginning at 9 a.m. The workshops were free of charge and participants earned one re-certification credit. The leaders, one female and one male, were members of the mathematical sciences department at a four-year state university in North Carolina. All the participants were women and each time one of the participants was a home-school teacher. The K-5 workshop had 10 participants. The K-8 workshop had 3 participants. The smaller response was possibly due to the workshop being offered later in the school year. The workshop was publicized by the Math and Science Center at the same university.

Pilot Procedure

Following an inviting workshop welcome, opening activities included a set of 10 Likert-scale questions filled out by the participants and a confidentiality agreement, signed by each participant and by the leaders that set the tone for a safe environment hinging on *trust*. Participants were encouraged to speculate, try new things, and be open to new ideas

that they had not previously associated with mathematics teaching. It was made clear that when students and teachers "understand that making mistakes is normal, expected, and understandable, they are in a good position to develop positive self-concepts as learners and teachers" (Purkey, 1978, p. 79). The participants agreed to make the workshop a personal event, making it more than a strictly cognitive presentation of mathematics concepts. Consistent with this agreement, the leaders then shared experiences revealing personal beliefs that illustrated the model (Experience⇒Belief⇒Behavior). The concept of teacher efficacy and its influence on the mathematics classroom experience were presented (Ashton & Webb, 1986; Gibson & Dembo, 1984; Guskey, 1988; Tracs & Gibson, 1986). Learning styles via the Myers-Briggs Personality Type Indicator (Myers & McCaully, 1985) and left-brain/right-brain theory (Edwards, 1999; Taggart & Torrance, 1984) were presented, and learning styles' relevance to understanding mathematics instruction (Kitchens, 2003; Kitchens & Marsh, 2007) was discussed.

Cognitive dissonance was a major topic of discussion. Change toward self-improvement can have the façade of one feeling happy and satisfied. However, when a newly-acquired positive belief is in opposition to a long-held negative belief, the person must make the decision to accept the new belief with its new responsibilities and discard the old. Dissonance is part of the journey (Bruning et al., 2004; Festinger, 1957).

The next handout discussed, "Notable Failures—Humbling Cases for Career Counselors" (Larson, 1973), was a one-page list of several prominent individuals throughout history who had been told by a supervisor or teacher that they were less than mediocre. The list includes: Einstein, Disney, Caruso, Lincoln, Pasteur, and others, and ends with Churchill.

A mathematics word problem, meant to arouse anxiety, was given to the participants to solve. Care was taken with the anxiety-provoking mathematics problem to wait until each participant had time to read the problem and demonstrate understanding with a plan for solving, or reach a point where they did not know what to do. Open-ended questions were asked about how they felt when the problem was presented, and how they felt as they began to work. "Were you excited? Challenged? Frustrated? Anxious?" Each person's experience was shared. This opened the door for heart-felt discussion. Participants also exchanged various problem-solving approaches, verifying the legitimacy of each of the different approaches. At that point, the group solved the problem together.

Relaxation was discussed as being important in thinking and learning, in developing confidence, and in changing beliefs. An exercise of guided imagery, prefaced by progressive muscle relaxation, led the participants to imagine themselves in a small, barred, confining cage unable to move. Then, as the bars crumbled, the symbolism was that their fears, anxieties or negative beliefs would also crumble. Just as without bars, they could feel themselves moving freely without hindrance, without negative beliefs (or whatever they had in their own mind as being represented by the bars), they were free to move and to behave in new ways. If that meant freedom to be

themselves, if that meant freedom to teach confidently, if that meant freedom to be worthy of the name "teacher," then that belief was then planted. Time was taken to let the participants recover by stating at the end of the imagery that they could open their eyes when ready.

After a break, the leaders mentioned that a key word could be used to trigger relaxation when time did not permit a muscle relaxation. Similar to the first problem, a second problem was introduced but worked without the guided-imagery exercise. Instead, a reminder to relax and to take deep breaths was given. Homework for Friday night was to reflect on: moments of challenge to personal beliefs, the relevance of the theories presented, and the importance of learning styles and relaxation in teaching and learning. Participants were also given the opportunity to request specific topics that they considered to be challenging or difficult to teach.

