STEM Course Enhancement: Introducing the Learning Assistant Model in Large Introductory Astronomy Classes

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STEM courses involved: This model will be implemented for one section each of FALL 2020 PHYS 1403.02 (Stars and Galaxies) and PHYS 1404.01 (Solar System Astronomy). Each has an enrollment of 100 – 125 students. Other sections of the same courses taught by the same instructors will be used as the "control" for our companion Scholarship of Teaching and Learning Teaching Enhancement Grant proposal.

PROJECT NARRATIVE

Executive Summary:

With changing learning spaces, changing pedagogies are sometimes required. A recent repurposing of the studio style space that has heretofore been the classroom for the lecture portions of PHYS 1403 (Stars and Galaxies) and PHYS 1404 (Solar System Astronomy) has encouraged us to consider a Learning Assistant model to facilitate our active learning in an auditorium-style classroom. Learning Assistants are specially trained undergraduates who are situated throughout a classroom to promote more meaningful student group interactions and to help improve both student understanding and overall course satisfaction. Learning Assistants are particularly valuable in fixed-seating classroom spaces, such as auditoriums. Because the instructor's physical access to student groups is limited in these classrooms, a single instructor is not able to provide the same level of guidance and facilitation as is possible in an open-seating arrangement. In this proposal, we discuss what the Learning Assistant model is, along with the rationale for adopting the Learning Assistant model, and the process for identifying, hiring, training, and incorporating Learning Assistants in large STEM classrooms. In a companion proposal (Miller), we describe how we will research the impact of this change.

Introduction:

The use of Learning Assistants (LAs) in physics and astronomy classrooms is a relatively recent phenomenon. Distinct from Teaching Assistants, who lead lab sections and grade, LAs are peer experts within the lecture sections. Assigned to a set of 20 – 30 students, each LA is expected to facilitate group work, discussion questions, and tutorials in the context of an active learning classroom. While one benefit of the LA program is to improve learning outcomes through such facilitation, another is to help students connect better with the content and with each other, ideally improving course satisfaction. For courses with a large percentage of firsttime freshman, many of whom are from at-risk populations, the LA model promises connections with both the content and the classroom community.

Over the past fifteen years, a number of large universities have adopted the LA model with measurable learning benefits. The University of Colorado at Boulder was the first to employ this concept in physics in 2003, where they introduced the LA program to bolster student learning while simultaneously training future physics teachers (Finkelstein et al., 2006). Florida International University saw substantial improvements in learning outcomes on a valid and reliable physics concept inventory after the implementation of LAs (Goertzen et al., 2011). Looking past the aggregate learning benefits of using LAs, Van Dusen and Nissen (2017) argue that the use of LAs helps reduce disparities among ethnic/racial and gender groups, disparities that persist or even worsen within classes that incorporate active learning. Meanwhile, Talbot et al. (2015) provide evidence that LAs increase student satisfaction in large enrollment courses at the University of Colorado at Denver.

The use of LAs has expanded exponentially over the past decade. Currently 396 universities worldwide – including Texas State University in San Marcos – are part of the Learning Assistant Alliance (https://www.learningassistantalliance.org/), which provides resources and support for instructors and university learning centers. Far from being a program that will have to be invented, this is a program that has a substantial support structure.

In the past, the Department of Physics at SHSU has entertained the possibility of modifying classes to incorporate learning assistants. With the recent news that we will be moving our large astronomy classes to a new learning space, we feel that the time is ideal to make this change.

Hiring and Training Learning Assistants

There is currently no major in astronomy at Sam Houston State University, and few of our physics majors enroll in our introductory astronomy courses. Although we are in the process of finalizing our plans for an astronomy minor, our circumstances have led us to hiring former students who have performed well in our introductory astronomy courses as teaching assistants for our astronomy labs. This practice has proven to be highly successful, as we have maintained a rolling staff of 15 – 20 teaching assistants each semester, most of whom receive such high student evaluations that we rehire them for multiple semesters. We will follow this model in identifying, hiring, and training learning assistants for our courses. Near the end of the Spring 2020 semester, astronomy faculty members will identify students in their introductory astronomy courses who satisfy the following criteria: 1) they are currently performing well in the lecture course (a grade of 85% or higher), 2) they are currently performing well in the associated laboratory course (a grade of 90% or higher), and 3) they demonstrate the ability to communicate astronomical concepts and explain the course material to fellow students. The first two criteria are simple to ascertain. For the third, we will conduct peer evaluations during the course of the semester.

In our lecture classes, students are placed into permanent groups of 5 – 7 students, with whom they work on a daily basis. Given a class size on the order of 100 students, it is impossible for an instructor to monitor the daily interactions of every student. For this reason, we conduct peer evaluations, where students report on the daily interactions between themselves and their group members. They are asked to provide each group member with a score (out of 10 points) and to justify that score by telling us what they appreciate about a given group member, along with what improvements they would request from each group member. In this way we can determine which students excel not only at explaining conceptual course material to fellow students, but also in maintaining a good rapport with their peers.

During the Fall 2020 semester, each astronomy faculty member will hold weekly meetings with their assigned LAs, where they will go over the upcoming lectures for the week. They will discuss the concepts and activities that will be covered in class, explaining the material to ensure that the LAs feel confident in their understanding of it. We will go a step further, though, and incorporate the body of astronomy education research to detail the common misconceptions encountered in each lesson, along with research-backed best practices for tackling those misconceptions. In this manner, the LAs will be able to anticipate problems and facilitate conversations within groups that lead to better understanding. Because LAs will be spending three hours per week in the classroom and two hours per week in consultation with faculty members, *each Learning Assistant will be compensated for 5 hours of work per week, funded by the Department of Physics.*

Evaluation Plan

A detailed plan of evaluating these pedagogical modifications, as well as a dissemination plan, is included in our companion proposal (Miller).

References

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