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Summer bridge program characteristics and outcomes at institutions within the southeastern region of the United States

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Abstract

Background In response to the effort to increase minority enrollment in college science, technology, engineering, and mathematics (STEM) majors, STEM summer bridge programs were created to help minorities with the transition from high school to college with the long-term goal of increasing the diversity of professionals in STEM. The goal of this research is to collect and examine STEM summer bridge program information for institutions in the southeastern region of the United States. The institutions chosen for review have obtained accreditation from the Southern Association of Colleges and Schools Commission on Colleges (SACSCOC). The states include Alabama, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Texas, and Virginia.

Results This study conducted a manual search via institution websites that resulted 107 non-STEM and 77 STEM summer bridge programs that have published reports as well as those who have not published reports to the extent that the information is documented and available. A survey was sent to collect information such as individual program characteristics and program goals. There were 25 non-STEM and 28 STEM summer bridge program respondents. The responses of program goals to the specific programs were compared to manual search results.

Conclusions The results show a need for more published reports for summer bridge programs, especially ones that target incoming freshmen in the STEM majors. Comparing the program goals from the survey and the manual search resulted in inconsistencies. This can be implied that the summer bridge program websites need to be more explicit program goals and be kept up to date. By doing this, applicants can interpret the benefits of participating in the summer bridge program.

Keywords Summer Bridge Programs · STEM · First Year Students · Program Goals

Abbreviations

FAQ	Frequently asked questions
GPA	Grade point average
H-LSAMP	Houston-Louis Stokes Alliance for Minority Participation
POC	Point of contact
SACSCOC	Southern Association of Colleges and School Commission on Colleges
STEM	Science, technology, engineering, and mathematics
URM	Underrepresented minority

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1 Introduction

According to Fry, Kennedy, and Funk [4], underrepresentation is prevalent in the science, technology, engineering, and math (STEM) workforce. The researchers revealed that only about 17% of STEM-related employees are Black or Hispanic. Over the past few decades, there has been a push to retain and increase URM student participation in STEM fields. To address this need, there are STEM Summer Bridge programs that specifically target underrepresented minority (URM) students to assist with the transition from high school to college.

Previous studies analyzed the landscape STEM focused summer bridge programs by literature review and metanalysis. Ashley et al. [1] identified published reports on STEM bridge programs over a 25-year span. The authors gathered a synthesis of the program goals from published articles about these programs that include academic characteristic, psychological, and department-level goals. The recommendations from this research involved more publications of summer bridge program outcomes due to only 46 published reports found from 1992 to 2016. The findings also showed that about 50% of the STEM summer bridge programs specifically targeted URM students. Bradford et al. [3] extended this research by conducted a metanalysis of STEM summer bridge programs to examine the effectiveness on grade point average and retention. The findings indicated that participation was significant for both variables. The authors also indicated that the analysis was constrained due to the limited reporting of student outcomes for the programs. The authors also mentioned exploring URM-focused STEM summer bridge programs in terms of effectiveness. With the need of more publications, this opens up opportunities for STEM summer bridge programs to report their findings. This will inform the research community about various implementations of summer bridge programs. Also, with the previous studies focusing on published reports, there are programs that have not been included in literature reviews.

In this study, we are focused on identifying the summer bridge programs that were not originally identified in the previous literature review studies. This will include programs with publications since the previous studies and those without any publications. A wider range of summer bridge programs were identified with the use of website searches. The previous literature reviews included institutions from various locations, but this research will focus on the southeastern region of the United States due to the opportunities to explore URM groups.

The 2020 census reported that Black or African American, non-Hispanic is the second- most prevalent group in the Southeastern region of the United States Jensen et al. [8]. In 2021, the National Center for Education Statistics (NCES) reported an enrollment of 15.4 million undergraduate students. From that total, Black students made up 1.9 million. The report indicated that this ethnic group decreased by 27 percent since 2010. The overall decline of the total undergraduate enrollment could be attributed to the coronavirus pandemic [7]. Increasing the diversity of the STEM workforce starts with increasing the diversity of undergraduate fields. Understanding the implementations of STEM summer bridge programs in the southeastern region of the United States gives current and future directors a template for updating or creating these programs.

