

Creating an inclusive research lab with student onboarding materials

Ivan A. Hernandez, Jessi L. Smith, Miguel T. Villodas & Dustin B. Thoman

 Check for updates

Formal onboarding materials help to introduce new undergraduate researchers to a specific laboratory and the broader culture of the field. Research faculty members should be supported and encouraged to create these materials.

When undergraduate students join a research lab, they enter an unfamiliar environment where they must learn the lay of the land, form new relationships, and develop important skills. These experiences are common during a transition into any new context. However, within a research lab this initial onboarding phase is also likely to induce uncertainty among novice researchers, especially students with marginalized and minoritized identities. The culture of a research lab influences the motivation of these students to continue in the field¹.

In a lab, students develop specialized research skills and are exposed to the rules, norms and values of STEM. STEM research culture might differ from the norms and values students learn in classrooms¹. There are often unwritten rules that convey what is valued and rewarded in STEM, who participates and succeeds in research, and how and why research is conducted. Making those unwritten rules more transparent and thoughtful will help to improve the culture of research for everyone involved^{2,3}.

Onboarding materials range in their breadth and content. For example, shorter onboarding materials can include one-page [welcome letters](#) or [longer introductions](#). More extensive onboarding materials can include [comprehensive lab manuals](#). The goals of the onboarding materials vary, and the materials can consist of a wide array of information, including [lab guidelines](#), [expectations](#), training materials and [other essential resources](#)^{4–6}. Even if other types of onboarding occur (such as a face-to-face meeting or laboratory tour), written documents enable students to revisit these materials whenever they need to. Non-written onboarding is less systematic and leaves a lot of room for bias and informal assumptions about students' existing knowledge.

Developing and distributing written onboarding materials is not a widely adopted practice. An ongoing research project across three universities reveals that less than 1% of STEM faculty members had developed onboarding materials for their new undergraduate research assistants (D.B.T., unpublished work). On the first day of class, instructors review course syllabi, learning aims and classroom expectations. Faculty members should provide their new lab members with an analogous set of orienting information^{5,6}.

Benefits of onboarding materials

Establishing a package of onboarding materials for new lab members can be beneficial for all members of the lab. For undergraduate students

who are just entering STEM, onboarding materials set them up for success in four important ways.

First, onboarding materials provide incoming students with an orientation to the lab, their role in it and what is expected of them. For example, they can learn what to expect from their faculty research mentor, what types of tasks they will participate in, what outputs they can expect to produce, and how their research experience can translate and contribute to their goals after their undergraduate education.

Second, these materials facilitate connections to the research lab and expedite socialization into STEM. An onboarding package can facilitate and accelerate the adjustment of novice researchers to the culture of STEM. For example, some onboarding materials encourage new lab members to express their research ideas, describe how reading scientific literature is an important activity as a researcher and generally communicate what it takes to be a successful scientist. Becoming a STEM researcher includes learning what it means to 'do science' and what it means to 'be a scientist'.

Third, onboarding materials promote the type of lab culture that the faculty research supervisor wishes to cultivate (such as: innovative, supportive, productive, warm, positive and/or cooperative). Codifying expectations and norms in a document explicitly communicates the core values, guiding principles, shared beliefs, expected practices and desired identity of the research group up front. Such a written document encourages faculty research mentors to be intentional about the culture they wish to create in their lab and to remain accountable to these intentions, which would be easier to evade without formal written documentation.

Fourth, onboarding materials enhance communication and transparency while reducing uncertainty. For example, it is common for new undergraduate researchers to be unsure about how often they should communicate directly with their faculty mentor, the most appropriate way to communicate with their research mentor and generally the nature of the relationship between them and their faculty mentor. Onboarding materials allow the faculty research supervisor to be clear and transparent while pre-emptively answering questions such as these.

Collectively, these benefits compound to result in additional positive outcomes for the incoming undergraduate researchers (such as self-efficacy, satisfaction and the motivation to persist), the faculty research mentor (such as time saved and future stress prevented) and the research lab as a whole (such as a more positive environment, greater retention of students and increased productivity)^{5–8}.

As the scientific community grapples with how to diversify the STEM talent pool and workforce⁹, a focus on onboarding undergraduate researchers is particularly valuable for students from marginalized or minoritized backgrounds (such as first-generation college students, students of colour, women and transgender people) who have traditionally been left out of the scientific experience. Such students often need to overcome additional barriers when considering whether to

engage in a research lab (including microinvalidations, microaggressions, stereotype threat, acculturative stress and imposter syndrome). A thoughtful, supportive and informative onboarding process that includes a welcome package of onboarding materials can be especially beneficial for students from marginalized or minoritized backgrounds, who might hold cultural values and beliefs that are seemingly incongruous with the prototypical normative values, norms and beliefs within STEM culture¹.

Barriers to creating onboarding materials

We assume that faculty research supervisors are invested in the success of their students, their labs and STEM in general. However, two major barriers might prevent them from developing onboarding materials that can support this success.

One barrier preventing the broad use of formal onboarding packages is that faculty members are not adequately rewarded for developing thoughtful materials. The cost–benefit ratio for implementing and sustaining this practice is currently negative. The process of developing onboarding materials can be difficult initially and these materials should also be periodically revisited, revised, and updated⁶. Given that this process is not formally recognized, required or incentivized, creating and maintaining dynamic materials might seem like wasting time on non-work-related, non-incentivized tasks.

