PLAN B: IF I KNEW THEN WHAT I KNOW NOW

Danny Bernard Martin
Aleksandra Mironchuk
University of Illinois at Chicago
Chicago, IL 60612

First Year, First Day, First Class

Vignette: It was the first period of the first day of my first job as a teacher. I was assigned to teach a geometry class to tenth graders. Using my teacher education coursework and student teaching experiences as a guide, I had planned a short introduction, a textbook scavenger hunt, and a jigsaw activity for going over my syllabus.

After a couple of minutes taking care of routine business, I continued the class with some directions for the scavenger hunt and I let students work on the activity. I then walked around to check on students' progress.

Just a moment later, I heard a student call out "Yo teach!" When I turned around, I saw that one of my students was shaking uncontrollably. I froze for a moment. I thought that he might be pulling my leg, but the shaking did not stop. In a panic, I pointed to the door with the hope that one of my students would understand my signal for "Get security!" The girl closest to the door ran out and came back with security. My entire class and I were directed to the lunchroom; but since it was my first day, I did not know where it was located and one of my students had to show me.

Once we got to the lunchroom I sank down on the bench, feeling lost and deflated. The same girl that found the security officer came over and told me that I needed to sign my name next to my class on each student's course schedule. I did that and quickly went back to the bench and tried to gather myself.

I realized that I had seven more periods to go. One of the teachers later told me that upon seeing the look on my face coming out of my classroom, he said to the colleague standing next to him, "I give her until February."

Plans Never Go as Planned

The vignette presented above is a real story. It happened to the second author in her first year of teaching on her very first day and in her very first class. There is an old but familiar saying that serves to remind us: plans never go as planned. We invoke this saying in the context of thinking about empowering and supporting new teachers, particularly in urban settings.

Aleks is a practicing high school mathematics teacher with five years experience and an emerging scholar in mathematics education. Danny is a teacher educator and mathematics education scholar who has taught mathematics for 22 years to university, community college, and high school students. We both work in Chicago, the third largest city and school system in the nation. We share a concern with recruiting and helping to prepare teachers who are knowledgeable about mathematics content, who know and genuinely care about the students they teach, and who engage in culturally relevant pedagogy as an important component of preparing students for lifelong learning, critical citizenship, and meaningful participation in the larger opportunity structure (Greer, Mukhopadhay, Powell, & Nelson-Barber, 2009; Ladson-Billings, 1994; Martin, 2007).

Reflecting on our efforts to mentor new teachers, the two of us are well aware of the recent attention focused on preparing "highly qualified" teachers and subsequent efforts by researchers, policy makers, teacher educators, and administrators to specify the right combination of knowledge and experiences that will help prepare teachers to raise student achievement (i.e., test scores), if not to achieve many of the goals we outlined above (Conference Board of the Mathematical Sciences, 2001; Hill, Sleep, Lewis, & Ball, 2007). Methods courses in teacher education programs, for example, often stress the importance of planning and preparation. However, as many veteran teachers know, there is no real substitute for experience and ongoing professional development; learning for a mathematics teacher is a continuous endeavor. While university coursework is helpful, the preparation for planning discussed in this coursework is often in relation to idealized situations and scenarios. It is quite rare when what is planned for and what actually happens in the mathematics classroom align. Nevertheless, we do suggest that new teachers develop principled plans, visions, and goals—not scripts—for teaching and learning. Ad-hoc and reactive teaching, without principle and purpose, is bound to be lacking in depth, meaning, and effectiveness. Moreover, principled planning in relation to stifling policy mandates and shallow learning goals is also likely to be ineffective.

We suggest, as the vignette above would require, that new teachers begin, as early as possible, to develop what we call 'Plan B' ability. By this, we mean the capacity to reflect on and adapt to unexpected situations in the classroom by developing and implanting new, real-time action plans to address emergent goals (Zimmerlin & Nelson, 2000). A carefully planned, but inflexible and scripted, lesson can easily run off track and pose challenges for new teachers, especially when these challenges do not align with their lesson images—that is, their visions of what will occur in the classroom, how the lesson will unfold, and their expectations about student interactions and responses (Zimmerlin & Nelson, 2000). If these lesson images are cognizant of the realities and complexities of teaching and learning, teachers are better positioned to invoke new action plans and flexibility in their teaching.

Zimmerlin and Nelson's (2000) analysis of a beginning teacher engaging in a traditional lesson is a helpful example to new teachers. Briefly, they discussed a segment of Nelson's teaching that occurred during a lesson on exponents which took place in an urban, Algebra 1 classroom. This was the first teaching lesson for which Nelson had full responsibility as a student teacher. The students in the class had discussed examples such as $\frac{4^5}{4^3}$ and used the cancellation law to reason that the expression simplified to 4^2. Other examples included $\frac{m^5}{m^3}$ and $\frac{x^6}{x^3}$. The students came to discover the generalization $\frac{a^m}{a^n} = a^{m-n}$ (a≠0). However, the lesson veered away from Nelson's lesson image when students were given the problem, $\frac{x^5}{x^5}$. Students responded with many answers including x and 0, not the answer of 1 that Nelson had expected. Zimmerlin and Nelson's analysis details how Nelson was able to adapt to the demands of the unexpected turns during that episode.

