Improving Student Success in STEM with a Student Success Coach and Intrusive Advising

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We will present the results of a STEM Student Success program funded by the National Science Foundation's Division of Undergraduate Education at a large suburban two-year college. The program's objectives are to (1) increase the number of financially needy and academically talented students who graduate or transfer in a STEM program and (2) improve the retention and completion rates of STEM students through individualized and group support systems. The project was launched in the fall semester of 2016. Up to 60 students will receive full scholarships and support over five years to aid in their completion of a two-year program for graduation or transfer in either Chemistry, Physics, or Engineering.

A central feature of the program is the use of a STEM Student Success Coach as the first line of support for participating STEM students. The Student Success Coach provides personal one-on-one meetings advising sessions and arranges workshops and other STEM activities on and off-campus. Just as important, the S-STEM coach provides close and enforced academic monitoring. Students were required to provide grade reporting sheets at the midpoint of the semester and cannot drop or add a course without the permission of the coach. The use of the Success Coach provides a testing ground for the "intrusive advising" method used in the Guided Pathways support model currently being implemented at numerous two-year colleges.

We will present the most recent results of both qualitative survey feedback from the supported students along with quantitative results of their course success rates compared to their peers. As of May 2019, 100% of the responding indicated they were extremely (94%) or somewhat (6%) satisfied with their overall experience in the S-STEM program. All students indicated their meetings with the S-STEM Student Success Coach were extremely or somewhat informative. Also, success rate of S-STEM students is higher than the other students in all STEM courses (e.g. calculus I, engineering statics, physics I). At the present, the actual impact of the Student Success Coach on academic success remains to be determined as incoming ACT scores indicate that the S-STEM cohort is academically better prepared. Further analysis is planned to investigate this. Additional updated and detailed information will be provided on our poster.

Introduction

There is significant concern about students in higher education, particularly in community colleges, spending time and money on classes, but leaving their school without a degree or worthwhile certificate [1],[2]. Students are presented with a large "buffet" of courses but receive inadequate guidance on which courses to take to meet their desired goal. In this "cafeteria" style of education, students may end up making wrong decisions about which courses to take or even about which program to enter. They may not know when to seek help or where to go for that help. As a result, many may leave college without completing a marketable degree or

transferring to a four-year school. In addition to leaving school without achieving a correct end-goal, they may leave school in debt.

A proposed solution to this problem is the "Guided Pathways" model of student support. The model has four key pieces.

- First, colleges need to create a clear map of the required courses for each general program they offer.
- Second, colleges need to provide guidance and counseling to incoming students to allow them to select that correct general program that meets their goals and needs.
- Third, colleges need to work closely with the students to make sure they stay on the track for their program in terms of registering for the correct courses each term.
- Fourth, colleges must closely monitor the student to ensure they successfully complete these required courses and rapidly intervene with extra support when students appear to be struggling.

It is the third and fourth pieces, sometimes referred to as "intrusive advising", that are of interest to this paper. The College of DuPage has received a grant from the National Science Foundation's (NSF) Scholarships in Science, Technology, Engineering, and Mathematics (S-STEM) program to support financially needy science, technology, engineering and math (STEM) students. As part of this support, the selected students were provided with a Student Success Coach who worked with closely them to make sure they selected the correct courses for their major and monitored their progress. This method of the Success Coach is very close to the methods used in the intrusive advising proposed by the Guided Pathways model. By evaluating the effect of the Success Coach on the students supported by the grant, we may be able to predict the results when such support is provided on a broader scale under the Guided Pathway system[1].

The Grant

The College of DuPage is a large community college in suburban Chicago with an enrollment of approximately 25,000 students enrolled in credit classes with a full-time equivalent enrollment of approximately 13,600 students. There are approximately 250 to 300 students enrolled in its engineering program who plan to transfer to a four-year engineering school. A smaller, but significant number of students plan to receive degrees in other STEM fields.

In the fall of 2016, the College of DuPage received a five-year $650,000 grant from the National Science Foundation's S-STEM program to "(1) increase the number of financially needy and academically talented full-time students who graduate or transfer in a STEM program; and (2) Improve the retention and completion rates of students in STEM programs by providing individual and cohort student support, internships and research opportunities" [3].

[1] The first two pieces of the Guided Pathways model are also completed in this case. The first piece in completed since this project only involves students who have already selected a STEM major and the second piece is completed since most STEM programs such as engineering rather have a rather rigid and clearly defined pathway of required courses.

