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New Curriculum: Frustration or Realization?

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The first day of school is rapidly approaching and the calm, stress-free life of summer is fading away. As the time draws near when voices fill the hallways signifying the start of a new school year, excitement and anxiety start to creep into the psyche. But this is not an ordinary start. This customary excitement and anxiety quickly turn into fear and pressure because this year will be different. This year is the first year the new mathematics curriculum is implemented in the ninth grade. Even after the training provided by the state and school district, many teachers, including me, feel overwhelmed by the expectations the new school year and the new curriculum bring.

The aforementioned is a brief description of how I felt at the start of the 2008–2009 academic year when the new, state-mandated, high school mathematics curriculum, the Georgia Performance Standards[1] (GPS), was to be implemented. Even after attending almost all the professional development sessions supplied by the state and school district and learning about the task-based curriculum while obtaining my Master's degree in secondary mathematics education, I still had a very uneasy feeling in my stomach. I thought the feeling would subside, but as my fellow colleagues and I tried to implement the new curriculum, we were faced with many challenges and questions. This uneasiness would turn into a long trek of reevaluating my pedagogy to better understand my students and their mathematical experiences as well as combating traditional norms set by society with

[1] The mathematics curriculum mandated by the Georgia Performance Standards is an integrated curriculum in which the content, knowledge, and skills introduced in the traditional courses of algebra, geometry, trigonometry, and data analysis and statistics are developed throughout an integrated mathematics sequence of courses: Math I, Math II, Math III, and Math IV. Each course in the sequence uses mathematical tasks to model "real-world" scenarios in an attempt to connect mathematics to students' lives; the tasks increase in mathematical complexity as students progress through the course sequence. On the whole, the curriculum stresses student-centered, collaborative groupwork where the teacher is a facilitator in the mathematics classroom as students, individually and collectively, work through the mathematical tasks. For complete information regarding the Georgia Performance Standards, see www.georgiastandards.org.

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with respect to the teaching and learning of mathematics. Here, in this public story, I describe some of the frustrations and realizations I have come across while implementing the Georgia Performance Standards high school mathematics curriculum.

Reflecting on Teaching

The fear and anxiety subsided as I began teaching the new curriculum, but the challenges of change could be heard loud and clear. Reflection became my mantra because it was something I had to do constantly under the weight of expectations from the state and school district. Going from a "traditional" mathematics classroom where the teacher was the presenter of knowledge (Hiebert, 2003) to a standards-based, student-centered classroom was exciting—and scary. Given that I had to teach differently, I developed new strategies to use in my classroom. Using the implications of existentialism, I came to the realization that, to change my pedagogy, I must change myself as a teacher (Feldman, 2003). I must let go of a quiet, inactive classroom where each student is working individually and move toward a noisy, active classroom where students' mathematical discussions and debates are occurring. Mathematics exploration replaced mathematics demonstration. That is, "teaching" was no longer providing numerous demonstrations of similar mathematics problems with little, if any, mathematical understanding from the students. It has been a struggle because I was taught mathematics in the traditional way, but I have learned much from my students with respect to their mathematical abilities and frustrations in my attempts to provide a different learning environment. Not every student learns mathematics the same way, so it is important to diversify teaching strategies to promote understanding and yearning for knowledge.

As I engaged in a self-study or self-reflection, the importance of aligning my pedagogical philosophy with actions (i.e., teaching strategies) in my classroom became apparent (Loughran, 2007). When one becomes more familiar with oneself and develops a multifaceted philosophy of teaching or pedagogy, one is better able to develop an understanding of others (Ellis & Bochner, 2000). In the discussion that follows, I highlight aspects of my attempt to reflect upon my developing pedagogy as well as the growth I have encountered while teaching the GPS curriculum. Learning to adapt strategies to meet the needs of my students, as well as myself, has been an eye-opening experience.

Frustration: Combating Traditional Norms

It has been a long, hard struggle over the past 2 years to understand the framework of the GPS curriculum and to implement it in its intended, non-

traditional way. How can teachers be successful in changing their pedagogical style in a classroom where a standards-based approach is expected when there is so much resistance from students, parents, and even teachers? This resistance has been the most frustrating part of implementing the GPS curriculum and subsequent pedagogical strategies.

All students have the right to learn mathematics, and it is the teachers' job to differentiate their strategies in acknowledgement of this right. Promoting student voice and democracy (Dewey, 1937/1987) regarding student learning in our schools can open doors to possibilities for all children. The educational system in the United States, I fear, has gotten away from promoting democracy in the schools by forcing students to become robots who regurgitate material for the teacher and perform on standardized tests. I believe that the GPS curriculum, however, is trying to give each student a voice in the mathematics classroom. As the GPS and subsequent classroom practices are an unfamiliar approach to mathematics education, I have to constantly inform parents about the changing curriculum and explain the reasons behind the change (Kilpatrick, 1992). Change is difficult for everyone to endure, but it is necessary to provide a more thought-provoking curriculum and create better problem-solvers to fill the needs in our society (Brownell, 1947/2004).

