Annual Evaluation Report

for the First Year of

Texas A&M University – Kingsville's NSF IUSE: HSI Project

Texas A&M University – Kingsville

National Science Foundation Award # 1928611

Prepared by: West Texas Office of Evaluation and Research

West Texas A&M University

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Executive Summary

Overview and Background

Texas A&M University – Kingsville (TAMUK) received funding from the National Science Foundation (NSF) in federal fiscal year 2020 for an Improving Undergraduate STEM Education: Hispanic-Serving Institutions project entitled *Integrated Pathways of Excellence for Seamless Transition of Engineering Minority Students* (IPE for STEM). The five-year project seeks to accomplish five objectives. These focus on increasing the number of students who enroll in Engineering, developing bridge programming for freshmen and transfer students, assisting early career students in STEM gateway courses, increasing experiential learning opportunities, and tracking student progress and outcomes.

Purpose Pursued

The West Texas Office of Evaluation and Research (WTER), the external evaluators for IPE for STEM, have worked with project leaders to establish exchange of information that will facilitate project processes, assessment of those processes and the associated outcomes, and completion of formative and summative evaluation. This report describes progress and outcomes in each area of grant-funded activity during the first year of implementation including the impacts of the COVID-19 pandemic.

Key Findings

1. Project implementation was completed with substantial fidelity to the approved plan although restrictions due to the COVID-19 pandemic did impact the summer research programming.
2. Middle and High School targeted programming was eliminated in pre-award discussions with the funder.
3. Personnel commitments outlined in the proposal have been enacted enabling completion of all but two project elements. The first, on-site summer research experience, was impossible to accomplish given COVID-19 related restrictions and the second, a project website, is in development.
4. Multiple lines of evidence exist indicating that communication of purposes and about programming and processes is adequate and accurate.
5. Baseline and comparison data sources for short- and long-term outcomes have been identified although considerations of long-term outcomes like improved retention and increased graduation rates are not yet possible.
6. Three data streams support various forms of psychological support or advancement experienced by student participants (e.g., increases in confidence and comfort).
7. Peer mentors reported that students in the section of General Engineering (GEEN) in which a team project in robotics had been implemented increased their confidence in pursuing an engineering degree and, as a related construct, their sense of belonging in the engineering field. The peer mentors noted that they also felt personal advancement in these areas.

8. Psychosocial development of students was reported by each faculty in the GEEN pilots as learning collaborative and cooperative processes, enjoying the task, and an associated sense of identification with engineering processes.
9. Peer mentors felt they had experienced personal growth in relating to supervising faculty, expanded their repertoire of social skills, and had taken on an informal and continuing role as a sounding board for and guide to some of the students from the course in which the robotics project was implemented. They also noted that the students had been exposed to similar opportunities, albeit as project team members.
10. Substantial learning was reported by peer mentors, regarding their mentees and themselves, by faculty in respect to students in the learning by design activities, and through pre- and post-participation surveys in the summer bridge programming.
11. Curricular materials for implementation of STEM modules in engineering preparation courses were developed for College Algebra (MATH 1314), Trigonometry (MATH 1316), Calculus I (MATH 2413), General Inorganic Chemistry (CHEM 1311), and University Physics I (PHYS 2325).
12. Pre-participation ratings of prior learning/experience were possible for the community college students who participated in summer programming. A rank order of 21 skills occurred as six groups following natural breaks in the scores. The groups were: (1) general computer skills, (2) introductory exposure, (3) basic patterns of differentiation and application, (4) intermediate application, (5) specific skill sets, and (6) cross-cutting systems or synthesis.
13. Converting the summer bridge program for community college students to an online activity does not appear to have diminished the value of the offering as 34 of 37 respondents submitted overall ratings of Very Good ($n = 9$) or Excellent ($n = 25$). The remainder thought the three-week experience was Good ($n = 2$) (one student did not submit a response).
14. Substantial learning was reported in all 21 areas surveyed for the summer bridge program. There was a statistically significant increase in the mean for every statement ($p = .001$ for one and $p < .001$ for the 20 others).
15. Summer bridge participants also reported increased awareness of engineering opportunities (mean of 8.83 on a ten-point scale), increased interest in engineering (mean 8.69), and receiving information relevant to career decisions (mean of 8.46).
16. Members of the summer bridge program cohort found different activities to be valuable which is likely related to personal background and varied levels of experience or interest in respect to the topics covered. The most common response was the group activity was the most valuable element of the summer bridge program.
17. Evidence of the planned collaboration with University student support services was present with high numbers of students accessing each service.

Background

Overview and Background

Texas A&M University – Kingsville (TAMUK) received funding from the National Science Foundation (NSF) in federal fiscal year 2020 for an Improving Undergraduate STEM Education: Hispanic-Serving Institutions project entitled *Integrated Pathways of Excellence for Seamless Transition of Engineering Minority Students* (IPE for STEM). The five-year project seeks to accomplish five objectives. These focus on increasing the number of students who enroll in Engineering, developing bridge programming for freshmen and transfer students, assisting early career students in STEM gateway courses, increasing experiential learning opportunities, and tracking student progress and outcomes. To accomplish those purposes, IPE for STEM committed to enacting the following.

1. Classroom demonstrations at middle and high schools that emphasize hands-on STEM activities and that involve project participants as facilitators.
2. Integrating STEM content and peer mentoring into science gateway courses to aid and intrigue students in pre-engineering study.
3. Adding design projects to UNIV Success or other courses that pre-engineering students take.
4. Offering early career engineering students, freshmen and sophomores, on campus opportunities to participate in research during the summer.
5. Developing and offering a summer research training bridge program for students transferring from community college.
6. Offering peer mentoring to community college transfer students.
7. Providing a suite of support services and opportunities intended to facilitate student growth and achievement in engineering study.

Purpose Pursued

The West Texas Office of Evaluation and Research (WTER), the external evaluators for IPE for STEM, have worked with project leaders to establish exchange of information that will facilitate project processes, assessment of those processes and the associated outcomes, and completion of formative and summative evaluation. This report describes progress and outcomes in each area of grant-funded activity during the first year of implementation including the impacts of the COVID-19 pandemic.

Approach

Data Gathering and Data Types

Data gathering for evaluation includes processes completed by project personnel at TAMUK and activity enacted by the external evaluator. TAMUK personnel are responsible for gathering documentation of processes, like participation data and implementation of the educational modules in introductory courses, and some outcomes like student persistence and graduation records. These data are provided to the evaluator at least once a year. All student data, with the exception of contact information for use with interviews and surveys, is provided in de-identified format. The external evaluator completes interviews, focus groups, and surveys with students and interviews with project personnel. The result of the internal and external data gathering planned is a broad and rich stream of information about the project which includes two or more forms of input about each project initiative. In many cases this occurs as quantitative and qualitative data available about the same initiative. The presence of two or more forms of data available about each project activity facilitated a mixed methods consideration of each element of the project and when preparing this report.

Data Analysis

Qualitative data was subjected to continuous comparative analysis (Kolb, 2012). Descriptive and inferential statistics were used with quantitative data. The project objectives expressed in the narrative, the goals for the activities, milestones related to the project goals, and, whenever possible, historic or pre-participation data were utilized as the standards for comparison.

Tables summarizing data analysis are positioned throughout the report. Placement was determined by the activity in which the data was gathered although, as applicable, comment about data related to an activity can occur at various points in the document.

Findings

External evaluation of the project is limited to gathering material about training opportunities, outreach activity, and project processes. In the sections that follow, description of data sets and findings have been grouped by topic area. The topics are the project elements, listed in the proposal and above in the Overview and Background section of this report, and the evaluation questions. The material in each section has been divided into subsets, as applicable.