Students selected for the program had to be majoring in the STEM fields of biological science, computer science, chemistry, math, or physics[2]. Students were selected for the program mainly based on financial needs as long as they had a minimum Composite ACT score of 21 and grade point average (GPA) of 2.5 for incoming freshman or a GPA of 2.5 if already enrolled in college[3].

Students selected for the program received a scholarship that would cover the tuition for 32 credit hours and an allowance to cover $375 of book cost per academic year. Funds were also provided to support summer research programs and travel for five STEM students per year.

In addition to the purely financial support, the selected students received the support of a Student Success Coach. The Success Coach was a half-time employee completely dedicated to monitoring and supporting these 20 to 24 students.

Support from provided by the Coach included:

- Student support services: Provides aggressive individualized academic advising and career support through case management and counseling
- One-on-one meetings: both electronic and in-person
- Academic monitoring: use of mid-term grade sheets to monitor progress; mandatory meetings with the coach before dropping any classes
- Resource guides: on career exploration, resume creation, external scholarships and internship searches created and distributed to students
- Workshops: on mindfulness, setting priorities and goal-setting along with meetings with Career Services, 4-year college visits and meeting with successful COD alumni.

Table 1 shows the number of students selected and supported during the first four years of the five-year grant. To support a total of 22 to 24 students each year, 16 to 17 new students were selected each year after the initial year depending on the graduation and transfer rates of the students selected.

	Year 1		Year 2		Year 3		Year 4	
	Fall 2016	Spring 2017	Fall 2017	Spring 2018	Fall 2018	Spring 2019	Fall 2019	Spring 2020
New to program	11	0	12	4	14	3	12	5
Continuing in program	0	11	8	16	8	18	13	19
Total	**11**	**11**	**20**	**20**	**22**	**21**	**25**	**24**

***Table 1** – The number of new and continuing students supported by the grant. The goal was to have 22 to 24 students supported by the grant at any given time.*

[2] The majority of the students selected turned out to be engineering majors.

[3] The terms of the NSF grant also required that selected students were also required to be a US Citizen, US National, US Permanent Resident, or Admitted Refugee.

General Student Response

Students in the program were surveyed at the end of each year to determine their satisfaction with the program and to ask for feedback on possible improvements. Figures 1 and 2 show solid student satisfaction with the program and the success coach.

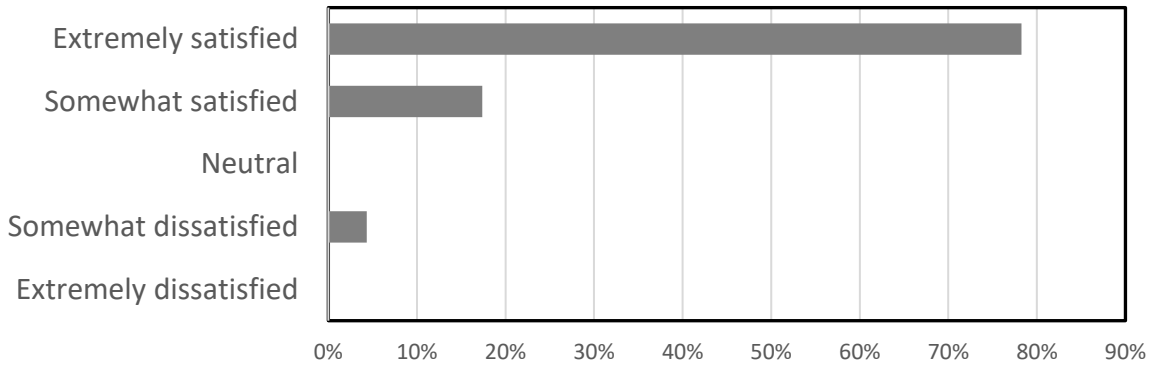

Figure 1– How satisfied are you with the S-STEM program so far? *-Student Survey results from the first three years of the project showing solid student satisfaction with the program.*

