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Getting over the Atlas Complex: A College Professor's Reflective Journey Through Journalizing of her own Teaching

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The authors examined a college mathematics professor's change process in teaching practice by analyzing the teacher's reflective journal. Her change engaged cooperative learning method in a college Algebra course and was geared toward the reform-oriented methods. The change processes were revealed as a bumpy road that was full of struggles and challenges to both the teacher and students. The analysis also showed that a reflective journey needed a proper means and support system from a teacher's environment such as institution. This research clearly showed that brining a genuine change in teaching practice toward a broad educational goal was a combined effort among the participants of education.

INTRODUCTION

Efforts to implement "reform-based" education have flourished as a significant movement in mathematics education society since the late 1980s. Release of the *Curriculum and Evaluation Standards for School Mathematics* in 1989 and the *Principles and Standards for School Mathematics* in 2000 by the National Council of Teachers of Mathematics is two catalysts in the movement. Several themes prominent to many of the contemporary reform efforts are exemplified; cooperative learning, incorporation of journals and portfolios, increased role of student engagement in the teaching and learning of mathematics, and use of alternatives in evaluation and assessment of student work. More generally speaking, curriculum and pedagogy have been subjects of the major

reform efforts at various levels such as elementary, middle, secondary and college.

This body of research on the reform-related issues done at elementary, middle, and secondary levels provides knowledge on both teaching and learning of mathematics. To put it differently there exists two different perspectives; one is learner perspective that provides much knowledge about students and learning processes and another is teacher perspective that studies teachers and teaching in classrooms. In contrast, educational practice at college level does not convey such equilibrium in terms of the perspectives. While there are many studies on learning processes of college/university students, which provides learner's perspective and also many studies on college-level curriculum change effort such as "calculus reform", there is less knowledge about teaching practice in the college level. That is to say, it is hard to get an idea of how teaching at the college-level has moved along the line of reform movement from university faculty's perspective. Therefore, it is difficult to correctly and concisely summarize the current state of mathematics education reform efforts at a collegiate level. Perhaps part of the problem is the difficulty in getting access to teaching particularly in college mathematics classrooms.

In this paper, we walk together with a college mathematics professor who tried to implement a reflective journey that fits to today's reform movement. The themes cited above are present in the professor's teaching practice. In particular, the professor's use of journals and cooperative learning groups during instruction is the main lenses through that we witness the reflective journey of the change. As Fullan (1993) mentions about change that brings about "periods of cloudy thinking, confusion, exploration, trial, and stress, followed by periods of excitement, and growing confidence" both for the educator and students, this journey provides an evidence for these various modes of personal experiences.

HISTORICAL REMARKS

The professor's journey began with participating in a NSF-funded project, called the UIC-CC CETP[1] (University of Illinois at Chicago–Community Colleges Collaborative for Excellence in Teacher Preparation). The project included various efforts in faculty development, mathematics and science curriculum development, induction and mentoring of teachers, and recruitment and retention of outstanding teacher candidates. The goal of the faculty development effort was to facilitate reflective practice by faculty and support them. The first action made towards the goal was for the project to hold a weeklong workshop in May 1999 where the professor had a chance to work on high quality

[1] This project was supported by the National Science Foundation. Opinions expressed are those of the authors and not necessarily those of the Foundation.

instruction with many other faculty participants from seven different higher education institutions. The professor then continued to meet over the next year at four periodic follow-up meetings and individually with the project leaders. The professor launched a change project as she implemented reformed instructional practices in one of her courses. The specific activities that she did were the following; doing a change project, participating follow-up meetings, arranging class observations and communicating the results with the researchers, keeping on-going communication with the project investigators, and writing final reports about the change project. This paper is written based upon the professor's final report about her own journey of trying to implement the reform-based methods of teaching in an elementary algebra course at a community college.

FRAMING THE PROBLEM

The professor's previous experience of teaching elementary algebra was problematic in the sense that more than half of her students drop out of class by midterm. By the end of the semester, she would have only a handful of students attending classes, but many of those who were still registered for the class would come to the final only to fail. In fact, she was not the only teacher who experienced this problem. Traditionally, at her college half of elementary algebra students withdraw from class before midterm, and half of the rest fail the course. Students taking elementary algebra at the community college often have not had positive experience in a math class before arriving at the college. They are already convinced that they are not mathematically inclined. She knew that what she was doing in class was not effective. She knew that she needed to provide a different more positive experience.