Findings are noted in each section and summarized above in an executive summary. Conclusions reached by the evaluator and any recommendations made are found at the end of the report.

To aid in recognition of topics and subsets, a numbering system was included with the headers. The topics are presented in the order in which they occur above (see Overview and Background) and in the funded proposal. The points under each main heading (project activity) are assigned a second number following a period or, for topics with three levels of subordination, a second and third number separated by a period (e.g., 1.1, 2.3.2).

1. General Considerations.

The proposal included on-site programming for high school students and their teachers during the summer. This was eliminated during pre-award processes. This occurrence will be noted as part of the adjustments made in the first year of funding but the topic will not appear in reporting in subsequent years.

COVID-19 responses and restrictions, within the Texas A&M University System (TAMUS) and those mandated by state and local authorities, impacted project implementation. TAMUK, like all TAMUS institutions, moved courses exclusively online during the spring semester of 2020 and enforced health policies during the summer that made completing IPE for STEM activities a challenge or, for a smaller number of project elements, a practical impossibility. The team was able to plan and conduct an online summer bridge program that took the place of the on-site program that had been proposed for CC transfer students. This and other adjustments made in response to COVID-19 impacted the volume and variety of data gathered for project evaluation. Alternate sources of information were sought and employed, as possible, to achieve the most thorough review possible.

The implementation and evaluation plan for the project included regular interaction between the project team and the evaluator. A teleconference for project's coordinating lead and the evaluator was scheduled on a quarterly basis. Additional conversations were scheduled as required.

Provision of formative feedback by the evaluator was included in the project plan. This service is taking place via conversation in the teleconferences, as e-mail exchanges around specific topics (i.e., revision of programming and requests for data), and in memoranda and reports created by the evaluator.

Human subject research is included in the evaluation as interviews, focus groups, and surveys and is covered by an Institutional Review Board (IRB) application. WTER obtained and has maintained IRB approval of human subject research included in evaluation activity, as defined in the project narrative submitted to NSF, and the exchange of information between the various entities. WTER's IRB protocol for the IPE for STEM project began in late May of 2019 and remains active. The next renewal date is May 27, 2021 at which time a continuation request will be filed.

The personnel commitments made in the project proposal have been fulfilled. This allowed the grant to reach full operational capacity and adapt to the unforeseen challenge of a pandemic in the spring and summer of 2020.

1.1 Comments based on review of project documents.

Documentation of the project's educational processes and activities parallels normal institutional practices. As this is the case, documentation of curricular planning and products, student participation and outcomes, and other project-relevant information is both available and completed at a level of detail which facilitated success in implementation and assessment of those processes.

1.2 Findings from interviews.

In each interview with IPE for STEM personnel, interviewees were asked about the purposes of the project. While the individual's responsibilities relevant to the project impacted perspective, all had a general understanding of the major purposes of the undertaking.

The faculty with whom the evaluator interacted were asked to comment on the level and quality of communication taking place as part of the IPE for STEM project. All felt that the volume, content, and intent of the communication taking place was very good. This speaks well of the project and its leadership as necessary changes at institutions of higher education enacted in response to COVID-19 could easily have eclipsed and caused extended pauses in project processes.

Means of enacting nearly every form of proposed activity were found. The exceptions were undertakings that involved travel, close personal contact, or group gatherings during the spring and summer of 2020, all of which were prohibited by COVID-19 restrictions.

Student interviewees reported access to and responsiveness on the part of project team members. They also noted, as is described in more detail below, advances in their understanding, interest, and commitment to engineering as a result of participating in the project's programming.

2. Comments Relevant to Evaluation Questions.

2.1 Impact on student retention, transition, and degree completion.

The project has just completed its first year. Students will not return to campus and classes for several weeks and being retained after the 12th day of the semester is the standard definition of retention. As that was the case, tracking retention for active students was not possible for this report. Because the project is in its first year, transition tracking and degree completion were also not possible.

Historic persistence and graduation data from three years prior to the period will be employed in assessing the impact of the project in these areas. These records exist and are maintained by the Institutional Research Office at TAMUK. Customized requests for this information will be submitted at the same time that the first requests for persistence and graduation data from the project period are submitted. This will occur for the first time in the second year of the project.

2.1.1 *Student retention.*

Project participant retention information will be compared to historic rates in future annual reports. It was not possible for this report as the fall semester had yet to begin when the report was being drafted and the data necessary to calculate student retention was not available.

2.1.2 *Student transition.*

Information about transitions to TAMUK and within TAMUK to upper level study will be gathered. This will be initiated in the second year of the project beginning the individuals who participated in the summer program for CC students.

2.1.3 *Degree completion.*

The TAMUK IPE for STEM project began in the fall of 2019. None of the active participants would be eligible for graduation less than a year later although it is possible that peer mentors who were active in the project may reach that milestone in the coming year. Tracking of graduation rates will begin in the second year of funding.

2.2 Impact on student psychological, social, and intellectual development.

The IPE for STEM initiative includes altering understanding, perspectives, and orientation of participants. These have been divided into three topic areas, psychological development, social skill development, and intellectual development.

2.2.1 *Student psychological development.*

Two lines of data from students and one from faculty were available for the 2019-2020 school year regarding changes in confidence, impact on transfer shock, and impact on sense of identity (engineer/scientist). These were the pre- and post-participation survey results from the summer program, comments made by peer mentors in interviews, and written assessments of learning by design activities enacted in General Engineering courses.

Summer program data indicates significant increases in confidence (Tables 4 and 6, section 3.3.1 Summer Bridge Program). For all 21 education objectives, students reported highly significant increases in their experience and understanding. While a query specific to transfer shock was not included in the measures taken, it is possible that the increases in experience and understanding may translate to that construct. The reports of increased awareness of opportunities in engineering, increased interest in engineering, and receiving information relevant to career decisions appear to support this idea. Responses to open-ended questions on the post-participation survey for the summer program participants also included statements of increased interest in and certainty regarding pursuit of engineering degrees at TAMUK. Follow-on data gathering is planned in respect to transfer ease and/or shock. As has just been noted, the summer programming did impact sense of interest in and identification with engineering (mean 8.69 on a ten-point scale).

Peer mentors were asked in semi-structured interviews about mentee confidence, transfer or new student shock, and potential impact of program processes on identification with engineering. They were also asked to reflect on these constructs in respect to themselves. The peer mentors reported that students in the section of General Engineering in which team projects in robotics had been implemented increased their confidence in pursuing an engineering degree and, as a related construct, their sense of belonging in the engineering field. Peer mentors also noted having expanded their personal networks to include students from the course in which they assisted and that continuing to offer these students encouragement and assistance in informal ways was a means of easing their transfer into engineering study. The peer mentors noted that they also felt personal advancement in confidence and belonging. Their confidence increased because they were able to lead teams, implement processes they had been taught, provide guidance to others, trouble shoot, and develop programming in collaboration with a professor. This, in turn, confirmed for them that they were pursuing the right degree path and, for one, helped refine career goals within the field of engineering.

Learning by design projects were completed by three faculty members in three different sections of the General Engineering 1201 course. Each section focused on preparation for a different potential major in Engineering. Those were Mechanical Engineering, Electrical Engineering/Computer Science, and Chemical/Natural Gas Engineering. The design projects implemented were reverse engineering and 3D printing for prospective majors in Mechanical Engineering, a robotics design task for Electrical Engineering/Computer Science, and a water filtration project for Chemical/Natural Gas Engineering. Psychological development of students (Bean & Eaton, 2001) was reported by each faculty as learning collaborative and cooperative processes, enjoying the task, and an associated sense of identification with engineering processes.

