The Peer-Led Team Learning International Society
Proceedings of the Inaugural Conference
May 17-19, 2012
New York City College of Technology of
the City University of New York
Brooklyn, NY 11201-2983

How Can Female Students in a Math Workshop Increase their Problem-solving Capabilities?

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Introduction

The way women perceive their surroundings plays an important role in how they behave, think, and express themselves (Belenky et al., 1986). During workshop sessions I observed different attitudes among female and male students. That is why this topic of females in mathematics caught my attention. Also, as a female, I have been through similar situations as other females in a classroom setting.

Literature Review

Developmental theories are suggested ways that people develop psychologically and in other ways throughout their lives. William Perry (1981) studied male students at Harvard University, and developed a nine-stage "scheme" of intellectual and ethical development suggesting that students may go through in college. Belenky and colleagues (1986) replicated Perry's study with women and found that women also pass through several stages before getting to a point of self-confidence. This is a stage where they realize that knowledge is "contextual" and "relative."

Silence: "A position in which women experience themselves as mindless and voiceless and subject to the whims of external authority" (p. 15).

Received knowledge: "A perspective from which women conceive of themselves as capable of receiving… but not capable of creating knowledge on their own" (p. 15). *Dualism* stage in Perry's Scheme.

Subjective knowledge: "A perspective from which truth and knowledge are conceived of as personal, private, and subjectively known or intuited" (p. 15). *Multiplicity* stage in Perry's Scheme.

Procedural knowledge: "A position in which women are invested in learning and applying objective procedures for obtaining and communicating knowledge" (p. 15). *Relativism* in Perry's Scheme.

Constructed knowledge: "A position in which women view all knowledge as contextual, experience themselves as creators of knowledge" (p. 15). There is no right or wrong answer. It depends on the context in which knowledge is constructed. *Commitments in Relativism* in Perry's Scheme.

Both Perry's Scheme (1970) and Belenky and colleagues (1986) found that their developmental theories had similar conclusions, except for the addition of *silence,* observed in Belenky et al.'s research. The silent learner may fit well into the mathematics classroom and "may even be rewarded for their silence with praise for being a good student" (Erchick, 1996 pg. 112, in Ocean, 1998).

Under *Procedural knowledge* there are two subcategories of knowing which are separate knowing and connected knowing. *Separate knowing* reflects individualist and competitive values of traditional mathematics education (Erchick, 1996, in Ocean, 1998). *Connected knowing* places emphasis on cooperation, discussion, and group work (Erchick, 1996, in Ocean, 1998). Women are more likely to value connected knowledge. If math were to be taught in a more experiential way with more discussions and open work then connected thinking would be more valued (Becker, 1995). An example of connecting knowing is "(Mathematics) is beautiful. It ties with so many things, it encompasses so many things" (Becker, 1995).

Observations

Case Study 1 – Female Student (FS1)
in MAT 1175 (Fundamentals of Mathematics)

FS1 repeatedly stated that she "hates" math and is not good at it. Every session she starts working on a module, but she skips problems that she seems not to understand. She is distracted very easily, for example using her cell phone or just looking around. When I asked her, "Why have you not finished that problem?" she said, "Because I know that my next step is going to be wrong." In week 1 she was really quiet, barely participated in group discussions and did not ask questions. She did not want to move her chair to form the group.

As the Peer Leader, in week 2, I paired her with FS2. When she did not know how to solve a problem FS2 helped her out. I asked her questions to lead her through the problems: "What method did you use to approach that problem? Do you think that method is working?"

In Week 6 I asked her to explain how to solve rational equations (a topic that I forgot how to solve.). She explained it in a way that I quickly understood. In Week 7, we were working on a review sheet for a test that she was going to have the week after. She asked me for an answer key so she could go home and work out the problems and check if she got the right answer or not. I told her that I could not give her the answers and she got upset. I talked to her about being more confident with herself and the skills she had for solving math problems.

After week 5 FS1 became a bit more engaged and interactive. She felt more comfortable asking questions and discussing with her peers. She worked more as a group member and less individually, and she was open to learn new methods to solve a problem. She picked the method that she felt more comfortable working with, and was more active going to the board. She felt proud of herself because she found she could help the peer leader.