1.1 Background

Ghazzawi et al. [5] conducted a descriptive study to provide longitudinal information about the impact of the Houston-Louis Stokes Alliance for Minority Participation (H-LSAMP) summer bridge program on graduation and workforce outcomes for student cohorts from the years 2004 to 2020. This study provided a foundation for research that investigates math impact, financial support, and other measures that affect student success in STEM. The data obtained from the University of Houston's Education Research Center showed that a larger demographic of bachelor's degree recipients in the College of Natural Science and Mathematics were female (56.8%), while 43% were male. A higher percentage of males received Engineering undergraduate degrees (69.5%), compared to females (30.5%). Out of the 2,044 undergraduate degrees obtained, about 27% were awarded to Black students and 24% to Latinx students. For the total number of H-LSAMP participants (n = 2839), about 74% of students graduated between 2004 and 2020. About 46% of the graduates were female and about 54% were male. The degree types were 51% NSM, 34.5% Engineering, 6% Computer/Technology, and 8.5% Other/non-STEM. Findings from this study provided evidence of the effectiveness of STEM intervention efforts in diversifying and increasing the proportion of underrepresented minority (URM) students successfully enrolling and graduating from STEM fields of study.

Gilmer [6] assessed a science, technology, engineering, and mathematics (STEM) summer bridge program at Bowling Green University. The program was designed to increase the number of female and URM graduates in the STEM fields. After conducting a quantitative analysis of the program, those who facilitated the program were able to achieve improved

GPAs and increase retention. About 67% of the original cohort in 2002 graduated in four years. The author also concluded that the summer bridge goals such as first-year retention, math performance, and GPA were correlated to graduation.

The Bagley College of Engineering (BCOE) Summer Bridge program at Mississippi State University offers a five-week program to newly admitted freshmen students who are pursuing an engineering degree. Verdell et al. [10] published a paper that outlined the practices of this program and quantitatively analyzed first year retention and graduation rates of the students. The analysis included a comparison of the 2010 through 2013 cohorts to students who did not participate in the program. The results showed that Black or African American students who participated in the program accounted for about 50% of all underrepresented minority groups in the engineering program. Also, the average retention rate for the Summer Bridge cohorts were 76% for the first year. The graduation rates only accounted for the 2010 and 2011 cohorts and showed successful completion through graduation within four years or five years following program participation. The practices that the program sought to address included academic performance, community building and belonging, teambuilding, financial support, student oversight, and networking with faculty. The authors indicated that factors such as K-12 academic matriculation, socio-economic status, and academic acculturation should also be used to understand performance and persistence of URM engineering students.

White et al. [11] conducted a qualitative study that included URM engineering students who participated in the BCOE Summer Bridge program in 2012. The goal of the research was to identify factors that led to persistence in engineering. The results indicated that financial support, student engagement, and mentorship were major factors for the retention of URM engineering students at a predominately White institution (PWI) in the South region of the United States.

From the studies, there are more factors than a high GPA, relatively speaking, that are shown to improve graduation rates of URM engineering students. Psychological factors such as sense of belonging and support from peers and faculty members have affected student retention. Studies have shown that academic preparedness, especially in mathematics, has also affected retention and graduation rates of URM engineering students. A literature review of STEM summer bridge programs asserts a necessity to pursue more research about what program goals affect academic success and retention.

1.1.1 Theoretical framework

The foundation of summer bridge programs involves providing students with the resources and experiences required to successfully transition from high school to college through college graduation. Many foundations of these programs can be tied to theoretical frameworks. Previous research findings help establish a foundation for identifying factors that affect the retention of URM students. The direction of this study is related to how previous experiences, environments in college, and characteristics after college are related to retention.

Astin [2] developed a model that centered around student demographics, environment and experiences in college, and student characteristics developed after college. The model also suggested that student engagement affects the persistence of students attaining their goals in college. Summer bridge programs can be tied to this framework where the inputs are the students' backgrounds, the environment is related to the involvement of the program, and the output involves the retention of the students.

Using this framework helps explore how summer bridge programs establish an environment to help facilitate student engagement. For this descriptive research, the goal is to identify program characteristics that are used by summer bridge programs in the southeastern region of the United States. The findings will serve as a foundation for institutions that do not have a summer bridge program, offering insights with potential program characteristics to start such a program.

1.2 Research questions

This study investigated the overarching research question "What is the current state of engineering-focused summer bridge programs in the southern United States?" through the following three research questions:

1. How many institutions accredited by SACSCOC have STEM-focused bridge programs?
2. What are the bridge program characteristics for the bridge programs located at SACSCOC accredited institutions?
3. How many bridge programs located at SACSCOC institutions have published their outcomes and successes?