In both examples presented above, Aleks' first day of teaching and Mark Nelson's student teaching experience, the idealized plans and lesson images developed by both teachers did not manifest themselves and, when they did, were challenged by the realities of classroom life. Flexibly adapting is a skill in itself and, in our view, is a function of several factors, including: (1) a teacher's confidence in, and depth of understanding for, their content knowledge, which allows them to make well-reasoned pedagogical decisions in response to unanticipated classroom occurrences; (2) a teacher's ability to build a community of learners who trust the adjustments a teacher needs to make in response to unexpected twists and turns in the classroom; (3) a teacher's ability to assess, individually and collectively, where students are in the learning process, from moment to moment; and (4) a teacher's willingness to reflect, record, and revise their lesson plans and goals. Below, we make suggestions in each of these areas as a way to support and empower new teachers.

Develop Confidence in Content Knowledge

Confidence in content knowledge comes after one has taught the content again and again. In high school, Aleks learned that dividing by zero was "illegal" in math; but it was not until she became a teacher and had to teach this concept to her students that she developed the understanding of why it is true. Following in the steps of her own teacher, who simply taught this as rule without explaining, she could just as easily have told her own students that they are not allowed to divide by zero because it is a rule. But part of developing a Plan B is being ready for those moments when students ask why about certain mathematical concepts and having confidence in your knowledge of mathematics that allows new teachers to address the why question.

In the example from Zimmerlin and Nelson (2000), it was brought to light that Nelson's lesson image included a series of nested action plans for events that were to unfold in the lesson. Although Nelson anticipated that:

> students would have trouble with this problem, and that there would not be student consensus on a correct answer, his next action would not be to confirm the correct answer or procedure, but rather, to decompose the problem with the class in a fashion similar to: $\frac{4^5}{4^5}$, $\frac{x^5}{x^5} = \frac{(x \cdot x \cdot x \cdot x \cdot x)}{(x \cdot x \cdot x \cdot x \cdot x)} = 1$.
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> The third part of his action plan would be to demonstrate that canceling would yield 1, thus $x^0 = 1$, and since this process could not be done for zero in the denominator (division by zero), 0^0 would be undefined. Thus, Nelson had a complex set of nested action plans that depended in part on other aspects of his lesson image, including expected student responses.... The confusion over the result of canceling in the middle of the planned discussion ... was unexpected and necessitated the creation of an "on-the-fly" action plan. On the spot, Nelson developed the plan to connect $\frac{5}{5} = 1$ with $\frac{(x \cdot x \cdot x \cdot x \cdot x)}{(x \cdot x \cdot x \cdot x \cdot x)} = 1$ .... After doing all he could to show $\frac{5}{5} = 1$, Nelson returned the discussion to [the original] problem..., showing that $x^0 = 1$.... This new, on-the-fly action plan was appended to his pre-determined action plan ... to show $x^0 = 1$. Interestingly, while this on-the-fly action plan did have its own local goal, and implementing it represents a goal shift, this goal clearly fit with his existing goal of showing that $\frac{(x \cdot x \cdot x \cdot x \cdot x)}{(x \cdot x \cdot x \cdot x \cdot x)} = 1$ and ultimately that $x^0 = 1$. Thus, while Nelson's lesson image had proved insufficient and his pre-determined action plans proved inadequate to achieve his goals, his goals remained largely intact. He supplemented his set of goals

with an emergent goal to deal with a developing situation, and thus, largely acted in a manner that was consistent with his pre-determined goals for the lesson. (Zimmerlin & Nelson, 2000, pp. 267-275)

As further stated by Zimmerlin and Nelson, "It is our contention that teachers plan down to the level of detail at which they feel they can comfortably manage improvisationally using established interactional skills and routines" (p. 267). In our view, these action plans and the ability to "manage improvisationally" also reflect Nelson's confidence in his content knowledge. Without such confidence, new teachers may be unable to develop "on-the-fly," Plan B action plans.

Building a Community of Learners

Zimmerlin and Nelson (2000) also noted that Nelson "carried out his intentions using his interactional skills and using his knowledge of the class, including that of individual students. He was sensitive to the context and history of the class in making choices during individual interactions" (p. 272). In other words, Nelson was attempting to do what we believe all new mathematics teachers should do: establish and build on knowledge of the learning community. In building a community of learners, issues of equity and identity emerge as highly important. In short, teachers, whatever their level of content knowledge, cannot teach students that they have not taken the time to get to know. For us, getting to know students entails knowing their academic, mathematics, and personal identities and understanding how those identities have developed and negotiated (Martin, 2000, 2009). It also entails understanding the teacher's role in shaping those identities. How does a teacher's orchestration of teaching and learning serve to position individual students in the classroom mathematics community? Do those positionings reinforce or challenge damaging stereotypes about who can and cannot do mathematics? How can teachers teach for positive mathematics identity development in addition to skills development? These questions imply that new teachers and veterans alike should not view teaching as a neutral endeavor, done in isolation of the race, class, gender identities of their students and the power relations around these identities that exist in the larger world and that are reproduced in the mathematics classroom.