2.2.2 *Student social development.*

For the 2019-2020 school year, two lines of data existed in respect to impacts on social development. That was comments made by peer mentors in interviews and written summaries of impacts observed by faculty teaching introductory courses in which learning by design projects were piloted. As just noted, the peer mentors provided evidence of social adaptation on their part and stated that they felt the same was applicable to the student participants. The peer mentors felt they had experienced personal growth in relating to supervising faculty, expanded their repertoire of social skills (e.g., team leadership, team trouble shooting), and had taken on an informal and continuing role as a sounding board for and guide to some of the students from the course in which the robotics project was implemented. They also noted that the students had been exposed to similar opportunities, albeit as project team members. The peer mentors felt the students who had been part of the robotics implementation had experienced learning regarding team processes and had begun to develop social networks that would prove beneficial to them as they continued to pursue a degree at TAMUK. The patterns observed by the peer mentors were also mentioned by the faculty responsible for the learning by design pilot courses. These included two courses, one preparatory for Mechanical Engineering and the other for Chemical or Natural Gas Engineering, in addition to the Electrical Engineering/Computer Science preparatory course in which the robotics project was enacted. Notation of similar impacts by a different group of observers and across three courses in which different learning by design projects were enacted confirms the social development assertions made by the peer mentors.

2.2.3 *Student intellectual development.*

Evidence supporting student intellectual development was generated from the summer bridge program for community college transfer students. This programming took place in the month of July in 2020. As is described in detail below (3.3.1 Summer Bridge Program), statistically significant increases in understanding in 21 of 21 topic areas were found. The topics were all identified as instructional goals for the undertaking by the faculty who planned the programming. Using a pre- and post-participation survey, ratings of experience/understanding were gathered from student participants. Substantial change was reported in all areas with the weakest level of significance being $p = .001$ and the 20 others at $p < .001$.

A second line of data regarding student intellectual development existed in the peer mentor interviews. Peer mentors stated that both students in the courses in which the mentors were assisting and the peer mentors themselves had experienced intellectual growth as a result of completing a hands-on robotics activity. The mentors felt, like was emphasized in the proposal submitted to the funder, that the ability to walk through a sequence task with a goal that required integration of learning and processes from a variety of disciplines was an excellent way to learn and/or gain confidence by applying prior learning.

Like was the case for social development, the faculty observed the intellectual challenges in and development for students based on the learning by design activities. This was the case in all three courses. While the instructors described the learning in more detail than the peer mentors had, the basic premise was the same. The students' experience combined application of theory and practical skills in the completion of a task that required analysis, design, experimentation, trouble-shooting, and refining processes to reach a goal. The result was learning in each realm.

2.3 Effectiveness of implementation patterns.

Evidence regarding implementation patterns exists as comments made by the Principal Investigator, data from the peer mentor interviews, process and curriculum documentation, written descriptions from faculty, a review of support services compiled by the Associate Dean for Undergraduate Affairs, and pre- and post-participation survey responses. These data indicate that the commitments made to the National Science Foundation have been actualized with two exceptions, summer research opportunities were curtailed by COVID-19 and one form of dissemination, a project website, has not been established. Given the severity and volume of disruption caused by the pandemic, this is a substantial record of accomplishment. Table 1 lists the patterns realized in each area of activity during the first year of the project.

Table 1

Implementation Tracking

Activity	Comments
TRANSITION FROM MIDDLE AND HIGH SCHOOLS TO 4-YEAR COLLEGES	
Eliminated	- Not pursued as a result of pre-funding negotiation.

TRANSITION FROM FRESHMAN/SOPHOMORE TO UPPER LEVEL	
Bridging STEM gateway courses with engineering concepts	- Curriculum development complete. - Modules to be implemented in fall 2020 course sections.
Learning by design experiences	- Curriculum development complete for freshman/ sophomore courses. - Three pilot projects implemented in 2019-2020. - Peer mentors note these were both helpful and enjoyable for early career students.
Summer undergraduate research experience	- Prevented by COVID-19 restrictions.
TRANSITION FROM 2-YEAR COLLEGES TO 4-YEAR COLLEGE	
Summer bridge program for transfer students	- Transitioned to online only programming with duration and daily involvement patterns altered. - Curriculum developed and implemented in spring and summer of 2020. - Pre- and post-participation survey results (presented below) demonstrate full and effective implementation.
Peer Mentoring	- Initiated in 2019-2020 but suspended due to COVID-19 restrictions. - Peer mentor interviews indicate consistent and effective implementation.
INTERVENTIONS FOR STUDENT SUCCESS ENHANCEMENT	
Professional training	- Peer mentors indicated making referrals that were successful. - TAMUK personnel affirmed active engagement at physical locations in 2019 and online following COVID-19 restrictions.
Career planning and readiness	
Internships/co-ops opportunities	
Pre-college career decision support	
DISSEMINATION AND INSTITUTIONALIZATION	
Dissemination	- No evidence of a website for the project was found. - Faculty networks and fliers were employed to recruit students for summer programming which is a means of dissemination. - Press release found on TAMUK website.
Institutionalization	- Project elements that may be institutionalized have begun. - Evidence of cooperation with existing entities was provided by PIs.

2.4 Progress made toward project goals.

The IPE for STEM project is broad and multi-faceted educational endeavor. As such, it has a series of inter-related goals. To accommodate brief consideration of the progress made toward these goals, Table 2 which lists project activities, their associated goals (as expressed in the proposal), and comments regarding progress toward those goals. In subsequent years, this table will be updated and the level of detail in the comments extended.

Table 2

Implementation Tracking

Activity	Goal	Comments
TRANSITION FROM MIDDLE AND HIGH SCHOOLS TO 4-YEAR COLLEGES		
Eliminated	- Not applicable.	- Not pursued as a result of pre-funding negotiation.
TRANSITION FROM FRESHMAN/SOPHOMORE TO UPPER LEVEL		
Bridging STEM gateway courses with engineering concepts.	- Freshman STEM gateway courses will be targeted: College Algebra, Trigonometry, Calculus I, Chemistry I and II, and Physics I and II.	- Curriculum development complete. - Modules to be implemented in fall 2020 course sections. - Baseline data exists.
Learning by design experiences	- Mini-design experience in UNIV Student Success Course (for PPEN and APEN students) or the General Engineering (GEEN) career courses. - Mini-design experience as project teams in introductory engineering courses with the design activity extending two to four-weeks and demonstration of a solution at the end of the activity.	- Curriculum development for freshman/sophomore level complete. - Robotics, water filtration, reverse engineering, and 3D printing tasks implemented in first and second year courses in 2019-2020.
Summer undergraduate research experience	- Develop an undergraduate summer research program specifically for students that have completed their freshman/sophomore course requirements at TAMUK. - Broaden student horizons, motivate them to complete their degree, and to consider the prospect of graduate education.	- COVID-19 travel and social distancing restrictions prevented implementation of this project element.
TRANSITION FROM 2-YEAR COLLEGES TO 4-YEAR COLLEGE		
Summer bridge program for transfer Students	- Intellectual stimulation, personal growth, and academic integration for students. - Establish partnerships with community colleges to create a pipeline to recruit and retain underrepresented STEM students.	- Three-week, online program completed in summer 2020. - Academic growth and interest data gathered. - Participants recruited in collaboration with CC contacts.
Peer Mentoring	- Pair successful upper level Hispanics with new CC transfers. - Regular tutoring. - Guidance re: techniques and approaches for success in intense engineering courses.	- Initiated in 2019-2020 but suspended due to COVID-19 restrictions. - Peer mentor interviews indicate consistent and effective implementation.
INTERVENTIONS FOR STUDENT SUCCESS ENHANCEMENT		
Professional training	- Transcript evaluation.	