In the 2 years that I have taught the GPS curriculum, I have found that many parents and some teachers were not informed of the motives behind the new curriculum; thus, it has been a struggle to adjust their way of thinking about how mathematics might be taught and learned in schools. Parents, and too many teachers, are often so consumed by the traditional style of teacher lecture followed by skills practice that they do not see the potential for students to become great thinkers of mathematics while coming to a deeper understanding of the discipline (Sfard, 2003) through a more active, engaged approach to mathematics teaching and learning. We have to transfer the responsibility for learning from the teacher to the student because they are creators of their own knowledge (Steffe & Kieren, 1994/2004). All teachers can really do is plant the seed and watch it grow.

I am passionate about allowing students to carve out their own space to develop their mathematical ideas and come to a deeper understanding of the discipline. But, I am not perfect. I still fall into the rut of lecturing and giving examples even when I see students "spacing out" and not paying attention. I know first-hand the struggles that a teacher must endure to let students work on their own while, at the same time, making sure they are being productive. It takes great effort to find the balance of student-centered learning with 30 or more students each bringing their own experience to the table (Lerman, 2001).

I know parents, students, and fellow teachers sense my enthusiasm when I discuss the GPS curriculum, but they still want mathematics to be taught the traditional way because that is how they learned it in schools. Where are the text-

books? Where are the examples? Where are the practice problems? are just some of the persistent questions and reminders to me that changing teaching strategies will be a long, difficult journey (Hiebert, 2003). I believe, however, that parents and teachers can all come together to look past the obstacles to promote mathematical and democratic growth for all students.

Realization: Changing Teaching Strategies

In the past, I prided myself in finding ways to connect mathematics to my students' daily lives and get them excited about mathematics. One way was to develop "catchy phrases" for my students to remember certain mathematical properties. For instance, regarding the property of negative exponents, I taught my students to "drop it like it's hot." This phrase followed students to their next mathematics class but, unfortunately, most did not understand the mathematics behind the phrase. Similarly, I believe the GPS curriculum attempts to connect mathematics to the "real world," but I do not think it effectively connects to the students' real world. That is to say, the GPS curriculum, I believe, unintentionally makes the same mistake that I have made over the past 7 years in my teaching: thinking that my world is the same as the students' world. Although promising, the GPS curriculum has still left me with troubling questions: Why do students need to learn the topics "covered" in the curriculum? Where do basic life skills such as balancing a checkbook, saving, and purchasing a home come into play? Where does critical mathematics literacy (Gutstein, 2006) fit in? I know that I cannot change the Eurocentric perspective which has dominated mathematical discourse for the past 200 years (Ernest, 2009), but how can I change my teaching strategies to encourage my students to become critical, independent, life-long learners interested in mathematics while being forced to perform on standardized tests?

One important aspect of answering this question for me has been to gain students' trust by connecting with them on a human level (Gutstein, 2006). I now open up to my students and let them know that I am more than just their teacher; I have my own struggles and triumphs and do not just sit at home grading papers. Making visible my human side has been important for my students to see, as they begin to relate to me more and develop a level of respect for me both inside and outside the classroom. This visible human side has assisted in the development of a reputation of respect and caring amongst students and parents—I show them respect and let them know that I care. Nevertheless, it takes more than respect and caring to create a positive atmosphere where students want to learn mathematics and excel to their utmost potential; it also takes a curriculum and a teaching atmosphere that intrigues the students and makes them want to learn more.

Over the past 7 years of teaching, 2 of which focused on implementing the GPS curriculum, I have found that students "feel that mathematics is cold, hard, uncaring, impersonal, rule-driven, fixed and stereotypically masculine" (Ernest, 2004, Linking Philosophies of Mathematics and Mathematical Practice, ¶ 12)—not to mention, useless in today's society. Despite my good rapport with students and my endless efforts to make mathematics "fun," I often miss the most important aspect of good mathematics teaching: utility. I have struggled only to find that utility is absent in the GPS curriculum even with its real-world tasks because those tasks are not part of the students' world. They are interested in technology, sports, social activities, and so forth, not about "Paula and her Peaches" or "Pete's Parking Deck Dilemma" (two of the GPS mathematical tasks). I have tried to adapt my teaching style along with the new curriculum to help students see the power mathematics has to offer, but I usually fall short of gaining their enthusiasm because the material does not intrigue them. In the future, I plan to adjust the tasks to scenarios the students might have an interest in, but for now, I feel that I need to go through the 4-year curriculum once to have an overview of what is expected of my students and me.

