



INVESTIGATION OF EMPLOYMENT OPPORTUNITIES WITH FOCUS ON CURRENT AND FUTURE STUDENT INTEREST

BMCC Pre-TI NSF 1719668



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Introduction

Bay Mills Community College

Bay Mills Community College (BMCC) is situated on the southeastern shore of Lake Superior, on the Bay Mills Indian Reservation, which is in Michigan's Eastern Upper Peninsula. The Bay Mills Indian Community (BMIC) is five miles northwest of Brimley, Michigan and twenty miles west of Sault Ste. Marie, Michigan.

BMCC is Michigan's only fully accredited (www.higherlearningcommission.org) Tribal College, located on an Indian Reservation and was designated as a Land Grant Institution by the Equity in Educational Land Grant Status Act of 1994. BMCC is chartered by the Bay Mills Indian Community as a nonprofit education corporation and has been declared tax-exempt by the Internal Revenue Service. Control is vested in a Board of Regents, which elects the officers of the administration and establishes overall institutional policy. BMCC is accredited by the North Central Association of Colleges and Schools and is a member of the American Indian Higher Education Consortium.

BMCC serves the twelve federally recognized tribes of the state. In addition to the Bay Mills Indian Community, BMCC has been working with all of the federally recognized tribes of the state with the goal of setting up academic programs. Although the college specialized in programs for American Indians, who represent approximately 60% of the annual student enrollment, its doors are open to all people who want to benefit from the educational process. BMCC is dedicated to providing academic and personal enrichment programs to Native Americans and residents of their neighboring communities.

In recent years, BMCC has developed an impressive, cutting edge technological infrastructure; this has allowed BMCC to reach beyond the borders of Michigan and offer on-line instruction throughout North America. BMCC initiated its first General Science associates degree in January of 2016 and is working diligently to expand research opportunities for scholars and students, particularly those of Native American descent. Enhancing student research and community engagement are at the forefront of the BMCC Mission Statement and Objectives, which are as follows:

Mission Statement: As a tribally controlled community college and land grant institution, the mission of Bay Mills Community College is to provide quality educational opportunities promote research and facilitate individual development in an accessible, community-based, and culturally diverse environment that supports and maintains the Anishinaabek culture and language.

In carrying out our mission, the BMCC Board of Regents stresses a positive, student-centered atmosphere, which promotes preservation of the customs and beliefs of Native Americans. The BMCC curriculum is designed to integrate traditional Native American values with higher education as a way of preparing students to assume responsible roles in their respective communities.

Objectives:

- to provide the Native American communities of Michigan with educated and trained human resources
- to provide educational opportunities, including academic, research, vocational, basic skill building, cultural and in-service programs leading to appropriate certificates, degrees, and diplomas
- to foster a spirit of pride in Native American language, culture and history through participation coursework and cultural activities
- to provide a qualified, dedicated, student-centered staff and faculty
- to help students attain the necessary skills and self-esteem which will facilitate personal and career fulfillment
- to prepare and encourage all students to pursue advanced degrees
- to provide continuing and community education

BMCC is exploring the adoption of specific research related goals to promote the inclusion of the Anishinaabe culture within STEM practices. Moreover, goals will focus on the advancement of the institution's ability to conduction and promote relevant research, while increasing student participation in STEM fields. Until official adoption, we will be using these goals to guide our research activities. We will also be using these goals to help guide our student skill building exercises (Table 1).

Region and employment demographics

Bay Mills Community College provides educational services for students throughout the country and state of Michigan via online and on campus course offerings. A majority of students enrolled in on-campus courses reside within Michigan's Chippewa County. As of July 2016, the population of Chippewa County lies just over 37,000, equating to a population per square mile of 24.7 (US Census Bureau, 2017). Approximately 20% of residents are under the age of 18. Moreover approximately 20% of individuals residing within the county have reported to the US Census Bureau as being of Native American or Alaskan Native decent. 80% of residents aged 25 years or older have received a high school diploma or associates degree, while less than 20% percent have earned a bachelor's degree or higher. The poverty rate for Chippewa County is nearly 20%.

Approximately 52% of residents aged 16 years or older are considered part of the civilian labor force, compared to 63.1% nationally (US Census Bureau, 2017). Within the county, it was estimated that in 2016 \$136,272 of revenue was within the accommodation and food services fields; \$170,051 was within the health care and social assistance services fields; \$90,140 was within the manufacturers and shipments fields; \$145,396 was within the merchant wholesale fields; and \$54,116 was within the retail sales fields. Although retail accounts for a nearly 50% of jobs within the county, retail sales per capita is only estimated to be \$11,669 annually.

Current offerings at BMCC

BMCC currently offers ~~3~~ three Associate of Applied Science programs: computer information systems, construction technology, and office administration. Current offerings for Associate of Arts include business administration, criminal justice- corrections emphasis, early childhood education, education, general studies, Great Lakes Native American studies, health and fitness, and social science. The college offers an Associate of Science in general science. Additionally, BMCC offers three certification programs: health science, medical office, and natural science, and eight certificates of completion: corrections, construction technology, early childhood education, emergency medical technician-basic, emergency medical technician-specialist/advanced, general studies- Michigan Transfer Agreement, medical coding and billing, and paramedics. BMCC is one of few institutions that offer a diploma in Anishinaabemwin- the Pane immersion program. Moreover, the institution is currently asserting efforts to complete its first bachelor's degree, which will be offered for early childhood education students.

Methods

Local Employer Surveys

Potential employers in STEM fields across the Eastern Upper Peninsula of Michigan were surveyed in order to gain insight into the current and upcoming employment gaps. STEM fields were broken into four broad categories: health care, natural resources, engineering, and agriculture.

Surveys (Survey Monkey) were created in hopes of gaining insight into the local STEM employment needs. Questions asked respondents to describe the current employment at local companies and agencies, the future employment outlook, and desired skills of potential employees. Positions listed within each industry's survey were noted during pre-survey conversations with local agencies or via current online employment searches in the area.

Health Care

Area health care providers were surveyed in order to assess the current and future needs of employment in the industry. We conducted an online search for Eastern Upper Peninsula (EUP) health care providers whose employees included persons with two-year degrees, as well as four-year degrees and beyond. We located a variety of providers ranging from large, broad spectrum providers such as hospitals, pharmacies, and laboratories to assisted living facilities and offices of medical and mental health specialists, physical therapists, massage therapists, dentists, and veterinarians. Once identified, health care providers were contacted via phone and asked to participate in entering survey data. Those wishing to participate indicated the best approach to obtaining the survey: via email with a link to Survey Monkey, or via hard copy in the postal mail. Surveys were generally distributed within one week of initial contact.

Natural Resources

Natural resources departments within the EUP were surveyed in order to assess the current and future needs of employment in the industry. Our search for Natural Resource employers

focused first on tribal and government agencies. We began by identifying tribal offices where employees support the protection and improvement of natural resources and expanded to conservation district offices serving counties across Michigan's entire Upper Peninsula. Next, we located State Department of Natural Resources centers, along with national and state park and forest supervisors. We then broadened our search to include Eastern Upper Peninsula county road commissions. Finally, we looked for sawyers, surveyors, and land use engineers, architects, and consultants. Once identified, natural resources departments were contacted via phone and asked to participate in entering survey data. Those wishing to participate indicated the best approach to obtaining the survey: via email with a link to Survey Monkey, or via hard copy in the postal mail. Surveys were generally distributed within one week of initial contact.

Engineering and Manufacturing

Engineering and manufacturing companies within the EUP were surveyed in order to assess the current and future needs of employment in the industry. We began looking for engineering and manufacturing firms close to home by using yellow pages for towns in the Eastern Upper Peninsula. Then we expanded our search to include Michigan's entire Upper Peninsula by doing browser searches of businesses in large and small towns. Our understanding of various types of engineering and manufacturing employers grew as we interviewed three local manufacturers and heard them describe specialties within their industries. Of special help was input provided by one of our team members whose career has centered on engineering and manufacturing. Once identified, engineering and manufacturing resources were contacted via phone and asked to participate in entering survey data. Those wishing to participate indicated the best approach to obtaining the survey: via email with a link to Survey Monkey, or via hard copy in the postal mail. Surveys were generally distributed within one week of initial contact.