Career planning and readiness Internships/co-ops opportunities Pre-college career decision support	- Provide tutoring and academic support even in resident halls. - Notice of professional development opportunities. - Notice of institutional and program deadlines. - Track student success.	- Peer mentors indicated making referrals that were successful. - 411 distinct students accessed tutoring at the Javelina Engineering Support Services Center. - 143 CC transfer students completed transfer orientation. - Students were referred to 18 different student organizations. - 130 students attended presentations about engineering certification. - Evidence of student tracking exists as academic recovery programming and counts of persons placed on academic probation.
DISSEMINATION AND INSTITUTIONALIZATION		
Dissemination	- Project website created and updated regularly. - Online sharing of progress, outcomes, and modules. - Share outcomes and modules with colleagues at TAMUK. - Student and faculty presentation and publication. - Social media posts.	- No evidence of a website for the project was found. - Press release found on TAMUK website. - Too early for all other forms of dissemination.
Institutionalization	- Build collaboration with in house academic and student support. - Build network with CCs. - Institutionalize freshman/ sophomore and CC transfer support.	- Project elements being established with institutionalization links being forged but too early for assessment beyond initial contact and collaboration.
QUANTIFIED OBJECTIVES		
Summer transfer program	- Recruit 40 participants annually.	- 37 participants in first year.
Enrollment	- Increase volume of engineering students by 20%.	- Baseline value requested.
Retention	- Increase retention in engineering by 15%.	- Baseline value requested.
ASSESSMENT OBJECTIVE		
Assessment	- Create assessment pattern to measure and assess outcomes.	- Evaluation is filling this role in the first year of the project.

2.5 Possible improvements to processes.

The last of the evaluation questions addresses what can be done to improve project processes. To avoid repetition, this material is addressed below as a subset in the discussion of possible improvements. That material can be found in section 5 of the report.

3. Comments Specific to Project Commitments.

3.1 Middle and high school programming.

Classroom demonstrations were proposed for IPE for STEM in collaboration with the STEM academy teachers in the Kingsville Independent School District. Selected schools were to be visited on a monthly basis. During these visits, TAMUK faculty, instructors and undergraduate students were to complete STEM demonstrations and interact with the students and teachers around the engineering concepts that are the basis of the demonstrations.

The IPE for STEM project also proposed a summer camp for high school students and their teachers to introduce the engineering profession, engineering problem solving, and provide calculus lectures, math-based activities to improve calculus readiness skills, and team-based engineering design projects. Plans included participants visiting local engineering-relevant industries or facilities. The teachers were going to work with TAMUK faculty in preparing and mentoring the participating students during the summer projects with the intention of helping the teachers learn to think like engineers and then apply this knowledge to their classrooms during the academic year.

Neither of these processes were completed. The first was curtailed by COVID-19 restrictions in the State and region. The second was removed from the project activity during pre-award interaction at the request of the National Science Foundation.

3.1.2 *Demonstrations in middle and high schools.*

No demonstrations in middle schools and high schools were completed due to COVID-19 related school closings, restrictions placed on public gatherings, and shelter-in-place orders.

3.1.2 *Summer camp for high school students and teachers*.

The planned summer camp for high school students and their teachers was not part of the funded project. It was removed at the suggestion of NSF reviewers in order to concentrate on college level instruction and concerns of transfer students.

3.2 Freshman and sophomore level programming.

Four areas of programming were planned to aid freshman and sophomore preparation for upper level engineering courses. Each is described briefly below and then results from data gathering in each area is presented.

The introduction of STEM modules was planned for freshman and sophomore level courses. They will be enacted in courses taught outside of the engineering college like College Algebra, Calculus, and Physics.

The modules were developed collaboratively by Engineering and Arts and Sciences faculty. They involve engineering concepts and examples to illustrating topics usually found challenging by early career students.

General Engineering (GEEN) for freshman had mini-design projects added. A simple and general design objective was assigned to student teams and a solution was to be demonstrated by each student team at the end of the activity. In all settings, students were expected to report on their design experience so that they were exposed to the formal aspects of engineering written and/or oral presentation. Older students, sophomores, were recruited to act as peer mentors in one GEEN section in which a robotics project was deployed.

An eight-week, residential summer research program was planned for participants. Students were to be paired with faculty mentors who would work closely with them to define a research problem to pursue. Emphasis was to be placed on technical issues faced by area industries addressing "cross-sector" understanding and activity. The intent behind this initiative was to increase the motivation level for students as they make the transition from STEM preparatory courses to mostly engineering courses. To facilitate this, a minimum of two weekly meetings with the faculty mentor regarding research and attendance at a series of research methods seminars were planned. Graduate students were to be hired as facilitators to conduct meetings with the undergraduate students each week in which questions would be answered, guidance or process-specific information provided, and engineering skills, such as use of software packages relevant to the research problems under investigation, taught. The plan for eight-week research opportunities was not implemented due to COVID-19 restrictions.

3.2.1 *STEM concepts in gateway courses*.

Five data sources were available for the STEM concept implementation in gateway courses for the 2019-2020 school year. These are conversations held with the Principal Investigator, e-mails from faculty members working in the project, curricular documents prepared by TAMUK faculty, post-implementation reports written by faculty, and institutional data regarding student outcomes.

A hands-on and team-based robotics, water filtration, reverse engineering, and 3D printing projects were added to freshman level classes. The robotics task was overseen by a faculty member who worked with and trained a group of students to act as peer mentors for the project teams. Data regarding the robotics activity was gathered in interviews with the peer mentors and as a written report from the faculty person who implemented the project. Two other reports, one from GEEN 1201 Mechanical Engineering and the other in GEEN 1201 Chemical/Natural Gas Engineering, were submitted by faculty who implemented learning by design tasks in their course. Specifics have been presented above and are included, as applicable, in sections that follow. Overall, the General Engineering learning by design activities were reported to have been successfully implemented and to have had positive intellectual, psychological, and social impacts for participants including the peer mentors who assisted with the robotics activity.

Curricular materials related to implementation of STEM modules in engineering preparation courses were provided to the evaluator were for College Algebra (MATH 1314), Trigonometry (MATH 1316), Calculus I (MATH 2413), General Inorganic Chemistry (CHEM 1311), and University Physics I (PHYS 2325).

There were ten or more modules created for each of the courses. Assessing the quality of these materials is beyond the scope of the evaluation but the volume and variety of materials speaks well of the emphasis given to introducing engineering concepts as part of these introductory courses.

The new modules will be implemented for the first time in fall of 2020. Baseline data as grade distributions for the courses during the nine preceding semesters was obtained from the institutional records system at TAMUK. The spring semester of 2020 was included in this set but excluded from inclusion in the baseline calculations as COVID-19 restrictions forced all instruction online whether the instructor had planned the course that way or not. As this change introduced an intervening variable that was likely to have a strong impact on the data, the records for Spring 2020 were excluded. The baseline values were calculated as percentages for the possible grades, a student being in progress toward completing the course at the time grades were posted, and the number of students who withdrew for each course (Table 3). The total count of cases in each of the baseline sets is sufficient for the values to be considered representative as the lowest number is 887 individuals. Comparisons of outcomes in courses in which the STEM modules are implemented to these values will be made in evaluation reports for the last four years of the project.

