HIGH SCHOOL RESEARCH: EXPERIENTIAL LEARNING INSIGHTS FROM A SCHOLAR AND A MENTOR

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ABSTRACT

Senior theses and capstone courses are experiential learning activities that high school seniors sometimes undertake in their last year of secondary education. These experiences allow students to research a topic of interest while applying the knowledge and skills they have acquired. This paper provides examples of such programs found in high schools throughout the world, shares the reflections of both a scholar and mentor on a senior thesis in marketing, and presents the limitations of such endeavors as experiential learning. Avenues for future research are identified regarding undergraduate and career outcomes for students who engage in high school research programs.

INTRODUCTION

Senior theses and capstone projects may be undertaken by students in their final year of high school and serve as culminating learning experiences (Hurtt, 2022). Specifically, the senior thesis allows students to explore a research question or topic in-depth and make an original contribution to their field of study. Senior theses typically involve extensive literature reviews, data collection and analysis, and the presentation of findings in a formal research paper. Conversely, "capstone projects" are typically undertaken by students to integrate and apply the knowledge and skills they have acquired throughout their academic program. They can take various forms, including research papers, presentations, creative works, or problem-solving initiatives, and may require students to work in teams to address complex issues or challenges (Kannapel, 2012). Both projects are forms of experiential learning, allowing young scholars to engage in observation, reflection, and active experimentation (Kolb, 1984).

Experiential learning is considered "a methodology of education which has a learning impact on the whole person, including feeling (affect) and behavior, in addition to cognitive stimulation" (Hoover, 1974, p. 1). Kolb argues that experiential learning changes how one views the world and is a "central process of human adaptation to the social and physical environment" (1984, p. 31). Kolb's (1984) experiential learning cycle is comprised of four stages: concrete experience, reflective observation, abstract conceptualization, and active experimentation. Recent discussion has emerged on what exactly constitutes a concrete experience, and a systemic literature review revealed five major themes: learners must be involved and active participants; knowledge is rooted in place and time; learners are exposed to novel experiences; inquiry is specific to real-world problems; and critical reflection mediates meaningful learning (Morris, 2020).

The outcomes of undergraduate research participation are well documented, but less is known about the impact of high school research programs on undergraduate research engagement and future career success. In one study, International Baccalaureate students showed increased self-efficacy leading to greater confidence and interest in conducting undergraduate research (Swan et al., 2018). Furthermore, students in China who completed the International Baccalaureate program Extended Essay said "they felt more confident about their ability to complete similar assignments at university" (Wright & Lee, 2014, p. 208). Another study suggests students who completed a senior thesis felt it improved their self-efficacy in both academic and professional endeavors (Hurtt, 2022). Additionally, students who completed the Advanced Placement (AP) Capstone, which includes AP Seminar, AP Research, and four other AP courses of the student's choice, "have significantly higher first-year college grades… and probability of participating in academic research, internships, and honors programs in the first year of college" than students who did not complete the capstone (Jagešić et al., 2020). Despite these positive findings, there are many practical challenges to overcome in implementing these programs in secondary schools. Additionally, there is insufficient research on other program outcomes that could support and guide their execution.

In this article, we outline examples of young scholar research programs that are available to young scholars and high school students. Next, we present mentor and mentee reflections on the senior thesis process and the challenges and insights gleaned from our individual experiences with a business research project. We then highlight the limitations of senior research projects as experiential learning. Finally, we identify avenues for future research on undergraduate and career outcomes of students who engage in high school research programs.

EXAMPLES OF YOUNG SCHOLAR RESEARCH PROGRAMS

At the K-12 level, The Henry Ford's Invention Convention Worldwide helps educators teach students about research through the invention process: "The Invention Convention Curriculum uses a framework that follows the seven steps of the invention process. It includes introductory lessons to help students get started. It also introduces students to entrepreneurial concepts to help them think about what happens beyond the invention process" (The Henry Ford, n.d., para. 2). The Invention Convention teaches students entrepreneurship skills and problem-solving skills. Young scholars can submit inventions that solve problems and compete nationally. They can participate as early as kindergarten and as late as the senior year of high school. The Invention Convention is an example of young people conducting research.

