

Preparing Gifted Students for College Success within the High School Science Classroom

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Abstract: Succeeding in college is a crucial step for many students in order to reach their desired career. Yet, research has shown that gifted students often have poorer college adjustment than their non-gifted peers. Gifted students have unique needs in high school classrooms, and when these needs are not met, they may not develop important skills they need for college success. It is important for all high school teachers to not only help their students achieve in a high school setting, but also to prepare them for success following graduation. This article discusses the areas gifted students often lack skills in as well as instructional strategies that high school science teachers can use to help their gifted students develop these skills. By using a combination of strategies like homogenous grouping, higher-order cognitive tasks, differentiation and project-based learning, high school science teachers will better prepare their gifted students for success in college.

Introduction

Imagine you are a gifted science student, just beginning your college career. You think you are ready. High school science was easy. You paid attention in class, turned in your work (mostly) on time and got A's on all the tests without needing to really study. You never had to go ask the teacher questions to understand how to figure out an assignment, you could do it on your own. You never felt challenged, but that was fine, you had a high GPA and got a good scholarship to college, so you are all set. You are the one who easily gets all A's, who is just naturally good at school. Why would college be any different?

Except college is different. There are not as many grades in the classes, so exams have higher stakes, and are more comprehensive and difficult. You find that you are not doing well on them without studying, but you have never needed to study before and are not sure exactly how to study. The papers and laboratory assignments are much harder, and you cannot seem to figure them out on your own. Maybe you should ask a peer or a professor? But you have never needed to ask for help before, so you hesitate now. Why can't you figure it out on your own? And all these assignments, exams, lab times, office hours and study times are a lot to keep track of. You never had to plan so much time around school work before; you usually finished assignments much more quickly than your peers in high school, so you never had to figure out how to manage your time wisely. You were the one with all A's, but now you are barely passing your classes. High school was easy, but college is much harder than you anticipated. You are stressed and anxious, and you do not like school anymore. You start to feel like maybe college is not the place for you.

Most people assume gifted students, especially those with high GPAs in high school, will flourish in college, but this is often not the case. "53% of high performing [gifted] high school students achieved relatively less well in college" (Peterson, 2000, p. 38). Think about the thought experiment above, and you can begin to see why this might be the case. Gifted students often do not develop the same skills

needed for success in college that their high-achieving non-gifted peers do. Gifted students have unique needs in the high school science classroom and face unique needs in the transition from high school to college. Unlike students with disabilities who are guaranteed Individualized Education Plans during their high school education, there is no federal law requiring differentiation and assistance for gifted students. In addition, definitions of what constitutes a gifted student vary from state to state and each school decides its own plan to meet the needs of gifted students. As a result, these students are at risk for not receiving the support they need to be successful.

Given their strengths, gifted students have great potential as leaders in their fields, but in many fields, college success is an important step on the path to reach that potential. If gifted students fail in college due to not developing the skills they needed while in high school, this can negatively impact their future as well as causing a loss of potential innovation in society. It is the responsibility of teachers to prepare all students, including gifted students, for success after graduation, which includes preparing them to succeed in college. Ideally, no gifted student should experience the struggles outlined in this introduction. The purpose of this article is to provide high school science teachers with instructional strategies that target the areas in which their gifted students need additional support in order to be ready for the increased academic rigor and personal responsibility of college.

Where Gifted Students Struggle in College

The scenario I offered of a gifted student starting college is based both on research of college transitions, as well as on my own experience as a gifted student struggling to make this transition. For example, a study by Gómez-Arizaga and Conejeros-Solar (2013) found that gifted students often feel unprepared for academics at the college level because they did not take notes during lessons in high school. Additionally, the gifted students in college reported that high school tests were easy so they could study quickly the night before and do well. However, in college, these students found that minimal studying was not sufficient if they wished to do well. These researchers subsequently conducted a study comparing the adjustment of gifted and non-gifted students and found that the main differences between them were in academic development and in relationship building with faculty members. The gifted students reported struggling more with time management and having weaker overall study habits than non-gifted students (Conejeros-Solar & Gómez, 2015). Another study found that when students were asked how they perceived their high academic ability as affecting their college adjustment, about 20% identified their high ability as a liability negatively impacting their college success. These students identified their giftedness as a hindrance due to it leading them to develop poor learning skills because they were not challenged in ways that required them to study in high school. Students who identified high ability as a detriment in college also identified perfectionism, tendencies to overburden themselves, and social deficiencies as struggles they experienced in college that they attributed to their giftedness (Peterson, 2000). Clearly, having effective study habits and time management skills are important for college success and these are areas in which gifted students often fall behind their non-gifted peers.

What High School Science Teachers Can Do

Although there is little research that directly links specific instructional strategies in science to better adjustment of gifted students in college, there are instructional strategies that have been linked to the development of skills important for success in college. In addition, certain instructional practices have been linked to higher achievement and engagement for gifted students in high school science. Students who are more engaged in science classrooms are more likely to develop skills essential for college success.

