Development of a Flexible and Structured Model of Supplemental Instruction

Steven Armstrong, Shad Bazaz-Jazayeri, Picabo Roscher, Brittney Ryun, Samson Stynen, and Dr. Jon Lau
Truckee Meadows Community College

Abstract

Entry level STEM courses serve as a gateway to the biomedical research pipeline. However, these courses have relatively high drop, withdraw, and fail (DWF) rates. Supplemental instruction (SI) has been shown to increase student success with particularly pronounced effects on first generation, female, and student of color populations. Unfortunately, participation in traditional SI is low. In order to increase participation we created a hybrid model of SI held through the social media platform Discord (DSI) for two Spring 2023 sections of BIOL 190A: Introduction to Cellular and Molecular Biology, a class with a DWF rate over 35%. DSI serves as a more accessible, yet still structured, environment where students can interact with SI leaders and their classmates in a hybrid manner. To date, we have seen high rates of engagement in DSI.

Introduction

Supplemental Instruction (SI) is a peer-led form of group instruction outside of class hours that has been shown to improve retention in courses with high DWF rates. BIOL 190A is a course in the biomedical research pipeline with a high DWF rate. Nonetheless, BIOL 190A students only attend SI at a rate of 0.54 sessions per semester due to stated time and scheduling conflicts. Previous research done at TMCC shows that synchronous online SI held via the video conferencing platform Zoom is as effective as traditional SI for our students.

In this project, SI will be delivered via the social media platform, Discord, with the intent of increasing BIOL 190A student participation in SI. Discord was selected because it is an online tool which both SI leaders and students can interact with on their own time. Further, Discord is great for facilitating discussion via the chat feature. Moreover, SI leaders can easily upload videos from YouTube, hold live review sessions, and post engaging activities such as Kahoot quizzes (fig. 1).

The Student Involvement Theory states that academic success is a product of both student inputs and environmental variables. Student inputs are the qualities inherent to students (age, gender etc.) while environmental variables are the policies, programs, and services provided by an institution (Astin, 1984). In this study we will assess student input and environmental variables with a focus on how participation in DSI impacts BIOL 190A course GPA. SI has been shown to be relatively more beneficial for underrepresented populations (Rabitoy, 2015). Therefore, the effects of DSI on groups such as first generation students, students of color, and female students are of particular interest.

The research questions guiding this study are as follows:

1) **Can BIOL 190A student course GPA be predicted by a linear combination of student input and environmental variables?**
2) **Can a hybrid online model of SI delivered using the Discord platform increase BIOL 190A students' participation in SI?**

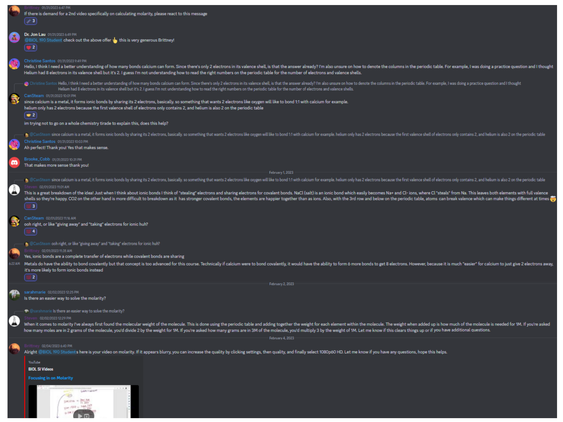

Fig 1. A sample screenshot of students and SI leaders engaging with one another. Included are multiple conversations over successive days. Further, a video shared by the channel SI leader can be seen in the lower left hand corner.

Methods

DSI was run in all of Dr. Lau's courses in Fall 2023. Students with previous success in the selected courses were chosen to act as SI leaders, and created a discord server to host DSI, as well as instructional materials. A survey was administered to the BIOL 190A classes to collect data on student input variables (gender, minority status, first-generation status, age, and student type) and environmental variables (participation in office hours, tutoring, DSI, and credit load). Additionally, data about students engagement with DSI was collected via a data collection bot on Discord.

Two SI leaders attended training to use the statistics program R, and created a linear regression model through which the relative correlations between each variable and final course GPA can be assessed.

