

**Social and Discursive Actions to Promote Online  
Collaborative, Mathematical Practices**

Arthur B. Powell

Rutgers University-Newark, USA

Abstract

The social realization of shared goals is the aim of discursive collaboration. It is the motive force of cognitive development (Vygotsky, 1978/1930) and is powerfully facilitated by digital technologies, particularly Web 2.0 architecture and tools. These technologies not only enhance discursive collaboration but also provide dynamic means to represent mathematical objects and relations. Discourse about objects and relations among them in technology-enhanced environments when productive involve essential mathematical actions and ideas such as representations, procedures, relations, patterns, invariants, conjectures, counterexamples, as well as justifications and proofs (Christou, Mousoulides, & Pittalis, 2004). Nevertheless, mathematics education researchers and practitioners seek to understand further how social and discursive actions with digital technological tools promote collaboration and mathematical practices and, in the process, what mathematical learning is engendered.

In this presentation, I will describe an ongoing research effort and some of its results that shed light on understanding the mathematical learning engendered as learners engage collaborating discursively within a virtual environment to solve mathematics problems and enact mathematical practices. Our work employs a specific virtual environment that supports synchronous collaborative discourse and provides tools for mathematics discussions and for creating graphical and semiotic objects for doing mathematics. The environment, Virtual Math Teams with GeoGebra (VMTwG), has been the focus of years of development by a team led by Gerry Stahl at Drexel University, Stephen Weimar at The Math Forum @ the National Council of Teachers of Mathematics, and me and the target of much research (see, for example, Alqahtani & Powell, 2015, in press; Grisi-Dicker, Powell, Silverman, & Fetter, 2012; Powell & Alqahtani, 2015; Stahl, 2008, 2015). I will share results that concern collaboration, task design, orchestration of productive mathematical discourse, and instrumental genesis.

References

- Alqahtani, M. M., & Powell, A. B. (2015). Co-action and dynamic geometry knowledge. In K. Beswick, T. Muir, & J. Wells (Eds.), *Proceedings of the 39th Conference of the International Group for the Psychology of Mathematics Education* (Vol. 2, pp. 17-24). Hobart, Australia: PME.
- Alqahtani, M. M., & Powell, A. B. (in press). Instrumental appropriation of a collaborative, dynamic-geometry environment and geometrical understanding. *International Journal of Education in Mathematics, Science and Technology*, 4(2).
- Christou, C., Mousoulides, N., & Pittalis, M. (2004). Proofs through exploration in dynamic geometry environment. *International Journal of Science and Mathematics Education*, 2(3), 339–352.
- Grisi-Dicker, L., Powell, A. B., Silverman, J., & Fetter, A. (2012). Addressing transitional challenges to teaching with dynamic geometry in a collaborative online environment. In L. R. Van Zoest, J.-J. Lo, & J. L. Kratky (Eds.), *Proceedings of the 34th annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (pp. 1024-1027). Kalamazoo, MI: Western Michigan University.
- Powell, A. B., & Alqahtani, M. M. (2015). Tasks promoting productive mathematical discourse in collaborative digital environments. In N. Amado & S. Carreira (Eds.), *Proceedings of the 12th International Conference on Technology in Mathematics Teaching*. (pp. 68-76). Faro, Portugal: Universidade do Algarve.
- Stahl, G. (2008). Social practices of group cognition in virtual math teams. In S. Ludvigsen, A. Lund, & R. Säljö (Eds.), *Learning in social practices: ICT and new artifacts—transformation of social and cultural practices*: Pergamon.
- Stahl, G. (2015). *Constructing dynamic triangles together: The development of mathematical group cognition*. Cambridge, UK: Cambridge.

Vygotsky, L. S. (1978/1930). *Mind in society: The development of higher psychological processes* (M. Cole, V. John-Steiner, S. Scribner, & E. Souberman, Trans.). Cambridge, MA: Harvard.