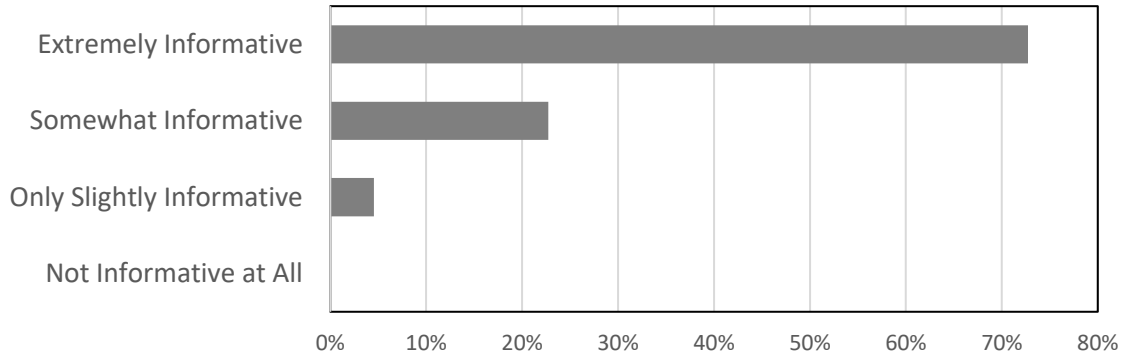

Figure 2– ***How informative do you think your meetings with your Success Coach were?*** **-** *Student Survey results from the first three years of the project showing solid student satisfaction with the Success Coach.*

Surprisingly, figure 3 shows that even when awarded a full-tuition scholarship, more than 60% of the students work in outside employment at least quarter-time and more than 25% work at least half-time.

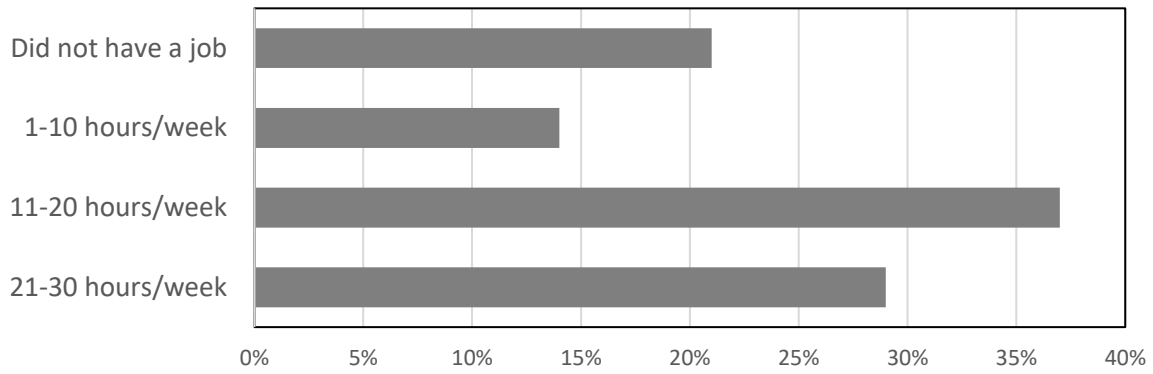

Figure 3– How many hours a week did you work during the last school year? *-Student Survey results from the first two years of the project showing students significant work schedules even when receiving a full- tuition scholarship.*

Effect of Success Coach on Completion Rates

The effect of the Success Coach was evaluated by comparing the rate of successful class completion for S-STEM students and a control group of students with similar backgrounds. The success rates of major interest were the success rates in classes taken predominately by STEM students such as Calculus or Engineering Dynamics.

To create the control group, the college's Office of Research and Planning created a cohort of students that

- Were Full-time (i.e. taking at least 12 credit hours),
- Had begun enrollment at COD relatively recently (i.e. after the fall term of 2014),
- Have a composite ACT score of at least 21[4],
- Received financial aid in some form and
- Appeared to be a STEM student either because (a) they have declared they intend to graduate with either an associate of science (AS) or an associates of engineering (AES) degree or (b) are taking a significant load of STEM courses (e.g. calculus).

The above criteria for the control group are an attempt to make the control group as similar as possible to the S-STEM student group. Table 2 shows the average composite and math ACT scores for students selected for the S-STEM grant and the control group. (The size of each sampled group is shown as a small number in parenthesis to the right of the score.) There is no statistical difference for the composite for the two groups for either score. Based on this information, the two groups are assumed to have equal levels of preparation when entering college.

[4] An analysis was also completed in which the students in the control group were required to have a Math ACT score of 21 as opposed to Composite ACT score of 21. The fundamental results of that analysis were the same as the analysis presented here.

	Composite ACT Scores	
Group	**Mean**	**Standard Deviation**
S-STEM Students	24.96 (26)	4.27
Control Group	24.91 (1609)	3.24

Table 2 – *The composite ACT scores for the S-STEM students and the control group. This small number in parenthesis is the size of the group. There is no significant difference for a one-tailed T-test for either score.*

Table 3 shows the percentage of students receiving a C or better in seven standard S-STEM courses (e.g. calculus) for both the S-STEM students and the control group during the first three years of the grant. In six of the seven classes, S-STEM students fared better than the control group. Unfortunately, because of the relatively small sample size in the S-STEM group, this difference is not statistically significant.

