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## **A Comparison of the Academic Performance of Rising Scholars with Other Student Demographic Groupings before and during the COVID Pandemic**

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**ABSTRACT.** *The Purdue University Rising Scholars program was established in 2016 by a NSF grant designed to examine the effect of adult mentor support networks on student performance. The first students began classes in the fall of 2017, and their performance and many aspects of the program have been reported in the literature. Unfortunately, during this same time period, the COVID-19 pandemic moved across the globe and dramatically changed collegiate education. The effects of the pandemic in education will be felt for some time following the eventual demise of the virus. Because of this NSF grant period, the research team was uniquely positioned with matched pair sets of matriculating students from the Rising Scholars program, engineering, and exploratory studies. This paper will compare the performance of these students and the general student population for GPA and retention between the pre-COVID period (< spring of 2020) and the COVID period (spring 2020 onward). It is commonly perceived among collegiate instructors that student performance has suffered during the pandemic. The Rising Scholar demographic has the potential to have increased adverse effects from the pandemic disruption, but they also have an established adult mentor support network. The researchers have looked at differential performance outcomes between the various groups and exposed a tendency toward diminished performance with thinner networked students. Sample sizes were too small for the evaluation of any meaningful statistical tests.*

**Keywords.** academic performance, COVID, NSF S-STEM, support networks, socioeconomic status

### **Introduction**

The global COVID-19 pandemic from the spring of 2020 to the spring of 2022 affected higher education students around the world in numerous unexpected and unfavorable ways. A National Science Foundation (NSF) sponsored program on the Purdue University West Lafayette campus examining the issues facing low socio-economic status students pursuing STEM degrees spanned this time period. These students have collectively become known as “Rising Scholars” (Kent State University, 2021; Stanford University, 2020). The Purdue effort was designed to aid these students in their journey through higher education by providing them with a nurturing environment and examining the influence of support networks on the success of these students (Baldwin et al., 2021a). The pandemic added an unexpected additional stressor during the tenure of these students in higher education. This paper will provide a brief background on these students, other studies detailing the effects of the pandemic on students in higher education, the methodology used to parse-out the effects of the pandemic upon these students, the results of this analysis, and the conclusions.

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## Literature Review

The Rising Scholar (RS) program was designed as a research project responsive to a National Science Foundation S-STEM grant program. It was funded in 2016 by NSF S-STEM #1644143 *Rising Scholars: Web of Support Used as an Indicator of Success in Engineering*. This S-STEM grant program has been designed as a scholarship program for low socioeconomic status (low-SES) students to better attend selective universities and obtain STEM degrees. The overall research question for the project was: Could the quality of an individual's adult mentor support network be used as an alternative indicator of potential collegiate and career success? Highly competitive, R1 universities have been shown to have certain gateway incoming metric values that favor high SAT/ACT test scores and high school GPAs (Bastedo & Bowman, 2017). This process inhibits equitable acceptance for students with such attributes as being: women, under-represented minorities, first-generation college students, or of low-socioeconomic status (Holloway et al., 2014). The overall research program hoped to show that students who have strong support networks can succeed with far lower incoming metrics. Applicants who had significant financial need that had applied to engineering, but were not admitted and chose another major, were the potential subjects of this study. The basis of the selection process and an analysis of the final 21 participants can be found in Baldwin et al. (in press 2022a).

Rising Scholar students have followed a “best practice” path through the university. This path was designed to allow significant contact with various university personnel to grow their personal mentor support networks. Knowing professors and staff that take an interest in the student and having a multiple semester research project allows the student to feel more at home at the university, promotes life-long learning, and engenders an appreciation for the overall liberalizing educational outcomes associated with higher education (Gallup, Inc., 2014). The Rising Scholars started their time on campus by attending a 5-week Academic Boot Camp with incoming engineers, which simulated the first semester of engineering courses in a consequence-free environment. Once a year, the students attended a seminar, which allowed discussions about success tools and provided time to reflect upon their previous activities and plan ahead for the next summer. Two research projects were performed in summers following the freshman and sophomore years. A Louis Stokes Alliance for Minority Participation (LSAMP) program had the student closely monitored by faculty and graduate students to learn about collegiate-level research. A second research project performed the next year was to allow Rising Scholars to select and take more ownership of their specific project. This effort could be a continuation of their LSAMP work or could be a new research area. These projects allowed students to build a connection with a larger community of researchers and meet additional like-minded individuals that could potentially serve as mentors (Baldwin et al., 2021b; Stwalley, 2017; Stwalley, 2016). Seminars provided the important reflective writing experience to encourage communication skills (McCarthy, 2011; Bolton, 2006). The final foundation to the Rising Scholar path was to find an internship either in industry or with another university project, depending on whether the student planned to continue their education or take a job after graduation (Baldwin et al., 2021c). These internships have been shown to significantly improve the process of finding an entry-level position (Stwalley, 2006a; Stwalley, 2006b).