1.3 Methods

This research is categorized as descriptive research because the goal is to identify the STEM summer bridge programs in institutions located in the southeastern region of the United States. Throughout this study, we examined each institution's website and searched for the program's information, eligibility criteria, recruitment efforts, etc. The SACSCOC also has a website that contains a database listing each of its accredited institutions [9]. The approach involved identifying summer bridge program information via website searches for each of the institutions. Once the programs were identified, the information such as the institution, program name, point of contact (POC), and program web address was added to a spreadsheet. Summer bridge program POCs received a survey which inquired about their respective program's characteristics, published reports, and retention rates. Our research was scoped to provide an overview of the current state of STEM summer bridge programs in the southeastern United States. The southeastern region was chosen because minorities are most prevalent there according to the 2020 Census [8].

1.3.1 Data source

This study focused on SACSCOC accredited institutions. In 2021, a total of 785 institutions were accredited by SACSCOC. This number included institutions that granted associate, baccalaureate, masters, or doctoral degrees. The survey examined summer bridge programs to collect the most useful information and answer the questions this study posed. The approach of this research was to identify and compare STEM summer bridge programs to non-STEM focused programs.

This study was reviewed by the Mississippi State University Institutional Review Board, and the protocols were approved (IRB-23-344). Survey participants provided consent to participate as part of the survey process.

1.4 Procedures

An internet search was conducted to identify the institutions accredited by the SACSCOC and the individual summer bridge programs. The first step involved gathering a list of the SACSCOC institutions via the website database [9]. The list of institutions was searched by state, where each state was separated in the list. The totals in each state included were 47 in Alabama, 78 in Florida, 80 in Georgia, 48 in Kentucky, 39 in Louisiana, 42 in Mississippi, 112 in North Carolina, 51 in South Carolina, 61 in Tennessee, 157 in Texas, and 70 in Virginia. Only summer bridge programs that targeted first-year students were added to the list. The programs that involved RN bridge programs, youth camps, leadership programs, summer research programs, and English language and cultural skills programs were excluded from this research. The list resulted in the institution name and the uniform resource locator (URL) for each individual program.

The resulting spreadsheet included the institution's name, point of contact's email address, and the name for each STEM summer bridge program. The bridge directors/coordinators received an electronic survey constructed with Qualtrics. The participants completed the 12-question questionnaire that included text entry and multiple-choice questions. The survey was submitted and analyzed by the researchers. The survey was initially delivered, followed by a second round of distribution to the POCs that did not previously respond. Each participant was only required to take one survey.

The information was gathered similar to the research collected by Ashley et al. [1]. The difference is that the summer bridge programs were gathered via each institution's website rather than only in published journals and non-peer reviewed articles since we hypothesized there were numerous programs in the SACSCOC that would be excluded by only considering published articles. Since we noted that many websites appeared to be out of date, we decided to survey program directors/coordinators with the goal to generate more current information for the state of summer bridge programs in the southern region of the United States.

1.5 Results

In response to research question number one relating to the number of institutions accredited by SACSCOC that have STEM-focused summer bridge programs, the manual website search identified 186 different summer bridge programs at institutions accredited by SACSCOC. An institution was considered to be active if the website contained a recent application portal from 2023 or an upcoming 2024 application portal or submission process. If the respective institution did not meet the indicator test, it was considered to be Unknown. Institutions with websites that contained an application from

2022 or older were deemed inactive programs. The search concluded with the following results: 120 active, 37 inactive, and 27 unknown programs. This study also analyzed the subjects taught at the various programs. For programs where subjects included topics outside of the STEM fields, the programs were deemed "all subjects." For programs which focused on only STEM fields, the programs were considered "STEM." Of the subjects taught, 107 programs targeted all subjects, three (3) targeted either or both all subjects and STEM subjects, and 77 only targeted STEM subjects.

In an effort to identify bridge program for the bridge programs located at SACSCOC accredited institutions, this study analyzed the manual search conducted in comparison to survey responses which examined whether the program provided residential support, the activities that were conducted for the respective program goals, the student retention rate, institution type, target population of students, program subject, and overall program goals. The study found that with regard to STEM bridge programs located at SACSCOC accredited institutions, the top three (3) program characteristics that identify these programs include: institution (public doctoral institutions); target population of students (incoming freshmen); program subject (all STEM subjects). On the other hand, non-STEM bridge programs located at SACSCOC accredited institutions, the top three (3) program characteristics that identify these programs include: institution (public doctoral institutions); target population of students (incoming freshmen); program subject (all subjects). In comparison, both STEM and non-STEM bridge programs located at SACSCOC accredited institutions aim to achieve the following key indicators of the overall goals of STEM bridge programs: (1) improved content knowledge; (2) maximize GPA; (3) increase retention; (4) sense of belonging and (5) sense of preparedness.