Agriculture

Agriculture entities within the EUP were surveyed in order to assess the current and future needs of employment in the industry. To locate agriculture employers, we first turned to Michigan State University County Extension offices in the Upper Peninsula and then expanded to organizations that support agriculture, such as a grape growers association and a slow food association. We interviewed an advisor for an agriculture research station located in Michigan's Upper Peninsula who added to our contact list. As we learned about local and regional farmers, we categorized them as large and small producers, and we were able to identify farmers whose products included dairy, beef, lamb, vegetables, hay, and grain. We also found breweries, wineries, and maple syrup producers. Finally, we turned our attention to area chefs and a local culinary school. Once identified, agricultural entities were contacted via phone and asked to participate in entering survey data. Those wishing to participate indicated the best approach to obtaining the survey: via email with a link to Survey Monkey, or via hard copy in the postal mail. Surveys were generally distributed within one week of initial contact.

High School Student Surveys

Students from EUP high schools were surveyed in order to gain an understanding of the interests of potential incoming students. Additionally, surveys aimed to expose high school students to STEM careers of which they may not have already been aware. Schools surveyed include Ojibwe Charter School, Brimley High and Middle Schools, Sault Area High School, and Rudyard High School. Students were asked to have parents sign a non-consent form, indicating if they *did not* want the child to participate in the survey. School administrators/teachers then allowed consented students to participate in the survey via Survey Monkey. Participating students were entered into a drawing for one of twenty-five \$50 gas cards. Upon board and administrator request, survey results were provided to each school. Board and administration approval at each district was obtained prior to data collection. Ethical approval for student surveys (all surveys) was obtained through the BMCC Institution Review Board, assurance number 2017-1.

BMCC Students Surveys

Results

Local Employer Surveys

Health Care

19 regional health care employers responded to the survey. A total of 173 RNs, 102 LPNs, 36 pharmacy technicians, 71 CNAs, 35 nursing assistants, 17 dental assistants, 15 physical therapy assistants, 11 radiology technicians, 7 respiratory technicians, 6 dental hygienists, and 6 clinical lab technicians are employed among 17 of the responding agencies. Moreover, these agencies tend to have many posted openings among these career fields (Figure 1). At the time of the survey, 17 CANS, 9 LPNs, 8 nursing assistants, 4 pharmacy technicians 3 RNs, 2 physical therapy assistants, 1 clinical lab technician, 1 dental hygienist, and 1 dental assistant were actively being recruited for hire within the service area. Those responding to the survey identified two individuals interested in each of the following 2-year programs: CNA, nursing assistant, LPN, RN, dental hygienist, and pharmacy technician. Additionally, responders noted that at least one individual with their agency may be interested in or benefit from a 2-year program in radiology, respiratory tech, and dental assistance. When asked if employers/hiring committees had *little to no problem finding qualified applicants, found it moderately difficult to find/hire qualified applicants, or found it very difficult to find/hire qualified applicants*, within the specified career fields, nearly a quarter of respondents noted difficulty finding qualified pharmacy technicians. 35% noted difficulty finding dental hygienists and LPNS, and a quarter expressed difficulty hiring RNs. Moreover, 68% noted a great need for 2-year degree holders within the health care fields within the next 5-10 years, and 32% noted some need.

Natural Resources

A total of 19 natural resource departments throughout the EUP provided survey responses. Among these, current employment totaled 12 invasive species technicians, 13 GIS specialists, 46 natural resource technicians, two water quality technicians, four environmental planners, 35 forestry technicians, 42 fishery technicians, five civil engineering technicians, 33 communications and outreach officers, 24 fishery biologists, six forestry biologists, and 37 other biologists (Figure 1.) Among these agencies, 3 GIS specialists, and 1 each of forestry technician, civil engineering technician communications and outreach officer, fishery biologist, and other biologist are currently being sought for employment. Among all respondents, the total number of individuals potentially seeking a two-year degree in in forestry tech was 6. Those numbers were one for GIS specialist, and communications/outreach officers, and water quality tech, and two potentially interested in natural resources tech, environmental planning, and civil engineering. Of those choosing to answer, one-quarter noted that it has been very difficult to find/hire qualified applicants in GIS and 16% said the same for hiring qualified communications officers and forestry biologists. Nearly 30% of respondents noted that there will be great need for natural resource professionals holding 2-year degrees within the next 5-10 years, and over half noted that there will be some need.

Engineering and Manufacturing

Within the engineering and manufacturing sector, twenty-six respondents completed the survey from agencies within the region. An overall total of 269 general engineers were employed by these agencies at the time of our survey distribution. 101 machinists, 81 assemblers, 78 welders and welding engineers (1), 15 painters, and 1 robotics engineer were employed among these facilities. A vast majority of job openings, 34, focused on general engineering (Figure 3). These agencies were also currently searching for 13 welders, 12 machinists, 6 assemblers, and 2 painters. When asked if respondents were aware of any individuals who may be interested in enrolling in a 2-year degree in the fields mentioned above, answers included knowledge of 5 individuals interested in a 2-year program in machining, 3 interested in welding, and 1 interested in robotics. When asked about difficulty in hiring qualified employees, 37.5% of respondents reported much difficulty in hiring engineers. That number for welders and machinists was 28% and 36%, respectively. Less difficulty was reported in hiring robotics engineers, painters, and assemblers. 58% of respondents reported great future need for employers holding 1 or 2 year degrees or certificates in related fields, while 42% reported only some need.

The research team was able to probe into mathematical and soft skill requirements that would benefit employment with their agencies. An understanding in basic algebra and metric conversions would be very beneficial to employees in over 60% of these agencies. Geometry was noted as very beneficial skills for employees in 52%, and trigonometry was noted as helpful for 33% of these agencies. Ability to demonstrate skills in basic internet usage, Microsoft Office, computer aided design, and computer numeric control were each listed as very beneficial employee skills for over 64% of respondents. In terms of soft skills, these employers stated that

it is very beneficial for their workers to demonstrate impeccable skills in time management, health and safety (PPE), project management, and business etiquette.

Agriculture

Involvement within the agriculture sector tended towards crop production, raising livestock, market gardening, and direct marketing to consumers. Survey respondents in this field spanned a broader geographical range; however, 64% of businesses were located in the EUP (other regions were the central UP, western UP, and northern lower peninsula). Among all responding businesses, there were two position openings. However, these businesses noted that marketing locally and regionally/beyond, 75% and 67% of respondents respectively, were of upmost importance to their practice. When asked about particular field skills, 45% of respondents noted that knowledge of making value added products (cheese, wine, syrup) was very important. That number was 36% for both hoop house/greenhouse management market gardening. More importantly, 77% rated harvesting and handling, and 73% rated soil fertility and tith as very important skills in the agriculture business. 45% of respondents noted that knowledge of raising cattle is of importance. In this field, previous on-the-job experience outranked 4-year or 2-year degrees in terms of importance in hiring a new employee.

High School Student Surveys

Counsellors and principals at area high schools were contacted to plan and conduct surveys with local students. Participating schools include Ojibwe Charter School, Brimley High School, Sault Area High School, and Rudyard High School. In total, we received 231 survey responses from high schools: 118 from Sault High, 18 from Ojibwe Charter School, 32 from Rudyard High, and 90 from Brimley High School.

64% of high school students stated that they knew what career they'd like to be working in 5-10 years after graduation. When allowed to state those career goals in an open-ended question format, students had a wide-range of responses (Table 2). 88% of students stated willingness to relocate in order to achieve academic and/or career goals. 83% of students plan to attend college or university after high school, but only 5 students stated BMCC as their school of choice. When asked specifically if they know what STEM is, only 47% answered yes.

