

Mathematics Teaching Assistant Preparation and Support: What Would Piaget, Vygotsky, and Dewey Have to Say?

Nathan Jewkes
North Carolina State University

The purpose of this paper is to analyze the philosophies of the three foundational learning theorists (Piaget, Vygotsky, and Dewey) and explore what can be learned from these theorists about mathematics teaching assistant-professional development (MTA-PD). I begin by reflecting on the professional development opportunities I personally received as an MTA and by analyzing how well my own experience aligns with each of the three theories. I conclude with an argument, based in the literature, why MTA-PD may best be served by Vygotsky's sociocultural theory.

Keywords: Mathematics Teaching Assistant (MTA), Learning Theories, College Teaching, Professional Development

Since 2009, at the conferences hosted by The Special Interest Group of the Mathematics Association of America on Research in Undergraduate Mathematics Education, there has been a working group focused on the professional development of college mathematics instructors. One of the group's goals, consistent with my own for writing this paper, is the "development of materials, processes, and *theories* to support the professional development of collegiate mathematics instructors" (Hauk, Deshler, & Speer, 2015, emphasis added).

Piaget (1964/1997) asserts that individuals construct their own knowledge and build on prior knowledge. Dewey (1899/1964) claims that knowledge is generated through problem solving, inquiry, and experimentation. Vygotsky (1978) posits a strong role for social interaction in learning. Which of these theories is most useful for analyzing MTA preparation and support?

Characteristics of successful K-12 teacher professional development include an intensive initial experience, spaced-across-time follow-up, opportunities to analyze student thinking, collaboration in teams to learn about teaching, and working with a mentor through multiple classroom visits and follow-up (Blank & de las Alas, 2009). Research specific to college teaching has revealed important elements of MTA-professional development (MTA-PD). These include a focus on MTAs' mathematical knowledge for teaching (Musgrave & Carlson, 2017; Speer & Wagner, 2009), an overall culture of department support for good teaching (Latulippe, 2009), and opportunities for practice and feedback from a mentor (Ellis, 2014). Since each of these elements involves high levels of social interaction, Vygotsky's sociocultural theory aligns well with successful MTA-PD. Indeed, Vygotsky's (1978) mechanism for learning is *internalization*, or the concept that knowledge is built first *between* individuals and then moves inward to the intrapersonal plane. MTA-PD that involves collaboration in teams, opportunities for practice and feedback from mentors, and a department culture of support for good teaching, therefore aligns well with Vygotsky's theory. His notion of the *zone of proximal development* (Vygotsky, 1978, p. 86) is also salient here, with more capable peers helping MTAs reach higher levels of good teaching that, if left to their own means, they would not be able to reach.

Since many universities rely on MTAs to teach of a wide variety of undergraduate mathematics courses, and because MTAs are "the source of mathematics faculty of the future" (Speer, Gutmann, & Murphy, 2005, p. 76), further analysis of MTA-PD through the lens of the three foundational learning theorists will likely prove important for the success of both present and future undergraduate learners of mathematics.

References

- Blank, R. K., & de las Alas, N. (2009). *The effects of teacher professional development on gains in student achievement: How meta analysis provides scientific evidence useful to education leaders*. Washington, DC: Council of Chief State School Officers.
- Dewey, J. (1964). The school and society. In R. D. Archambault (Ed.), *John Dewey on education: Selected writings* (pp. 295–310). Chicago, IL: The University of Chicago Press. (Original work published 1899).
- Ellis, J. F. (2014). Preparing future college instructors: The role of graduate student teaching assistants (GTAs) in successful college calculus programs. *ProQuest Dissertations and Theses*, 331. Retrieved from <https://search.proquest.com/docview/1609567060?accountid=15272>
- Hauk, S., Deshler, J. M., & Speer, N. M. (2015). Research on college mathematics instructor professional growth. Retrieved from <http://sigmaa.maa.org/rume/crume2015/working-groups.html>
- Latulippe, C. L. (2009). Encouraging excellence in teaching mathematics: MTAs' descriptions of departmental support. In L. L. B. Border, N. M. Speer, & T. J. Murphy (Eds.), *Research on graduate students as teachers of undergraduate mathematics* (pp. 85–96). Stillwater, OK: New Forum Press.
- Musgrave, S., & Carlson, M. P. (2017). Understanding and advancing graduate teaching assistants' mathematical knowledge for teaching. *The Journal of Mathematical Behavior*, 45, 137–149. <https://doi.org/10.1016/j.jmathb.2016.12.011>
- Piaget, J. (1997). Development and learning. In M. Gauvain & M. Cole (Eds.), *Readings on the development of children* (pp. 19–28). New York, NY: W.H. Freeman and Company (Original work published 1964).
- Speer, N. M., Gutmann, T., & Murphy, T. J. (2005). Mathematics teaching assistant preparation and development. *College Teaching*, 53(2), 75–80. <https://doi.org/10.3200/CTCH.53.2.75-80>
- Speer, N. M., & Wagner, J. F. (2009). Knowledge needed by a teacher to provide analytic scaffolding during undergraduate mathematics classroom discussions. *Journal for Research in Mathematics Education*, 40(5), 530–562. <https://doi.org/10.2307/40539355>
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. (M. Cole, V. John-Steiner, S. Scribner, & E. Souberman, Eds.). Cambridge, MA: Harvard University Press.