A second barrier preventing the broad use of formal onboarding packages is that there is not yet a culture supporting the use of onboarding materials. In general, STEM faculty members receive little training on how to create inclusive research environments, how to improve the quality of their labs or how to support student development within research spaces. Faculty research mentors might be hesitant to incorporate a practice without any formal training in how to do so successfully. Further, research faculty members probably did not receive any formal onboarding materials themselves when they first joined a research lab. Thus, they might be more comfortable reproducing their experience with an informal onboarding process within their own research labs.

Supporting the creation of onboarding materials

Barriers to developing onboarding materials contribute to the maintenance of the status quo. More STEM faculty members might provide onboarding materials to new lab members if these barriers were removed.

Policy changes must be implemented to shift the current cost–benefit ratio for creating onboarding materials from negative to positive. The work that STEM faculty members do to create inclusive and supportive lab environments should be systemically acknowledged. Faculty members should be encouraged to invest time and effort in engaging and retaining students in their research labs through formal systems that provide teaching credit for effective student mentorship. Formalizing this process could create a minimum standard for onboarding materials, analogous to course syllabi, to receive teaching credit for mentorship.

Additionally, creating meaningful onboarding materials should count towards formal evaluations in the same way that meaningful course syllabi and teaching portfolios do. Onboarding documents should be reviewable and rewarded as part of annual evaluation, promotion and tenure review, and for formal award recognition programmes. For instance, faculty members should be able (or even expected) to include these onboarding materials in their tenure packages. Meaningful and systematic mentoring practices should be evaluated and assessed formally, especially insofar as they align with institutional values of diversity, equity, and inclusion¹⁰. Faculty members are extremely busy and have many responsibilities, and they should be structurally

encouraged, recognized and valued for doing the important work of supporting early-stage scientists.

Further policy changes to support the use of onboarding materials include additional resources for STEM faculty members. STEM faculty members need training, professional development and funding to nourish the development of their research labs. Similar to course-development funds that support pedagogical innovations, competitive funding could be offered to enable faculty members to create thorough and inclusive onboarding materials. Specific training programmes and workshops could also be devoted to helping faculty members develop onboarding materials. Templates or toolkits for developing lab onboarding materials, similar to templates for course syllabi, could facilitate the wider adoption of this practice among faculty members.

The resources and support that faculty research supervisors receive from their institutions, professional STEM associations and their field provide the foundation for the practices implemented within their research labs. Normalizing the use of onboarding materials requires support beyond the individual faculty research supervisor and their individual lab practices. Pre-tenured faculty members are in particular need of support as they work to build their labs from the ground up. We encourage the creation of university-wide infrastructure and resources for faculty members who lead research labs. Formal offices or centres that parallel Centers for Teaching Excellence could support faculty members who are focused on innovative and inclusive practices within research labs. These centres should prioritize the provision of resources for creating inclusive research lab cultures. Although these centres are currently rare, those that do exist (such as [The Center for Student Research at UCSS](#)) can have a far-reaching positive impact for students, faculty research supervisors, and the STEM community in general.

Better incentive practices, support, and funding can help faculty research supervisors to support their students in meaningful ways. Supporting STEM faculty members as they train the next generation of researchers has the potential to broaden the range of individuals who feel welcome in STEM and shape science for the better.

Ivan A. Hernandez¹✉, **Jessi L. Smith**¹, **Miguel T. Villodas**¹ & **Dustin B. Thoman**¹

¹San Diego State University, San Diego, CA, USA. ²University of Colorado Colorado Springs, Colorado Springs, CO, USA.

✉e-mail: iahernandez@sdsu.edu

Published online: 20 February 2023

References

1. Thoman, D. B., Muragishi, G. A. & Smith, J. L. Research microcultures as socialization contexts for underrepresented science students. *Psychol. Sci.* **28**, 760–773 (2017).
2. Cate, L., Ward, L. W. & Ford, K. S. Strategic ambiguity: how pre-tenure faculty negotiate the hidden rules of academia. *Innovative Higher Education* **47**, 795–812 (2022).
3. Linn, M. C., Palmer, E., Baranger, A., Gerard, E. & Stone, E. Undergraduate research experiences: impacts and opportunities. *Science* **347**, 1261757 (2015).
4. Masters, K. S. & Kreeger, P. K. Ten simple rules for developing a mentor–mentee expectations document. *PLOS Comput. Biol.* **13**, e1005709 (2017).
5. Aly, M. The key to a happy lab life is in the manual. *Nature* **561**, 7–8 (2018).
6. Bennett, L. M., Maraiia, R. & Gadlin, H. The ‘Welcome Letter’: a useful tool for laboratories and teams. *J. Transl. Med. Epidemiol.* **2**, 1035 (2014).
7. Bauer, T. N., Bodner, T., Erdogan, B., Truxillo, D. M. & Tucker, J. S. Newcomer adjustment during organizational socialization: a meta-analytic review of antecedents, outcomes, and methods. *J. Appl. Psychol.* **92**, 707–721 (2007).
8. Goldstein, B. & Avasthi, P. A guide to setting up and managing a lab at a research-intensive institution. *BMC Proc.* **15** (Suppl. 2), 8 (2021).
9. Cech, E. A. & Waidzunas, T. J. Systemic inequalities for LGBTQ professionals in STEM. *Sci. Adv.* **7**, eabe0933 (2021).
10. Flaherty, C. The DEI pathway to promotion. *Inside Higher Ed.* <https://www.insidehighered.com/news/2021/05/14/iupui-creates-path-promotion-and-tenure-based-dei-work> (2021).

Competing interests

The authors declare no competing interests.