There are also STEM competitions for elementary and middle school students. For example, students in sixth grade and up can compete in Samsung's Solve for Tomorrow Contest. They solve a problem, develop a prototype, and compete nationally (Samsung, n.d.). Students develop creativity and entrepreneurship skills, which can be useful for careers in business. Winners at every level receive financial prizes and opportunities within the Samsung company. Some research competitions are reserved for high school students only, such as MIT THINK, a program that allows students to submit extensive research proposals. Selected students will conduct research with the help of THINK team members. Mentorships, funding, and networking opportunities are offered to the winners (MIT THINK Scholars Program, n.d.).

Many high school students worldwide have access to the College Board's AP Capstone Program, wherein students implement original research to earn college credit. According to College Board, "More than 2,000 high schools are approved to offer the AP Capstone Diploma program" (n.d.-b). Students must take two consecutive courses. The first course is AP Seminar, which teaches students to research and present synthesized arguments. The second course, AP Research, is rooted in the year-long research project. Students create research questions and answer them through experiments, surveys, and analyses. A teacher guides students throughout the year. Some students may work with an external expert mentor or advisor. If a student's research involves human participants, the student must receive Institutional Review Board (IRB) approval (College Board, n.d. -a). Though it is up to individual students to structure their papers, most of the submissions released by the College Board follow the usual format: introduction, review of literature, methodology, results, and discussion. The papers are limited to 5,000 words (College Board, n.d.-a).

The International Baccalaureate (IB) is a similar global program. In addition to completing research, students must take a specific curriculum over two years (IB Schools, n.d.). IB has over 8,000 programs offered worldwide through 5,700 schools (International Baccalaureate, n.d.). High school students take at least six IB courses and write a 4,000-word research paper (IB Schools, n.d.). Both IB and AP Capstone help students develop research and writing skills, which can be helpful for college and career. Many universities accept AP and IB credit, so some students can enter college as sophomores and graduate early. There is a lack of current research on the impact of AP and IB programs on undergraduate success, though numerous universities offer undergraduate research opportunities.

Beyond their international presence, these programs have many important implications for global education. By providing students with the opportunity to delve into in-depth investigations on diverse topics, these courses prepare students for challenges in critical thinking in higher education and beyond (Nardi & O'Day, 1999). The emphasis on research and independent inquiry also cultivates a culture of curiosity, strategic problem-solving, and innovation, all essential attributes for addressing complex global issues (Hmelo-Silver, 2004). Additionally, the collaborative nature of some capstone projects may require students to engage in cross-cultural interactions preparing them to better communicate with colleagues around the world. These experiences will not only help students navigate the complexities of a globalized society but also prepare them to contribute to a globally competitive and well-rounded workforce.

A HIGH SCHOOL STUDENT'S EXPERIENCE WITH BUSINESS RESEARCH

The first author graduated from a magnet school that focuses on college preparation for high-achieving students. Students are required to complete a senior thesis capstone. They must have a faculty mentor and an expert field advisor. The school offers students the option of completing the thesis through AP Capstone, which allows students to get AP credit and earn the AP Capstone Diploma. The research process lasted from August 2022 to April 2023 and included IRB certification, a proposal, a literature review, an online survey, a statistical analysis, and an oral defense.

The research project explored the impact of engagement on social media marketing. The research question was, "How do engaging posts on Facebook and TikTok influence consumers' perceptions of 10 companies from the 2022 Forbes Halo 100 list?" TikTok and Facebook posts were analyzed as part of the study. Two hundred sixty-five people took the survey reacting to

posts from 10 specific companies. The student had to determine the research question, review current research, decide on methods, write survey questions, and share the survey. Social media was used to collect data. The survey included several posts from Facebook and TikTok to gauge participants' genuine reactions.

Challenges

The first author experienced difficulties at each stage of the research process. These challenges ranged from not fully grasping the course requirements and the teacher's instructions, or lack thereof, to insufficient training for conducting rigorous literature reviews and the statistical skills needed for analyzing the data. Each challenge is discussed in more detail below.

Choosing a Topic

Numerous topics were considered during the brainstorming stage, from digital marketing to humor on social media. Choosing a topic was arduous, as the AP Research class did not set topic boundaries. Social media marketing was chosen because the first author was interested in marketing as a field of study.

Selecting Hypotheses

Choosing hypotheses for the study was challenging due to the broad impacts of social media engagement. Initially, the student researcher was instructed by the teacher to refrain from creating hypotheses, which further increased the difficulty of the process. After reading the literature and examining her main research focus, the student identified five hypotheses later in the process.