After conducting a manual search, a survey was sent to the point of contact (POC) for each program. The 12-question survey was dispersed via Qualtrics to ask similar questions to the information that was gathered during the manual website search. Additional questions were related to whether the program provided residential support, the activities that were conducted for the respective program goals, and an optional question for the student retention rate of the program. There were 53 responses that contained 25 all subjects and 28 that contained only STEM subjects. For this study, the program characteristics were compared between the manual search and the survey.

The information collected with the manual search was then broken down by institution type, target population of students, program subject, and program goals for both the manual search and the survey. Each state represented by SACSCOC was included in the results. The cumulative data included the categories of all subjects, all subjects with a STEM option, and only STEM. This study primarily focused on the STEM summer bridge program, which led to the inclusion of all subjects and STEM for this scope. The following sections show the results for each of the categories of information gathered by the manual search and survey. It is worth noting that there is a comparison between non-STEM and STEM summer bridge programs.

1.5.1 Institution type

The SACSCOC website provided a search option that included whether the institution is public or private and provided the highest approved degree offered. This was used during the manual search to indicate the type of institution that the respective summer bridge program was affiliated with. The types included private bachelor's, private master's, private doctoral, public bachelor's, public master's, and public doctoral. This information was collected not only to categorize the institution types, but also show which institution types provided summer bridge programs.

The results for the non-STEM summer bridge programs indicated that the majority of the summer bridge programs were affiliated with public doctoral granting institutions (n = 59). Public master's granting institutions had the least number of total summer bridge programs (n = 3). Table 1 displays the total non-STEM summer bridge programs by state for the institution types. The same was done with the summer bridge programs that target students majoring in STEM.

After obtaining the intuition types for the STEM-focused summer bridge programs, the results were similar. Public doctoral institutions provided the highest number of summer bridge programs (n = 49). The difference from the cumulative programs was that the public bachelor's institutions provided only one (1) STEM-focused summer bridge program out of the SACSCOC states. Table 2 displays the total STEM summer bridge programs by state for the institution types.

1.5.2 Target population of students

The scope of this study involved summer bridge programs that targeted first-time students, classified as incoming freshmen. For the cumulative summer bridge programs, there were a few specific types of incoming freshmen. There were programs that specifically targeted graduating high school seniors. This was included because the target students were in preparation to attend college. Other specific incoming freshmen targets included athletes and women. Summer bridge

Table 1 Represents the types of non-STEM summer bridge programs by state

Non-STEM Bridge Program Institution Type							
State	Private, Bachelor's	Private Master's	Private Doctoral	Public Bachelor's	Public Master's	Public Doctoral	Total
AL	1	0	0	0	0	2	3
FL	0	1	0	7	0	8	16
GA	3	1	0	3	1	4	12
KY	0	2	0	0	0	6	8
LA	1	0	1	0	0	6	8
MS	0	0	0	0	0	0	0
NC	0	4	3	0	0	5	12
SC	2	0	0	0	0	2	4
TN	2	4	1	0	0	3	10
TX	0	4	3	1	1	14	23
VA	0	2	5	0	1	3	11
Total	9	18	13	11	3	53	107

Table 2 Represents the types of STEM summer bridge programs by state

STEM bridge program institution type							
State	Private, bachelor's	Private master's	Private doctoral	Public bachelor's	Public master's	Public doctoral	Total
AL	1	1	1	0	0	7	10
FL	0	0	1	0	0	2	3
GA	2	0	0	0	2	4	8
KY	1	0	0	0	0	2	3
LA	0	0	2	0	1	2	5
MS	0	1	0	0	0	6	7
NC	0	0	1	0	2	2	5
SC	0	3	1	0	1	3	8
TN	0	1	2	0	0	3	6
TX	0	1	4	1	0	10	16
VA	0	0	1	0	0	5	6
Total	4	7	13	1	6	46	77

programs that targeted both incoming freshmen and transfer students were included in this scope, but not programs that only targeted the latter. Programs that indicated that all classifications were eligible were also included in this study.