Table 3

Baseline Grade Distribution Values in Courses in Which STEM Modules will be Introduced

Course	n	A	B	C	D	F	In Prgss	W
CHEM 1311	2128	18.2%	14.4%	17.8%	16.6%	23.7%	0.05%	8.8%
MATH 1314	3203	40.9%	19.9%	12.5%	6.4%	9.5%	0.2%	9.3%
MATH 1316	1351	20.7%	21.7%	20.1%	12.2%	11.5%	0.07%	13.7%
MATH 2413	952	20.6%	20.1%	21.4%	17.5%	14.2%	0%	6.2%
PHYS 2325	887	16.0%	18.8%	21.5%	16.5%	20.9%	0.1%	6.2%

3.2.2 *Mentoring by juniors and seniors*.

The data available regarding mentoring provided through the IPE for STEM project was comments made by peer mentors during interviews, comments from their faculty supervisor, information shared by the PI in project discussions, and material prepared by the Associate Dean for Undergraduate Affairs in the College of Engineering. As was noted above in sections 2.2.1, 2.2.2, and 2.2.3, upper level students, sophomores in this case, were recruited to provide peer mentoring for a robotics class project. Their primary form of activity in the first year of the project was to assist a faculty member in preparing for and implementing a hands-on robotics project in one section of an introductory level course. Several of these students were interviewed as part of the data gathering for this report and their insights regarding project processes and outcomes are described when applicable to topics in this report. Mentoring as guidance in completing studies was also available through a Living Learning Community. This is an Engineering-specific community focused on supporting students throughout their academic careers and includes informal mentoring by peers, active tutoring by upper level students, and guidance provided by college faculty and staff. Five junior and senior level students are also available as tutors in the Javelina Engineering Student Success Center (JESSC) and a portion of their role is also classified as mentoring.

3.2.3 *Learning through design projects*.

Two design project patterns were initiated in the first year of IPE for STEM. These were the design activities in General Engineering courses and the team projects in the summer bridge program. Evaluation data for these activities existed as peer mentor and PI comments, project planning and coordination documents, and written assessments from faculty.

The design projects in General Engineering have been discussed at several points in this document thus no further comment is required here. The summer bridge offering and outcomes are described below in section 3.3.1 Summer Bridge Programming. The details there provide strong evidence of a thoroughly and effectively planned initiative. These material indicate that the learning through design emphasis is on schedule and proved to be effective in all areas in which the process has already been enacted with students.

3.2.4 *Summer undergraduate research opportunities.*

Undergraduate research opportunities, at TAMUK and other sites, were planned for the project. COVID-19 restrictions related to travel and social gatherings prevented the plans from being realized.

3.3 Programming for community college transfer students.

The programming planned for community college transfer students has two specific foci, a summer bridge program and peer mentoring.

The summer bridge offering was planned as a four-week Research Training Program. Participants were to be selected through an open application and evaluation process with two sessions occurring each summer. The research activity was to be completed by five teams of four students in each session with the teams supervised by a TAMUK STEM faculty and mentored by a graduate student. The research projects were to have been designed by TAMUK faculty and would incorporate entrepreneurship components. Preparation of a poster, completion of a presentation, and drafting a report summarizing the research activity were the final steps.

The planned approach to summer bridge programming was not possible due to limitations imposed by COVID-19. The original plan was revised to become a single offering of a three-week online program with the same number of students involved as would have been part of the two on-site sessions. The online programming involved two, one-hour seminars each week day for three weeks, July 13-31. Eleven of the seminars were presentations prepared by TAMUK faculty. Five were presentations completed by engineers active in industry, government service, and outside the field of engineering. The remainder was time devoted to completing team-based research project and summarizing results as posters, an oral presentation, and a report.

The main objective of the planned mentoring program was to pair a successful Hispanic junior or senior with a new community college transfer student who has just made a transition to TAMUK. The student mentor provides regular tutoring to the mentee, as well as guidance on techniques and approaches for surviving the intense engineering courses facing the mentee. The student mentors' level of academic success and some evidence of the ability to tutor effectively were primary qualifications. They were also to be at least one semester further along in study than the students s/he mentored. At any time, a mentor was to have three to five mentees often in the same engineering discipline. Mentors are asked to meet with their mentees once or twice per week. This mentoring was to be provided, as applicable, year round. This pattern was enacted through the JESSC where professional advisors and student tutors provided assistance to 143 students dispersed across the 10 Engineering specializations taught at TAMUK.

3.3.1 ***Summer bridge program.***

The project plan included an on-site summer bridge program for community college transfer students. The on-site and hands-on programming was converted to online seminars, interactive activities, and team projects in a virtual environment. Process documentation and pre- and post-participation data was gathered. Twenty-one queries for pre- and post-participation surveys were developed from purpose and learning objective statements in the seminar summaries submitted by the participating faculty. This provided insight into the backgrounds of the students and the ability to judge impact by comparing survey responses from before and after the summer program.

A total of 37 persons enrolled in the online summer program. Demographic information was gathered from all of them. The participants were 18 females and 19 males. Twenty-seven of them identified as Hispanic while the remaining ten classified themselves as non-Hispanic. The Hispanic students conceived of their racial identity predominantly as Hispanic/Latino (n= 22) but four saw themselves as White and three others as both Hispanic/Latino and White (one did not respond to this query). Non-Hispanics were predominantly White (n = 7) with three African-Americans one of whom also identified as Asian. These patterns are similar to the general student population of TAMUK which is over 70% Hispanic, 6-7% African-American, and approximately 15% White with a gender ratio shifted slightly toward males (52.7% to 47.3% female) (TAMUK, 2016). Nearly two-thirds of the informants, 23 out of 37, were first-generation college students (defined in the question as "neither of my parents/guardians possesses a college degree"). The same number, although not the same students, felt their math skills were "above average" in comparison to their classmates while the remainder felt they were "average" (n = 11) or "in the highest 10%" (n = 3). Nineteen of the participants reported having taken Advanced Placement (AP) classes, 16 reported completion of dual enrollment classes (11 of these had also taken AP classes), and 12 indicated that they had not taken AP or dual enrollment courses.

Of the summer program participants, 36 accessed the pre-participation survey. Of them, one was under the age of 18 and not permitted to submit responses, three completed the informed consent questions but did not submit responses to the other queries, and two others provided responses but infrequently. Respondent counts for the pre-participation survey varied from 28 up to 33 by question. All 37 participants completed the post-participation survey. The one student who had been under the age of 18 prior to the summer program celebrated a birthday during it and was able to submit post-participation responses. Like the pre-participation submissions, some individuals elected to not answer several questions. The respondent counts were either 35, 36, or 37 for the post-participation survey queries. Responses received on the pre- and post-participation instruments regarding the 21 questions derived from the seminar objectives and instructional goals are summarized in Tables 4, 5, and 6.

The pre-participation responses facilitated a consideration of the knowledge base of the CC transfer students in the summer bridge program. This was completed as a rank ordering of ratings submitted by topic with the mean as the primary sort and standard deviation (lowest) and then mode (highest) as a tie breakers. The result is presented in Table 4. Tie breakers were not necessary as no two means were alike. The responses broke out into five groups based on natural breaks in the values for the groups' numeric average (μ). The evaluator assigned them the following group titles: (1) general computer skills, (2) introductory exposure, (3) basic patterns of differentiation and application, (4) intermediate application, (5) specific skill sets, and (6) cross-cutting systems or synthesis. The cut-off points between groups are marked in Table 4 by rows containing the group titles and these separate the remaining six cells containing the survey statements and means.

