Development of a Flexible and Structured Model of Supplemental Instruction

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Abstract

Introductory biology 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 BIOL 190A: Introduction to Cellular and Molecular Biology, a class with a DWF rate over 35%. One section of BIOL 251: General Microbiology was also included. DSI serves as a more accessible, yet still structured, environment where students can interact with SI leaders and their classmates in a hybrid manner. DSI participation was the strongest predictor of course GPA among the variables measured.

Introduction

SI is a peer-led form of group instruction that has been shown to improve student success in courses with high DWF rates (Martin & Arendale, 1992). BIOL 190A is a course in the biomedical research pipeline with a high DWF rate. Though BIOL 251 has a lower DWF rate, as another important class in the biomedical research pipeline we chose to include it in our study during the Spring semester. BIOL 190A students attend SI in person at a rate of 0.29 sessions per semester which is not a high enough rate to support student success (Rabitoy, 2015). 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 was delivered via the social media platform, Discord, with the intent of increasing 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. Furthermore, Discord is great for facilitating discussion via the chat feature and 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 assess student input and environmental variables with a focus on how participation in DSI impacts 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 students GPA in introductory biology courses 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 introductory biology students' participation in SI?**

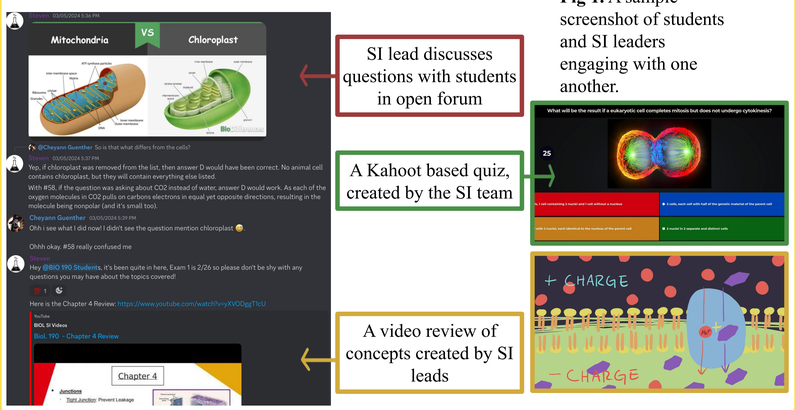

Fig 1. A sample screenshot of students and SI leaders engaging with one another.

Methods

Students in two spring and three fall sections of Dr. Lau's BIOL 190A course, and one spring section of BIOL 251 in 2023 were given access to a DSI server. Students with previous success in the course were chosen to act as SI leaders. A survey was administered to the BIOL 190A classes to collect data on student input variables, and environmental variables. Additionally, data about students engagement with DSI was collected via a data collection bot on Discord, which was combined with Kahoot Quiz participation to quantify each student's participation in SI (DSIE score). The relative correlation between each independent variable and the dependent variable of midterm exam scores was assessed through a linear regression model. It was then determined which variables were predictors of student success in BIOL 190A.

Results: Survey

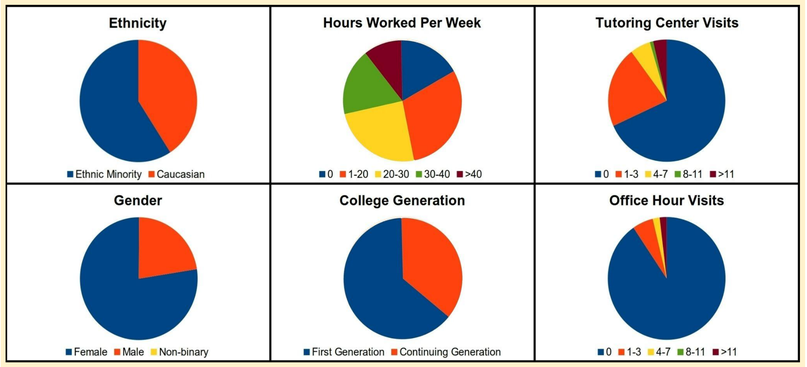

Fig 2. Student demographics and engagement with traditional forms of support provided by TMCC.