	Success Rate	
Course	**S-STEM Group**	**Control Group**
Calculus I	62% (13)	50% (324)
Calculus II	68% (19)	55% (226)
Calculus III	100% (13)	79% (136)
Physics I	92% (13)	81% (156)
Physics II	92% (13)	82% (135)
Engineering Statics	100% (9)	85% (79)
Engineering Dynamics	80% (10)	93% (56)

Table 3 – *Percent of student passing standard individual STEM courses with a C or better for the S-STEM and the control group. Small numbers in parenthesis represent the numbers in the sample group.*

Table 4 shows the percentage of students in each group receiving a C or better in courses with a STEM Classification of Instructional Program (CIP) code (e.g. CIP code 14 for Engineering) and for all courses taken. The data are broken down term by term for the first three years of the grant. The S-STEM group performed better in every term in both sets of data. When the difference is significant at the 0.01 level, the S-STEM number is marked with a "**". In all

six terms, the S-STEM perform better than the Control Group in both sets of courses and in two of those terms, the difference is statistically significant.

	STEM CIP Courses		All Courses	
Term	S-STEM Group	Control Group	S-STEM Group	Control Group
2016FA	89% (19)	78% (1254)	90% (30)	82% (2583)
2017SP	87% (23)	79% (1180)	90% (30)	82% (2390)
2017FA	90% (40)**	76% (1327)	93% (55)**	80% (2735)
2018SP	92% (36)**	76% (1099)	94% (52)**	80% (2203)
2018FA	78% (41)	77% (905)	81% (62)	80% (1807)
2019SP	83% (24)	74% (711)	85% (34)	75% (1381)
Grand Total	86% (183)**	77% (6476)	89% (263)**	77% (13099)

Table 4 – *Percent of students in each group receiving a C or better in courses with a STEM CIP code and for all courses. Small numbers in parenthesis represent the number of courses analyzed in the sample group. Pairs marked with a "**" indicate a difference at the 0.01 level of significance.*

Clearly, the S-STEM group is performing better than the control group. The question is what causes this difference. The selection criteria for the control group and a comparison of the ACT scores of the two groups suggest that the two groups were equally well prepared for college level courses.

The first possible answer is that because the S-STEM students received a full-tuition scholarship, they had to work less to pay for school and so had more time to study. We argue that this is unlikely to be the complete cause for two reasons. First, Figure 3 shows that over half of the S-STEM students work at least quarter-time even when provided the scholarship. Second, students in the control group did receive some financial aid from the college, although it may not be at the level of full-tuition payment provided the S-STEM students.

The next possible answer is that the "intrusive advising" or personal attention of Success Coach worked as suggested by the Guided Pathways model. Unfortunately, the data in the first two rows of table 4 do not support this answer. The Success Coach was hired in March of 2017 and so had no effect on the students taking courses in the fall of 2016 and only minimal effect of the students taking courses in the spring of 2017. And yet during those two terms there is still a difference between the success rate of the two groups for both all courses and for just STEM courses. While the support provided by the Success Coach may have positive effects not documented here, it does not totally explain the difference in success rates.

Another possible answer is that there is an unseen difference between two groups of students. This may be true, but the difference is not obvious. Both groups are attending the same school and taking roughly the same set of courses. The average ACT score of both sets is the same. Both sets have significant outside employment and both sets received financial aid in some form. That said, there may be an undocumented level in motivation. The application

process for the S-STEM scholarship was slightly more demanding that the application process for standard financial aid. This additional demand, however slight, may have required the S-STEM students to be more motivated and organized.

A final possibility is that it is a combination of factors. It could be that the students applying for the S-STEM grant were slightly more motivated to begin with and when the additional financial and personal support was added in, it caused an observable difference.

Future Analysis

We will continue to compare our S-STEM success rates to our control group for the remaining two years of the grant and to search for a reason for the difference in performance. We hope to involve the college's social science faculty in an effort to find some difference in the S-STEM and controls groups, such as motivation and organization skills, that is not evidenced by looking at their majors and ACT scores.

Another possible line of analysis is to find a school similar to the College of DuPage with an S-STEM grant which provided a different support system than ours and have them mirror our success analysis for their S-STEM and a control group. Although it would difficult to compare success rates between schools, we could compare the success rates within each school for S-STEM and control groups.

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