She was eager to learn ways by which she could improve retention rate in her class by dissolving what she called "the Atlas Complex". She knew of it by reading of an article that she received from one of the CETP meetings. According to the authors of the article, the Atlas complex is a state of mind that keeps teachers fixed in the center of their classroom, supporting the entire burden of responsibility for the course on their own shoulders (Finkel & Monk 1983, p. 96). Finkel & Monk (1983) characterize three professors as different models of teaching practitioner. Professor A and Professor B are described as a typical college mathematics professor while Professor C is introduced as a better teaching model. She identified her teaching style as somewhat similar to what they described as Professor B in the article. The following is a summary of teaching episodes of Professors A and B.

Professor A is a performer caught heavily up in such functions as polishing, timing, and

> motivating. In his class pacing and timing work perfectly and he always ends just in time to allow for his usual five minutes of questions; "Are there any questions?" A few students look up notebooks, but nothing else happens. He fills the silence by raising some questions that naturally arise from the theory. Then he answers the questions. The students dutifully record the answers. By the time the bell rings, Professor A is pleased with how well he pulled the lecture together. But he is bothered by how little the students seem to have been moved by it. In comparison to Professor A, Professor B is described as a stage manager of discussions who looks for the perfect sequence of questions so that the actors can play their parts. When she conducts a seminar in her own field of research, she asks a question that she believes to be central to the issues that underlie the work. One of the brighter students responds in a very thorough and lengthy manner, but, inevitably, the student does not understand the full depth of the issue. Now the Professor B has a strong impulse to correct and clarify the student's answer (pp. 83–84).

According to Finkel and Monk, both these professors are the central figures in their classrooms. They assume full responsibility for all that goes on. They supply motivation, insight, and clear explanations, even intellectual curiosity. In exchange, their students supply almost nothing but a faint imitation of the academic performance they witness. Both teachers so thoroughly dominate the proceedings that they are cut off from what the students know or are confused about. While Professors A and B exercise their authority through control of the subject matter and the social encounter in the classroom, they lack the power to make things happen for their students. They are both caught in the middle of their classes by a host of mysterious forces—hidden assumptions, hidden expecta-tions, and the results of their own isolating experience. And this state is also the presentation of the Atlas complex.

In contrast, Professor C[2] does not put himself in the center of the class and that still benefits from the teacher's expertise.

> Professor C walks into his class of forty students and hands out a dittoed "worksheet" to every student. The students start to form groups of five (as the worksheet instructs them to do), and seat themselves around the tables in the room. They begin to engage in discussion with one another over the questions on the sheet. After a few minutes, Professor C joins one group, where he quietly watches and listens, but does not talk. A few minutes later, he moves to another group. After listening to the discussion there, he suggests to group members that they are not getting anywhere because they misunderstand the example given in the first question. He tells them to draw out in pictures what the example describes, and as they do so, he makes clarifying comments. He listens as discussion resumes, and then moves to yet another group. Meanwhile, many students are not only talking but also making notes as they do. Some groups are engaged in heated discussion; others are quieter, as individuals pause to think or to listen to a member who reads a passage aloud from reading that accompanies the worksheet. In one way or another, however, all the groups are

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[2] Finkel and Monk do not offer the example of Professor C not as a model for Professor A, Professor B, or any other teacher to imitate. Instead, the example of Professor C shows that a teacher can be in his class without being caught in the middle. They acknowledge that answers to teaching problems are never easy.

working with the sequence of questions and instructions contained in the worksheet (pp. 88–89).

Professor C may seem to be a teacher with no real function. He, however, puts all his expert knowledge about teaching. For example, keeping a class of forty students actively involved with course material with a minimum of direct support from the teacher requires an artfully written set of instructions and questions. Breaking his own finished knowledge of his disciplines down into its component processes and then provoking students to discover these processes take at least as much intellectual work as a finely crafted series of lectures would require. As Finkel and Monk explain, he becomes free to perform a number of helping teaching functions as well as to expound, probe, or press on the basis of his expertise by having done this work and set the students to interacting with one another and with the worksheet.

