

Verizon Innovative Learning Minority Male Program

Case Study Brief

Summer, 2016

The Verizon Innovative Learning Minority Male Program (VIL MM) provides minority, male, middle school students with opportunities to engage in science, technology, engineering and mathematics (STEM) learning experiences in university settings. The goals of the program are to increase students' interest in STEM subjects, attending college, and STEM careers, while promoting technology proficiency. Program activities include instruction in mobile app development, 3D modeling and printing, engineering, robotics and computer science. Personal development is supported through mentorship.

SRI International's Center for Technology in Learning, with support from the Verizon Foundation, developed this research brief as part of a two-year case study research project, designed to explore the commonalities and unique characteristics of the VIL MM program at four historically black colleges and universities (HBCUs); Jackson State University (JSU), Kentucky State University (KSU), Morgan State University (MSU), and North Carolina Agriculture and Technical State University (NCAT). These campuses initiated VIL MM program offerings during the summer of 2015 and continued to engage students during the school year through Saturday events (see 2015-16 Annual Report). The purpose of this research is to promote understanding of the experiences of VIL MM program participants and stakeholders by giving voice to the perspectives of students, educators, mentors, parents and administrators involved during the 2016 summer program.

The study addressed the following research questions:

- To what extent does participation in the VIL MM program increase students' interest in STEM subjects, STEM careers, and attending college?
- To what extent does exposure to VIL MM program activities increase students' knowledge of 3D modeling and printing, mobile app development, problem solving, and coding and programming?
- What unique elements of the VIL MM program locations enhance students' STEM learning experiences?
- How can the VIL MM program be refined to support students', teachers, mentors and administrators?

This brief summarizes the key findings, accomplishments and promising strategies developed by each program site,

as well as considerations for program improvement based on the results of site visits, observations, focus groups, interviews, student surveys and assessments collected by SRI during the 2016 summer program. Results from the VIL MM Youth Summit Survey are also included.

Key Findings

- Students' STEM proficiency increased significantly, as determined by self-reports on a program-created pre-post student survey (see figure 1).
- Students' knowledge of 3D modeling and printing increased significantly, as determined by a pre-post program-created student assessment (see figure 2).
- Students who participated in both the academic year and the 2016 VIL MM summer program demonstrated increased knowledge of mobile app development. Students who also participated in the 2015 summer program scored higher on mobile app development pre-test items than these students and new students.
- Students' knowledge of engineering design and problem solving did not change significantly, as determined by a pre-post program-created student assessment.
- Parents of participating students reported that they would like increased communication regarding their students' activities.
- Mentors who received training prior to the program reported that it helped prepare them for working with the students. Mentors who did not receive training stated that they would have benefited from it, if it had been provided.

Figure 1 depicts the results of an on-line, pre-post survey that asked students to rate their proficiency in STEM, based on a one to five scale (1 equals no proficiency and five equals high proficiency). Overall, increases in students' self-reported STEM proficiency were statistically significant.

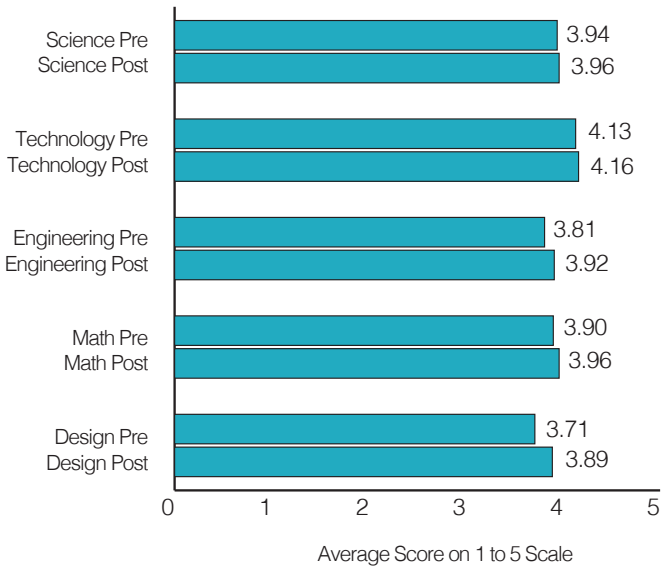
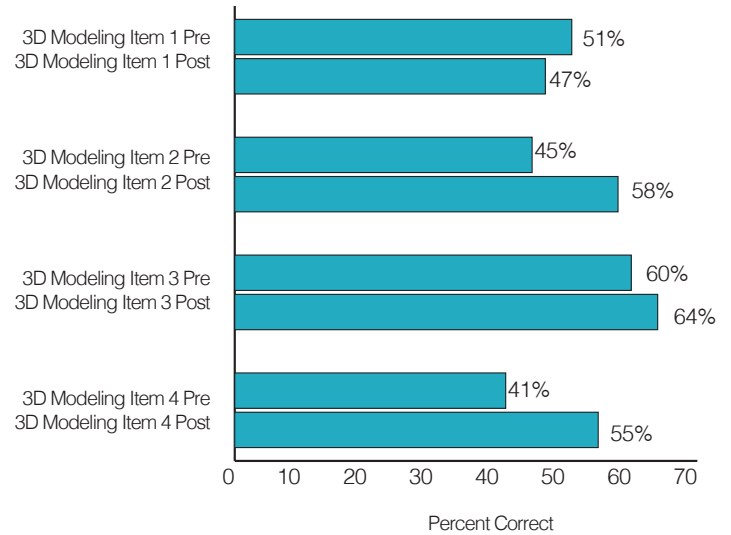