Students were asked focused questions on each of the four general STEM fields presented in this project. They were asked to rate level of interest in a number of health care careers. Of the presented health care careers, students expressed most interest in registered nursing (24%) and veterinary/animal health sciences (22%). Students were also very interested in nursing and health care fields of CNA and LPH (each 16%). Detailed student interest data can be seen in Figure 5. Students were also given the opportunity to list any career fields of interest that were not listed in the questionnaire. A majority of responses (12) listed surgeon, 6 listed medical doctor, 5 listed EMT, three listed biomedical engineer, sport medicine, and pharmacist, and two listed physiologist, counselor, psychologist, physical therapist, and physician assistant. The following careers were each mentioned by one student: genetic research, dermatologist, chiropractor, orthodontist, medical technician, neurologist, midwife, nurse practitioner, pathologist, speech pathologist, anesthesiologist, physical therapy assistant, optometrist, oncologist,

OCT assistant, and dental hygienist. 34% of the students reported knowing very little about careers in the health care field, 31% reported some knowledge in this area with interest in learning more, 17% have already planned on a health care career in the future, and 23% stated that they will not seek a career in the health care field (Figure 6).

Students expressed little interest in the natural resources careers listed. The career with most student interest was biologist (Figure 7). However, when asked if they were interested in natural resource careers not specified on the questionnaire, three students listed geology and DNR, and two listed conservation officer and zoology. 37% of students reported having little knowledge about natural resources related careers, 26% stated that they might pursue such a career and would like to learn more, 3% stated that they are planning a career in the field, and 33% reported little to no interest in seeking a career in natural resources related fields (Figure 8).

When probed for interests in engineering and manufacturing careers, students expressed most interest in robotics and general engineering (9% each) electrical engineering (8%), and welding and chemical engineering (6% each). For a full summary of student interest by career, see Figure 9. Students listed biomedical engineering, aerospace engineering, architectural engineering, audio/sound engineer, car engineer, and carpentry as careers of interest, in addition to specific careers surveyed. 35% of students reported having little to no knowledge about engineering and manufacturing careers, 25% reported potential interest in such careers but would like to learn more, 9% reported already having plans to pursue a career in this field, and 30% reported certainty that they would not be pursuing a related career (Figure 10).

Within the agriculture field, students reported most interest in animal science (4%). 3% reported being very interested in food science (Figure 11). 10% of students expressed interest in attending agriculture related courses at BMCC (Figure 12).

High school students were asked to provide any non-STEM careers that they are interested in pursuing. The most prominent non-STEM careers were fine arts, criminal justice, law, cooking/baking/hospitality, writing and journalism, and auto mechanics (Figure 13). In general, students reported being very receptive to job shadowing, interviews with professionals in careers of interest, and attending workshops about careers (Figure 14). This information, along with the general lack of knowledge about each career field listed in the survey, suggests that any added program at BMCC should include specific attention to community engagement and building bridges with local youth.

[BMCC Students Surveys](#)

Sixty-six current BMCC students completed surveys via Survey Monkey. Students ranged between first-semester students, and those ranking at sophomore status.

When asked to rank interest in health care fields, 12 reported high level of interest in registered nursing, 11 reported interest in a career as an LPN, 11 are interested in becoming a radiology technician, and 10 are interested in becoming a physical therapy assistant (Figure 15). 31% know very little about the health care field, 28% reported an interest in the health care field and would like to learn more, 17% are planning a career in health care, and 40 are certain they will not pursue a health care career (Figure 16).

Fewer students reported interest in a career in environmental and natural resources 5 students reported being very interested in a career as a general biologist (Figure 17). 4 students reported high interest in becoming a fisheries biologist. The same number of students are very interested in a career in natural resources technology. 44% of students know very little about these career fields, 19% may pursue such a career and would like to learn more, 5% are planning a career in natural resources, and 49% are certain they will not be pursuing a career in environmental or natural resources (Figure 18).

Again, fewer students reported high interest in engineering and manufacturing careers than health care fields. The career field with the highest student interest was welding, with six students (Figure 19). Robotics, general engineering, and machinist each had 4 students interested. 40% of students reported knowing very little about engineering/manufacturing, 13% suggested that they might pursue a career in this field and would like to learn more, 2% are planning an engineering/manufacturing career, and 56% are certain that they will not be seeking a career in engineering or manufacturing (Figure 20).

When asked about types of agricultural sciences of interest, 5 students reported interest in food science (Figure 21). 5 also reported interest in hoop house and greenhouse management. 4 students expressed interest in horticulture and 3 students expressed interest in equine sciences and floriculture. Students were asked about their interest in enrolling in agriculture courses at BMCC. 11% would like to complete a 1 year certification program, 3% would like to complete a 2 year associate degree, 3% would like to transfer to a 4-year degree program in a related field, 19% would enroll for personal enrichment, and 63% would not be interested in such a program (Figure XXX).

Students were asked what skills they would like to refine while attending classes at BMCC. This open-ended question is meant to better STEM and non-STEM programs at BMCC. Students responded with both skills of interest as well as degrees of interest. Answers included: Excel; nursing; working with people with disorders, learning disabilities, behavioral disabilities; behavioral analysis; forensics; payroll; medical phrases; real career experiences; CCDF grantee and admin; health care; prep for BSN; hands-on experiences; human interactions; life advice; pre-med; fashion; justice; anatomy and physiology; abnormal psychology; welding; interior design; kinesiology; engineering; 4-year degree; ECE; international business; sociology; management; health care; medical science; administration; electrical engineering; environmental science; forestry; accounting; education; computers and practical skills. Students were asked in a separate rank-style question to name any programs they'd like BMCC to provide. 40% of students are interested in early child care, 27% listed law and fine arts, 23% were interested in history and criminal justice, 23% were interested in creative writing (Figure 22). Fewer students reported interest in careers in literature, politics, community service, teaching non-STEM subjects, cooking, auto or truck mechanics, baking, hospitality, truck driving, cosmetics, and retail sales.

Conclusion

Among all survey responses, the five highest currently employed positions were engineer (269), registered nurse (173), licensed practical nurse (102), machinist (101), and assembler (81).

Offering a similar perspective, the profession with the highest amount of openings at the time the survey was conducted is engineering (34). Positions for CNAs (17), welders (13), machinists (12), and LPNs (9) were also open at that time. Unfortunately, BMCC students were not necessarily interested in the most abundant jobs within our local workforce. The medical fields of nursing, radiology, and physical therapy assistance topped the charts as the three most common fields of interest for students. The cross over between the employment need and student interest appears within the RN and LPN fields. However, we do see 10% interest in welding. The most abundant positions of employment or position openings such as machinist, assembler, and engineers did not score as being of high interest to BMCC students.

The mis-marriage between employment opportunity and lack of interest in fields of work may mean that while local employers are not able to fill positions, our students may be unaware of fields of work within our region. Any academic BMCC programs aimed to graduate students in any one such field must include development of interest for local students, beginning at young ages. Generating future student interest via pathway-building has been demonstrated at a number of institutions on many levels.

Face-to-face conversations with employers, along with on-the-job engagement with employees, have the capacity to not only inform high school students about local employment opportunities, but also influence their career choices. Therefore, career fairs where students meet employers and visits to job sites where students shadow employees are both tools that BMCC might use to narrow the gap between students' expressed career interests and employers' revelations about available jobs. BMCC could become a recognized leader in our region for helping students develop into a work force highly valued by employers. Although this endeavor would legitimately be presented as a service to our community, in truth the debriefing sessions that we would hold with students and employers after fairs and on-site shadowing would enrich our understanding of our area's employment picture and inform our future programming decisions. A summary of similar projects, as presented at the 2017 Association of American Colleges & Universities Transforming STEM Higher Education (San Diego, CA) is offered in Appendix B.

Had we not been given the resources to survey our community extensively, we would not have realized how large the gap is between students' career interests and regional employment opportunities. Our new understanding and emerging plans to build pathways between students and employers are the direct result of having received the NSF PreTI grant.

