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MED 702  
January 18, 2005

Selden, A., & Selden, J. (2003). "Validations of Proofs Considered as Texts: Can Undergraduates Tell Whether an Argument Proves a Theorem?" *Journal for Research in Mathematics Education*, 34:1, 4-36.

In this article Selden & Selden report the results of an exploratory research study of validation of mathematical proof. Eight mathematics and secondary education mathematics majors enrolled in a transition to proof course were interviewed and asked to reflect on four student-generated "proofs" (three were deemed by the authors not to be proofs of a particular theorem). Results suggest that undergraduates tend to focus on surface features of arguments and that their ability to determine whether arguments are proofs is limited.

### **Summary and Review**

Selden & Selden (2003) report on the results of a research study, which also lends itself nicely to the theoretical perspective of social constructivism. This paper gave me a good introduction to the idea of "proof validation," as I had not previously been acquainted with a specific definition of the term. As a result, I gained a better idea of what we will be doing this summer in our similar project.

Prior to being introduced to this paper, I was not familiar with any other papers specifically dealing with proof validation. However, I am aware that researchers find topics dealing with mathematical proof interesting. Hanna (1989) explored the difference between proving and explaining, as did Dreyfus (1999). Leron (1983) investigated the structure of mathematical proof, and Smith, Eggen, & Andre (1990) conducted research investigating the transition from computational mathematics to advanced mathematics.

One item in the study that I found to be particularly troublesome was the fact that during the interviews, the interviewer was the students' instructor. I feel this introduced unnecessary bias into the study. In my experience, the nature of the student/teacher relationship can be an intimidating one. Though the intent in this structure was to keep the tone of the interviews as relaxed and conversational as possible" (p. 20), this may not have happened. It is stated in the article that at times the students needed encouragement and prompting to continue reading and thinking about the proofs. This could be a result

of their fear of answering “wrong” and having the idea that, even though the interviews took place outside of the classroom setting, they were being judged on their responses.

I find it reasonable that as time progressed during the interviews, the students’ accuracy improved on whether the responses were proofs. However, in the excerpts provided by Selden & Selden, the interviewer seemed to be leading the respondents at times. Granted, these were deemed “teaching interviews,” but I took that to mean that questions from the students would be answered as they arose—not the students’ asking for verification of their response and receiving it. I do not agree with the format of the instructional interview for this reason. It encourages the students to read and discuss mathematics in a questioning manner, something I have struggled with myself. In my opinion, the interviewees should not have gotten feedback about the mathematics during the actual interview. The issues discussed during the interview would have been better noted and then approached at some time afterwards, such as in class. The students’ questions and misconceptions would have then benefited the entire class, instead of each individual in the moment.

Despite this disagreement, the paper is well written. It is obvious that Selden & Selden are familiar with qualitative research, and are well versed in Patton (2002). Every aspect of the study is thoroughly discussed and the paper is presented in a way that is easy to understand. As is apparent in the current study we are working on, it is written in a manner that is easily replicable.

Also, based on the responses made by the students, Selden & Selden see important implications for instruction that may benefit students who are learning to write mathematical proofs. They see “bridge” courses in mathematical proof (such as the one the interviewees were enrolled in) as beneficial. However, they do not feel that how students say they read proofs is a reliable predictor of their ability to validate them. As a result, students require additional practice in validating actual student “proofs,” coupled with small-group discussion. This is especially important for pre-service secondary teachers, who may one day be faced with the task of judging the correctness of their own students’ proofs.

As we begin research in this topic, I found this to be a particularly helpful paper to read. I was not previously aware of other researchers who addressed the topic of proof

validation, and was not entirely sure what the actual term meant. Also, for the first time in my readings, I discovered why it is important for researchers to include suggestions for further research. I actually have not encountered before a situation where I read a follow-up to a study. Now being part of “future research,” we have these results to draw upon, and a basis for a methodology. Though I did not agree with every aspect of the study, I find it beneficial to learn from my disagreements with others as I begin my own scholarly writing.

**References** Dreyfus (1999) Hanna (1989) Leron (1983) Patton (2002) Smith, Eggen, & Andre (1990)

*Note on score: If a first semester S&R, 15/20; if a second semester or later S&R, 13/20 (communication score lower, references not cited using APA style).*