The Ideal Classroom Environment

There are certain aspects of high school classrooms that have been linked to gifted student engagement and achievement in science. A 2013 study by Gómez-Ariza and Conejeros-Solar found that students who participated in an enrichment program designed for gifted students felt that the program's accepting environment and opportunities to interact with gifted peers helped them develop important social skills and overcome personal challenges during college. Another study that asked gifted college students to reflect on their high school science experiences found that the qualities that the gifted students valued in their science teachers were high skill levels in the field of science, high expectations of the gifted students, and demonstrations of personal interest in the lives of students. Additionally, students were more likely to form positive peer relationships in homogenous over heterogeneous grouping (Muller et al., 2017). The importance of interactions with gifted peers and supportive teachers is further supported by research showing that gifted students reported enjoying specialized classes, such as Advanced Placement and International Baccalaureate, not only because of the more challenging curriculum but also because such classes offered them opportunities to work with like-minded peers. Gifted students also emphasized the importance of teachers who made them feel valued, supported them, and held them to high standards (Coleman et al., 2015). Overall, these results suggest that the best high school science classrooms for gifted students should include opportunities for homogenous grouping, hold students to high expectations and value the key individualities of each student.

Differentiation

An important aspect of ensuring the needs of gifted students are being met is including differentiation for the gifted students. Differentiation is the process of gauging student ability and assigning different tasks to these students based on that ability. Differentiation can occur at the level of content, process, or product, and can help ensure gifted students are being challenged appropriately. Differentiation also can help teachers avoid having their classes be so easy for gifted students that they do not need to develop effective study and time management skills. For example, in one study, three chemistry teachers differentiated the tasks for their classes during a thematic unit by allowing students to work at their own pace and assigning different students different tasks based on their abilities. All three teachers that used differentiation showed high levels of engagement and positive feedback from both the gifted and non-gifted students in their classes. This study also found that asking

gifted students to generate unique products and giving options that allowed for visual, oral, performance, and written assessments increased engagement and achievement in chemistry (Park and Oliver, 2009). Differentiation is one way that science teachers can increase engagement and achievement of gifted students.

Higher-Order Cognitive Tasks

In general, any task that engages gifted students in higher-order thinking is beneficial for achievement and engagement in science as well as preparing them for college. High school science teachers preparing gifted students for college may wonder whether to prioritize covering broad swathes of content knowledge or to instead focus on in-depth critical thinking experiences. The research suggests that higher-quality thinking is more valuable than greater content coverage. For example, a study of an enrichment program that had gifted high school students engage in college level science experiences found no advantage for those students who had more chemistry knowledge entering the program. Instead, results showed students who had little prior chemistry knowledge scored higher on the posttest (Worrell, 1987). This implies that prior knowledge is not necessarily an advantage in a rigorous academic environment. An additional 2004 study conducted by Ngoi and Vondracek on a gifted student enrichment program asked students to think critically about advanced topics within science and to problem solve within science. The authors found that the rigor of this program and its commitment to critical thinking and problem solving in science greatly benefited gifted students: “Approximately 95% of all graduates who have taken the Chemistry / Physics Program have reported in surveys that they definitely feel better prepared for college and careers not only because they had college-level material in high school, but also because of the study skills and time-management skills they developed” (Ngoi & Vondracek, 2004, p. 146). This study found a connection between critical thinking in science and the development of study and time-management skills and college success. Another study similarly found when gifted students reflected on high school experiences in science and math, they placed a high value on critical thinking and devalued classes that focused on memorizing large portions of information rather than on complex critical thinking tasks. Students valued the classes in which they had the freedom to critically think and to figure out concepts on their own through inquiry (Muller et al., 2017). Overall, science teachers who focus on providing opportunities for critical thinking in science rather than covering as much content as possible will have more engaged gifted students who are better prepared for college.

Project-Based Learning (PBL)

PBL is an instructional strategy that has been linked to increased engagement and achievement of gifted students in science, as well as one that engages student in higher-order cognitive tasks and provides a framework that can be easily differentiated. The PBL approach in any content involves having problems for students to approach that require the student to have an understanding of relevant information. This relevant information is the content and the PBL approach has the students actively engage in exploring and using this content. This creates a learning environ-

ment that is more student-centered than teacher-centered. Coleman recommends PBL for gifted students because it meets many important goals for gifted students, including helping students develop higher-order thinking skills and self-discipline, as well as providing opportunities for them to engage with advanced content (Coleman, 1995). Other researchers have also found that gifted students had significant increases in creativity, self-regulation, frequency of content discussion, and interest in science following PBL experiences in science (Jo & Ku, 2011). The use of PBL and differentiation together for gifted students have also been associated with the development of skills associated with creativity, developing creativity provides “the skills and habits of mind that support innovation” (Vantassel-Baska, 2012, p. 2). Undoubtedly, using PBL with differentiation can help gifted students not only develop skills important for college success but also for being innovators and leaders in their fields.

Conclusion

To prepare gifted students for success in college, high school science teachers should use instructional strategies that develop gifted students’ critical-thinking, time-management, and study skills. Research has shown that using PBL and differentiation can help increase engagement of gifted students in high school science while also helping these students develop critical thinking and time management skills. Additionally, studies have identified the importance of using homogenous grouping and having high expectations of gifted students in order to foster both the engagement and achievement of gifted students in science classrooms. High school science teachers who are designing instructional plans to help their gifted students prepare for college will not find one simple answer on what is best. However, by using a combination of suggested strategies such as PBL, higher-order cognitive tasks, differentiation and homogenous grouping, educators can nurture the development of study, time-management, and critical-thinking. High grades can be a false indicator of gifted students’ preparedness for college, so it is important to collect additional data and speak with gifted students to ensure they are being appropriately challenged and that they are developing these important skills. In addition, science teachers should be aware that gifted students have unique needs and should regularly communicate with gifted students and families to ensure their needs are being met.

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Julia Boehler obtained her Bachelor's degree in Biology and Master of Education through the University of Toledo. She teaches science and helps run the Science Olympiad Team at Springfield High School. She also enjoys educating people about conservation and animals through her part-time work with the Toledo Zoo education department.