The majority of the non-STEM summer bridge programs targeted incoming freshmen specifically (n = 101). There was one (1) program each that specifically targeted graduating high school seniors, incoming freshmen athletes, and incoming freshmen women. Table 3 shows the total number of non-STEM summer bridge program for each target population of students by state. The STEM-focused summer bridge programs targeted mostly incoming freshmen (n = 74) with the least being incoming freshmen women and all levels of classification (n = 0). Table 3 shows the total number of STEM summer bridge program for each target population of students by state Table 4.

1.5.3 Program subject

The cumulative program subjects, non-STEM programs, include 108 programs that target all subjects, 3 programs that target all subjects with a STEM option, and 73 programs that target only STEM. The cumulative data shows that Texas provided the most summer bridge programs with 39, regardless of the subject target. Upon review of summer bridge programs that target STEM majors, Texas led with 16 summer bridge programs followed by Alabama which is home to 10 programs. The programs that target all subjects with a STEM option were included with the STEM results. Table 5 displays the number of each summer bridge program subjects by each state.

Table 3 Displays the target population of students for the non-STEM summer bridge programs

Non-STEM Target Population of Students							
State	All Levels	Graduating High School Seniors	Incoming Freshmen	Incoming Freshmen, Athletes	Incoming Freshmen, Transfer	Incoming Freshmen, Women	Total
AL	0	0	3	0	0	0	3
FL	0	0	16	0	0	0	16
GA	0	1	11	0	0	0	12
KY	0	0	8	0	0	0	8
LA	0	0	8	0	0	0	8
MS	0	0	0	0	0	0	0
NC	1	0	11	0	0	0	12
SC	0	0	4	0	0	0	4
TN	0	0	10	0	0	0	10
TX	1	0	20	0	2	0	23
VA	0	0	9	1	1	0	11
Total	2	1	100	1	3	0	107

Table 4 Displays the target population of students for the STEM summer bridge programs

STEM Target Population of Students							
State	All Levels	Graduating High School Seniors	Incoming Freshmen	Incoming Freshmen, Athletes	Incoming Freshmen, Transfer	Incoming Freshmen, Women	Total
AL	0	0	10	0	0	0	10
FL	0	0	2	0	1	0	3
GA	0	0	8	0	0	0	8
KY	0	0	3	0	0	0	3
LA	0	0	5	0	0	0	5
MS	0	0	7	0	0	0	7
NC	1	0	4	0	0	0	5
SC	0	0	8	0	0	0	8
TN	0	0	6	0	0	0	6
TX	0	0	15	0	1	0	16
VA	0	0	5	0	0	1	6
Total	1	0	73	0	2	1	77

Table 5 shows the number of summer bridge program subjects

Summer Bridge Program Subjects				
State	All Subjects	All Subjects + STEM Option	STEM	Total
AL	3	0	10	13
FL	16	0	3	19
GA	12	0	8	20
KY	8	1	2	11
LA	8	0	5	13
MS	0	0	7	7
NC	12	1	4	17
SC	4	0	8	12
TN	10	0	6	16
TX	23	1	15	39
VA	11	0	6	17
Total	107	3	74	184

Table 6 The number of published reports for non-STEM summer bridge programs

Non-STEM Summer Bridge Program Published Reports			
State	Peer-Reviewed Journals	Other Formats	Total
AL	0	1	1
FL	2	1	3
GA	0	0	0
KY	0	1	1
LA	0	0	0
MS	0	0	0
NC	1	3	4
SC	0	0	0
TN	0	0	0
TX	1	3	4
VA	0	1	1
Total	4	10	14

Table 7 The number of published reports for STEM summer bridge programs

STEM Summer Bridge Program Published Reports			
State	Peer-Reviewed Journals	Other Formats	Total
AL	1	1	2
FL	1	0	1
GA	4	0	4
KY	0	0	0
LA	0	2	2
MS	6	4	10
NC	2	4	6
SC	0	0	0
TN	2	0	2
TX	5	10	15
VA	0	1	1
Total	21	22	43

1.5.4 Bridge program published reports

The third question within this study queried the number of bridge programs located at SACSCOC institutions which have published their outcomes and successes. This study found that 38 bridge programs, STEM and non-STEM, located at SACSCOC institutions have published their program's outcomes and successes. Published reports were categorized by peer-reviewed journals and reports in other formats such as conference, dissertations/thesis, and whitepapers. Google Scholar was used to search for papers related to each of the programs. There was a total of 57 published reports found, with 28 STEM summer bridge programs publishing 43 of the identified published reports. In addition, of the total 57 reports published, ten (10) non-STEM bridge programs published 14 of the identified reports. Table 6 displays the number of published reports by each state. This means that STEM summer bridge programs accounted for approximately 75 percent of the 57 total identified published reports. The total number of published reports for STEM summer bridge programs by each state are shown in Table 7.