Results: Survey

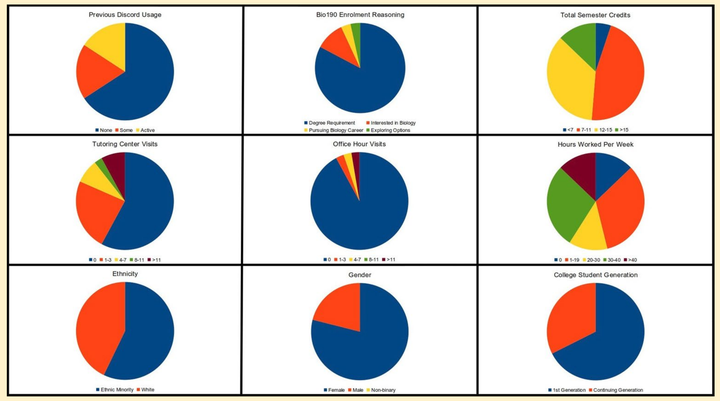

Fig 1. Select survey results of student's input variables, environmental variables, and discord familiarity.

Results: Engagement

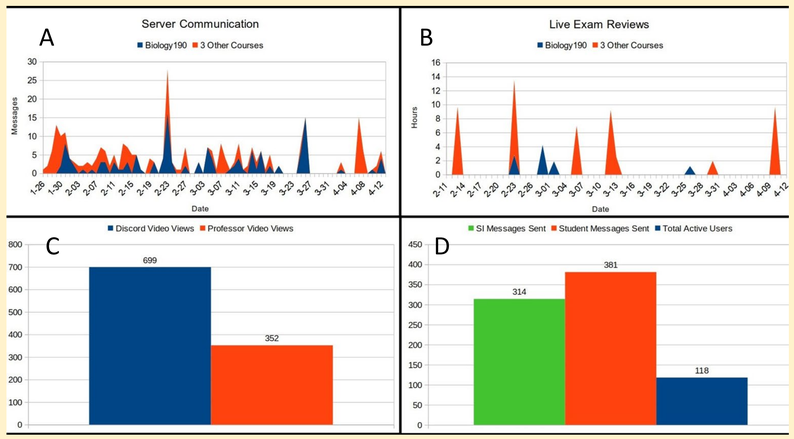

Fig 2. Demonstrating student engagement. A) How Biol. 190 communication compared to the other courses (Biol 100, 106, and 251) on Discord. B) Participation in the live exam reviews. C)The number of SI leader made videos watched compared to the number of professor made videos. D) Total messages sent on DSI, separated by SI leader and student, as well as number of unique members.

Linear Regression Model Development

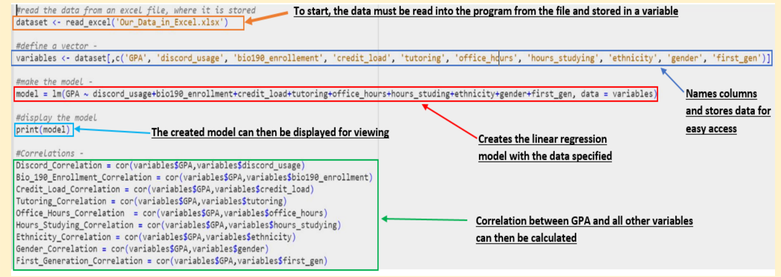

Fig 3. An image of the code in which the linear regression model will be developed for the purpose of data analysis

Variables	Name	Coding	Measurement	Categories
Y	Student Success		GPA	Continuous
X_1	Gender	(sex)	Male = 0 Female = 1	2
X_2	Minority status	(min)	Minoritized = 0 Non-minoritized = 1	2
X_3	First generation status	(gen)	First generation = 0 Non-first generation = 1	2
X_4	Student type	(type)	New = 0 Continuing = 1	2
X_5	Student age	(age)	Under 18-24 = 0 25+ = 1	2
X_6	Credit load	(credit)	Full-time = 0 Part-time = 1	2
X_7	Office hours attendance	(oha)	yes = 0 no = 1	2
X_8	Tutoring attendance	(tut)	yes = 0 no = 1	2
X_9	DSI engagement score	(DSI)	Number of times OSI was attended in the semester	Continuous

Fig 4. Coding for multiple linear regression variables for the following predictive model: $Y = b0 + b_1(sex) + b_2(min) + b_3(gen) + b_4(type) + b_5(age) + b_6(credit) + b_7(osi)$

Future Directions

- In order to increase sample size we are considering making participation in the DSI program mandatory. This would allow us to better analyze our data and be more confident in the results.
- Develop a mechanism to quantify student engagement.
- Following the completion of this semester, we will further assess DSI outcomes in comparison to previous semesters.

References

- Astin, A. W. (1984). Student involvement: A developmental theory for higher education. Journal of college student personnel, 25(4), 297-308.
- Rabitoy, E. R., Hoffman, J. L., & Person, D. R. (2015). Supplemental instruction: the effect of demographic and academic preparation variables on community college student academic achievement in stem-related fields. Journal of Hispanic Higher Education, 14(3), 240-255.

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