The Importance of Supporting Astronomy Education Research, Curriculum Reform, and Professional Development in Astronomy Education

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We recommend that funding agencies support excellence and equity in astronomy education at all levels by:
1. Funding astronomy education research
2. Funding curriculum development, evaluation, dissemination, adoption and implementation
3. Funding and incentivizing professional development for astronomers engaged in teaching, outreach and mentoring

For decades there have been national calls for science education reform at all levels (e.g. American Association for the Advancement of Science 1990; Bransford et al. 2010; Fox & Hackerman 2003) and astronomy should be no exception. It is imperative that we support and incentivize effective and equitable education practices. The importance of broadening participation, equity, and inclusion in astronomy and of the professional development necessary for improving practices are discussed in other position papers being submitted to the ASTRO 2020 committee. Recommendations from the 2015 Inclusive Astronomy conference (Nashville Recommendations), the AAS Task Force on Diversity and Inclusion in Astronomy Graduate Education (Rudolph et al. 2019), the AAS Site Visit Oversight Committee (Best Practices for an Inclusive Climate, 2018), and the APS Committee for the Status of Women in Physics (Effective Practices for Recruiting and Retaining Women in Physics) detail numerous research-based inclusive teaching practices. Here we focus on the importance of supporting astronomy education research as well as the implementation of curricula, findings, and principles. We emphasize that all three pillars of teaching: content, pedagogy, and equity are important for teaching excellence.

1 https://tiki.aas.org/tiki-index.php?page=Inclusive_Astronomy_The_Nashville_Recommendations
2 https://aas.org/files/aas_svoc_effective_practices_approved180602.pdf
3 https://www.aps.org/programs/women/reports/cswppractices/index.cfm
Astronomy education research has had major impacts on the way astronomy educators view teaching and learning, especially through the creation and dissemination of learning materials and assessment instruments at the general education (“ASTRO 101”) level. Numerous studies have shown that active learning results in large conceptual gains (e.g. Prather et al. 2009, Rudolph et al. 2010 and references therein) and that poor pedagogy can turn students away from STEM fields (e.g. Seymour and Hewitt 1997). Furthermore, we know that students from marginalized groups often experience classroom environments and dynamics differently than students from majority groups (e.g. Johnson et al. 2017) but that it is possible to mitigate some of the effects of bias, stereotype threat, and other issues through appropriate strategies (e.g. Estrada et al. 2018).

While many astronomers are engaged in education practice, astronomy education research itself remains a relatively small sub-field, with many avenues of research yet to be explored. There is much room for growth in astronomy education research around the dimensions of: demographic/population effects, for example students from marginalized groups; context, for example our undergraduate majors and graduate students; types of astronomical phenomena, especially modern topics, tools, and practices; and new theoretical perspectives and methodologies. There is also much room for fruitful collaboration between astronomy education researchers and other STEM education researchers and social scientists. We recommend funding for astronomy education research along all of these dimensions.

It is also essential that the tools, techniques, and ideas of astronomy and STEM education research are broadly disseminated, and that curriculum reform based on research-validated practices and principles of inclusive design be supported. We recommend funding for: (1) curriculum development and evaluation in new areas and (2) adoption of research-validated curricula and equity practices in new and existing areas, along with associated support for implementation, such as communities of practice and professional development. We especially support funding for departments at minority-serving, hispanic-serving, and other institutions that serve large fractions of under-represented students and may not have abundant institutional resources.

References