Finding Literature

TikTok is a relatively new social media platform, so when it came time to review current research, it took a substantial amount of time to find studies about TikTok. The student tried to find research that incorporated multiple social media platforms. Frequently, the only available research was centered around Facebook.

Using Qualtrics

Another challenge was using Qualtrics to create the survey to ask people about consumer engagement. Qualtrics was an unfamiliar software, so creating the survey took longer than expected. Additionally, the teacher did not have access to Qualtrics or any paid surveying software. Thus, a mentor's Qualtrics account through the local university was used.

Data Analysis

The first author needed help understanding the statistics and math reasoning needed for analysis. She sought help from experienced educators, including professors from a local university and an AP Statistics instructor. Asking for help allowed the first author to narrow her research focus. The mentors often suggested different methods for analyzing data. These mixed messages made it difficult for her to determine a path forward. By relying on mentors and textbooks about statistics, the analysis was completed.

Written Paper

The next challenge was sharing the data in a written format: the thesis. After completing multiple drafts, the young scholar received feedback from mentors and revised the paper again. Finally, in April, the student presented an oral defense to peers and AP teachers. The AP Research oral defense presentation is limited to 20 minutes, including a series of questions (AP Central, n.d.-a). While it was difficult to condense the data to fit the time constraints, the student scored a 5 out of 5 on the AP Research exam and received college credit.

Insights

These suggestions apply to high school students and to teachers, professors, and mentors who are advising these young scholars. Firstly, students should consider researching a field related to their future college major. Marketing was chosen in this case because of the first author's interests and academic plans. Students should hone their writing skills before taking on an intensive research project, which might involve getting extra assistance through a writing center or after-school program. Students need to find the right mentors and experts. In our experience, two formal mentors were selected while three others coached the student informally on different elements of the project. High school students are starting with limited knowledge, if any, about the research process. Mentors and experts can help students narrow research focuses, plan, and conduct research. The first author relied on mentors for knowledge about statistics, research technology, and writing. High school students should also consider testing multiple ideas before settling on one topic, as they will work with the ideas for an entire school year. Lastly, students may experience anxiety or nervousness about completing a research project. Students should aim to reduce anxiety and focus on learning throughout the project. In summary, the first author identified these key lessons learned from the experience:

1. Relate research to future college major or career.
2. Practice writing.
3. Find mentors who are a good fit.
4. Consider multiple research ideas.
5. Reduce anxiety by focusing on the learning goals.

MENTOR'S PERSPECTIVE

The second author is an assistant professor of management at a regional university and was an informal mentor during the research design and statistical analysis portions of the first author's senior thesis. The following section outlines her experience, insights, and suggestions for others who may advise high school students on similar projects.

At the heart of any academic endeavor is excavating the truth regarding a phenomenon of interest. When advising young people on their research journeys, faculty witness first-hand the struggles, resilience, and personal growth necessary to root out these truths and see a research project to completion. In the second author's opinion, the most rewarding aspect of this process is observing the truths students often learn about themselves. Beyond enhanced knowledge in a specialized area or the improved writing, quantitative, and critical thinking skills students often develop, they learn much about their work ethic, creativity, and mental toughness. The experience is gratifying but comes with a few advisor-specific challenges:

Balancing Guidance and Independence

Serving as an advisor to any research project requires providing clear guidance to students while facilitating their independent development (Lee, 2019). Advisors should remain available for communication, encourage students to ask questions and to seek clarification when needed. At the same time, it is essential to give students the space to explore and develop unique research problems and ideas without imposing one's agenda, which can enhance student engagement and motivation (Kuh, 2012). Advisors can then help students refine these ideas, select appropriate methodologies, and build a theoretically sound research project.

Finding the Right Resources

Providing resources that are both helpful and manageable to students is also a challenge. A mixture of statistical software tutorials and methods videos, examples for writing up results, and outlines for a typical research project are beneficial. In particular, the second author has found the College Board AP Research website to have resources that are highly accessible for high school students (AP Central, n.d.-b). Additionally, research topics are vastly broad and unique to individual students, making applying a one-size-fits-all approach to research challenging. While advisors cannot become experts in every area or field, they should be able to foster connections with other experts and scholars and be adept at tracking down the right resources for each project. Having a business background enabled the second author to provide coaching related to the statistical analyses and the results for the first author.