He can also take time just to listen to students. Professor C is different from Professors A and B in a sense that he has the opportunity to be an outside observer of students' conversation without the concerns of a discussion leader; thus, Professor C can gain a clearer view of what actually happens than even most teachers can. He does not take the whole responsibility for all that goes on in the class, therefore, he gives students room to experiment with ideas, to deepen their understanding of concepts, and to integrate concepts into a coherent system.

DESIGNING OF THE CHANGE PROJECT

The general purpose of the change project stated by the professor was to dissolve the Atlas Complex by being more like Professor C. She said that it was not until recent days that she knew there was a name for what she wanted to do. The method that she tried to implement was providing handouts for students in a cooperative learning setting to explore the topics in Algebra in a more appropriate way. She identified six reasons for using cooperative learning in her class believing that cooperative learning is an appropriate approach to dissolve the Atlas Complex that she felt she had:

(1) There can be little doubt that cooperation promotes higher achievement in math class than do competitive and individualistic efforts.
(2) Mathematical concepts and skills are best learned as part of a dynamic process with active engagement on the part of students.
(3) Mathematical problem solving is an interpersonal enterprise.
(4) Math learning groups have to be structured cooperatively.
(5) By working cooperatively within math classes, students gain confidence in their individual math abilities.

(6) The choice of what math courses to take and what careers to consider is heavily influenced by peers.

A more focused goal specified by the professor was to write good handouts so that she could provide students ways to explore mathematics in their group setting. She started practicing to write for exponents. And then she did the same for graphing linear equations. She had the students use the handouts to get an introduction of the topics in class. In order to evaluate the impact, she planned to monitor the changes of the level of the student engagement in mathematics. She wrote teacher journal in order to find out what she called "the muddiest point" from every day's class. She also wrote what she learned and what she still needed to learn in her journal after each week was over. For her own analysis, she observed the mathematical questions asked in class and analyzed the answers to questions in handouts and to essay type questions. She also compared the retention rates as the semester went by. By midterm she still had more than half of the registered students in class.

REPORTING THE EXPERIENCES[3]

Week 1: On the first day, I talked about the syllabus, gave every student a nametag so that I can learn their names, and handed out a page of terms that students "should" know from the course. I let my students attempt to define the terms by themselves and then after a few minutes encouraged them to share their work with a classmate and to fill in more definitions. If they could not define it, I allowed them to give me examples. Only a couple of students asked questions from each other. A few asked me questions. The rest remained quiet. For homework assignment, I asked them to look up the words in the book and write down the textbook definition. On the second day of class, I put students in groups and asked if there is anything they know for certain and if there is anything they are still confused. After 10–15 minutes each group replied that they knew everything. I did not know how to respond to the students because I assumed and expected that they would ask questions. I also did not want to question them on their reply because I wanted to trust them. So I ended up lecturing on the rest of the material.

Week 2: I found that chapter 1 was a repeat of chapter review with the addition of real numbers. Students were bored because they felt that they had already seen this material even though I tried to emphasize the new aspects of the chapter. In the test of review and chapter 1 test given on week 3, after Labor Day, students were confused about

[3] In this part of the paper, the authors decided to use the professor's voice. So the pronoun, "I" is used instead of "she".

LCM and GCF. Covered solving linear equations using addition and multiplication principles. A new student who had been sitting in the wrong class came. He asked questions in a combative manner.

Week 4: I returned tests. Some were happy about the results. One was already failing and knew that he was very lost. I gave two problems for students to solve. They seemed to know what to do. Covered solving equations where addition principle, multiplication principle, distributive property are used. I gave students time on word problems to work in groups of four. Announced that two of the problems will be on the test and that the scores on these problems depend on the average of the raw score of the members of their group. Those who did not attend this class fail this question. A couple of groups discussed, a couple did not, and one group tended to socialize.