When Aleks went back to her classroom on day two she had to start from scratch. She had to begin building a community in the classroom. This proved to be difficult; students did not want to share their responses because of fears of being ridiculed and they constantly questioned their work, even if the answers they got were correct. Although Aleks did not have her "overarching" goals clearly stated the way Nelson did, she quickly realized that her content goals could not be achieved unless students were willing to share their thinking with the rest of the class without fear or without taking pride in their method of solving a problem. She developed an incentive system that encouraged participation. When students volunteered, they could turn in sheets of paper with "1 point" written on them. This encouraged students that would normally want to ridicule others to participate themselves because they, too, wanted to be rewarded. Once the culture of sharing answers with the class was established she was able to take away the sheets of paper. Secondly, she made sure that every lesson she taught included the question, "Does anyone have a different way of solving this?" Not only did this technique make students feel proud of their work, but it also helped students learn, as one of the new ways was sometimes more easily understood by the students than her own.

Learn to Assess, Individually and Collectively

While most teachers know which methods of assessments are not very helpful (i.e., asking "Does everyone understand?"), few probably seek to self-assess or have someone else assess them. Using a videotape to record their teaching, or asking a colleague to come in and write down every question a teacher asks of their students are two ways that new teachers can come to understand their teaching. Are all of the questions posed yes or no or multiple choice? Is there a tendency to inflect slightly on the correct answer? Are incorrect answers dismissed with a disapproving look, without realizing it? Analyzing their own questioning technique will help new teachers refocus their questions so that the answers they receive allow them to see whether students are grasping the concepts they are teaching.

In seeking to assess students, Aleks, for example, always has a "show your work" section on all her quizzes and exams and works to establish a classroom norm where it is expected that students do not simply write down answers but are also responsible for explaining how they got the answer. Students are encouraged to show more and more of their thinking as the expected way that mathematics is done in her classroom. In showing their work, they are responsible to Aleks, as the teacher, to themselves, and to their classmates. In the context of these norms, Aleks is able to see how her students think about the problem and arrive at the answer. She can then quickly address misunderstandings individually, instead of pondering how each student arrived at their incorrect answer. By discussing the various ways that individual students approach a problem, a space is created for the whole class to ask questions, clarify, and propose alternative ways to solve a given problem.

Reflect, Record, Revise

As we stated earlier, establishing a classroom community and knowing (and appreciating) the identities of the students who make up that community is a must for successful planning and improvisation in teaching. Relationships need to be established so that if a lesson is not going as planned and the teacher wants to shift gears, the students trust the teacher and are willing to go along with the new plan and direction. The teacher and the students must have enough confidence in the teacher's content knowledge that they believe mathematical dilemmas can be addressed in ways that lessen student frustration. Yet, the ability to skillfully improvise and implement Plan B comes with experience. We suggest that new teachers begin, early on, a process for recording and reflecting on these opportunities when they arise. How did you handle the sudden turn in a lesson or deal with an unexpected classroom occurrence? What could you have done better or differently? How confident did you feel about your content knowledge when students expressed unanticipated mathematical difficulties? How did your orchestration of teaching and learning on a given day or during a particular week or unit position some students as knowledgeable and others as lacking in knowledge? What effect did your choice of tasks have on students' mathematical identities?

Aleks has documented her own teaching by using a binder for each class she teaches. The binders help document her growth as a mathematics teacher. The binders contain her lesson plans but also include notes on what went well and what needs improvement. The binders have also proven useful in documenting Plan B moments and plans as well as how Aleks and the class responded to those moments and plans. In future iterations of her lessons, these same Plan B moments will not arise in the same way but Aleks is better prepared to improvise because her reflection contributes to her being principled in her decision-making.

Conclusion

In commenting on how to empower new teachers, the impulse is usually to prescribe, to encourage teachers to develop a fool-proof plan or to provide materials and support that are thought to be fool-proof. But teaching is a complex endeavor. The vignette opening this article demonstrates this and so does the example with Mark Nelson. Teaching is complex because it is done in relation to and with real students and real situations, not idealized students and situations. All teachers, especially new teachers need to be flexible and be able to adapt. We propose that this flexibility and adaptability, what we call the ability to develop Plan B, is a function of (a) a teacher's content knowledge and confidence in that content knowledge; (b) a teacher's ability to build a community of learners based on knowledge of, and respect for, the multiple identities of students, including their mathematical identities; (c) learning to assess yourself and your students, individually and collectively, in ways that inform your teaching and decision-making; and (d) the willingness to document your teaching and actions as well as reflect on that documentation. These are not prescriptions for new teachers; they develop over time. However, we see them as necessary to insure that new teachers become effective in their practice.

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