Appendix A- Tables and Figures

Table 1. Potential research goals to be adapted by BMCC, modeled after the North Dakota faculty research model (Davis *et al.*, 2007). Outlined research goals fit within and aim to fulfill the research objectives exhibited in the BMCC Mission Statement and Objectives.

<ol style="list-style-type: none"> 1. Examine the indigenous science perspective; 2. Develop community relevant student research projects; 3. Provide research experience for students; 4. Establish skills and expectations for research projects; and 5. Determine the quality of research by establishing requirements for reports, presentations, and dissemination of knowledge gained. <p>Suggestions to assist students include:</p> <ol style="list-style-type: none"> 6. Be prepared to introduce research and scientific methods to students <ol style="list-style-type: none"> a. Inform students of the individual and community-based benefits of getting involved in research; b. Recruit students and get them involved in research; c. Identify research opportunities (tribal college, industry, federal/state agencies); d. Acquire necessary equipment and instrumentation; e. Determine whether to include the project in the curriculum or if it should be used as an enrichment activity for selected students only; f. Be prepared to instruct and mentor using the Native science paradigm throughout the research process; 	<ol style="list-style-type: none"> 7. Work with the student and the university faculty to develop and conduct the student research project and determine elements the project should contain; 8. Decide what the expected student outcomes will be from such an experience (this will be very helpful in evaluation); 9. Explain the skills students are expected to achieve; 10. Provide guidance for development of expected products, e.g., reports, presentations, papers, participation in conferences, etc; 11. Prepare students to present their research. Require students to prepare a poster that can be presented at conferences or at their home institution for other students and/or faculty to see. It will help students to learn to present their research; and 12. Decide what measures will be used for assessing outcomes such as skill level attained (this will be very helpful in evaluation). <p>*While all students will benefit from participation in scientific inquiry, students selected to engage in STEM research are required to indicate a major in one of the STEM disciplines and maintain a minimum cumulative GPA of 2.5.</p>
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Table 2. High school students provided non-STEM careers of interest

If you do know what you'd like your career to be, what is it?									
Health Care	Medical specialist	Medical research	Family Therapist	Physical Therapist	Foster parent	Firefighter Paramedic	Vet	Dog trainer	
21	22	1	1	2	1	3	1	1	
Pilot	Pro Athlete	Chef or Baker	Business & Mgmt	Marketing Specialist	Accoun't	Architect	Aircraft mechanic	Auto mechanic	Co
2	2	4	4	1	1	1	1	1	Me
Engineer	Electrical Engineer	Mus/Video Engineer	Comput'r Engineer	Biomedical Eng'r	Robotics	Software Develop'r	Computer Animator	Computer Program'r	Co
4	1	1	1	1	1	2	1	2	Te
Librarian	Educa- tion	Interna- tional	Legal	Forensics	Criminal justice	Conserv'n DNR Off'r	Industrial Tech	Wood- worker	Co
1	4	2	2	2	8	4	1	1	
Quantam Physics	Biology	Zoology	Biochem-ist	Metero- logist	Electrical Lineman	Train Engineer	Fashion Designer	Cosmo- tology	Ho:
1	1	1	1	1	1	1	1	1	
Theater & Music	Theater Make- up	Comme- dian	Artist	Photo- grapher	Writer	Politics	Self- employed	Military	
5	1	1	1	1	3	1	1	9	

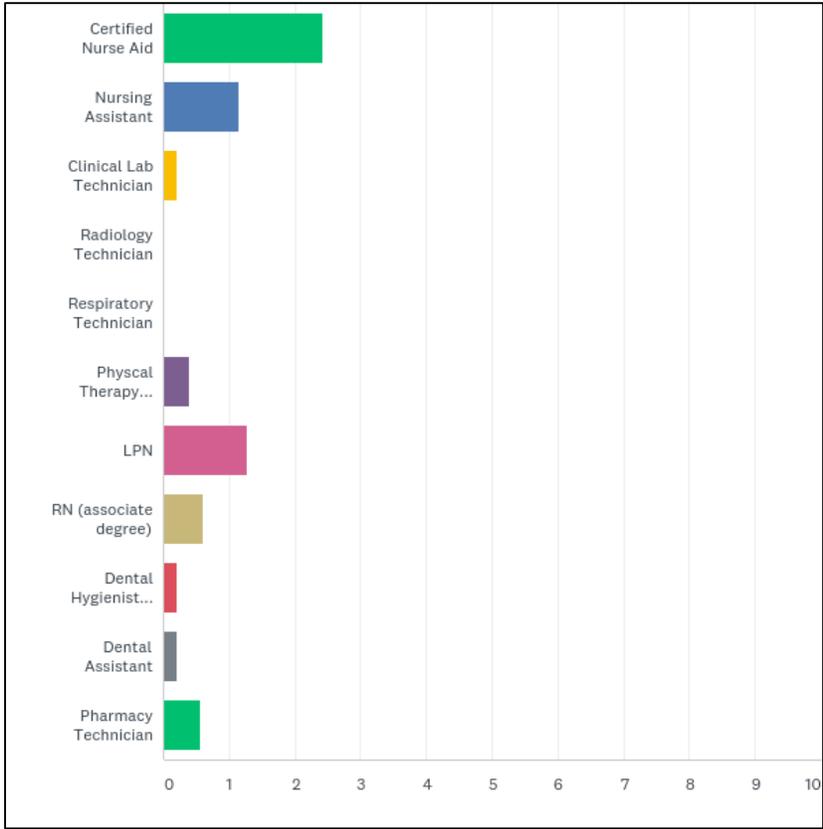


Figure 1. Average number of openings per position for all respondents in

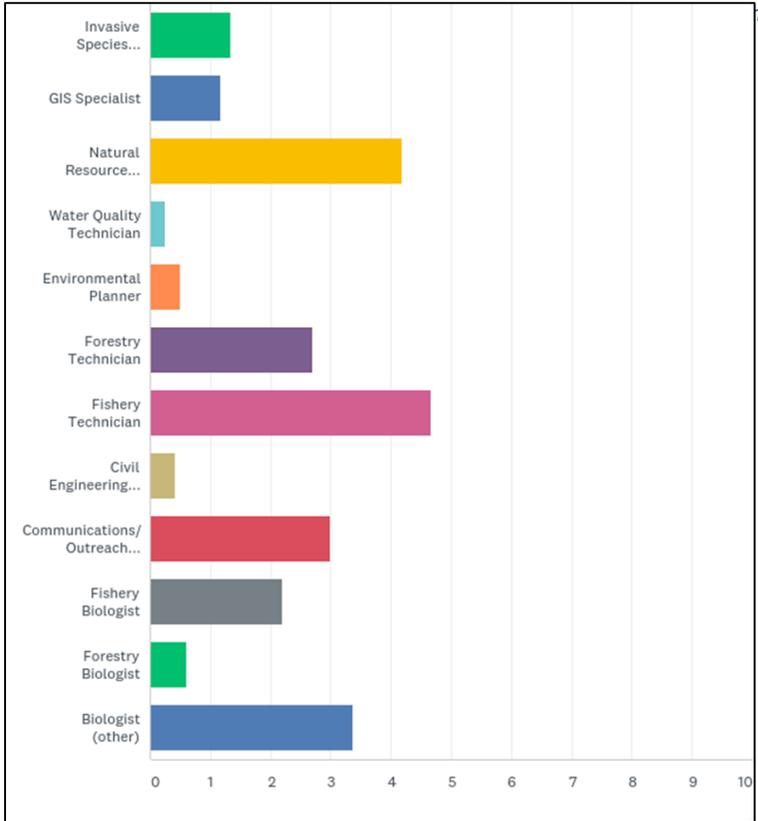


Figure 2. Total current employed within the selected natural resource positions.

