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Situations in Teaching Secondary Mathematics: A Guide to the Situations and Their Use

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We developed a collection of situations in teaching secondary mathematics as a way of capturing classroom practice. Each situation portrays an incident in which some mathematical point is at issue. (For details of our approach, see Kilpatrick, Blume, & Allen, 2006.) Looking across situations, we attempted to characterize the knowledge of mathematics that is beneficial for secondary school teachers to have but that other users of mathematics may not necessarily need.

Each situation begins with a *prompt*—an episode that has occurred in a mathematics classroom and raises issues that illuminate the mathematics proficiency that would be beneficial for secondary teachers. The prompt may be a question raised by a student, an interesting response by a student to a teacher’s question, a student error, or some other stimulating event. We then outline, in descriptions called *mathematical foci*, mathematics that is relevant to the prompt. The set of foci is not meant to be an exhaustive accounting of the mathematics a teacher might draw upon, but we believe the foci include key points to be considered. These foci, each of which describes a different mathematical idea, constitute the bulk of each situation. There is no offer of pedagogical advice or comment about what mathematics the teacher should actually discuss in a class in which such an episode may occur. Rather, we describe the mathematics itself and leave it to the teacher or mathematics educator to decide what to use and how to do so. Along with the foci, each situation includes an opening paragraph, called a *commentary*, to set the stage for the mathematical foci. The commentary gives an overview of what is contained in the foci and serves as an advance organizer for the reader. Some situations also include a *post-commentary* to include extensions of the mathematics addressed in the situation.

Throughout the process of writing and revising the situations, we have used aspects of what we would come to include in our MPT framework. For example various *representations* helped us to think about the mathematics in the prompt. Perhaps there was a geometric model that was helpful or a graph or numerical representation to provide insight or clarification. At times a particular analogy was pertinent to the prompt. We were not interested in making every situation follow a particular format in which the same representations (such as analytical, graphical, verbal) were used again and again. We wanted to emphasize representations that we perceived as particularly helpful or relevant in relation to the prompt.

Another example of our use of aspects of mathematical proficiency in writing and revising situations was the use of *connections* to other mathematical ideas, or *extensions* to concepts beyond those currently at hand. For example, if a prompt addressed sums of integers, we described (though not in great detail) sums of squares. This is an example of a topic to be discussed in a post-commentary at the end of the situation. Another way to extend a mathematical focus is to adjust the assumptions. For example, in a geometry problem, one could consider the implications of relaxing the constraint of working only in Euclidean space.

Our use of these aspects of what would eventually constitute the MPT framework (Wilson & Heid, 2010) drew our attention to what we believed were pertinent elements of mathematical proficiency for teaching. This process helped us construct, clarify, and understand the framework and also provided us with examples to illustrate the elements of the framework.

Users of the situations may wish offer students a prompt and ask them to suggest possible foci. Or they may wish to offer the foci that we have included with the situation as a means of provoking analysis and discussion. We make no claims as to the comprehensiveness of the foci we have developed, nor do we consider them the most mathematically elegant way of addressing the situation described in the prompt. What we do claim is that these prompts, together with the foci we propose, capture the mathematics that arises in secondary classrooms and that teachers, prospective or practicing, need to understand.

References

- Kilpatrick, J., Blume, G., & Allen, B. (2006, May). *Theoretical framework for secondary mathematical knowledge for teaching*. Unpublished manuscript, University of Georgia
- Wilson, P. S., & Heid, M. K. (Eds.). (2010, April). *Framework for mathematical proficiency for teaching*. Unpublished manuscript, University of Georgia and Pennsylvania State University.