Nevertheless, I have changed the way I introduce the material over the past 2 years through reflection on my teaching, my students' learning, and the curriculum in general. It is always a new day in my class, even though there are routines. I require explanations on all assignments and assessments in order for students to develop their mathematical understanding and communication. Depending upon the content to be taught, I shift between teacher centered and student centered, group discussion and class discussion, individual assessment and group assessment. I try to balance teaching the intended content and getting my students engaged in their own learning, which is not easy. I stress to my students that we are going to try multiple ways to get the knowledge and skills across and that their input is invaluable. Believe me, they are not hesitant to let me know if they do not like doing something a certain way.

With these changes comes more student confidence (Frankenstein, 2005). They feel comfortable talking about ideas in class and discussing different problem-solving strategies. I believe they are developing a deeper understanding of the mathematics behind the tasks and are able to make connections amongst some concepts. My students of the past 2 years are the first group to go through the GPS curriculum, and the process has been a slow one, probably too slow for their parents. Parents are frustrated with the lack of multiple homework problems every night along with the absence of textbooks containing examples that explain procedures. Parents often feel helpless in assisting their child because the structure of the curriculum is so different from the one they knew. I am hopeful that, over time, the frustration will subside and the mathematical abilities of the students will soar.

Indeed through time, I have found using multiple strategies of teaching and assessing not only allows students freedom to express themselves but also various ways to do so. Parents, too, seem to value the idea of collaborative groupwork as long as their child's grade is not affected by someone else's performance, or lack thereof. Overall, parents and students appear to understand the importance of collaboration in gaining an understanding of mathematics. Collaboration has also been a tool to address the different learning styles of the students in my classroom and has been a positive component of the GPS curriculum overall.

Realization: Growth of Students

I have decided to go through all 4 years of the GPS curriculum to see how the state has sequenced the mathematics content. My students understand that I am in the trenches and will experience the new curriculum with them. (I am attempting to loop through all 4 years of the curriculum with the same students.) Over the past 2 years, the changes I have witnessed in my students' reaction toward mathematics have been encouraging. At the beginning of their freshman year, they were typical rowdy teenagers who wanted to be anywhere other than a mathematics classroom. They complained about doing tasks and constantly mimicked the sentiments of their parents that this "new way" of doing mathematics did not make sense. They gave up frequently and it was hard to keep them focused and excited. I grew extremely frustrated during that first year, and my discussions during lunch in the faculty workroom were very negative. I found myself putting so much time and effort into something that I was not getting much out of with respect to student learning and motivation. I complained about the students and their lack of mathematical ability. I found comfort in my colleagues because they were experiencing the same lack of motivation, basic skills, and work ethic from students that I was.

As hard as it was that first year (i.e., Math I), I did see change. Toward the end of their freshman year, many students stopped complaining (all the time) about working tasks. They began to communicate their thought processes and ask thoughtful questions. Students started to put the pieces together and inquired about more advanced mathematical ideas. I was proud of my freshmen when they argued for a particular approach to solve a problem, only to determine that there were multiple approaches. They stopped fighting me when I placed them in groups, and they learned how to collaborate with their peers instead of always asking me to do the mathematics.

During my second year, the students' sophomore year (i.e., Math II), they knew what to expect from me at the very beginning. We covered some difficult topics and made connections to their previous learning in Math I. I found that they reminded each other to explain their reasoning. They spent more time on tasks

instead of giving up as soon as it was given to them. All in all, students took on challenges with more ease. Now this change could be because they were a year older and a little wiser regarding the new curriculum, but, even if this was the case, they got away from the traditional "drill and kill" notion that has plagued mathematics for too long. It was exciting to hear them work on a mathematical task together and use the language of mathematics in their discussions. It was also interesting to see how students were learning to negotiate their positions and perspectives during collaborative groupwork while still keeping their beliefs intact.

Maintaining or Breaking the Status Quo

It has been a difficult road to conquer in trying to implement a new method of mathematics teaching and learning with all the resistance from students, parents, and teachers, but I have found it rewarding for student growth, confidence, and understanding. I have invested much time and effort into this new method, and I believe my students are responding well because they are able to tackle more advanced problems and ideas for longer periods of time. In the classroom, "if students are not able to transform their lived experiences into knowledge and to use the already acquired knowledge as a process to unveil new knowledge, they will never be able to participate rigorously in a dialogue as a process of learning and knowing" (Macedo, 2000, p. 19). Even though currently the tasks do not address the students' interests per se, I believe I can adapt them in the future to garner students' curiosity while teaching the intended mathematics content. I have had to learn to negotiate amongst the varying views of students and parents as well as combat the traditional stance taken by many of my colleagues.