There were 21 initially recruited Rising Scholars who entered in the fall 2017, 2018, and 2019 school years, and 17 remained active in the program. The preliminary results from these students' time at the university has shown that they are performing and being retained at equivalent or higher rates than their matched pair counterparts entering through engineering and the undecided major (Baldwin et al., 2021d). Initial results for the analysis of the 17 active Rising Scholars' support network has shown that while the selection process seemed to have chosen all “strongly-webbed” individuals, some students were not as skilled at recruiting new mentors or utilizing their networks as others.

Practice has consistently demonstrated that a combination of social, emotional, and academic learning has the highest chance of producing a well-rounded individual, when coupled with a strong mentor support network (Scales et al., 2006; Scales et al., 2005; Weissberg & O'Brien, 2004). The Rising Scholar mentoring model was based on parts of Mr. Derek Peterson's Success Phactors® methodology. Peterson developed this framework to allow adolescents to build an active web of supporting adults. He found with Alaskan native populations, that if a child had five strong mentors, then that child would be successful in school. These adults could come from the family, school system, sporting groups, faith-based counselors, or other involved individuals (Peterson, 2016; Peterson, 2010).

The Success Phactors® methodology was built-on other developmental models. Benson's 40 Developmental Assets taught youth to be pro-active about their social development. This method had 40 questions that the individual could use iteratively to determine how they were progressing with their developmental goals (Benson, 1997). These questions empowered the student to learn ways that they could interact with adults to develop them as a mentor. Likewise, Catalano's Social Development Model (SDM) constructed a developmental pathway that children and young adults follow to be socialized within a given culture. These students could then become productive citizens within the larger society, or follow the same elements in an anti-social pathway, such as joining a gang. These developmental processes followed the route of

having opportunities, being involved with others in the group, gaining skills that provide recognition, and rewarding the individual for developing those skills (Catalano et al., 2021; Catalano et al., 1996).

Both of these models, along with the Peterson framework, were important to the development of the Purdue RS program. One of the main goals for the Rising Scholars was to have the students become active with various members of the collegiate campus to start them on a positive path for success. Mr. Peterson held a seminar during the students' first semester to help teach them how to build their webs of support. Yearly semester-long seminars also built on these methods and encouraged the students to become involved with their major departments' personnel and organized activities, particularly with members of the faculty and staff.

The development of COVID and the rapid change in collegiate course delivery in March 2020 made it much harder for the RS students to practice the ideals taught in the program. This problem was felt around the world on college campuses by all students. The students of a residential Indian university were queried about their satisfaction with the sudden transfer to on-line classes. Approximately 20% of the 12,000 matriculated students completed the survey. A vast majority were undergraduate students, and they were equally split between males and females. The results clearly showed that the students did not care for the on-line classes, particularly those that had trouble accessing adequate internet connectivity bandwidth. They felt that they needed to do more work to be successful within the class and that the professors were not adequately trained to optimize learning in an on-line class (Agarwal & Khara, 2021).

Analysis of changes in social interactions and mental health could be compared between prior to the pandemic (Sept. 2017 to Sept. 2019) and following the COVID lockdown (April 2020) using the Swiss student life study of Elmer, Mepham, & Standtfeld (2020). Networks, similar to the Rising Scholar web of support surveys, were evaluated. Students were asked to list up to 10 individuals to determine their network size, the ways that the student knew the mentor, and how they felt supported by the individual. Mental health scale scores were used to find depressive symptoms, anxiety, stress, and loneliness. The sample size was 212 students who had completed both the prior and during COVID surveys. The study found that while friendship and support networks remained stable, interactions between students and the ability to utilize study partners significantly decreased following the COVID lockdown. A higher percentage of students (22.6% vs. 39.2%) provided no contacts within their support networks following the pandemic. Social isolation resulted in an increase in anxiety. Students with small networks were found to be lonelier, and students who lived alone reported an increase in depressive symptoms (Elmer, Mepham, & Standtfeld, 2020).