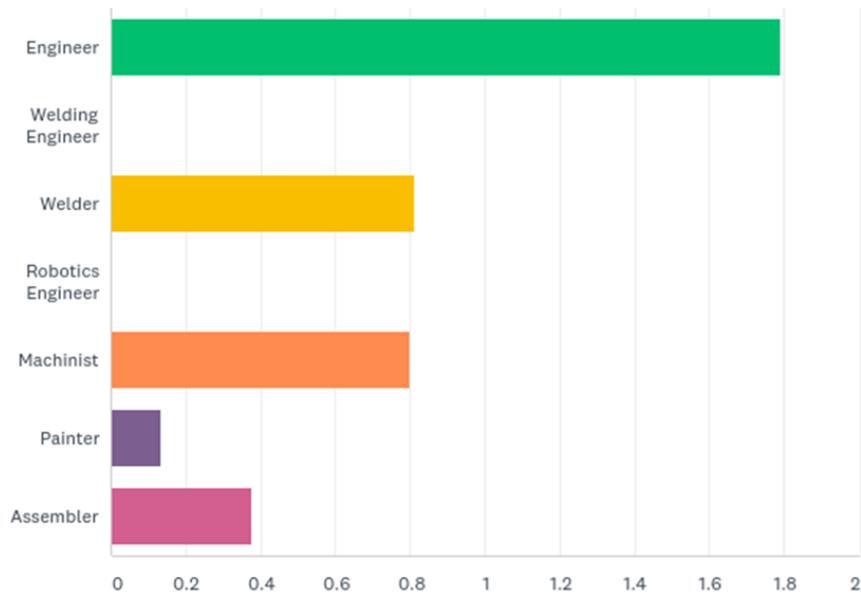


Figure 3. Average number of openings per position for all respondents in engineering and manufacturing sector. Average skewed by number of agencies not hiring within that position field (e.g. the average number of general engineers being sought per employer at time of survey was approximately 1.8, while the total actual number of CNA postings for all employers was 34).

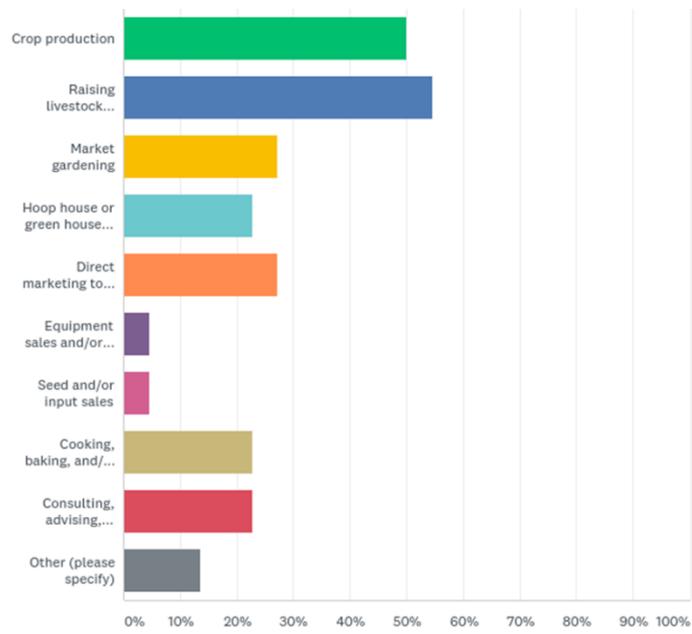


Figure 4. Percentage of agriculture businesses by trade.

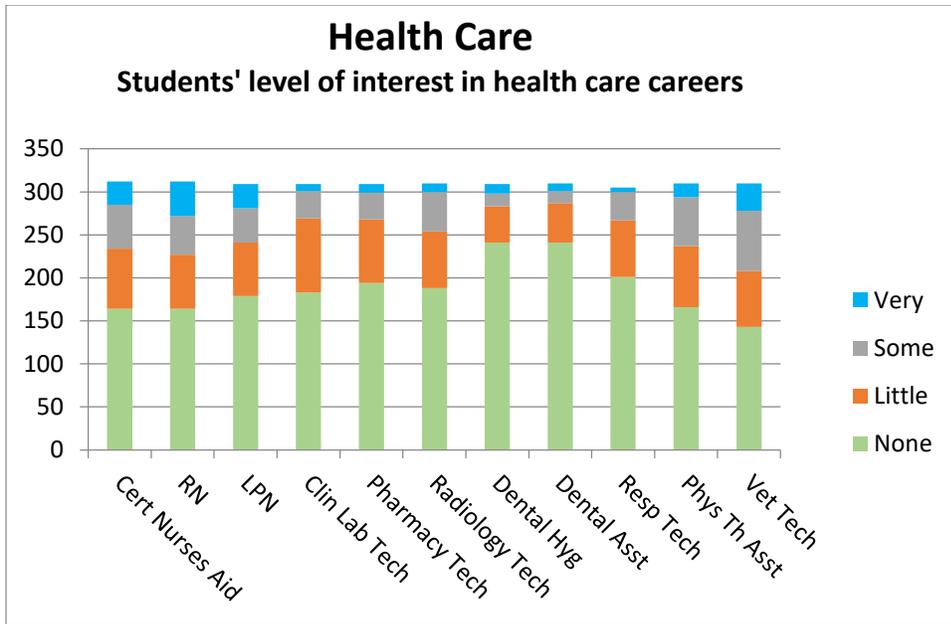


Figure 5. High school student interest in health care careers. Students were provided 'very interested' (blue), 'some interest' (grey), 'little interest' (orange) or 'no interest' (green) as possible ranking responses to denote their interest in 11 health care related careers.

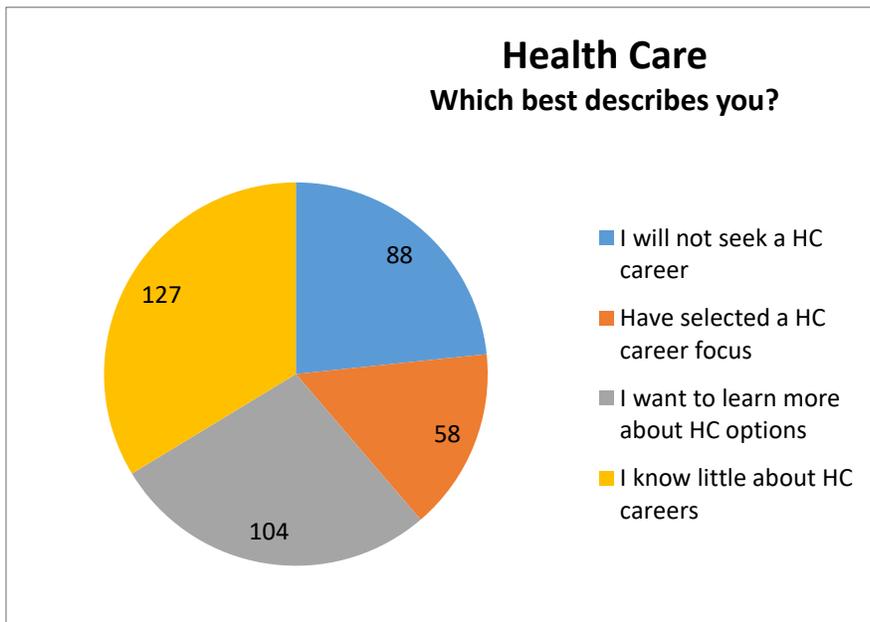


Figure 6 Percentage of high school students reported to know little about health care careers (yellow), that would like to learn more about health care careers (grey), have selected a career with a focus in health care (orange) and that are not planning to pursue a career in health care.