Figure 2 depicts results from an on-line, pre-post assessment, created for the VIL MM program, that indicates students' knowledge of 3D modeling and printing increased significantly.



Accomplishments

The 2016 VIL MM summer program was implemented during one week, two week or four week long sessions and served over six hundred students at four universities. The table below describes the number of students served during the summer of 2015 and 2016, as well as the number of students who participated in both summers and the academic school year program, and the number of students who enrolled, but did not complete the programs.

2015 & 2016 VIL MM Summer Program Participants

University	Number of Students who Participated in the 2015 VIL MM Summer Program	Number Dropped	Number of Students who Participated in the 2016 VIL MM Summer Program	Number Dropped	Number of Students who completed both 2015 & 2016 Summer	Number of Students who completed both 2015 & 2016 Summer programs and the academic year
Jackson State University Four week program	34	11	80	6	15	15
Kentucky State University Two week program	86	0	84	21	55	55
Morgan State University Four Week program	38	3	56	11	25	17
North Carolina A & T University Four 1 week programs	320	0	398	3	120	118
Total	478	14	618	41	215	205

Jackson State University

Promising Strategies

The VIL MM program at Jackson State University offered two levels of instruction. New students engaged in acquiring foundational skills involving 3D printing, mobile app development and engineering. Returning students explored robotics, drones and virtual reality. Recreational time was integrated during each day. The program serves local students, as well as those enrolled in the on-campus middle school (Blackburn Middle School). This school was designated as a laboratory school for Jackson State University and has a strong relationship with the College of Education and Human Development and the College of Science, Engineering and Technology. Breakfast and lunch were provided to VIL MM students each day at the school, through a summer feeding program.

During 2016, the VIL MM program at JSU partnered with the National Society for Black Engineers (NSBE) to provide NASBE memberships to VIL MM students, and utilized NSBE activities as part of the program. The students also participated in a field trip to Nissan North American Plant, where they learned about business and industry. During a focus group, students reported that they enjoyed the program. One student noted “My behavior is changing and so is my knowledge about apps and what is behind a website, like the coding and the layout. I am learning about how to write code and learning about how to make apps. My attitude in school is now great.” Another student stated “If I take a science class, it will help me to be able to type. It will help me if I have to read. In my school, you have to be able to design and create things. My school is going to be using some of the same strategies about 3D printing.”

At the end of the program, a teleconference and power point presentation was conducted with the mentors, in collaboration with the National Cares Mentoring Program (NCM). The mentors found this helpful, as it provided the mentors with answers to some of their questions about how to handle specific situations that they encountered.



“In my school you have to be able to design and create things. My school is going to be using some of the same strategies about 3D printing.”

– Jackson State VIL MM Student

Discussions included strategies regarding acceptance and how to be sensitive to students’ needs. The VIL MM administrators thought the information presented was on target and that this session would help the existing mentors to prepare for the fall program.

Considerations for Program Improvements

Focus groups revealed suggestions for program improvements. Mentors reported that it would be helpful to have the instructional materials in advance, so that they could be better prepared to help the students. Parents noted that communication could be improved through emails and Facebook, which would allow them to see some of the things that their students were doing. One parent stated “Communication is very important to me. I wish I knew more about what my child is doing. I would like weekly newsletters on Thursdays or Fridays. If we had an objective, an elaborated lesson plan or syllabus, then we would know what the students are doing on a weekly basis”.