Results: Engagement

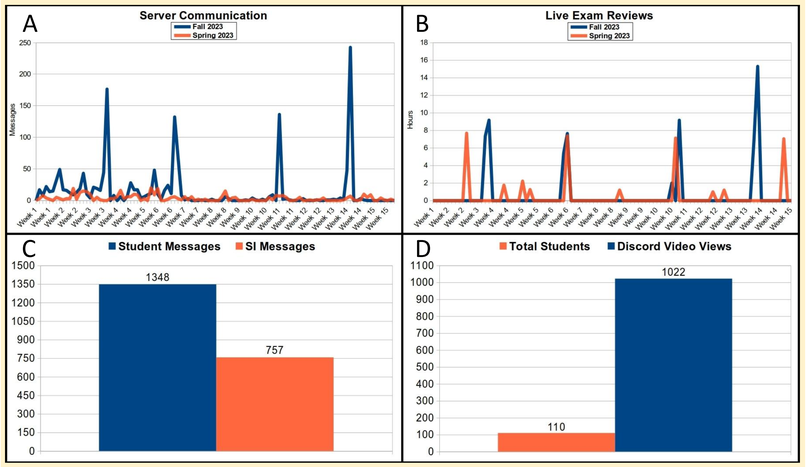

Fig 3. Demonstrating student engagement. A)Messages sent by students in comparison to SI leads. B) Participation in the live exam reviews. C)Total messages by students compared to total sent by SI. D) Number of server members compared to the total view count on review videos posted by SI leads.

Results: Multiple Linear Regression Model

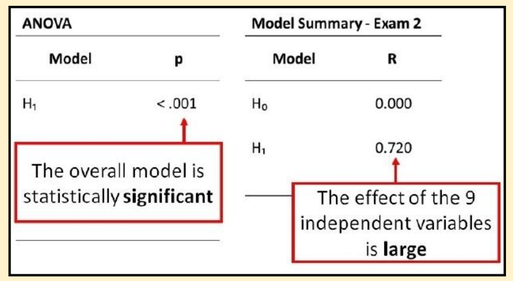

Fig 4. Selected results from the ANOVA and Model Summary generated by the linear regression model. The overall model is significant (p = <.001). The effect of the 9 independent variables is large (R = 0.720).

Coefficients

Model		Unstandardized	Standard Error	Standardized	t	p
H_0	(Intercept)	65.561	2.357		27.820	< .001
H_1	(Intercept)	66.278	6.222		10.652	< .001
	*DSIE	1.278	0.256	0.517	4.989	< .001
	credit load	-2.162	4.032	-0.059	-0.536	0.594
	gender	5.446	4.954	0.124	1.099	0.277
	*age	17.820	5.423	0.341	3.286	0.002
	1st gen	-1.063	4.109	-0.028	-0.259	0.797
	status	4.386	3.985	0.118	1.100	0.276
	working	-7.142	4.699	-0.158	-1.520	0.135
	TLC	0.451	4.180	0.011	0.108	0.914
	SOC	-6.536	4.018	-0.177	-1.627	0.110

Engagement with Discord SI is **significant** in the model and the **strongest predictor** of BIOL 190A student success on the midterm

Fig 5. Regression model results. DSI engagement is the strongest predictor of students success in BIOL 190A. Input variables defined as: gender (self-reported binary sex), age (under or over 25), 1st gen (1st generation status), status (new or returning), working (hours worked), SOC (ethnicity). Environmental variables defined as: DSIE (level of engagement with discord), TLC (tutoring center visits), credit load (full-time or part-time). Overall: (F(9, 61) = 6.237 = p < .001, R2 = .720). p < .01*

Future Directions

- Disaggregate data by student cohort
- Investigate the relationship between student age and student success

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.
- Martin, D. C., & Arendale, D. R. (1992). Supplemental Instruction: Improving First-Year Student Success in High-Risk Courses. The Freshman Year Experience: Monograph Series Number 7.

Acknowledgments

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