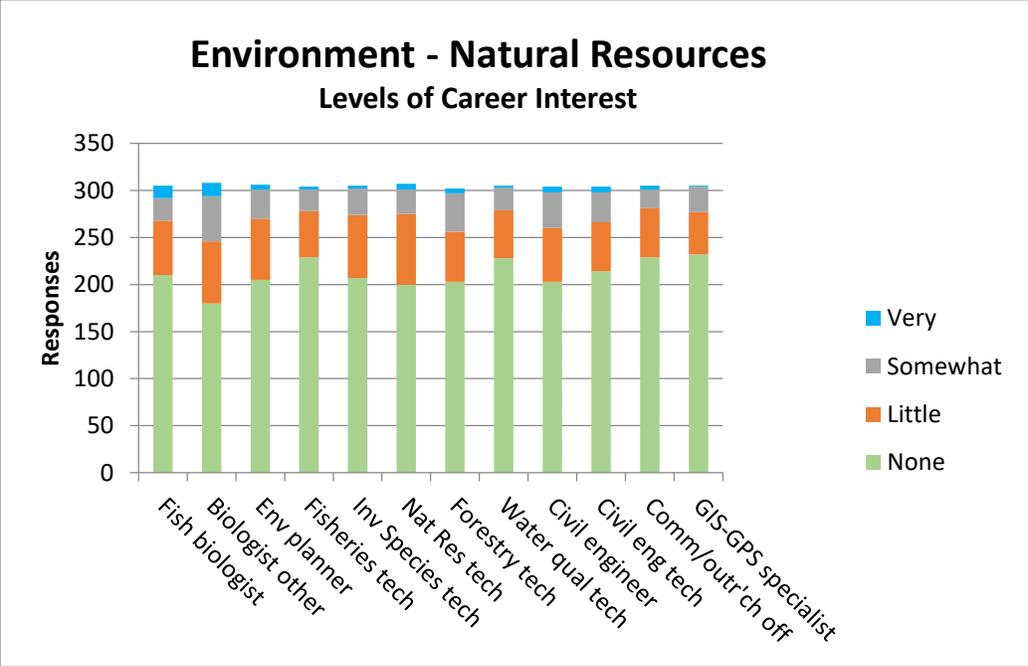


Figure 7. High school student interest in natural resources and environmental careers. Students were provided 'very interested' (blue), 'some interest (grey)', little interest (orange)' or 'no interest' (green) as possible ranking responses to denote their interest in 12 natural resource related careers.

Environment - Natural Resources

Which best describes you?

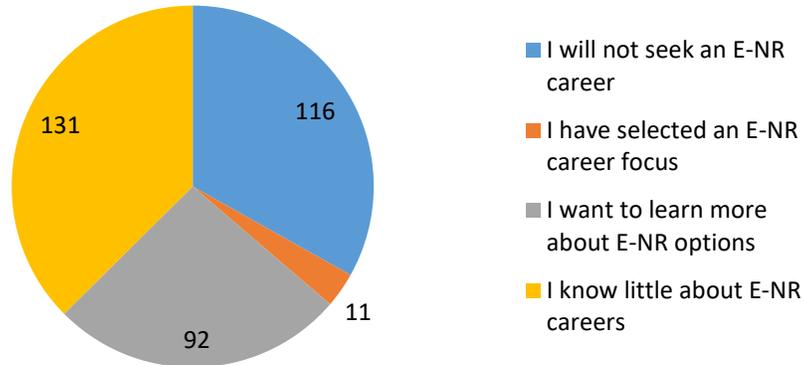


Figure 8. Percentage of high school students reported to know little about natural resources careers (yellow), that would like to learn more about natural resource careers (grey), have selected a career with a focus in natural resources (orange) and that are not planning to pursue a career in natural resources.

Engineering - Manufacturing

Levels of Career Interest

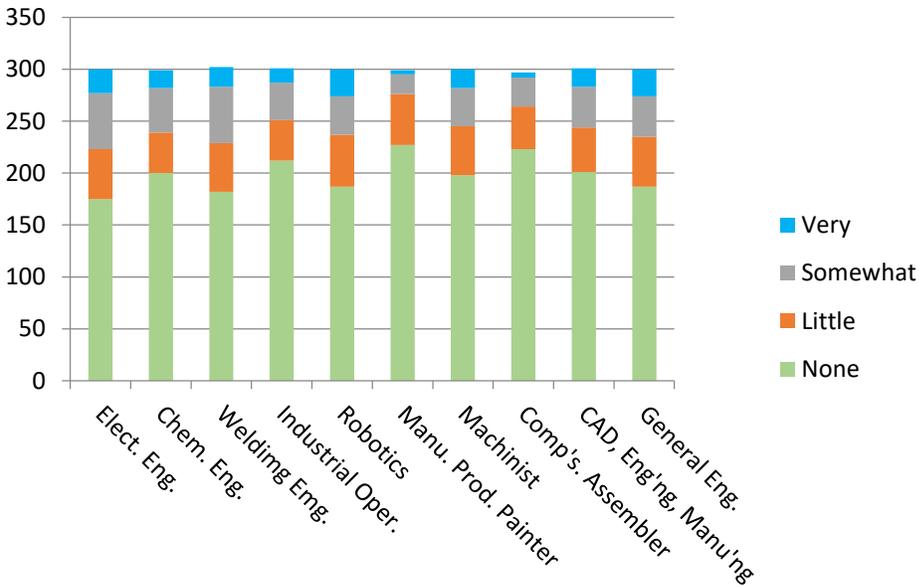


Figure 9. High school student interest in engineering and manufacturing careers. Students were provided 'very interested' (blue), 'some interest' (grey), little interest (orange) or 'no interest' (green) as possible ranking responses to denote their interest in 10 engineering and manufacturing related careers.

Engineering-Manufacturing Which best describes you?

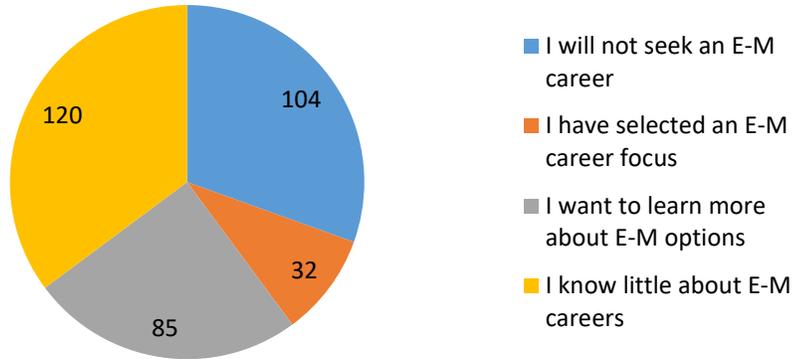


Figure 10. Percentage of high school students reported to know little about engineering and manufacturing careers (yellow), that would like to learn more about engineering and manufacturing careers (grey), have selected a career with a focus in engineering and manufacturing (orange) and that are not planning to pursue a career in engineering or manufacturing.

