

High School Biology Preparation: Do Students Feel They Have Been Adequately Prepared for Introductory College Biology?

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Abstract: *High schools in South Dakota can drastically differ in size, facilities, and funding. However, each high school is required to meet the same state standards. This study focuses on high school biology courses, which have standards designed to “ensure graduates of South Dakota’s public schools have the knowledge, skills, and competencies essential to be college, career, and life ready” (South Dakota Department of Education, 2018). Analyzing the effects of high school biology preparation on postsecondary success is important because success in high school STEM courses is directly related to success in college science courses (Hinojosa et al., 2016). The goals of this study are to determine whether or not high school students in South Dakota feel they have been adequately prepared for introductory college biology courses and why they feel prepared or not.*

Key Words: introductory college biology preparation, academic confidence

LITERATURE REVIEW

An important component of a student’s success in college is academic confidence. Academic confidence describes a student’s belief in his or her ability to meet the academic and social demands of college. A student’s success in introductory college classes is related to academic confidence (Bickerstaff, Barragan, Rucks-Ahidiana, 2017). Sander and Sanders (2006) determined that academic confidence is primarily derived from a student’s previous academic experiences and social interactions. A positive experience in high school and college science courses, for example, increases the likelihood that a student will develop high academic confidence.

High school environment is another component relating to a student’s success in college. Factors that influence a high school’s environment include: available resources, funding, quality of school buildings, and quality of staff (Beaulieu et al., 2005). Maintaining a high school environment conducive to academic achievement is often difficult in rural schools. The National Science Foundation (NSF) worked to address this problem by funding Rural Systematic Initiative (RSI) projects from 1994 to 2008. RSIs were designed to “ensure that all students in some of rural

America's most impoverished communities are prepared for the 21st century as citizens and workers with a quality education in mathematics and science" (Harmon, Smith, & Edvantia, 2007, p. 3). The NSF found significant improvements in student achievement after the implementation of RSI across the country (Harmon, Smith, & Edvantia, 2007).

In addition to academic confidence and high school environment, another major factor relating to student success in introductory college classes is whether a student has taken Advanced Placement (AP) classes or not. Students who have taken AP classes in high school have a significant advantage over those who have not. This advantage is present because AP classes allow students to learn college level material before entering introductory college classes (Gagnon & Mattingly, 2016).

Academic confidence, high school environment, and access to advanced science courses are all factors that influence a student's success in introductory college courses. Since South Dakota has a wide range of high school students from rural schools to urban schools, the most prevalent cause of success or lack of success in introductory college biology courses is unknown. The following methods were used to determine if students in South Dakota believe they have been adequately prepared for college biology courses.

METHODS

A mixed methods survey was designed and administered to freshman students at South Dakota State University. Specifically, these students had completed either general or honors Biology 151 in the fall of 2017. The professors of general and honors Biology 151 distributed the survey link to students in the spring semester of 2018. A mixed methods approach best suited this research question because the qualitative data provided an explanation to trends found in the quantitative data. Mertens (2005) further explained the intent of a mixed methods approach: "[T]o seek a common understanding through triangulating data from multiple methods, or to use multiple lenses simultaneously to achieve alternative perspectives that are not reduced to a single understanding" (p. 293).

RESULTS

There were 75 participants included in the study from a pool of about 300 students. This cohort of students is comprised mostly of students from the Midwest, which is comparable to the student population at South Dakota State University.

QUANTITATIVE DATA ANALYSIS

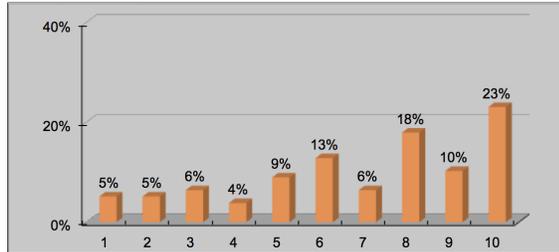
Figure 1 depicts findings from the quantitative data. The survey asked students to rate how they felt about the question on a scale of 1-10. A low score indicated a negative response to the question, and a high score indicated a positive response to the question. Based on the results shown in Figure 1, students generally felt positive about how well their high schools prepared them for introductory college biology. In addition, 88% of students felt their experience in Biology 151

either did not impact their future goals or had a positive impact. Lastly, most students felt their experience in Biology 151 had no impact or a positive impact on self-confidence.

The following quantitative data were analyzed using SPSS. The statistical test used was Spearman’s rank order correlation. Spearman’s correlation coefficient is appropriate for analyzing ordinal data (Field, 2005, p. 129). Several significant correlations are present in the data.

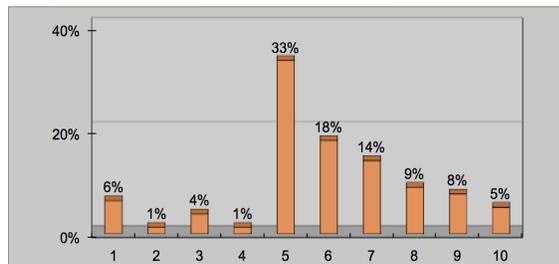
- Students who attended small schools were more likely to report that an honors and/or AP biology course was not offered at that school.

How well do you feel your high school prepared you for Biology 151?