Table 4

Rank Ordering of Pre-Participation Survey Responses for the Summer Bridge Program

GENERAL COMPUTER SKILLS	
1. I can write a formula in Excel.	[μ = 6.94]
INTRODUCTORY EXPOSURE	
2. I know several types of jobs or projects in which engineers in each of the major disciplines might be involved.	[μ = 6.13]
3. I can explain how 3D modeling software serves as a communication tool for designers, manufacturers, and end users.	[μ = 6.10]
BASIC PATTERNS OF DIFFERENTIATION AND APPLICATION	
4. I have seen how 3D modeling software can be used in engineering design and analysis.	[μ = 5.73]
5. I know several options for visualizing data in Excel.	[μ = 5.58]
6. I can explain how engineering is different than science and mathematics.	[μ = 5.48]
INTERMEDIATE APPLICATION	
7. I can explain how the types of material that could be used in a structure impact the way the structure can be designed and built.	[μ = 4.90]
8. I have been taught a design process specific to engineering.	[μ = 4.77]
9. I can define computer science.	[μ = 4.74]
10. I have used an engineering design process to complete a project.	[μ = 4.65]
11. I can explain how calculus is important in creating technological solutions to human problems or needs.	[μ = 4.56]
SPECIFIC SKILL SETS	
12. I can describe what people who work in computer science do.	[μ = 4.31]
13. I know how to nest formulas in Excel.	[μ = 4.13]
14. I can explain how simultaneous equations apply in engineering.	[μ = 4.00]
15. I can give accurate examples of the types of projects and problems on which computer scientists work.	[μ = 3.87]
16. I can describe how geographic information systems relate to spatial data, attribute tables, and temporal data.	[μ = 3.63]
17. I can correctly use the phrases statically determinate and statically indeterminate when describing engineering analysis.	[μ = 3.57]
18. I can describe the use of algorithms in computer science.	[μ = 3.38]
19. I could explain to a friend what it means to solve a computer science problem at the conceptual level.	

Table 4 *Rank Ordering of Pre-Participation Survey Responses for the Summer Bridge Program*
[μ = 3.21]
CROSS-CUTTING SYSTEMS OR SYNTHESIS
20. I can describe the relationship of licensure for engineers and public safety in the use of products designed by engineers. [μ = 2.36] 21. I know the data science life cycle. [μ = 2.19]
Note: μ denotes the mean value.

The material above provides insight into the areas in which CC transfer students are prepared when they arrive at TAMUK and in which areas that preparation is strongest. This has implications for in course and broader within program curriculum emphasis and structure. As such, it will be tracked and to supplement this presentation in subsequent years.

Using the means for the post-participation survey responses to produce a second rank ordering of the 21 statements and comparing it to the list for the pre-participation survey is informative (Table 5). When the means were the same, statements with lower standard deviations were ranked higher.

Table 5 *Rank Ordering and Cross-Walk of Pre- and Post-Participation Survey Responses for the Summer Bridge Program*	
GENERAL KNOWLEDGE	
1. I can write a formula in Excel. [μ = 6.94]	1. I can write a formula in Excel. [μ = 9.14] 2. I know several types of jobs or projects in which engineers in each of the major disciplines might be involved. [μ = 9.08]
INTRODUCTORY EXPOSURE	
2. I know several types of jobs or projects in which engineers in each of the major disciplines might be involved. [μ = 6.13] 3. I can explain how 3D modeling software serves as a communication tool for designers, manufacturers, and end users. [μ = 6.10]	3. I have seen how 3D modeling software can be used in engineering design and analysis. [μ = 8.64] 4. I know several options for visualizing data in Excel. [μ = 8.63] 5. I have used an engineering design process to complete a project. [μ = 8.61] 6. I can explain how engineering is different than science and mathematics. [μ = 8.53] 7. I can describe what people who work in computer science do. [μ = 8.44] 8. I can explain how the types of material that could be used in a structure impact the way the structure can be designed and built. [μ = 8.31] 9. I can explain how 3D modeling software serves as a communication tool for designers, manufacturers, and end users. [μ = 8.31] 10. I can define computer science. [μ = 8.28] 11. I have been taught a design process specific to engineering. [μ = 8.19]

Table 5

Rank Ordering and Cross-Walk of Pre- and Post-Participation Survey Responses for the Summer Bridge Program

4. I have seen how 3D modeling software can be used in engineering design and analysis. [μ = 5.73] 5. I know several options for visualizing data in Excel. [μ = 5.58] 6. I can explain how engineering is different than science and mathematics. [μ = 5.48]	*ALL MOVED UP ONE LEVEL*
ELIMINATED CATEGORY	
7. I can explain how the types of material that could be used in a structure impact the way the structure can be designed and built. [μ = 4.90] 8. I have been taught a design process specific to engineering. [μ = 4.77] 9. I can define computer science. [μ = 4.74] 10. I have used an engineering design process to complete a project. [μ = 4.65] 11. I can explain how calculus is important in creating technological solutions to human problems or needs. [μ = 4.56]	*ALL BUT ONE MOVED UP TWO LEVELS* *EXCEPTION – "…explain how calculus is important…"*
SPECIFIC SKILL SETS	
12. I can describe what people who work in computer science do. [μ = 4.31] 13. I know how to nest formulas in Excel. [μ = 4.13] 14. I can explain how simultaneous equations apply in engineering. [μ = 4.00] 15. I can give accurate examples of the types of projects and problems on which computer scientists work. [μ = 3.87] 16. I can describe how geographic information systems relate to spatial data, attribute tables, and temporal data. [μ = 3.63] 17. I can correctly use the phrases statically determinate and statically indeterminate when describing engineering analysis. [μ = 3.57] 18. I can describe the use of algorithms in computer science. [μ = 3.38] 19. I could explain to a friend what it means to solve a computer science problem at the conceptual level. [μ = 3.21]	12. I can describe the relationship of licensure for engineers and public safety in the use of products designed by engineers. [μ = 8.08] 13. I can explain how calculus is important in creating technological solutions to human problems or needs. [μ = 8.08] 14. I can give accurate examples of the types of projects and problems on which computer scientists work. [μ = 8.08] 15. I know how to nest formulas in Excel. [μ = 7.86]
SIMILAR PLACEMENT – 18, 14, and 19 became 16, 17, and 18	16. I can describe the use of algorithms in computer science. [μ = 7.47] 17. I can explain how simultaneous equations apply in engineering. [μ = 7.47] 18. I could explain to a friend what it means to solve a computer science problem at the conceptual level. [μ = 7.36]

Table 5 *Rank Ordering and Cross-Walk of Pre- and Post-Participation Survey Responses for the Summer Bridge Program*	
INDETERMINATE AND REQUIRE ADDITIONAL INFORMATION	
20. I can describe the relationship of licensure for engineers and public safety in the use of products designed by engineers. [μ = 2.36] 21. I know the data science life cycle. [μ = 2.19]	19. I can correctly use the phrases statically determinate and statically indeterminate when describing engineering analysis. [μ = 7.14] 20. I know the data science life cycle. [μ = 7.05] 21. I can describe how geographic information systems relate to spatial data, attribute tables, and temporal data. [μ = 6.94]
Note: μ denotes the value of the mean.	

Means for agreement with the statements increased markedly which moved eight of the statements up one or two groupings in the rank. Thus, the educational objectives of the programming were achieved. This is slightly less apparent in the lower half of Table 5 when comparing ranks but noting the changes in the mean for the statements demonstrates substantial progress was made on all fronts. There was an increase in the mean for every statement and all of the increases were highly statistically significant (Table 6). Only one significance value was $p = .001$. All others were $p < .001$. The clear indication is that the educational programming was effective in altering students' understanding, even in areas in which they felt they had a good understanding prior to participating. The ability to have such a strong and positive impact on student understanding in areas foundational to success in engineering study is valuable. This initial finding must and will be reconsidered in subsequent years but should the pattern hold, institutionalizing the summer bridge program may prove to be beneficial to TAMUK students.