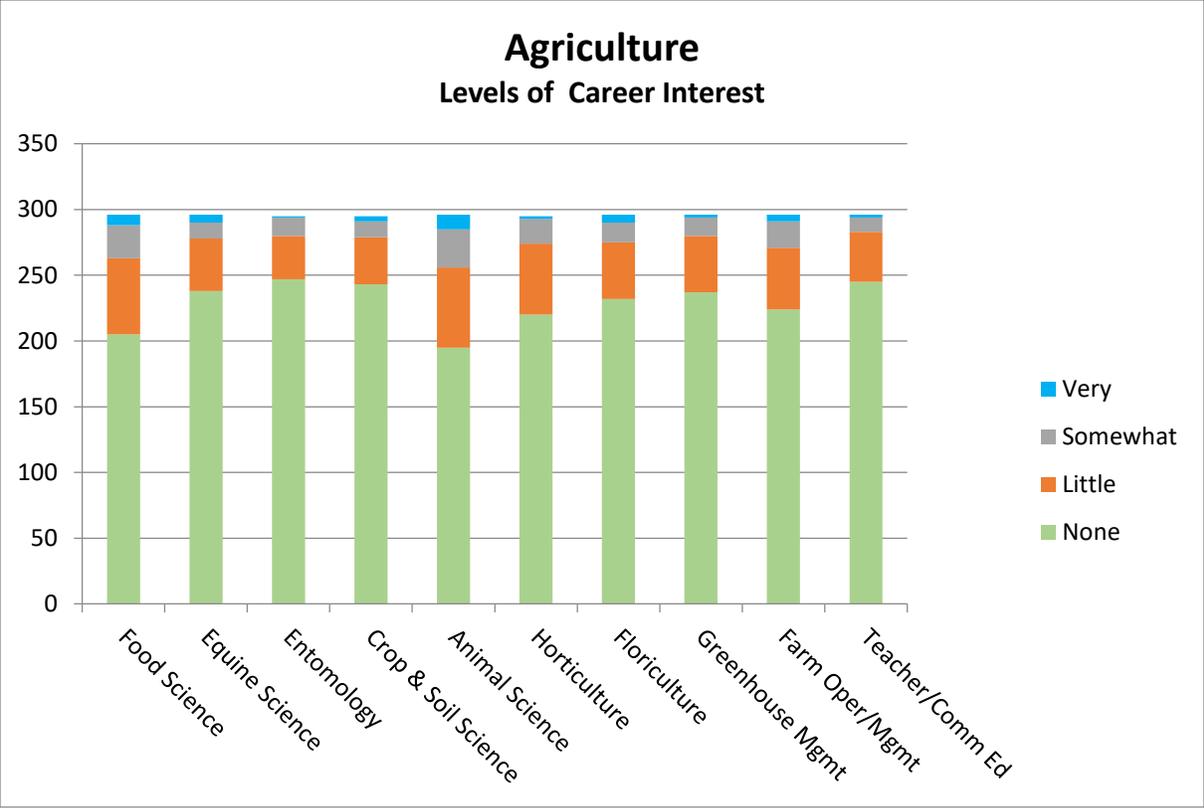


Figure 11. High school student interest in agriculture careers. Students were provided 'very interested' (blue), 'some interest (grey)', little interest (orange)' or 'no interest' (green) as possible ranking responses to denote their interest in 10 agriculture related fields.

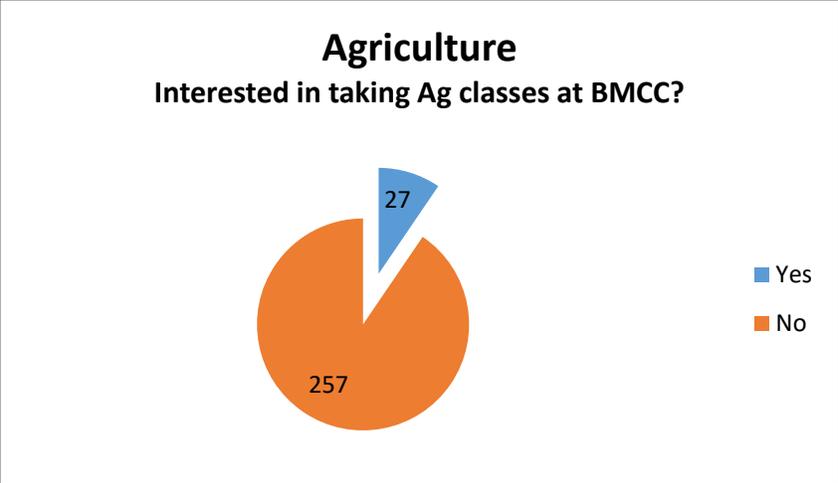


Figure 12. Percentage of students interested in taking agriculture courses at BMCC (blue, 27%).

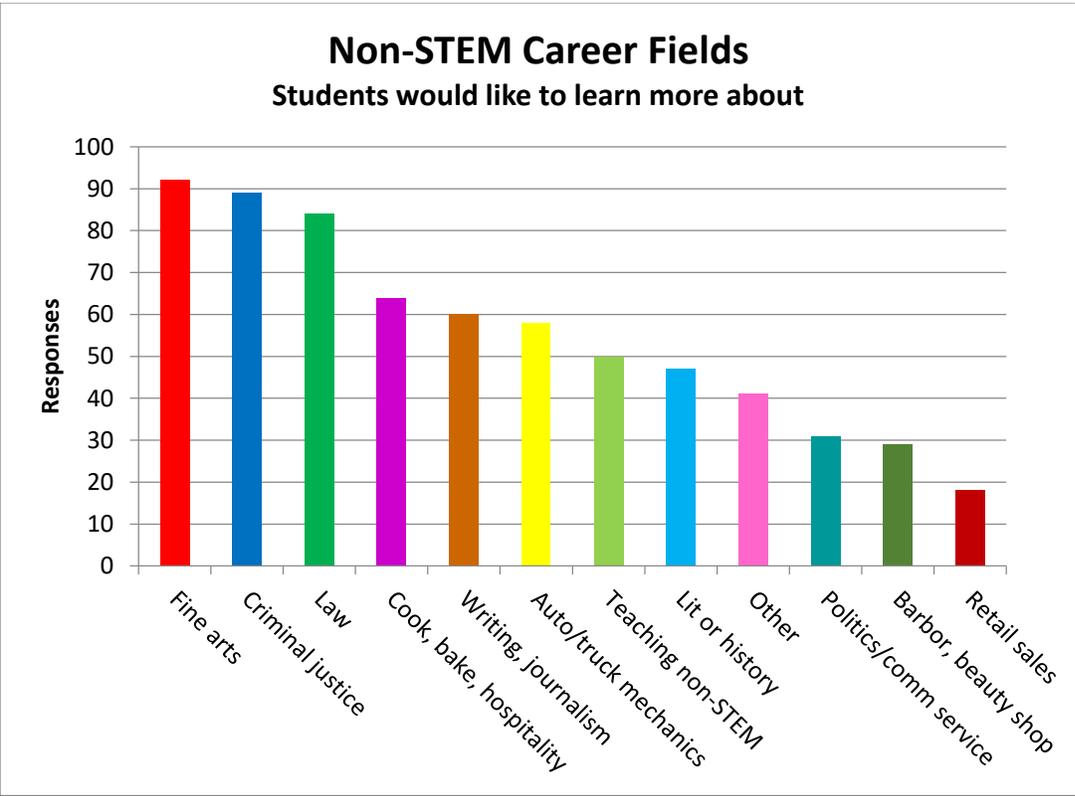


figure 13. High school students were asked to rank interest in non-STEM careers. Among most high interest level were fine arts, criminal justice, law, cooking/baking/hospitality, and writing and journalism.