On Saturday morning, discussions about the homework served as a review of the concepts from Friday. One at a time, four more word problems were given to the group to solve, each prefaced by a relaxation exercise. After lunch, the areas of concern, requested by the participants, were acknowledged. Discussion included modeling the teaching of the concept (signed numbers, word problems, ratio and proportion, and geometric problems) modeling the use of manipulatives as teaching aids, and linking each concept to the affective discussions of Friday. Each workshop ended with a post-workshop set of 10 questions and one open-ended question asking participants what they intended to do in their classrooms with the ideas from the workshop.

Pilot Evaluation

Three-and-a-half months after the second workshop, an independent evaluator telephoned each participant in the second workshop and asked each of them seven Likert-style questions (on a scale of 1 to 5), and six other open-ended questions. A summary of the results were as follows: Participants were unanimous in the feeling of acceptance. They felt free to express their feelings, doubts, beliefs and concerns openly with the leaders and other participants. Participants' anxiety, from the mathematics problems during the workshop, was lessened by relaxation exercises and the support of the workshop leaders. Participants benefited from discovering how their own beliefs, not the mathematics, caused their anxiety. When asked if they had used any of the workshop ideas in the classroom in the last 3 months, all said "yes" and one responded, "yes, everyday." From the reactions during the workshop and the reactions during this evaluation, the workshop leaders concluded that the participants could see the relevance of the affective component in learning. The workshop also helped participants to reflect on their teaching and experience growth.

The workshop leaders presented an abbreviated workshop, 90 minutes in length, entitled "Become a More Powerful Teacher: How to Think, Teach, and Believe in Yourself" at the National Council of Teachers of Mathematics (NCTM) conference in Pasadena, CA, April 8, 2005 and at the North Carolina Council for Teachers of Mathematics (NCCTM) conference, in Greensboro, NC, October 13, 2005.

Recommendations for Further Study: The Proposed Workshop

"…(A)n educator's professional development does not end at the initial preservice training" (Steyn, 2006, p. 18). Continued growth through awareness, reflection and discourse, as implemented in these pilot workshops, is valuable for the professional development of inservice teachers. Suggestions for such a workshop would include the following additions to the pilot:

- Introduce invitational theory.
- Study how to evaluate the workshop, statistically.
- Target all teachers. Originally, the intent of the workshop leaders was to help teachers who did not feel comfortable teaching mathematics. However, all teachers could benefit from self-reflection, theoretical presentations, and interaction.

One consideration for those offering a similar workshop is to become familiar with invitational theory. If discussing the affective component in teaching and learning is new and this unfamiliarity causes hesitation or concern for the workshop leaders, they can still offer the workshop and grow with the participants through reflective conversation. Research, reflection, and conversation with colleagues (on beliefs, teacher efficacy, learning styles, cognitive dissonance, and relaxation, as they relate to the mathematical reform strategies of NCTM) would contribute to the ongoing development of the workshop leaders.

Conclusions

Teaching mathematical concepts involves much more than a cognitive focus on understanding the mathematics and presenting it to a class. Equally important is a focus on the personal growth of students and a focus on the personal and professional development of teachers. If I know and feel that I am accepted, I can relax and improve in my efforts to grow as a student or teacher. Coupled with an understanding of the relevance of beliefs, invitational theory is paramount in teacher education. Choosing to attend workshops as proposed, without any stigma of appearing weak in mathematics, should be promoted for all teachers on a regular basis by local school systems. The ideals of invitational theory may provide the balance needed for teachers to have the confidence to discuss with other teachers the affective component in teaching in harmony with the implementation of the *Standards* in their classroom.

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Dr. Anita Narvarte Kitchens, is a professor in the Department of Mathematical Sciences at Appalachian State University in Boone, NC and Dr. Robert G. Wenta is an assistant professor in that department. Correspondence about this article may be sent to kitchnsan@appstate.edu