Week 5: I gave group work on solving inequalities. I assumed that some had already worked with inequalities. I did no lecture today. I, instead, walked from one group to another to answer questions. I required students to use knowledge about solving equations to solve inequalities. Then, I reviewed common problems students had on chapter 2 homework assignments. I emphasized that students pay attention to the units, labeling variable, and answering the questions fully. I covered % word problems and solving for a specified variable when there is more than one variable. I covered exponents including basic definition, introduction to a^1 and a^0 and a^n where $n < 0$. A few students asked questions such as "what about $(-239)^0$?" One student really wanted to understand why $a^1 = a$.

Week 6: I gave a quiz on chapter 2 and continued chapter 4 by giving handout starting with review of chapter 4 covered in previous class. The student did not seem to have trouble with handout during class, but on the second class of the week, the students did not seem to know how to translate formulas/theorems. They did not seem to know how to apply theorems and formulas. First few parts of the handouts were OK, but last two parts were too confusing to students. In retrospect, I believe it needed to be more exploratory.

Week 7: Students were anxious that they are getting too many topics at once. A couple of them asked that I spend more time at the beginning of class going over homework problems. Students were also anxious about new material. I felt the need to lecture it rather than leaving them to learn from the handout or giving them opportunity to explore. Students seem calmer. I kept asking if there were more problems, but no one asked. I spent 10 minutes reviewing chapter 4 and then began chapter 5. I felt the need to focus on handout material.

Week 8: Quiz on chapter 4 and covered more of chapter 5. Before quiz, four or five students asked specific questions about how to do certain problems. Division of polynomials seemed to be the most feared topic of the day. I encouraged students to read

ahead in chapter 5. Results of Chapter 4 test showed that students range from B to F with 2F's. One of the students who failed has not been doing well since the beginning; so, I recommended that he drop the course before it must appear on his transcripts. Finished covering chapter 5 and announced that Monday's group work will be on world problems and that everyone is encouraged to do the problems before coming to class.

Week 9: I am behind, but students wanted me to slow down even more. One of the two students who failed still returned. Group work on word problems had asked students to work on the questions over the weekend, but most did not. How to ask more interesting questions? I covered more of chapter 6. Word problem group work—still three to four students did not do any more. One who missed last Wednesday's class sought tutoring and felt confident enough to show a fellow classmate the material she learned. Groups were in three or two. Most shared answers or the algebraic equations for the word problems. In one group, one did not work on the problems; the other did, but was confused about most of the questions. In another group, both students chatted about non-math related topics. When I asked if they shared questions, they replied that they had already completed the assigned tasks. In retrospect, perhaps students should have been asked to write an essay discussing the parallels and differences between fractions and rational expressions. Perhaps I needed to find a real life problem with graphs to discuss how to interpret, how to collect data, and report it on the graph.

Weeks 10–11: By this time, I barely wrote notes about class, as my primary focus was to cover all of the topics. During this time, I noticed that a couple of students were beginning to read ahead of class and ask questions about items that have not been discussed.

Week 12: I gave a last attempt to collaborative learning by giving students a handout on physical fitness that involved creating a table, graphing, finding the slope, and estimating. Students were given part of class to do it in groups of 3. They were expected to complete whatever they could not finish in class on their own in two weeks. Only a handful was able to complete this project, and these did not demonstrate increased understanding of the material.

SHARING THE KNOWLEDGE LEARNED

In order to analyze the professor's experience methodically, she choose to use a list of five conditions by Johnson & Johnson (1990) on the aspects that allow cooperative learning to be more productive than individual learning. The five conditions are:

(1) Teachers must clearly structure positive interdependence within each student's learning group.

(2) Students must engage in promotive (face-to-face) interaction while completing math assignments.
(3) Teachers must ensure that all students are individually accountable to complete math assignments and promote the learning of their group mates.
(4) Students must learn and frequently use required interpersonal and small group skills.
(5) Teachers must ensure that the learning groups engage in periodic and regular group processing.

