Inclusive Teaching in Primary and Post-Secondary Education

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Abstract

In order to inspire young students to pursue STEM, as well as retain students at a college level, there is a need to increase inclusivity in both primary and post secondary education. This project aims to increase retention rate of students in STEM by using inclusive pedagogy to create a sense of belonging for students. To encourage middle school students, curriculum was developed for students to perform labs within the School District of Philadelphia using planarians, *Dugesia dorotocephala*. Practices of inclusive pedagogy were used to give students tools and experiences to those of lab scientists. There is also a need to enhance education of inclusive pedagogy among STEM faculty to create more inclusive academic environments. To encourage STEM at the college level, development of an interactive platform at Bryn Mawr College to share evidence-based inclusive pedagogy techniques with science faculty for use in curricular development was started. By incorporating and using inclusive strategies, this project helps create a more inclusive STEM experience for students of all ages.

Introduction

In recent years, there has been increased access to higher education which has shifted the demographic profiles of colleges and universities. In the past 35 years, Black students have increased from 10 to 15% and Latinx students from 4 to 15% (Killpack & Melón, 2016). In the past decade as well, enrolled students over the age of 25 rose by 35% (Killpack & Melón, 2016). However, as diverse student experiences increase, classrooms have failed to be inclusive of all students, especially in STEM fields. As found in one study, “20% of Latinx students and 40% of Black students who intended to major in the natural sciences in their first year of college do not earn natural sciences degrees; for white and Asian students, the percent loss is 1.5 and 7%, respectively” (Killpack & Melón, 2016). With some colleges actively recruiting diverse students, higher education must adopt inclusive strategies to give all students an equal opportunity for success.

One proposed solution to this problem is to expose pre-college students to an inclusive learning environment in STEM. Research aimed to create curriculum for middle school students to work with planarians, *Dugesia dorotocephala*. The project aims to foster belonging at a young age by engaging students in the scientific process and teaching scientific techniques. Curriculum includes active learning activities for students to work in a laboratory setting. By exposing middle school students to research-based experiences in STEM designed to foster belonging and mitigate the effects of stereotype threat, we hope to increase a sense of “STEM” or scientist identity among young students prior to entering college.

Once students are in higher education, educating faculty on the importance of inclusive teaching and learning environments is also proposed to retain students in STEM. Traditional STEM environments have been see as exclusionary and creating a sense of belonging has been shown to retain students (Canning, et al., 2019). Literature was collected on inclusive teaching in STEM in higher education and organized into a database for faculty to access. A website was also created to summarize the main points of the literature to give faculty easier access to concepts before reading literature. By educating faculty on the importance of an inclusive teaching environment and strategies on how to implement one, we hope to increase sense of belonging and STEM retention of students, especially those historically underrepresented in academia.

Progress

We developed a curriculum for a module on planarians for middle school students. This included creating laboratory experiments, guides, tools, and other resources. We also created lesson plans and slides for teachers to teach students how to develop a detailed lab notebook, as well as follow lab safety rules for working in a lab with planarians (Figure 2B). Slides incorporated active learning techniques for students to better engage with material (Figure 1A,B). These slides will also be able to be presented and modified for virtual learning if the instructor desires, especially during the 2020 pandemic. Goals included increasing understanding of the day-to-day life of a scientist, content knowledge of biology topics like stem cells, and a sense of belonging.

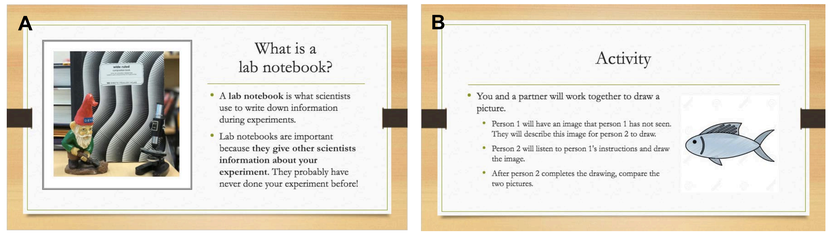

Fig. 1(A-B). Screenshots of slides from presentation on how to set up a lab notebook. A) Introductory slide defining what a lab notebook is and the importance of using one. B) Activity for students to learn the importance of taking detailed notes in lab notebook. This is an active learning activity that could be modified for online learning by having the class all draw one image from instructions given by the teacher.

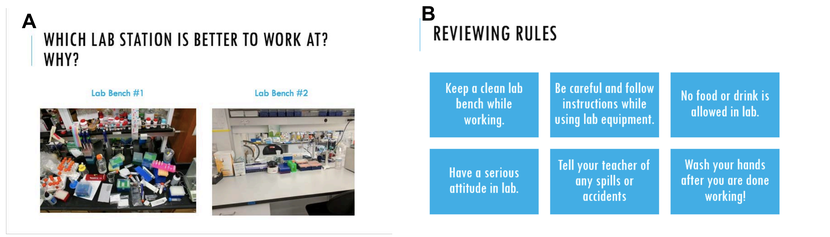

Fig. 2(A-B). Screenshots of slides from presentation on lab safety while working with planarians. A) Slide asking students which lab station would be better to work out, promoting critical thinking and engagement. B) Slide reviewing all lab safety rules at the end of the presentation.

Discussion

To promote inclusive teaching, not only is educating oneself on inclusive strategies but working with other faculty and students is important as well. In addition to the inclusive pedagogy resource created, a talk to inform STEM faculty on inclusive pedagogy was given by Dr. Jennifer Skirkanich. From this, it was also suggested for faculty to meet and discuss inclusive pedagogy strategies they have used that are beneficial, especially for online teaching.

Student voices are also important for faculty to learn the needs of their classes and the effects of inclusive teaching. Bryn Mawr College’s SALT program has student consultants for faculty of all disciplines and has shown much success. Student consultants could work with faculty to help them better learn about inclusive pedagogy as a further step to these resources.

A website was developed as a resource for faculty to learn more about inclusive teaching. This resource includes an introduction on inclusive teaching, as well as four aspects of psychosocial factors for learning: mindsets, stereotype threat, bias, and belonging. Also included in the resource is an annotated Zotero database of literature on inclusive pedagogy and a list of inclusive teaching websites from other universities. Faculty will have the ability to browse this resource for general tips and overviews but also be able to engage more deeply with primary resources detailing evidence-based best practices in inclusive teaching.

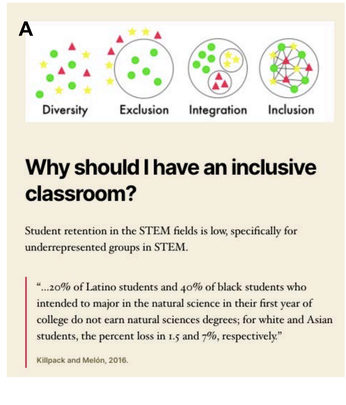

Fig. 3(A-B). Screenshots of inclusive pedagogy resource for faculty, titled “Inclusive Teaching in STEM Education: Bryn Mawr College”. A) Screenshot from page on inclusive classrooms, explaining why inclusive teaching in STEM is important for students. B) Screenshot from page on mindsets with table highlighting differences between a fixed and growth mindset.

Conclusions

Implementation of inclusive strategies at both middle school and college level education can increase interest and retention of all students in STEM. A better understanding of the psychosocial factors that affect teaching and learning at both primary and post-secondary levels can help faculty create more inclusive and accessible classroom environments, enhancing sense of belonging and retention in STEM. In the future, it will be interesting to see the effects of implementing these strategies on sense of belonging in STEM and attitudes towards science for students.

References

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