Mental health surveys run on American college campuses prior to COVID were adapted to discover effects felt by students by the pandemic. Over 18,000 students on 14 campuses took one of two different instruments between late March to May 2020. Two-thirds of the students felt their financial security was reduced during this time, and this is a well-known predictor of problematic mental health. Over fifty percent of the students found it more difficult to access mental health care. There were also slight upticks of reported anxiety and depression, which adversely affected academic performance (American College Health Association and The Healthy Minds Network, 2020). Other negative effects on college students included confusion, anger, and post-traumatic stress symptoms. Pandemic-induced stressors were found to include frustration, boredom, and fear of infection or quarantine (Monika, 2020).

These types of impacts on students would likely be exacerbated within the Rising Scholar cohort, since the RS students had little collegiate experience in their original familial support networks. The combination of being a part of an underrepresented group both financially and ethnically could potentially increase their fears resulting from job stability within families and social isolation. The current study compared the academic achievement during the first two semesters impacted by COVID with prior performance. The thickly-webbed Rising Scholars were analyzed against their thinly-webbed counterparts and each group's matched engineering students.

## Methodology

The Rising Scholars program was approved by the Purdue Institutional Research Board (IRB), and students were provided consent forms and surveys to acquire data about their journey though the university. They were asked during recruitment and in the following fall and spring semesters about their support networks. The names of mentors were collected to allow study of newly added supporters and how included people might change throughout the student's college career. How they knew a supporter and what ways the person "noticed" them were used to categorize the mentor and how strongly they were connected to the student. The goal of teaching the students about professional mentors was to not to replace early key supporters, but to add university personnel. The Peterson's web used only adults as supporters, since his students were pre-college. The period of study being researched in this program was the college students' transition period between childhood/adolescence to adulthood. Not as much data is available for this transition period, and so, collegiate peers were additionally added to the mix of potential supporting mentors.

Baldwin, et al. (2022b) discusses the web of support analysis of the 17 active Rising Scholars. All accepted Rising Scholar applicants were initially considered thickly-webbed (TW) or could learn to be more webbed with encouragement. As it turned out, some of the students continued to have thin webs and did not effectively utilize the web of support methodology taught within the program. Subsequent analysis showed that there were 11 thickly-webbed Rising Scholars and six thinly-webbed (tW) students. The TW group started by having stronger family ties (3.4 vs 1.8), but they were also better connected with people from their high school (2.9 vs 0.8). They also found support with a wider variety of adults that were around them (1.4 vs 0.0). This data showed that both groups continued to keep similar connections with their families, although the thickly-webbed students continued to have higher support from their initial supporting mentors by their third year of the program (4.2 vs 1.8). The TW students also were quicker to include university personnel and became more strongly connected and reliant upon them.

The Rising Scholars have had semester grade, retention, and graduation data recorded since they began their time at the university. A matched pair student was selected for comparison from the general admission engineering and exploratory studies (undecided) students based upon similar residency, gender, ethnicity, and high school metrics. The current COVID issues study only used the Rising Scholars and Engineering students' comparisons. The previous method that these data has generally been presented is that all first-year students' performance has been compared, independent of which semester cohort the student was in Baldwin et al. (2022a, 2022b, 2021d). This would mean that in the earlier studies, the students coming into the university in fall 2017 would have a first semester of F17, but the entering students of the third cohort in fall 2019 would have a first semester of F19. Data from these various time frames would be aggregated. However, this study wanted to see whether there was a change in grades prior to March 2020 and then what happened during that spring semester and the following fall 2020 semesters. These two semesters had the largest change in course presentation due to COVID, so they could potentially have more effect on student learning. Therefore, it was necessary to utilize comparisons based upon calendar status, rather than academic class position. The new research question in this part of the RS program was: Were thinly-webbed Rising Scholars impacted more by the change in course delivery and isolation of the COVID collegiate environment than their thickly-webbed counterparts?

