

Board 316: Improving Two-Year Students' Spatiotemporal Computing Skills through START Internship

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Introduction

A shortage of 3.4 million skilled technical workers by 2022 (or 13% of the U.S. workforce ages 25 and older) was predicted by the National Academies of Sciences, Engineering, and Medicine [1]. With the increasing demand for spatiotemporal computing skills in the real-world job market, project-driven internships have become an important source of work experience for students with interests concerning geographic information systems (GIS) and related geospatial technologies [2]. However, while GIS internships offer benefits to college students, rarely do 2-year college students being trained in this field, even rare to see such internships being evaluated, especially during the pandemic.

There is some research on the learning of geospatial technology and spatiotemporal computing skills which focused on high school [3], [4]. There are only a few papers on college students [7], [8], [9], and a few on the challenges of learning in developing countries [10]. Very few focus on the virtual internship learning environment [11], [12], [13], [9]. There is no study at present on spatiotemporal computing skills for 2-year associate degree students. In addition, there is no research on the impact of remote or virtual internships on spatiotemporal GIS learning during the pandemic. Our study fills that gap and provides an urgent assessment for internships during the pandemic.

During the pandemic, with the financial support of the NSF START grant, 2-year associate degree students from Valdosta State University were involved in a collaborative internship with the NSF Spatiotemporal I/UCRC in Virginia. The objective was to train students with advanced spatiotemporal computing research and technology skills to fulfill skills set in critical service activities such as telecommunication and software design for geospatial applications. Interns were interviewed, and ten students were selected and matched with mentors with projects and Ph. Ds and doctoral student mentors based on their interests and skills. Students then completed basic spatiotemporal skill training and started to work with their mentors on a daily basis remotely on eight spatial-temporal projects during the 8-month internship in the academic year of 2021-2022.

Our research questions are as follows: Has the internship program increased students' knowledge and skills in spatiotemporal computing, research, and communication? What success did we obtain from such a program? What improvement could we make to the program? The study will help to shed light on spatiotemporal internships for 2-year associate degree students.

Methods

In order to answer the above questions, anonymous pre- and after-internship online surveys and in-person focus groups would be applied to gather information. Both quantitative and qualitative research methods are adopted to evaluate the impact of the internship on student learning. We designed and conducted anonymous survey questions and focus group questions for the 2-year

student interns to understand their experiences and evaluate how the virtual internship has improved their spatiotemporal computing knowledge and skills. The surveys include anonymous pre-internship and after-internship surveys. The survey results were summarized quantitatively and average scores in each category were calculated. Moreover, focus groups were conducted at the end of the internship. Students were asked to express their opinions and feedback in a group setting. The transcripts were typed and a thematic analysis was conducted.

Results:

Anonymous intern surveys demonstrate significant improvement of student knowledge and skills in 10 areas, including computing (computer coding, debugging, and GitHub), research (reading and reviewing the literature, time management, motivation, and general research skill), and communication (collaboration, presentation, and writing skills) (see Table 1).

Question	Pre-test Mean	Post-test Mean	Difference of Mean
How familiar are you with computer coding?	1.78	2.78	1.00
How familiar are you with debugging?	1.44	2.44	1.00
How familiar are you with GitHub?	0.11	2.22	2.11
How familiar are you with reading and reviewing the literature?	2.33	3.44	1.11
How familiar are you with research skills?	1.11	3.89	2.78
How well are you with time management?	2.56	3.89	1.33
How is your academic motivation?	3.78	3.89	0.11
How well are you collaborating with your mentors?	3.00	3.33	0.33
How good are your presentation skills?	3.00	4.11	1.11
How good are your writing skills?	3.44	3.67	0.22

Table 1: Mean Difference between Pre- and Post-Internship Skills

After comparing the mean difference between pre- and post-internship skills, it is clear that all variables (on a 5-point scale) post improvements, the largest being average general research skills (2.78), followed by using GitHub (2.11), and both of them improved averagely by over 2 points on a 5-point scale. Computer coding, debugging, reading and reviewing the literature, time management, and presentation skills have also improved by over 1 point on average on a 5-point scale. Students' collaboration and writing skills improved by 0.33 and 0.22 respectively. The smallest improvement was academic motivation. Considering all interns selected were very

motivated from the start, it is understandable that the improvement was small. Overall, results confirm a very significant improvement among all variables for the 2-year students in less than 8 months of spatiotemporal internship training.

The focus groups revealed four major themes. The first is that the internship has increased students' spatiotemporal technical skills. None of them had any computer coding skills at the start of the internship, but ended up learning a lot on the subject during the eight months. They were able to write codes under the supervision of the mentors. The second is that the internship has improved their research and critical thinking skills. None of them ever did any spatiotemporal research and many never worked in a team research setting before, but most learned how to conduct the literature search, read papers, and critically evaluate papers during the internship. The third is that the internship has increased their communication skills. The 2-year students range between 17 to 20-year-olds and many never worked in a team research setting and lacked experience in communication with team members. However, the internship enables them to learn how to effectively communicate with their mentors and teammates. They also learned how to present their research formally at weekly meetings and at conferences. The weekly practice improved their presentation style and confidence. Last, the internship stimulates interns' personal growth and career goals. At the end of the internship, interns reaffirmed their desire to transfer to 4-year universities after graduating from their 2-year program and a few aspires to go to graduate schools in the future. Three interns already transferred to top flagship 4-year degree programs after the completion of the internship in 2022, with a few more freshmen interns following the steps to transfer to 4-year programs after finishing their 2-year program in 2023.

However, there is room for improvement. Students pointed out communication can be an issue with a virtual internship with their mentors out of state. Time zone differences also caused problems for one intern particularly. The mentor and mentee have a 3-hour time difference and it was very hard for them to connect during the daytime when the mentee has questions. Virtual meetings were not very personable sometimes. In addition, some interns had other part-time jobs during the internship, and it was hard for them to juggle between school work, other jobs, and internships. More guidance and advice, such as communication, time management, and work-life balance, would be helpful at beginning of the internship. Due to the limited time frame and small numbers of students, more study would be needed to further evaluate similar programs.

Overall, results from the evaluation of our spatiotemporal internship demonstrate improvements in all knowledge and skill areas for 2-year program interns, including computer skills and soft skills such as research, presentation, and writing. The internship also helped students to achieve their academic goals and transfer to 4-year flagship university programs. It also provides insights into further improvement of such a successful program.

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