Scholarship of Teaching and Learning: Evaluating the Impact of 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 evaluation plan.

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, as well as our plans for evaluating the impact of this change on learning and attitudes. A dissemination plan is also described. In a companion proposal (James), you will find a description of how we will identify, hire, and train Learning Assistants.

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. Before settling on our plan permanently, we must evaluate the impact that this change has on student learning and course satisfaction.

Hiring and Training Learning Assistants

Our companion proposal – STEM Course Enhancement: Introducing the Learning Assistant Model in Introductory Astronomy Classes (James) – fully describes the process of identifying, hiring, and training our learning assistants.

Evaluation Plan

To evaluate the impact of our pedagogical modifications to the introductory astronomy courses, we will begin by implementing the use of LAs in only one section of PHYS 1403 (Stars and Galaxies) and one section of PHYS 1404 (Solar System Astronomy). Because each faculty investigator is scheduled to teach two sections of the same course (Dr. Miller will be teaching PHYS 1403 while Dr. James will be teaching PHYS 1404), one section of each will be our control group and one section of each will incorporate learning assistants. We will then collect data from pre/post content surveys to assess the impact of LAs on student learning outcomes. The content survey will consist of roughly 35 questions, gathered from a number of tested and verified astronomy concept inventories; such as the Astronomy Diagnostic Test (ADT, Hufnagel et al., 2000, Hufnagel, 2002), the Solar System Concept Inventory (SSCI, Hornstein, Prather, English, Desch, & Keller, 2010), the Star Properties Concept Inventory (Bailey 2007); and the Test of Astronomy Standards (TOAST, Slater, 2009). We will choose questions covering a range of concepts that will be emphasized over the course of the semester and that assess key misconceptions commonly held by students.

To assess student satisfaction, we will administer a survey of attitudes during the first week of the course and the last week of the course. The Survey of Attitudes Towards Astronomy (Zielik et al., 1999) will be our primary resource to assess participant attitudes towards astronomy and towards science in general. This survey is designed to assess attitudes in four areas: affect (general attitudes towards astronomy), cognitive competence (attitudes about intellectual knowledge and skills related to astronomy), value (attitudes regarding the value of astronomy), and difficulty (attitudes regarding the difficulty in learning astronomy). Participants will be asked to rate 34 statements on a 5-point Likert scale, ranging from “strongly disagree” to “strongly agree”. To prevent respondents from simply circling the same value repeatedly, the attitude survey is designed such that a number of statements are phrased negatively, such that an indication of “strongly disagree” actually indicates a positive attitude.

The impact of the Learning Assistant model will be disseminated through local channels (e.g., SHSU PACE Teaching and Learning Conference), regional meetings, and national meetings (e.g., the American Astronomical Society’s annual meeting, which has a large Astronomy Education presence). In addition, we plan to publish the results in the *Journal of Astronomy and Earth Sciences Education,* or similar publication.

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