Kentucky State University

Promising Strategies

The VIL MM program at Kentucky State University kicked off with an orientation for parents prior to the start of the summer program. Program activities were designed to promote STEM engagement and social development, while supporting students in acclimating to a college campus and reducing any apprehension about being able to succeed in college. Coursework emphasized the basic principles of mathematics, 3D printing, mobile app development, and coding. The 3D printing instructor conducted a Race Car Derby as a culminating event for the students. This involved racing 3D printed cars down a ramp, logging the data using accelerometers embedded in the cars, and calculating the winning average speed after five attempts. The instructor reported:

“We used Python for coding the data from the accelerometer because it is nimble and easy to understand. We used TinkerCAD and 123 Design modeling software to design the cars. We emphasized math and engineering design during the process. Students used temperature sensors, accelerometers, digital converters, and battery packs to create prototypes. Everything had to fit inside a derby car. Students learned about milled prototype cars, breadboards, wrapping the wires and soldering.”

The program also included a field trip to the River Research Boat, to learn about research in agriculture science and how pollution relates to it.

The program administrator reported that, in addition to working with the National Cares Mentoring representative, part of the mentor training included meeting with a specialist to discuss student issues, such as those living in foster care or taking medication or on the autism spectrum. This helped the peer educators understand that some students need alone time to get away from noise, and too much stimulation, while others have light sensory sensitivity.



“We emphasized math and engineering design during the process. Students used temperature sensors, accelerometers, digital converter, and battery packs to create prototypes.”

*– Kentucky State University
VIL MM Instructor*

Considerations for Program Improvements

The program administrator suggested the idea of utilizing a Resource Inventory. He stated “We are considering cataloging those potential resources, including human capital resources, that each of our staff know and put the linkages together to improve our program. This would allow us to utilize informed collaborations.” The mentors with content expertise in computer science suggested developing resource guides to help the other mentors with 3D printing and coding. One middle school teacher suggested the use of staff meetings and an organizational chart that could provide visual information about what everyone was doing and the activities that were scheduled.” To improve the program design, the program administrator recommended offering a four week residential program that would allow more time for teaching the core concepts in such areas as coding and programming.

Morgan State University

Promising Strategies

The VIL MM program at Morgan State University included instruction in 3D printing, mobile app development, robotics, and bridge building. Field trips included a visit to the Baltimore Museum of Industry, where students designed roller coasters and learned about the electric wiring of a house. Another field trip was taken to a Rocking Jump center where students enjoyed physical activities. Program support included feedback provided by an evaluator from the American Association for the Advancement of Science.

The program administrator reported “This summer we had the new students use TinkerCAD and the veterans used 1, 2, 3, Design. Unlike last year, the 6 and 7th graders were with one teacher in math and some 7th and 8th graders. This was done because some kids were more advanced. In other content areas, the students were grouped by experience. This summer, we had different themes. The first week the students looked at bridges, created bridge prototypes and made spaghetti bridges. Then they tested them with weights to see when they failed. The second week, we did something similar to the Arduino robot lesson from the spring.”

The administrator reported that the VIL MM program at MSU provided two weeks of training for the mentors, prior to the 2016 VIL MM Summer Program. During the training, one of the sessions was with Stephen Powell from the National Cares Mentoring program and one was conducted by a program staff member. The National Cares Mentoring training was 3-4 hours long and included slides, discussions about expectations and some role playing. Each mentor received a copy of the book *The New Way Forward - Healing What's Hurting*. The faculty administrator for the program reported the following feedback: “I liked his training. The only thing we need is follow up. It would be great if there was a session after the first or second week, where the mentors could check back in. It might be helpful to conduct a webinar.”



“During the academic year, we only built one robot and this summer only one, so we need to build more and go into more robotics events.”

– Morgan State University VIL MM Student

MSU offered a week long professional development workshop for 12 local teachers to develop five lessons plans on 3D modeling and printing. The program administrator connected with these teachers in September, during a presentation.

Considerations for Program Improvements

Regarding improving the program, parents reported that they would like to have more communication. One parent said “I think they could provide communication about what the kids are learning and provide more explanation. We would like an over-all picture of what they are doing and have a day where we can view what they are working on.”

One student suggested “We could start building more things. During the academic year, we only built one robot and this summer only one, so we need to build more and go to more robotics events.”

One mentor stated “I know that on day one, it was ‘hit the ground running’ and we did not have a ‘get to know you’ time. The kids did not get to ask us ‘Oh, what are you trying to do in life?’ Providing some one on one time that would allow them to talk with us and build our trust would help.”