## Results and Discussion

The F19 cumulative grades were used to determine the historical baseline performance of the students. Figure 1 shows the pre-COVID cumulative GPA compared to the Sp20 and F20 term GPAs of the thickly-webbed Rising Scholars, their engineering matched-pair students, the thinly-webbed Rising Scholars, and their engineering matched-pair students. The TW RS students had the highest cumulative GPA (2.96) going into the pandemic, and they clearly performed better than the other groups during the two most affected semesters (3.22, 2.58). The two paired groups both showed a similar curve as the TW RS students. The group that showed the largest impact from the change in course delivery and access to academic and emotional support was the thinly-webbed Rising Scholar students. These students started the pandemic with a middle of the pack cumulative GPA (2.66), but they ended the F20 semester with the lowest term GPA average of 1.85, which is well under the probation range. This data is shown numerically in Table 1. There are only five students in the tW paired group, since one student had voluntarily withdrawn (Vol. Wthd.) from the university, prior to the COVID outbreak. This tendency follows-through in all these various analyses.

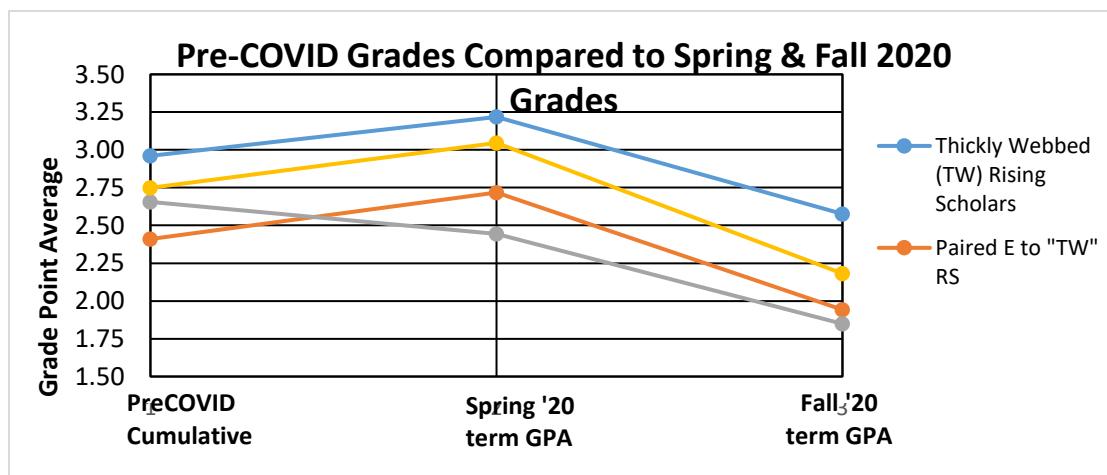


Figure 1 – Comparison between groups of the Pre-COVID cumulative GPAs compared to term GPAs during the first two semesters of the pandemic.

Table 1 - Comparison between groups of the Pre-COVID cumulative GPAs compared to the term GPAs during the first two semesters of the pandemic.

	Pre-COVID cumulative GPA	Spring 2020 term GPA	Fall 2020 term GPA
Thickly Webbed (TW) Rising Scholars (n=11)	2.96	3.22	2.58
Paired E to "TW" RS (n=11)	2.41	2.72	1.94
thinly Webbed (tW) Rising Scholars (n=6)	2.66	2.44	1.85
Paired E to "tW" RS (n=5)	2.75	3.05	2.18

Table 2 presents the issues each group had with academic attainment during the first two semesters of the COVID pandemic. Neither group of Rising Scholars had any student ending the Sp20 semester on probation. It should also be noted that the two students who voluntarily withdrew at the beginning of the F20 semester, either received a “not passing” or withdrew from their classes toward the end of the prior semester. There was a special extended deadline in place for the Sp20 semester, because of the extenuating circumstances. Both of these students would have ended-up on probation without this dispensation. During F20, classes were presented in a hybrid fashion for the duration of the semester. Smaller classes had some material presented in person with social distancing, but larger classes remained on-line. It can be seen that all groups performed at a lower level than during the Sp20 semester. Three students ended-up on probation in both the “TW” Rising Scholar group and the engineering students that were paired with them. One student in the engineering comparison group also left the university voluntarily at the beginning of the semester, and one student was dropped at the end of the semester. The other student who left at the beginning of the F20 semester was a thinly-Webbed Rising Scholar. Two others of this group went onto probation at the end of that semester. The engineering student group paired with the tW Rising Scholars had one student who was dropped at the end of the semester.