Nonetheless, I labor to negotiate the GPS curriculum because I believe education can either persist in a cyclical pattern of maintaining the status quo or it can break the pattern and transform the world (Shaull, 1970/2000). It is up to teachers, students, parents, and other stakeholders to decide how the future will look with respect to mathematics education. I feel this new approach to mathematics will give the students a voice and a better understanding of the world in which they live. It will take some time to develop, but in the long run, I hope and trust, students will become active in their communities. They will not conform to the traditional views of education that left so many behind; they will act as agents of change for the new generation of students behind them. The self-reflection I have encountered along this journey has strengthened my understanding of mathematics as well as diversified my teaching strategies. My students, parents, colleagues, and I have learned much from each other during this time of change, and hopefully it will benefit us all.

References

Brownell, W. A. (2004). The place of meaning in the teaching of arithmetic. In T. P. Carpenter, J. A. Dossey, & J. L. Koehler (Eds.), *Classics in mathematics education research* (pp. 8–14). Reston, VA: The National Council of Teachers of Mathematics. (Original work published 1947)

Dewey, J. (1987). Education and social change. In J. A. Boydston (Ed.), *John Dewey: The later works*, 1925–1953 (Vol. 11, pp. 408–415). Carbondale, IL: Southern Illinois University Press. (Original work published 1937)

Ellis, C., & Bochner, A. P. (2000). Autoethnography, personal narrative, reflexivity: Researcher as subject. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of Qualitative Research* (pp. 733–768). Thousand Oakes, CA: Sage.

Ernest, P. (2004). What is the philosophy of mathematics education? *Philosophy of Mathematics Education Journal, 18*. Retrieved from http://people.exeter.ac.uk/PErnest/pome18/PhoM_%20for_ICME_04.htm.

Ernest, P. (2009). The philosophy of mathematics, values, and Keralese mathematics. In P. Ernest, B. Greer, & B. Sriraman (Eds.), *Critical issues in mathematics education* (pp. 189–204). Charlotte, NC: Information Age.

Feldman, A. (2003). Validity and quality in self-study. *Educational Researcher*, 32(3), 26–28.

Frankenstein, M. (2005). Goals for a criticalmathematical literacy curriculum. In E. Gutstein & B. Peterson (Eds.), *Rethinking mathematics: Teaching social justice by the numbers* (pp. 19–28). Milwaukee, WI: Rethinking Schools.

Gutstein, E. (2006). *Reading and writing the world with mathematics: Toward a pedagogy for social justice*. New York: Routledge.

Hiebert, J. (2003). What research says about the NCTM standards. In J. Kilpatrick, W. G. Martin, & D. Schifter (Eds.), *A research companion to Principles and Standards for School Mathematics* (pp. 5–23). Reston, VA: The National Council of Teachers of Mathematics.

Kilpatrick, J. (1992). A history of research in mathematics education. In D. A. Grouws (Ed.), *Handbook of research on mathematics teaching and learning* (pp. 3–38). New York: Macmilliam.

Lerman, S. (2001). A cultural/discursive psychology for mathematics teaching and learning. In B. Atweh, H. Forgasz, & B. Nebres (Eds.), *Sociocultural research on mathematics education: An international perspective* (pp. 3–17). Mahwah, NJ: Erlbaum.

Loughran, J. (2007). Researching teacher education practices: Responding to the challenges, demands, and expectations of self-study. *Journal of Teacher Education*, 58, 12–20.

Macedo, D. (2000). Introduction to the anniversary edition. In P. Freire, *Pedagogy of the oppressed* (pp. 11–28). New York: Continnuum.

Sfard, A. (2003). Balancing the unbalanceable: The NCTM standards in light of theories of learning mathematics. In J. Kilpatrick, W. G. Martin, & D. Schifter (Eds.), *A research companion to Principles and Standards for School Mathematics* (pp. 353–392). Reston, VA: The National Council of Teachers of Mathematics.

Shaull, R. (2000). Forward. In P. Freire, *Pedagogy of the oppressed* (pp. 29–34). New York: Continnuum. (Original work published 1970)

Steffe, L., & Kieren, T. (2004). Radical constructivism and mathematics education. In T. P. Carpenter, J. A. Dossey, & J. L. Koehler (Eds.), *Classics in mathematics education research* (pp. 68–82). Reston, VA: The National Council of Teachers of Mathematics. (Original work published 1994)