North Carolina A & T

Promising Strategies

The program administrator reported that the summer schedule included a parent orientation on Mondays, as well as course work in 3D printing, app development, robotics, entrepreneurship and personal development.

Professional development was a focus of the spring VIL MM program that helped prepare the staff for the VIL MM summer activities. The program administrator stated:

“We started with professional development in January. We had made some observations in the academic year. Our K12 teachers were not in the classroom, they were our mentors. This summer we shifted to put them in the classrooms. We partnered with CTE teachers and had them come on Saturdays. The professional development was focused on instruction and mentoring. The first part was focused on the 5 E lesson Plan approach. This is a template that derives the school of thought for the pedagogy. It is important to help with the process of teaching and it brings a framework for difficult content areas and for the population that we are serving into a pedagogical design that makes it hands on and helps the teacher the break it down (instead of lecturing).”

Feedback surveys were collected from students at the end of each week. One mentor noted “I think the biggest thing is getting the opportunity to teach the kids something. The surveys are a big part of it. When I read the surveys, I am proud that the kids are actually grasping the things that we are teaching them.”

Mentorship was overseen by a project coordinator, who developed a mentoring training program that builds relationships and personal development. The program administrator noted:

“We have no expulsions for students. No throw away kids. We train everyone on mentoring and we have the expectation that you will be an instructor and a counselor, because you are growing kids. You have strategies for connecting with the kids. I had one student who was shutting down. We could see this



“We train everyone on mentoring and we have the expectation that you will be an instructor and a counselor, because we are growing kids.”

– North Carolina A & T Administrator

happening, so we had strategies to work with. We could have expelled kids, but we have gone above and beyond to not do that. We have provided one on one for a week. If we had them for more than a week, we might not be able to do that. We have high school volunteers. We have the support and we try to have a lot of those conversations throughout the year. . . Last year we saw kids eating alone; we dealt with it and tried to have them not eat alone the next day. We have to go deeper. No child should have to eat lunch alone. Some students are on medication. Here, they have a private place to take their medication.”

Considerations for Program Improvements

Strategies for improving mentor training include increasing communication between National Cares and NC A & T staff. It was suggested that it would be more effective to conduct a training day with multiple sessions, where National Cares presents some sessions and NC A & T staff present other sessions. The students recommended adding an entrepreneurship class and more team events.

Results of Youth Summit Survey

VIL MM participants from each campus were invited to attend the Verizon Innovative Learning for Minority Males Summit in San Francisco from July 27-30, 2016. This event included a tour of the Verizon Innovation Center, a workshop at the Lucasfilm Industrial Light & Magic Premier Theater, an outing to Fisherman's Warf, a tour and hands-on introduction to design theory and engineering methods at San Francisco 49ers STEAM Lab, and a gala showcase event at the Exploratorium Museum, where students presented artifacts created during the summer program. SRI International created a survey to capture the students' impressions of this event. Results from 42 students who responded to this survey are provided below.

Figure 3. "Has participation in the VIL MM Youth Summit increased your interest in taking..."