According to Johnson & Johnson (1990), positive interdependence is the perception that one is linked with others in a way that one cannot succeed unless the others do (and vice versa) and, therefore, that their work benefits one and one's work benefits them. Her attempts to create structure cooperative learning in her class included having nametags for every student so that students and she could learn each other's name and grouping the students randomly by counting off, by using color chips, etc. She assigned roles to each student in a group or asked students to assign a role to each other. She tried to create positive interdependence when she instructed students that their grade for the quiz is the average of the grades that their group members received. The first attempt of this failed because in every group there was at least one member who did poorly enough that the average grade for each group would have been a D or an F. Why is it that students come unprepared?

Promoting interaction includes assisting, helping, supporting, and encouraging each other's efforts to achieve. In class, she tried to be patient when a student asked a question. She hoped that her students would learn by example ways to support each other in learning the material, but she did not take the time to show them how to do it for each other. She tried to send a message to students that they must know that they cannot 'hitchhike' on the work of others. Therefore, there were ample assignments and quizzes in which students were accountable for their own learning and could not rely on others. She wanted to let students know that cooperative skills include leadership, decision-making, trust building, communication, and conflict-management skills, but she recalled that she did not address this at all in class. She assumed that when her students are thrown together they would begin to share with each other, support each other, and know how to communicate with each other in a meaningful way. She knew that group processing is the discussion of how well group members are learning mathematics and maintaining effective working relationships among members. But this was not always the case in class. When she saw that students were not communicating as animatedly as she expected, she made the decision that the group process was not working well. She thought that she did not give her students the structure they needed to learn and understand how to work together effectively. Students in this elementary algebra class

come with a low level of confidence in their ability to do the mathematics. They also come with distrust in the ability of their classmates to teach them something. As a result, it was not enough for her to focus on ways to make any single activity effective. She needed to build the students' confidence throughout the semester.

Much reflection on her ways of teaching was written in the teacher journal. She knew there should be the teacher's role in cooperative learning such as objectives of a cooperative lesson, decisions on the size of groups and on how students will be assigned to groups, explaining the tasks and goals, monitoring and intervening, and evaluating and processing the collaborative work. Again, she realized that she had not methodically thought through each of the aspect of cooperative learning. When she assigned an activity to students, she spent enough time explaining the task, but hardly enough time on the goals. Consequently, students became confused about the material. Moreover, in retrospect, she needed to have the students explore rather than do extra worksheet that was essentially a rewritten the section of the book in fewer words. A problem that she could not control is that she did not have the authority to change the curriculum so that she provide time for her students to do the activities. She felt she had to cover every topic listed in the syllabus particularly when she was told during the first departmental meeting of the semester that she must cover all topics. To provide enough time to include cooperative learning, she needed more support from the department as a whole or at least among elementary algebra faculty.

She believed that three students, at least, became independent learners when they began to study from the textbook and ask her questions before, during, and after class and during her office hours. She, however, reflected that in the confusion, she lost track of the goals of the course that was not only to teach students the topics of elementary algebra but also to teach them to think mathematically. Ultimately, to be Professor C required three circumstances. First, she must learn more about and practice introducing cooperative learning effectively to students and into the curriculum. Second, she needed to improve on her general teaching techniques. Finally, the department needed to be involved in the curriculum change.

DISCUSSION

The professor's story is remarkable in a sense that she was reflecting on her teaching in a very honest way on a regular basis throughout the whole semester. Her struggles from dealing with the low-level students and having lack of supports from her teaching environment explain to us well why most teachers who wish to perform better teaching practice do not go far to promote change even when backed by strong resolve. Finkel and

Monk claimed that to effect genuine change, a teacher must first differentiate teaching functions, and then distribute them in the course so that the responsibility for learning is shard with students. Only then can the Atlas complex be dissolved. To do this, the various parts of the course must be clearly distinguished so that the functions appropriate to them can be distributed (cf. Finkel & Monk 1983, pp. 92–93). It, however, seems that both getting over the Atlas complex from a teacher's perspective and brining a genuine change in teaching practice toward a broad educational goal is not a simple matter for an educator to provide a means. One thing that is clear from the sharing of a college professor's reflective journal might be that we, educators, can be sparked to make changes in their practice through this kind of a reflective journey which shows the need of being accountable as a practitioner in classrooms.

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