Factors That May Guide the Design, Execution and Research of Professional Development

Karen Koellner
Arizona State University

Kiley Pooler
Arizona State University

Olivia Bruner
Arizona State University

Nanette Seago
WestEd

Sarah Warner
WestEd

Nicora Placa
Hunter College

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There is considerable research on effective professional development (PD) in both undergraduate and K-12 educational settings, but less on how the characteristics of PD can influence teacher uptake and retention of PD resources and lessons (Zhang et al., 2024, Hill et al., 2013, Henderson et al., 2011). The TADD 2.0 (NSF DRL No. 2405432) project focuses its research on teachers' perceptions of critical characteristics of PD impact on sustainably affecting teacher instruction and student learning. Using the preliminary findings and analysis of the survey of 157 teachers who participated in 1 of 6 chosen large-scale NSF-funded research projects within the last 1 to 5 years can shed light on the characteristics that could also be emphasized in STEM undergraduate PD.

The initial survey was designed to utilize Likert-scale items and follow-up open-ended questions, allowing participants to elaborate on their numeric responses based on six characteristics of PD. Upon factor analysis and Cronbach's alpha tests, researchers used a five-factor model to define the characteristics. These new categories included administrative support, resources and materials, community, classroom practices, and facilitation. The results of the factor analysis reveal that teachers' perceptions of what is thought to be well-defined in the research community may not be as explicit as thought. The same could be said about feedback in undergraduate PD, as the variety of training and experience can vary greatly in a department (Postareff, 2008).

Upon redefining and analyzing the categories, researchers determined the average scores of participants across each factor and conducted descriptive statistics, along with ANOVA tests, which showed that the factors were statistically significant across all PDs. Results showed that all PDs were of high quality, with no median value falling below 5. Fortunately, administrative support (median = 8.5-10) and facilitation (median = 9.2 - 10) were rated very highly. Sustained administrative support and facilitation are not always common in undergraduate PD and often inhibit scaling and uptake from professors (Chasteen, 2015, Henderson et al., 2011). Factors with lower medians were community (median = 7.5 - 10), resources and materials (median = 5.8-9.8), along with classroom practices (median = 6.5-9.2). Classroom practices surrounding pedagogy and content ratings being lower aligns with findings in K-12 spaces as it is more difficult to implement and takes longer to see sustained changes (Kennedy, 2016, Koellner & Jacobs, 2015). Pedagogical change is understandably challenging to support in undergraduate spaces, particularly due to culture and community (Reinholz & Apkarian, 2018, Chasteen et al., 2015, Postareff, 2008).

Each PD served different communities and had varying goals towards teacher pedagogical change, but the factors appear to show important attributes of PD. While K-12 schools have different contexts, nuances, and challenges than undergraduate teaching spaces do, these survey results may provide guidance when designing, implementing, and conducting research in undergraduate communities.

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References

Chasteen, S. V., Wilcox, B., Caballero, M. D., Perkins, K. K., Pollock, S. J., & Wieman, C. E. (2015). Educational transformation in upper-division physics: The Science Education Initiative model, outcomes, and lessons learned. *Phys. Rev. ST Phys. Educ. Res.*, *11*(2), 020110. https://doi.org/10.1103/PhysRevSTPER.11.020110

Henderson, C., Beach, A., & Finkelstein, N. (2011). Facilitating change in undergraduate STEM instructional practices: An analytic review of the literature. Journal of Research in Science Teaching, 48(8), 952–984.

Hill, H. C., Beisiegel, M., & Jacob, R. (2013). Professional development research: Consensus, crossroads, and challenges. *Educational Researcher*, *42*(9), 476–487. https://doi.org/10.3102/0013189x13512674

Kennedy, M. M. (2016). How does professional development improve teaching? *Review of Educational Research*, *86*(4), 945–980. https://doi.org/10.3102/0034654315626800

Koellner, K., & Jacobs, J. (2015). Distinguishing models of professional development: The case of an adaptive model's impact on teachers' knowledge, instruction, and student achievement. Journal of Teacher Education, 66(1), 51–67. https://doi.org/10.1177/0022487114549599

Postareff, L., Lindblom-Ylänne, S., & Nevgi, A. (2008). A follow-up study of the effect of pedagogical training on teaching in higher education. *Higher Education*, *56*(1), 29–43. https://doi.org/10.1007/s10734-007-9087-z

Reinholz, D.L., Apkarian, N. Four frames for systemic change in STEM departments. *IJ STEM Ed* **5**, 3 (2018). https://doi.org/10.1186/s40594-018-0103-x

Zhang, L., Stylianides, G. J., & Stylianides, A. J. (2024). Enhancing mathematical problem posing competence: A meta-analysis of intervention studies. *International Journal of STEM Education*, *11*(1), 48. https://doi.org/10.1186/s40594-024-00507-1