Table 6

Comparison of Pre- and Post-Participation Survey Responses for the Summer Bridge Program

Query	Period	Mean	SD	Mode	Sign.
I have been taught a design process specific to engineering.	Pre	4.77	2.96	3	< .001
	Post	8.19	1.74	8	
I have used an engineering design process to complete a project.	Pre	4.65	3.41	4	< .001
	Post	8.61	1.69	10	
I can describe the relationship of licensure for engineers and public safety in the use of products designed by engineers.	Pre	2.36	2.44	1	< .001
	Post	8.08	1.66	8	
I can explain how calculus is important in creating technological solutions to human problems or needs.	Pre	4.56	2.86	6	< .001
	Post	8.08	1.70	10	
I can explain how engineering is different than science and mathematics.	Pre	5.48	2.80	7	< .001
	Post	8.53	1.84	10	
I know several types of jobs or projects in which engineers in each of the major disciplines might be involved.	Pre	6.13	2.84	7	< .001
	Post	9.08	1.40	10	
I can explain how simultaneous equations apply in engineering.	Pre	4.0	3.0	0	< .001
	Post	7.47	2.80	10	
I can explain how the types of material that could be used in a structure impact the way the structure can be designed and built.	Pre	4.90	2.93	7	< .001
	Post	8.31	1.79	10	
	Pre	3.57	2.95	0	< .001

Table 6

Comparison of Pre- and Post-Participation Survey Responses for the Summer Bridge Program

Query	Period	Mean	SD	Mode	Sign.
I can correctly use the phrases statically determinate and statically indeterminate when describing engineering analysis.	Post	7.14	3.03	10	
I can define computer science.	Pre	4.74	3.02	5	< .001
	Post	8.28	1.77	10	
I can describe what people who work in computer science do.	Pre	4.31	2.93	4	< .001
	Post	8.44	1.59	10	
I can give accurate examples of the types of projects and problems on which computer scientists work.	Pre	3.87	2.45	5	< .001
	Post	8.08	1.83	10	
I can describe the use of algorithms in computer science.	Pre	3.38	2.78	0	< .001
	Post	7.47	2.12	10	
I could explain to a friend what it means to solve a computer science problem at the conceptual level.	Pre	3.21	2.83	0	< .001
	Post	7.36	2.07	7	
I can write a formula in Excel.	Pre	6.94	2.86	10	< .001
	Post	9.14	1.33	10	
I know several options for visualizing data in Excel.	Pre	5.58	3.26	8	< .001
	Post	8.63	1.68	10	
I know how to nest formulas in Excel.	Pre	4.13	3.36	0	< .001
	Post	7.86	2.33	10	
I have seen how 3D modeling software can be used in engineering design and analysis.	Pre	5.73	3.51	8	< .001
	Post	8.64	2.04	10	
I can explain how 3D modeling software serves as a communication tool for designers, manufacturers, and end users.	Pre	6.10	3.22	10	= .001
	Post	8.31	2.17	10	
I know the data science life cycle.	Pre	2.19	3.10	0	< .001
	Post	7.06	2.47	10	
I can describe how geographic information systems relate to spatial data, attribute tables, and temporal data.	Pre	3.63	3.45	0	< .001
	Post	6.94	2.51	7	

The supposition that the summer programming was efficacious is supported by responses to the first question asked on the post-participation survey. That was “What is your overall rating of the TAMUK online programming you participated in this summer?” Thirty-six of the 37 respondents submitted responses on a five-point Likert scale (Poor to Excellent). There were two responses of Good, nine of Very Good, and the remaining 25 were Excellent. The conversion to online programming does not appear to have diminished the value of the offering.

Three other objectives of the summer activity were addressed on the post-participation survey. These were increasing awareness of opportunities in engineering, increasing interest in engineering, and contributing information relevant to career decisions. The questions for these topic areas were: (1) “The presentations and activities increased my awareness of the variety of opportunities available to people who study engineering.” (2) “The presentations and activities increased my interest in studying engineering.” And, (3) “The presentations and activities helped me refine my career goals.”

Students were asked to provide a rating between zero (0) and ten (10) for each statement. They were instructed that zero indicated "no impact" and ten "a very large change." One student did not respond to this set of three questions.

The mode response for each question was the highest possible score, ten. The numerical average score was 8.83 for increasing awareness, 8.69 for increasing interest, and 8.46 for assistance refining career goals. These are very positive outcomes although it should be noted that the standard deviations for ratings approached or exceeded the value two, 1.84, 1.91 and 2.37 respectively, which indicates substantial variety in responses. The range of ratings for the first question, one to ten, illustrates this. This may be related to a number of factors including prior experience and understanding on the part of the participants. For example, a student with substantial prior experience or a firm commitment to a specific career path may not be strongly swayed by a three-week, online education offering.

Three open-ended questions were included in the post-participation survey. These asked what the informant considered to be the "most valuable form of learning in the summer program," "the most valuable activity," and whether the student had any other comments to share with the project team and faculty members. The responses to the first question can be sorted into nine primary topic areas. They were (listed in the order in which the occurred in the answer set):

- Multiple perspectives shared regarding work experiences and careers.
- Information about the variety of opportunities in the engineering field.
- Information provided by guest presenters about their experiences.
- Engineering ethics material.
- The opportunity to work on a team toward a shared goal/ the group projects.
- Learning to use software applications.
- Interacting with and being able to ask questions of engineers.
- Learning from peers.
- "Unsure."

The query about the most valuable activity elicited a broad range of replies including a response that the entire "program [was] extremely valuable and informative." Summarizing examples of the submissions are listed below. It appears that various members of the group found different activities to be valuable. This is likely related to personal background and varied levels of experience or interest in respect to the topics covered in the faculty and guest presentations and/or the group project. The most common response was a statement focused on the group activity identifying it as the most valuable.

- "Work on coding"
- "The introduction activity because it showed a simplified version of a real life situation."
- "…the group project to design a steel truss bridge. I was able to learn Visual Analysis, the role of material and member selection in engineering design, and fundamental understanding of load paths in structures."
- Guest presentations about "job experiences and work."
- Learning "how to use visual analysis software and utilize it to construct a design relative to my major."
- "The team building project that we participated in the beginning that helped us break the ice with our group."

- The group project; “Doing the group project while having the daily sessions with engineers and running into and experiencing the things they spoke about while working in groups, allowing us to adhere to their advice and practice our team skills;” “…it required a lot of learning to achieve and troubleshooting so solve problems.”
- The report and presentation.
- “…the numerous group sessions with an advisor. This helped with keeping the focus of the students on the right track.”

Overall, these comments affirm that the material covered was broad but proved effective.

The final question was: “Is there anything else you would like the project team and faculty members to know about your experience this summer?” The responses were primarily expressions of praise and thankfulness although there were several suggestions made. One student noted that gaining familiarity with TAMUK personnel made him more likely to consider TAMUK as his next stop in higher education and another that he would be transferring to TAMUK. Many of the responses were detailed and examples that in one form or another address every topic mentioned, divided into positive comment and suggestion sets, follow.