Approachability and Accessibility

Extensive research and literature underscore the importance of the mentor-student connection (Dolan & Johnson, 2009; Ives & Rowley, 2005). Advisors that are nurturing and supportive can significantly enhance student engagement, motivation, and persistence (Hagenauer & Volet, 2014). This type of support is critical when working with students in the middle of adolescence, the transitional period between childhood and adulthood (ages 10-24) marked by significant neurodevelopmental changes (Blakemore & Choudhury, 2006). Research can be stressful for fully developed adults. It can be even more stressful for students grappling with increasing autonomy, experimenting with and seeking out their identity in the world, and navigating the early career search and college application process. Making oneself approachable and easily accessible for research questions and encouragement can greatly impact student success.

Helping Students Find and Tell the Story

In addition to discovering truth, researchers must construct and tell a coherent and compelling story (Pollock & Bono, 2013). Narrative elements help readers organize and retain information, provide context, and make abstract concepts more relatable (Green & Brock, 2000; Kerby, 2015). Storytelling enhances readability and can make research more actionable, potentially inspiring change in public and political arenas (Bruner, 2002). Young scholars will need guidance isolating the most exciting research problem(s), developing tension and conflict in their writing, resolving the story with findings and astute implications, and positioning the research in a broader context.

Making the Project Manageable

Students with a passion for a particular topic may need help narrowing the scope of their research. Too many research questions and objectives can reduce project clarity and make it challenging to draw meaningful conclusions. Encouraging

students to continually engage and reflect on the size and potential impact of their research may be necessary. Current research also suggests that orienting students toward problem-solving can lessen students' burden regarding research (Gallos, 2022).

LIMITATIONS & FUTURE DIRECTIONS

Despite their value, secondary school research programs have several inherent challenges and limitations. Firstly, students that are not native English speakers or have learning differences will need significant accommodations to participate in these programs (Hurtt, 2022). There is a steep learning curve for most students regarding searching for literature, analyzing their findings, designing research, interpreting data, and writing up results. Because of this, students may also grapple with anxiety related to research (Gallos, 2022). Moreover, high school seniors are incredibly busy with coursework, extracurriculars, and college applications, making it challenging to dedicate time to in-depth research and writing.

Schools may also have limited access to research resources, including databases, data collection and statistical analysis software, labs, and specialized hardware and equipment. Furthermore, the availability and competence of supervision can vary widely, especially when considering the wide variety of ideas and projects students may elect to undertake. These factors can impact the quality and validity of high school senior theses. Finally, debate continues regarding the impact generative artificial intelligence (AI) may have on academic integrity and student learning (Dai et al., 2023; Eke, 2023). Programs will need to institute clear guidelines and expectations for using these tools.

There are many opportunities to study the impact of young scholar programs on academic outcomes. Specifically, researchers may wish to examine enrollment in undergraduate and graduate programs as it relates to the student's topic of interest. Also, analyzing the undergraduate GPA of students who complete these programs in high school could have significant implications for their adoption. Additionally, research could explore how senior research programs impact student success in specific subjects such as science and mathematics.

Beyond academic success, research on career-related outcomes is also warranted. Investigating whether participation in these programs enhances career readiness levels is one approach. Another is examining how access to mentors and field experts in their research program impacts a student's ability to secure internships and positions during and post-college. Finally, comparing the career paths and job placements of students who completed such programs to those who did not could produce interesting results and insights.

Finally, the impact these programs have on students themselves and their overall societal contribution is worth considering. Research on the psychological changes students experience beyond enhanced self-efficacy could make an important contribution. Potential increases in resilience and grit, intellectual humility, and optimism are all interesting avenues to explore. Examining whether participation encourages greater diversity by attracting traditionally underrepresented and socioeconomically disadvantaged groups to STEM careers would be a strong endorsement for these programs. The structure of the programs themselves in terms of rigor, time commitment, and mentor quality may also influence student success. Examining these elements in relation to future student endeavors is another avenue for research.

CONCLUSION

Senior research programs are touted for enhancing critical thinking and reasoning, problem-solving, and quantitative and writing skills. Still, there is minimal empirical evidence of student success past high school. As these programs take immense resources and time to develop and implement, it is necessary to provide evidence of their efficacy and return on investment. We hope our experience conducting business research in a secondary education setting will provide practitioners and scholars with useful ideas for implementing and measuring the outcomes of these programs.

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