I, as the Peer Leader sent an email after FS1 was absent for two sessions. She replied, "I knew I was going to fail since the first week of school" so she decided to withdraw from the class saying that "Dropping the class seem like the biggest benefit for me" and recognized that "math has always been my biggest weakness."

Case Study 2 – Female Student (FS2)
in MAT 1175 (Fundamentals of Mathematics)

FS2 also "hates" math. She started as an accounting major and changed her major because of the math levels requirements. She is always willing to work, but gets distracted very easily with her cell phone and staring out the door waiting for some friend to come and "chat" with her through gestures. When she understands a topic she can work out the problems by herself and compare answers with others. However, she skips steps while working through the problems and after discussions with her peers she realizes where she made a mistake. She is willing to go to the board to work the problems out. She helped FS1 to become involved in solving the problems.

As the Peer Leader, I asked her questions about how to solve the problem, such as, "What methods could you use to approach the final answer?" In week 2, I used the pair-problem solving technique.

As a result, FS2 was open to new methods of solving a problem, even though she had her own way of doing it. She became more careful when solving a problem, but needs to practice more. She feels insecure when there is the possibility that the peer leader does not know how to solve the problem or has not worked out the problems and doesn't have the answer. In a later week, we were working on modules that contained a lot of Geometry topics. I did not know how to solve certain problems and she kept asking me "Do you understand Geometry?" FS2's thinking gets blurred when she has to practice what she has learned in the class, but she is still coming to the workshop sessions.

Discussion

The two case studies presented here demonstrate how two women in a basic math course workshop resisted asking questions when they did not understand a topic. They both appeared to be in a stage of "Received knowledge" (Belenky, et al, 1986). The effect of this stage was marked by their unwillingness to engage with their male colleagues. They appeared reluctant to become part of the group and discuss their questions.

In Case I, FS1 effectively moved backward to "silence" by withdrawing from the class. In Case II, FS2 moved from "silence" to "received knowledge" and "subjective knowledge." She is able to understand what is taught in class but when it comes to putting it in practice some of her thinking is not clear on how to approach some of the problems from the modules. After discussions with her peers she starts to understand how what she learned before links to how the problem is solved.

In both cases, the presumption might have been that due to their silence, FS1 and FS2 were "good students" when in fact, their lack of engagement was not good for them (Erchick, 1996, in Ocean, 1998). In both cases FS1 and FS2 are open to learn different methods on how to solve the same problem.

Conclusions

These two female students are still in the process of accepting math not as a "nightmare" but as a subject that they can relate to their daily lives. This makes reference to connected knowing, a way of knowing that may better fit the way women learn. Gallos (2001) interviewed a woman in her mid-thirties who said she was able to speak fluently with women, but when it came to speak with men in a classroom setting she would "never" be able to do it. Even professional women with experience in the workforce appear to have the same issue that female students face in classroom settings.

Workshops can be a good scenario for female students to develop *connected knowing* because the purpose of the workshop is to work in groups and create discussions based on the modules used in every session. In problem solving, for example, the same problem would be solved in different ways rather than additional examples solved exactly the same way. (Ocean, 1998) These female students found it helpful looking at different ways and methods to solve a particular problem even though this was not enough for FS1 who withdrew from the class.

I suggest that workshop modules should be redesigned in a way in which more connected knowing is needed to make the students discuss more about the topics. Female students can improve their problem-solving capabilities by practicing more problems in an environment that satisfies their need of learning and knowing. As a peer leader I learned that I have the necessary patience to help others when they do not understand something. I also learned to be more self-confident. This experience was rewarded by the support that the students in my workshop gave me during the workshop sessions.

References

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Cite this paper as: Tavera, G. (2012). How can female students in a math workshop increase their problem-solving capabilities? *Conference Proceedings of the Peer-Led Team Learning International Society*, May 17-19, 2012, New York City College of Technology of the City University of New York, www.pltlis.org; ISSN 2329-2113.