Figure 2 and Table 3 present the data comparing the cumulative class completion rates before the pandemic and the term completion rates of the first two semesters of the modified class presentation methods during the pandemic. The completion rate is calculated by taking the credits completed during the term divided by the number of credits attempted. The Thickly-Webbed Rising Scholars had the lowest drop in completion rate, losing only 7% across the pandemic period. The students that were paired with this group had a slightly higher increase to 16%. Both the thinly-Webbed Rising Scholars and their engineering counterparts had over 30% drops in their completion rates during this same period.

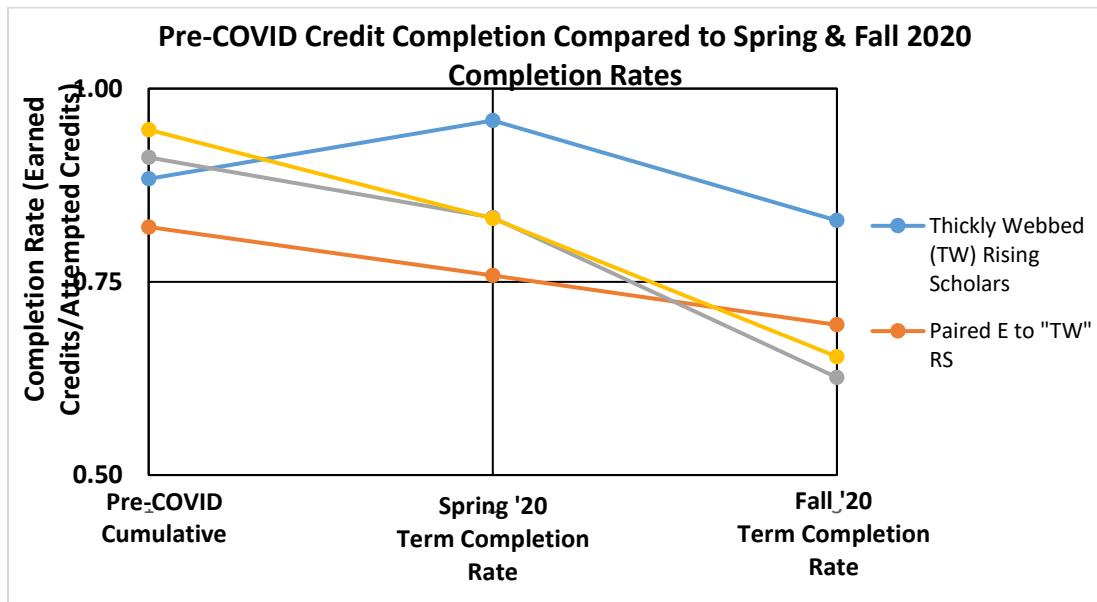


Figure 2 - Completion Rates of Classes taken by the four groups compared in this study prior to the pandemic and across the first two terms.

	PreCOVID CGPA	Spring 2020 tGPA	Fall 2020 tGPA	PreCOVID Completion	1st COVID Completion	2nd COVID Completion
Thickly Webbed (TW) Rising Scholars	2.96	3.22	2.58	0.88	0.96	0.83
Paired E to "TW" RS	2.41	2.72	1.94	0.82	0.76	0.69
thinly Webbed (tW) Rising Scholars	2.66	2.44	1.85	0.91	0.83	0.63
Paired E to "IW" RS	2.75	3.05	2.18	0.95	0.83	0.65

## Conclusion

This analysis clearly shows that all of the groups had significant academic difficulties during the pandemic. However, thickly-webbed students with an adequate adult support and effective mentoring navigated the changing academic environment better than those without. The TW RS students had the highest term GPAs for both the Sp20 and F20 semesters. Although there was a decline, it was not as severe as the other three comparison groups. These Rising Scholar students also had less of a disruption to their retention and had the highest term class completion rate for both analyzed semesters. The number of students in these groups did not allow for meaningful statistical comparisons. However, it seems completely obvious that the pandemic had a detrimental effect upon all students in higher education. The well-supported students and those who could draw upon a familial knowledge base of collegiate experiences fared better than those students who were more lightly supported. It can only be hoped that the lesson here, that thinly-supported students suffer more during crisis and need additional help, can be taken to heart and acted upon, because no one would want the conditions necessary to repeat this study with larger groups to ever occur again.

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