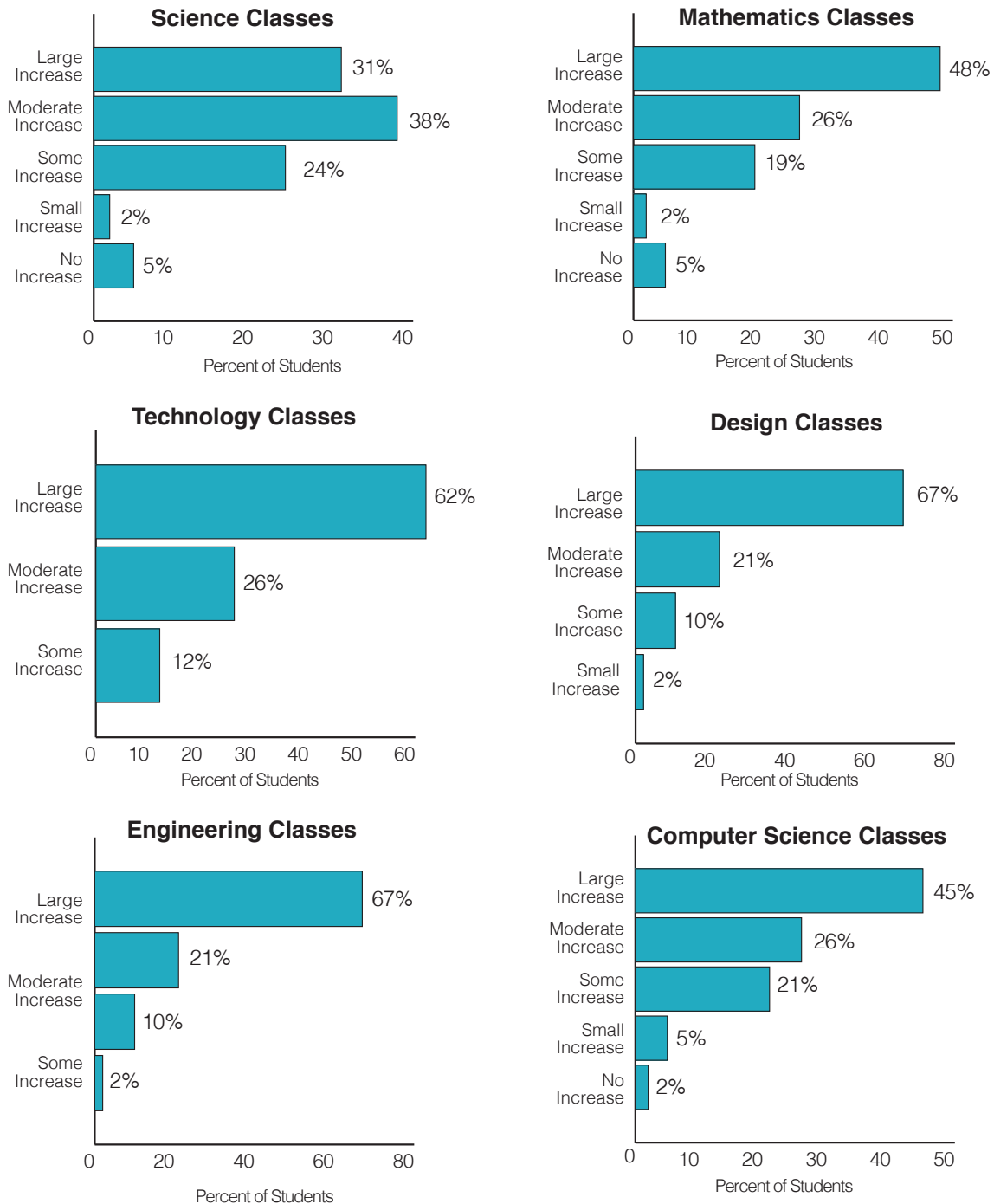


Figure 4. “Has participation in the VIL MM Youth Summit increased your interest in pursuing a...”