3.3.1.1 *Positive comments.*

A good general summary of the positive comments might be the following: “This summer program helped me personally in so many ways: academically (I learned more about mechanical engineering), professionally (because I can now add this to my resume) and financially (because the money I earned will help me pay my tuition this coming semester). It was a great program that I will no doubt recommend to others!” Additional positive comments submitted by participants, arranged in the order they occurred on the survey submission spreadsheet, were:

- “It was a great experience and happy I got to be a part of it! “
- “I really enjoyed using Visual Analysis because I was able to experiment with different beams and see how the effect the design.”
- “I am very thankful for being given the opportunity to partake in this summer program. I was able to learn about different fields that I would not have been exposed to in my academic classes. The many presentations taught me what needs to be done in order to accomplish becoming a professional engineer and the different career paths that can be taken from an engineering degree. I would have never thought there were so many different career paths that could be taken. I have learned a great deal from this amazing program.”
- “I really appreciated being given the opportunity to participate in this program, I started the beginning of the 3 weeks knowing absolutely nothing pertaining to engineering and hadn’t started my math courses yet. I’m leaving with a better understanding of how things work together in this particular industry. The weekly stipend afforded me the time away from work this took from me, without it I wouldn’t have been able to afford to miss work and I would have missed out on this beneficial program. I wanted to thank everyone for their time this summer and I hope you’re able to continue to impact more students in my position in the future.”

- “I really enjoyed my time working in the Mechanical Engineering group and Raj did a great job working with us, answering any questions we had, and teaching us all of the necessary prerequisite knowledge to do whatever needed to be done.”
- “I would like to express my deep gratitude for the opportunity, for their dedication, and for providing a comfortable learning experience apart in format from the classroom experience.”
- “Placing students on a project that isn't of their interest isn't wrong, it actually helps them deal or try to deal with problems and experiment a bit more.”

3.3.1.2 *Suggestions.*

Participating students also made suggestions for the program. They are listed here in the order in which they occurred in the raw data and will be summarized below in section 5, Suggestions for Improvement.

- “It was fun but a little bit rushed.”
- “I wish there was some way to monitor the groups so that the program coordinators could see who was not contributing to the project as that was an issue in my group.”
- “One improvement that can be made though is to include weekly presentations by each group to showcase their progress on their project.”
- “I did not enjoy the engineers working in other fields…it felt unnecessary, this is a program for engineering students, not med/law students.”
- “For the future I would love that the program also continues to use the online method alongside the in-class program when everything returns to normal. If this program was not offered online I would not be able to participate in it.”
- “Please have more engagement with students and faculty to work out student disagreements.”
- “I personally would have enjoyed fewer panels and more one on one question-answer session with an engineer.”
- “I want them to know that we devote a lot of time into designing and building our project. When we present we would like to not be interrupted or cut short, especially if we have more than enough time to finish our presentation. We respect your lectures so please respect our presentations when we've spent weeks preparing. Thank you.”

3.4 General supports in conjunction with other programming.

Four general supports for students participating in the project were noted in the proposal. These were access to the student success centers at the institution, one for all students and a second for engineering students, study groups for first and second year students facilitated by the peer mentors, encouraging participants to be active in student organizations, and offering internship opportunities. Data relevant to each is discussed below.

There are three sites at TAMUK where engineering students can get help. The University tutoring center is located in the library, the Javelina Engineering Student Success Center is at the College of Engineering, and the Lucio Residence Hall is dedicated to an Engineering Living Learning Community where students can also be tutored. Tutoring at all three locations covers Math, Chemistry, Physics, and introductory

Engineering courses in a variety of disciplines. Tutoring services were transitioned to be exclusively online in response to and to continue providing support during the COVID-19 pandemic.

Transfer students are provided orientation sessions and there are two professional advisors who are part of the University Success Center assigned to advise transfer students. Advising transfer students includes evaluating student transcripts to identify appropriate courses, complete paperwork for course substitution approvals, and recommend courses should to take.

There are also 18 student organizations at TAMUK which are specific to engineering. These are intended to serve different audiences of engineering student and occur by specialization, targeting minority students, and as programs for females. Career fairs, internships, and professional credentialing information are also available from the success centers and their employees. And student progress is monitored including academic outcomes. Should GPA fall below 2.0, a probation protocol that involves recovery programming is initiated. It involves coaching, tutoring, counseling, and career goal assistance.

3.4.1 *Accessing and use of success centers.*

Peer mentors noted that they referred students to the tutoring centers. The Associate Dean responsible for these centers provided counts of students who utilized the services (see Table 2). These sources indicate that the commitment to integrate institutional student support services into the grant processes and to use those services to aid students are being actualized.

3.4.2 *Study groups.*

The project commitment to study group support was enacted in the first year. The team-based learning processes employed in the General Engineering courses, the summer bridge program, and the tutoring service offerings functioned as study groups for a process-specific purpose. In addition, an Engineering specific Living Learning Community exists in Lucio Residence Hall. Group processes are encouraged and supported through that community.

3.4.3 *Introduction to and involvement with student groups.*

University processes exist to channel interested students to any of 18 engineering focused student organizations. Scores of referrals were made during the 2019-2020 school year.

3.4.4 *Participation in internship opportunities.*

University programming to support identification of internship opportunities and application to them is in place. Students are notified at the beginning of every semester about the campus career fair and which companies are scheduled to attend. These companies, not infrequently, have internship opportunities. Students are also encouraged to attend industry information sessions throughout the semester at which industry representatives present and usually schedule interviews for full-time jobs as well for internships. The College internship coordinator contacts students about these events and helps students work on their resumes to prepare for them.

4. Institutionalization of Practices and Dissemination of Findings.

4.1.1 Institutionalization of project practices.

Connections with TAMUK colleagues and representatives of community colleges have been established. These working relationships are the platform on which the project team proposed they would work toward and establish institutionalization of practices. The necessary first step has been taken.

4.1.2 Dissemination of findings.

Since the project has yet to reach its first-year anniversary, there are no findings to disseminate. All programming that has been implemented was established in a first or pilot phase. Refinement and validation is necessary to establish the veracity of the approaches.

5. Suggestions for Improvement

The following suggestions for improvement of current processes were made by participants.

1. Increase the period of time for the summer bridge program to decrease the pace a little.
2. Seek ways to monitor internecine conflict in group processes and help the students resolve them.
3. Add weekly progress presentations from each work group to the summer bridge program.
4. Keep the summer program online as that format makes it approachable for persons who may have other practical or transportation limitations.
5. Several additional context specific statements listed above in section 3.3.1.2.

The students who served as peer mentors were also offered the opportunity to offer suggestions. They had none stating that their experience had been very positive. Each indicated an interest in continuing as a peer mentor in the coming year. The evaluator has no suggestions to add as the programming enacted proved to be very successful.

Conclusions/Observations

The evaluator reached the following conclusions based on the information gathered.

1. Project implementation, in terms of objectives, goals, milestones, staffing, and relevant IRB protocols, matches proposed plans and is well within reasonable expectations when initiating a multi-disciplinary, multi-institutional consortium.
2. In the first year, all the staffing commitments made in the narrative were maintained.
3. The faculty and other participants indicated that the volume, content, and intent of the communication taking place was very good.
4. The activity taking place is consistent with the objectives, goals and milestones expressed in the proposal.
5. The adjustments made in response to COVID-19 restrictions were appropriate and effective and preserved all but one element of the proposed programming.
6. The programming was universally efficacious.

Recommendations

The evaluator makes the following recommendations.

1. The CC student self-reports of experience/skill provided on the pre-participation survey for the summer bridge program are valuable information. They could inform curricular emphasis in several TAMUK courses. Continuing to gather this information and then considering it curriculum planning is recommended.
2. While the first iteration should be considered a pilot, the online summer online program appears to have been highly effective. Having such a strong and positive impact on student understanding in areas foundational to success in engineering study is valuable. Should the pattern from the first year hold, institutionalizing the summer bridge program may prove to be beneficial to TAMUK students.
3. The project is appropriately organized and the participating faculty are executing coordinated and individualized offerings. Continuing the patterns as initiated is advised.
4. Establishing a project website would help with dissemination of announcements and communication of opportunities.

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