1.5.5 Program goals with manual search process

The summer bridge program goals indicated in the research by Ashley et al. [1] was used in this study for the programs in the southeastern region of the United States. The categories include academic success goals, psychological goals, and department-level goals. The manual search was conducted to make inferences based on the information provided by the respective website of the program. A combination of making assumptions and explicit statements of the program

Table 8 The academic success goals for non-STEM summer bridge programs identified during the manual search process

Non-STEM Bridge Program Academic Success Goals						
State	Remediation	Improve Content Knowledge	Maximize GPA	Increase Research Participation	Increase Retention	Increase Graduation Rates
AL	100%	100%	100%	0%	67%	67%
FL	100%	100%	100%	0%	100%	94%
GA	100%	100%	92%	8%	83%	50%
KY	100%	100%	100%	0%	100%	50%
LA	100%	100%	88%	0%	88%	25%
MS	N/A	N/A	N/A	N/A	N/A	N/A
NC	100%	100%	100%	8%	100%	33%
SC	75%	75%	50%	0%	100%	25%
TN	91%	82%	91%	0%	91%	36%
TX	100%	100%	96%	0%	100%	22%
VA	91%	91%	91%	0%	91%	0%
Total	97%	96%	93%	2%	95%	40%

Table 9 The academic success goals for STEM summer bridge programs identified during the manual search process

STEM Bridge Program Academic Success Goals						
State	Remediation (%)	Improve Content Knowledge (%)	Maximize GPA (%)	Increase Research Participation (%)	Increase Retention (%)	Increase Graduation Rates (%)
AL	100	100	100	21	100	100
FL	100	100	67	33	100	100
GA	100	100	63	25	63	38
KY	100	100	100	33	100	67
LA	100	100	100	40	100	40
MS	100	100	86	14	86	86
NC	60	60	60	20	60	20
SC	88	88	88	75	88	75
TN	100	100	100	50	100	50
TX	88	88	100	13	88	38
VA	100	100	83	33	83	33
Total	94	94	89	30	88	59

characteristic was used during this process. Each of the categories provided specific goals which are key indicators of the overall goals of the program.

There are six (6) goals in the academic success category of goals, these goals include: (1) remediation, (2) improving content knowledge, (3) maximizing GPA, (4) increasing research participation, (5) increasing retention, and (6) increasing graduation rates. The cumulative results for the summer bridge programs during the manual search show that remediation and improving content knowledge had the most occurrences. Increasing research participation was the least reported for both non-STEM (2%) and STEM summer bridge programs (30%). Tables 8 and 9 show the percentages of each of the academic success goals identified for the non-STEM and STEM summer bridge programs, respectively.

There are five (5) goals which fall within the psychological category of goals; they are: (1) increasing interest in the major, (2) a sense of belonging, (3) a sense of preparedness, (4) self-efficacy, and (5) networking with faculty. The cumulative data resulted in the most reports for the sense of preparedness category. Increasing interest in the major was the least reported for the non-STEM summer bridge programs (2%). Table 10 displays the percentages of the identified psychological goals for the non-STEM summer bridge programs by each state. The STEM-focused bridge programs also had similar results, but there were significantly more programs that indicated the goal on the respective websites (74%). Table 11 displays the percentages of the identified psychological goals for the non-STEM summer bridge programs by each state.

Table 10 The psychological goals for non-STEM summer bridge programs identified during the manual search process

Non-STEM Bridge Psychological Goals					
State	Increase Interest in the Major	Sense of Belonging	Sense of Preparedness	Self-Efficacy	Network with Faculty
AL	0%	100%	100%	100%	33%
FL	12%	100%	100%	100%	88%
GA	0%	83%	100%	100%	50%
KY	0%	88%	100%	100%	75%
LA	0%	88%	100%	63%	63%
MS	N/A	N/A	N/A	N/A	N/A
NC	0%	100%	100%	100%	92%
SC	0%	100%	100%	100%	50%
TN	0%	91%	91%	91%	73%
TX	0%	100%	100%	100%	65%
VA	0%	100%	100%	91%	36%
Total	2%	95%	99%	95%	67%

Table 11 The psychological goals for STEM summer bridge programs identified during the manual search process