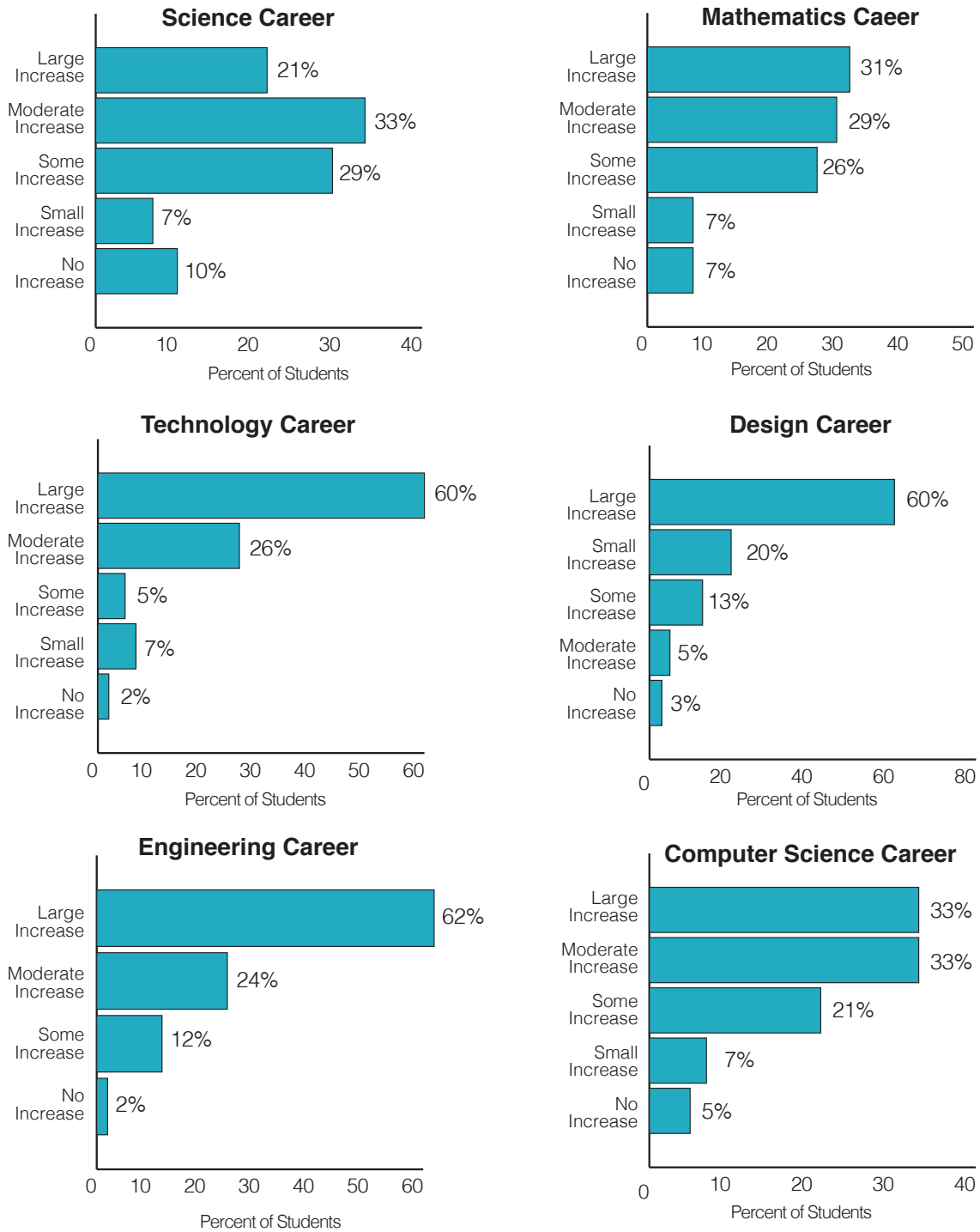
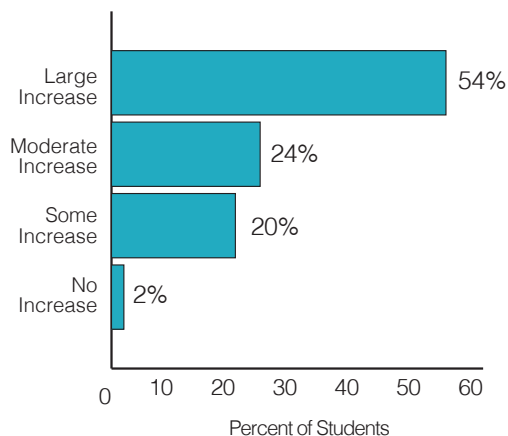


Figure 5. “Has participation in the VIL MM Youth Summit increased your understanding of how to apply the skills you have learned during the summer VIL MM program to business and industry?”



Conclusions

Evidence collected during the 2016 VIL MM summer program indicates progress toward program goals. Approximately 43% of students who attended the 2015 VIL MM program also participated in the 2016 summer program. Returning students scored higher on pre-test items related to knowledge of mobile app development. Students' self-reported proficiency in science, technology, engineering, mathematics and design increased significantly, as determined by results of a pre-post student survey (see figure 1), while interest in attending a four year university did not change significantly. Knowledge of 3D modeling and printing increased significantly as determined by a pre-post student assessment (see figure 2), while knowledge of engineering design and problem solving, and coding and programming did not significantly change. Students who participated in the 2015 and 2016 VIL MM summer program scored higher on pre-test items related to knowledge of mobile app development, as compared to new students and those who participated in the academic year. Results from the Youth Summit (see

figure 4), survey revealed that 88% of students increased interest (moderate or high increases) in technology, engineering and design classes, while 86% reported increased interest in technology and engineering careers. In addition, 80% reported increased interest (moderate or high increases) in design careers and 78% reported increased understanding (moderate or large increases) of how to apply the skills learned during the VIL MM program. Focus groups and interviews with stakeholders revealed that mentors, students and local teachers benefited from program offerings. Recommendations for program improvements include increasing communication with parents; supporting closer collaboration among teachers and mentors; and providing resources, such as lessons plans and training to mentors, in advance of program activities. Follow up mentor trainings were also suggested. Stakeholders requested that the programs offer longer sessions and residential options so that students can have greater exposure to STEM learning opportunities. Implementation of these recommendations could positively impact program outcomes.

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