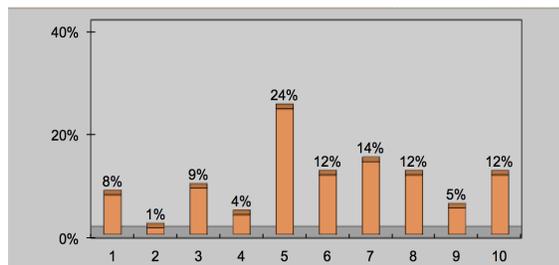
Mean: 6.83

Has your experience in Biology 151 impacted your academic or career goals?



Mean: 5.91

Has your experience in Biology 151 impacted your self-confidence?



Mean: 5.96

Figure 1. Quantitative data analysis.

Correlation: **-0.41** (Honors, $p < .01$), **-0.51** (AP, $p < .01$)

- Students that rated their high school biology courses as more difficult generally rated their experience in Biology 151 as having a positive impact on their academic or career goals. Correlation: **0.33** ($p < .01$)
- Students that rated their high school biology courses as more difficult generally rated their experience in Biology 151 as having a positive impact on their self-confidence. Correlation: **0.36** ($p < .01$)
- Students that received an A in Biology 151 typically stated they felt their high school prepared them better for college biology compared to their peers. Correlation: **0.44** ($p < .01$)

QUALITATIVE DATA ANALYSIS

Student responses to the qualitative section of the survey were first split into groups based on whether the response was positive, indifferent, or neutral. Then, these groups were further categorized based on common themes. Table 1 depicts the breakdown of responses to each question based on the coding described above.

Table 1. Main categories for qualitative data analysis.

	Positive	Neutral	Negative	Total
Q18. Describe your experience in Biology 151.	26	23	25	74
Q19. How has Biology 151 impacted your future academic and career goals?	46	18	10	74
	Change to Bio	No Change	Change from Bio	Total
Q20. How did your experiences in Biology 151 impact your decision for your major?	9	52	13	74
	No Change	Neutral	Change	Total
Q21. If you could change anything about your high school preparation for introductory college biology classes, what would you change and why?	24	3	47	74

IMPORTANCE TO THE FIELD

The data indicates that there is not equal access to advanced biology courses in high schools. High schools with a smaller student body are less likely to offer honors or AP biology courses. This may be due to a lack of funding, qualified teaching staff, or student interest in these courses (Gagnon & Mattingly, 2016). Having a more rigorous biology course in high school was found to typically increase the grade received in college biology. Thus, students who have access to advanced high school biology courses are at an advantage to those who do not.

Several qualitative responses supported this conclusion. For example, one student stated, “I wish I would’ve been able to experience possibly AP Bio or even a more advanced bio than just my high school biology.” Another student explained, “I really liked my high school bio, but I feel that there needed to be a section for kids going on in a science field, and one for kids who just simply needed it for a graduation requirement. I don’t feel I was pushed as much as I could have been.”

The averaged data show that students generally felt either neutral or slightly positive about their high school biology and Biology 151 experiences. However, the data at the very positive and very negative extremes should not be ignored. For example, one student relayed their positive experience in Biology 151: “It was a great time. It was basically a repeat of AP bio. I knew the material already, so it wasn’t terribly hard.” A different student shared their negative experience: “I honestly had a difficult time grasping onto concepts because my prior biology knowledge was very simple.” The fact that some students felt great about their experiences while others felt poorly indicates there is a problem beyond the scope of this study.

Further research on specific student success indicators, such as motivation and grit, may help identify why students have different experiences in high school and college biology courses. The amount of student responses is a limitation of this study. In future studies, students from each grade level and potentially different universities should be surveyed.

REFERENCES

- Beaulieu, L. J., Gibbs, R., Southern Rural Development Center, M. M., Economic Research Service (USDA), W. D., & Rural School and Community Trust, W. D. (2005). The Role of Education: Promoting the Economic & Social Vitality of Rural America. *Southern Rural Development Center, Mississippi State University*. Retrieved from <https://files.eric.ed.gov/fulltext/ED493383.pdf>
- Bickerstaff, S., Barragan, M., & Rucks-Ahidiana, Z. (2017). Experiences of earned success: Community college students’ shifts in college confidence. *International Journal of Teaching and Learning in Higher Education*, 29(3), 501-510. Retrieved from <http://www.isetl.org/ijtlhe/>
- Field, A. (2005). *Discovering statistics using SPSS*. Thousand Oaks, CA: SAGE Publications Inc.
- Gagnon, D., & Mattingly, M. (2016). Advanced placement and rural schools. *Journal of Advanced Academics*, 27(4), 266-284. Retrieved from <http://www.journals.sagepub.com/>
- Harmon, H. L. Smith, K., & Edvantia. (2007). *A legacy of leadership and lessons learned: Results from the rural systemic initiatives for improving mathematics and science education*. Retrieved from <http://www.edvantia.org>
- Hinojosa, T., Rapaport, A., Jaciw, A., LiCalsi, C., & Zacamy, J. (2016). Exploring the foundations of the future STEM workforce: K-12 indicators of postsecondary STEM success. (Report No. 2016-122). Retrieved from <http://www.ies.ed.gov/>
- Mertens, D. M. (2005). *Research and evaluation in education and psychology: Integrating diversity with quantitative, qualitative, and mixed methods*. Thousand Oaks, CA: SAGE Publications, Inc.
- Sander, P. & Sanders, L. (2006). Understanding academic confidence. *Psychology Teaching Review*, 12(1), 29-42. Retrieved from <https://eric.ed.gov/?id=EJ876468>
- South Dakota Department of Education. (2018). South Dakota content standards. In *Science standards*. Retrieved from <https://doe.sd.gov/contentstandards>