STEM Bridge Psychological Goals					
State	Increase Interest in the Major (%)	Sense of Belonging (%)	Sense of Preparedness (%)	Self-Efficacy (%)	Network with Faculty (%)
AL	100	100	100	100	79
FL	100	33	100	100	67
GA	100	100	100	100	88
KY	33	100	67	100	100
LA	60	100	100	80	60
MS	71	100	86	86	100
NC	60	80	100	80	100
SC	13	88	88	88	88
TN	83	100	100	100	83
TX	81	100	100	100	81
VA	67	100	100	83	33
Total	74	95	96	94	80

There are two (2) goals which fall within the department-level category of goals which include: (1) enhancing diversity of the major and (2) recruiting students to the major. For non-STEM summer bridge programs, the former had only two (2) percent that indicates that goal. Table 12 shows the percentages of the identified department-level goals for the non-STEM summer bridge programs by each state. There was a different result for the STEM summer bridge programs. In this case, recruiting students to the major had more reports at fifty-four (54) percent. This was the only category where the STEM-focused summer bridge program data resulted in a different distribution from the non-STEM programs. Table 13 shows the percentages of the identified department-level goals for the STEM summer bridge programs by each state.

1.5.6 Program characteristics with survey results

This section examines the results through goals for each of the categories addressed in the survey that was distributed to the POCs for the respective summer bridge programs. The comparison of the results from the manual search are limited to the programs that had a response from the survey. The goal of this process involves whether or not the information from the websites yielded similar results to the responses from the POC from the respective program.

Table 12 The department-level goals for non-STEM summer bridge programs identified during the manual search process

Non-STEM Bridge Department-Level Goals		
State	Recruit Students to the Major	Enhance Diversity of the Major
AL	0%	0%
FL	12%	35%
GA	0%	8%
KY	0%	25%
LA	0%	38%
MS	N/A	N/A
NC	0%	8%
SC	0%	25%
TN	0%	0%
TX	0%	0%
VA	0%	9%
Total	2%	14%

Table 13 The department-level goals for STEM summer bridge programs identified during the manual search process

STEM Bridge Department-Level Goals		
State	Recruit Students to the Major (%)	Enhance Diversity of the Major (%)
AL	71	93
FL	67	67
GA	75	38
KY	0	0
LA	40	60
MS	71	57
NC	20	60
SC	75	75
TN	100	33
TX	31	13
VA	17	33
Total	54	49

The academic success category of goals for the survey resulted in different goal indicators when compared to the manual search. For example, there were fewer indicators for all of the goals except increasing research participation and increasing graduation rates. The STEM-focused programs resulted in similar results for the academic success goals.

The psychological category of goals also resulted in different goal indicators for the survey and manual search. The non-STEM summer bridge programs resulted in less indicators for the survey except increase graduation rates, increase interest in the major, and recruit students to the major. There were one (1), six (6), and five (5) more reports, respectively. The goals that had the same indicators for the website search and survey were increase research participation and network with faculty. The STEM programs show that all of the characteristics except increase research participation, increase graduation rates, and enhance diversity of the major had less indicators in the survey in comparison to the manual search. The goal that had the same indicators for the survey and manual search was recruit students to the major.

The departmental-level category of goals provided relatively closer results than the previous categories. The non-STEM summer bridge programs more goal indicators from the survey than the manual search for enhance diversity of the major. The STEM-focused programs had an exact number of reports for recruiting students to the major, and 4 more indicators for enhancing the diversity of the major. Tables 14 and 15 show the comparisons of the number of goals that were identified by the survey responses and the manual search. The former presents the outcomes of the non-STEM

Table 14 Comparison of non-STEM summer bridge program goals identified from the survey and the manual search

Non-STEM Bridge Program Goals		
Goals	Survey	Manual Search
Remediation	7	25
Improve Content Knowledge	12	25
Maximize GPA	12	23
Increase Research Participation	1	1
Increase Retention	18	24
Increase Graduation Rates	16	15
Increase Interest in the Major	7	1
Sense of Belonging	23	24
Sense of Preparedness	24	25
Self-Efficacy	18	24
Network with Faculty	15	15
Recruit Students to the Major	4	1
Enhance Diversity to the Major	4	5

Table 15 Comparison of STEM summer bridge program goals identified from the survey and the manual search

STEM Bridge Program Goals		
Goals	Survey	Manual Search
Remediation	6	28
Improve Content Knowledge	21	28
Maximize GPA	11	26
Increase Research Participation	6	3
Increase Retention	24	26
Increase Graduation Rates	22	12
Increase Interest in the Major	17	18
Sense of Belonging	25	28
Sense of Preparedness	23	26
Self-Efficacy	16	26
Network with Faculty	18	21
Recruit Students to the Major	10	10
Enhance Diversity to the Major	13	9

summer bridge programs, while the latter showcases the STEM summer bridge programs. It is worth noting that the summer bridge programs that received responses from the survey was included in the manual search results for this comparison. Table 16 shows the differences of the number of identified goals from the survey and the manual search.

1.6 Discussion

This study was an analysis of summer bridge programs that either did or did not have a published report. The authors in Ashley et al. [1] indicated that their findings for the STEM-focused summer bridge programs only included ones that had published reports between the years of 2016 and 2017. This study also includes published reports and bridge programs that have been established since then. The results from this study indicated a few things. The first being that there are more summer bridge programs than were previously reported in prior studies. In particular, there were more STEM-focused bridge programs after conducting website searches. The other finding involves the differences between the program goal indicators for the manual search and the survey.

There were more STEM bridge programs that were found in this study because of the inclusion of programs that do not have published reports. This study identified that there were 36 published reports from 25 unique STEM summer

Table 16 The number differences of STEM summer bridge program goals identified from the survey and the manual search

STEM Bridge Program Characteristics (Manual Search vs. Survey)		
Goals	Non-STEM difference	STEM difference
Remediation	−18	−22
Improve Content Knowledge	−13	−7
Maximize GPA	−11	−15
Increase Research Participation	0	3
Increase Retention	−6	−2
Increase Graduation Rates	1	10
Increase Interest in the Major	6	−1
Sense of Belonging	−1	−3
Sense of Preparedness	−1	−3
Self-Efficacy	−6	−10
Network with Faculty	0	−3
Recruit Students to the Major	3	0
Enhance Diversity to the Major	−1	4

bridge programs in the southeastern region of the United States. There were 76 unique STEM-focused summer bridge programs that were identified after conducting a website search. The assumption is that there are even more published reports and STEM summer bridge programs with the inclusion of other parts of the country. This shows a need for more published results that show the impact that summer bridge programs have on students pursuing degrees in STEM.

The website search process for the individual programs show that there are differences in the program goals from what was indicated from the survey. In other words, the interpretation of the program goals on the websites yielded different results than what the POCs of the individual programs indicated from the survey. This shows that the websites do not fully reflect the program goals for the respective programs. Although there could be an error with the interpretation, a suggestion for the program websites would be to explicitly indicate the program goals. This could also affect the recruitment of students based on the information that is provided on the websites. There were some programs that provided frequently asked questions (FAQs) and a contact for more information, but there isn't a guarantee that potential students will utilize these options after first glance at the websites.

1.6.1 Implications

To evaluate and better understand the needs of students, college programs, and STEM professions, researchers and program directors need more reports on STEM summer bridge program implementation. Because there are relatively few STEM bridge program publications, more information is needed for how to increase the effectiveness of these programs. One way to address this challenge is to identify and report the institutions that have programs but do not have published reports. This survey of the programs, specifically programs which do not have published documentation, provides a better indication of what has been done so far. This study targeted institutions located in the southeastern region of the United States. The hypothesis is that there are many STEM summer bridge programs that have not been published in journals or non-peer reviewed articles. After this study, analyzing the effect that summer bridge programs have on retention rates could be a future analysis.

The participants' response and information provided researchers with a more complete data set for the bridge programs at SACSCOC. This information serves as the foundation to produce a publication that will be available to each participant and may inspire ways to improve their own programs. This will give a better sense of the characteristics of STEM bridge programs in the southeastern region of the United States.

2 Conclusions

This study provided information about what summer bridge programs were found through website searches. The findings indicated that there are more summer bridge programs that can be found that do not have published reports. This leads to a need for more programs to publish findings and descriptions of the program goals. Also, there is a need for

the updating and an explicit indication of program goals on the respective websites. The possible misinterpretation of the information provided on the website could affect the submission of applications to the program. Future directions of this study include analyzing the retention of students based on the program characteristics and extending the study to other parts of the United States.

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Code availability Not applicable.

Declarations

Ethics approval and consent to participate The Mississippi State University Institutional Review Board reviewed this study and approved the protocols (IRB-23–344). Survey participants provided consent to participate as part of the survey process.

Competing interests The authors declare no competing interests.

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