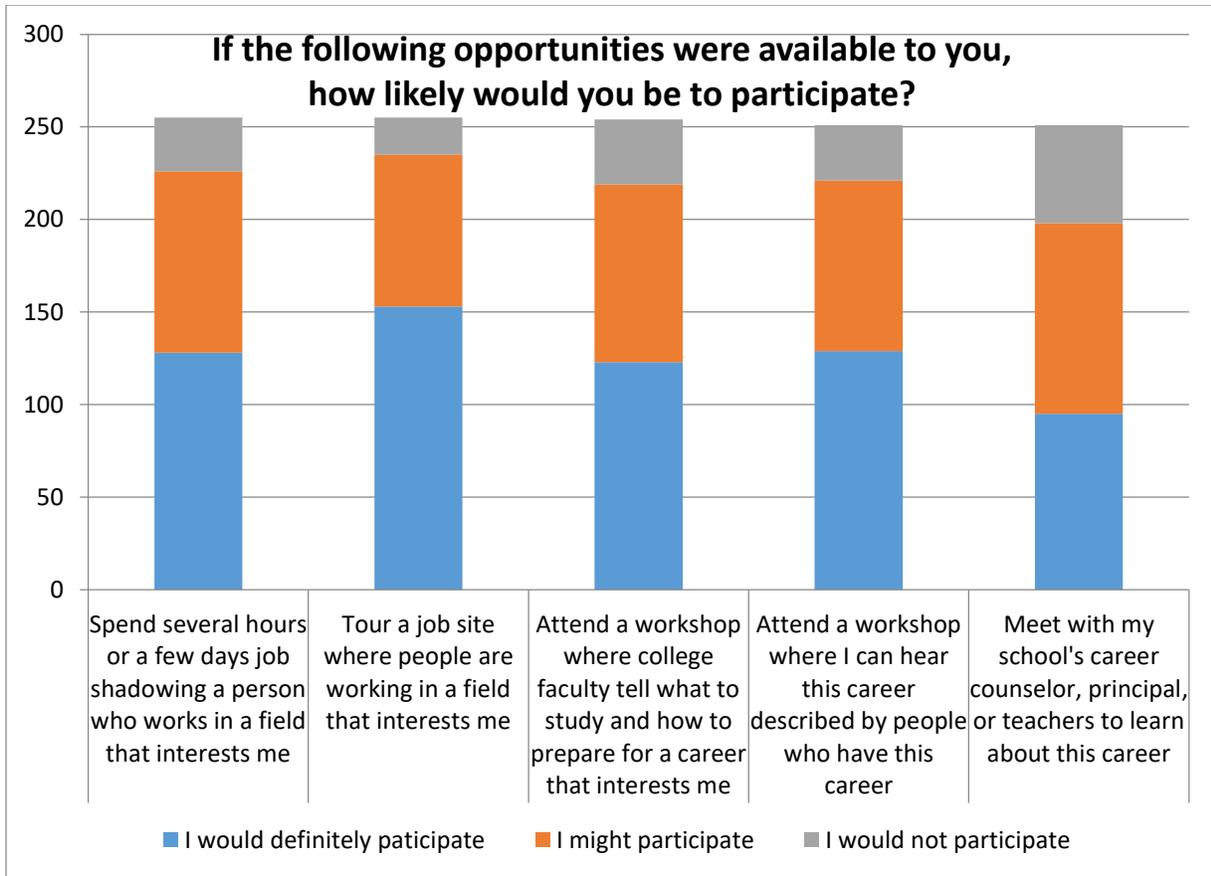


Figure 14. High school students listed willingness to participate in a number of career preparation workshops, tours, job shadowing, and meetings with advisors.

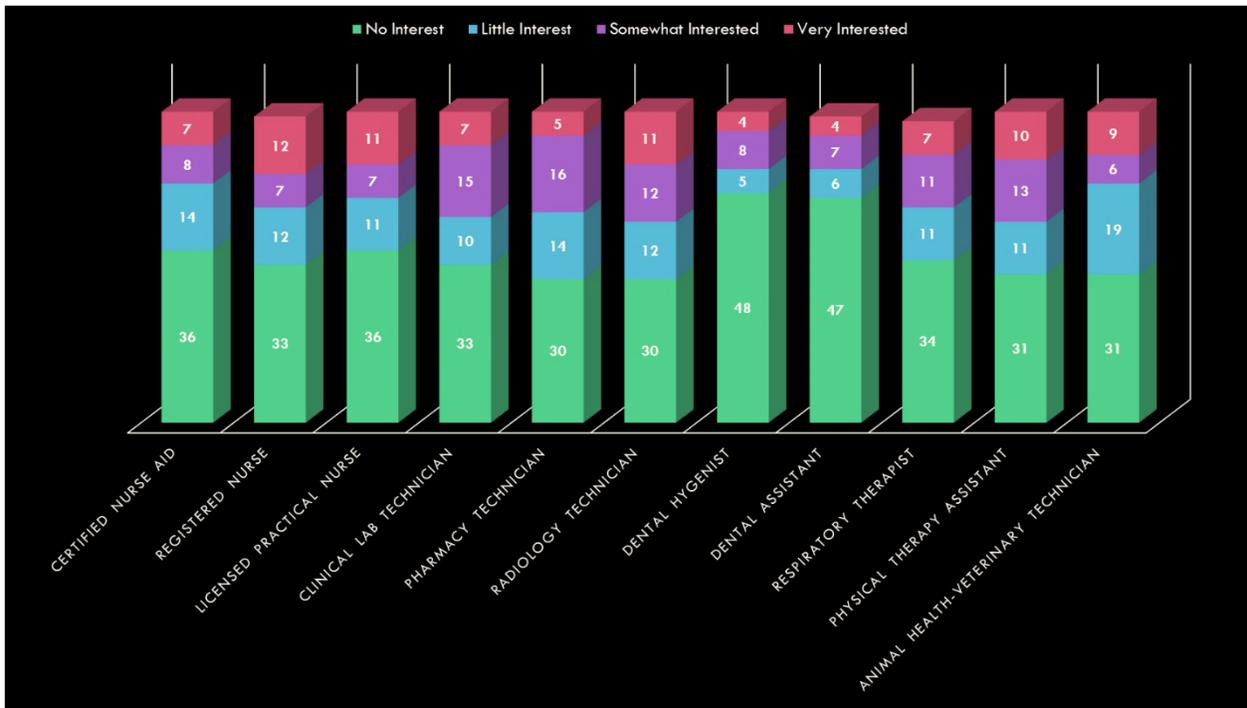


Figure 15. BMCC student interest in health care careers. Students were provided 'very interested' (pink), 'some interest (purple)', little interest (blue)' or 'no interest' (green) as possible ranking responses to denote their interest in 11 health care related careers.

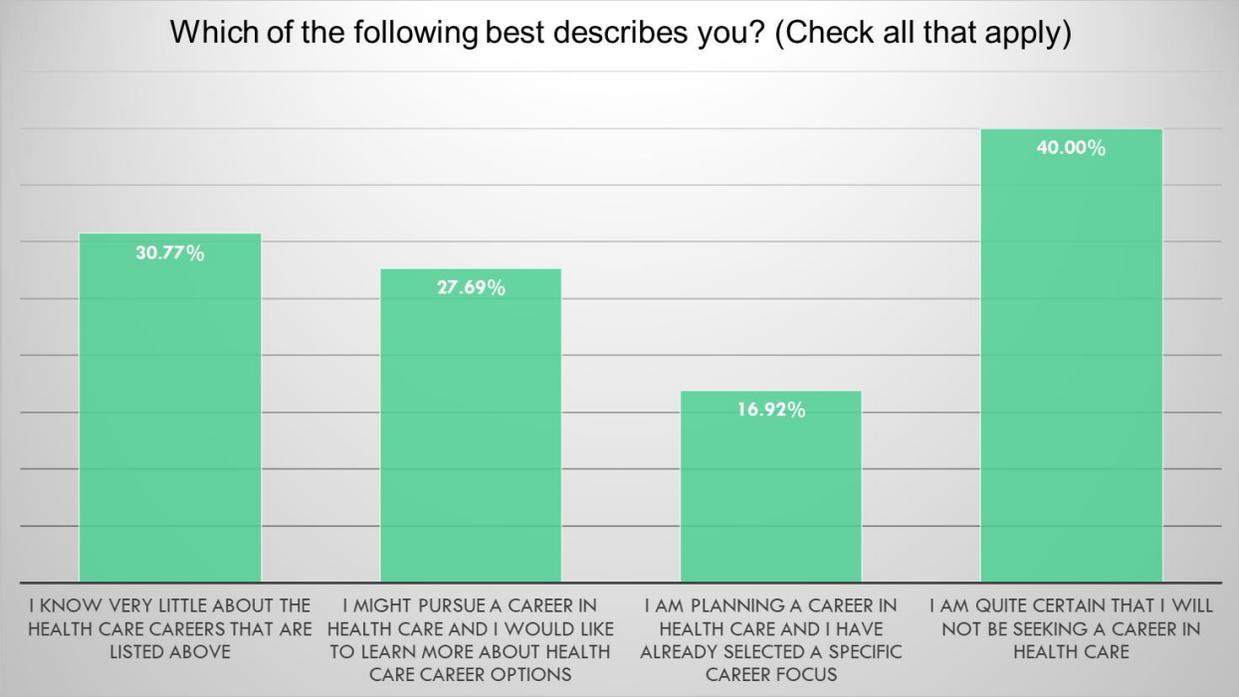


Figure 16. Percentage of BMCC students reported to know little about health care careers, that would like to learn more about health care careers, have selected a career with a focus in health care, and that are not planning to pursue a career in health care.

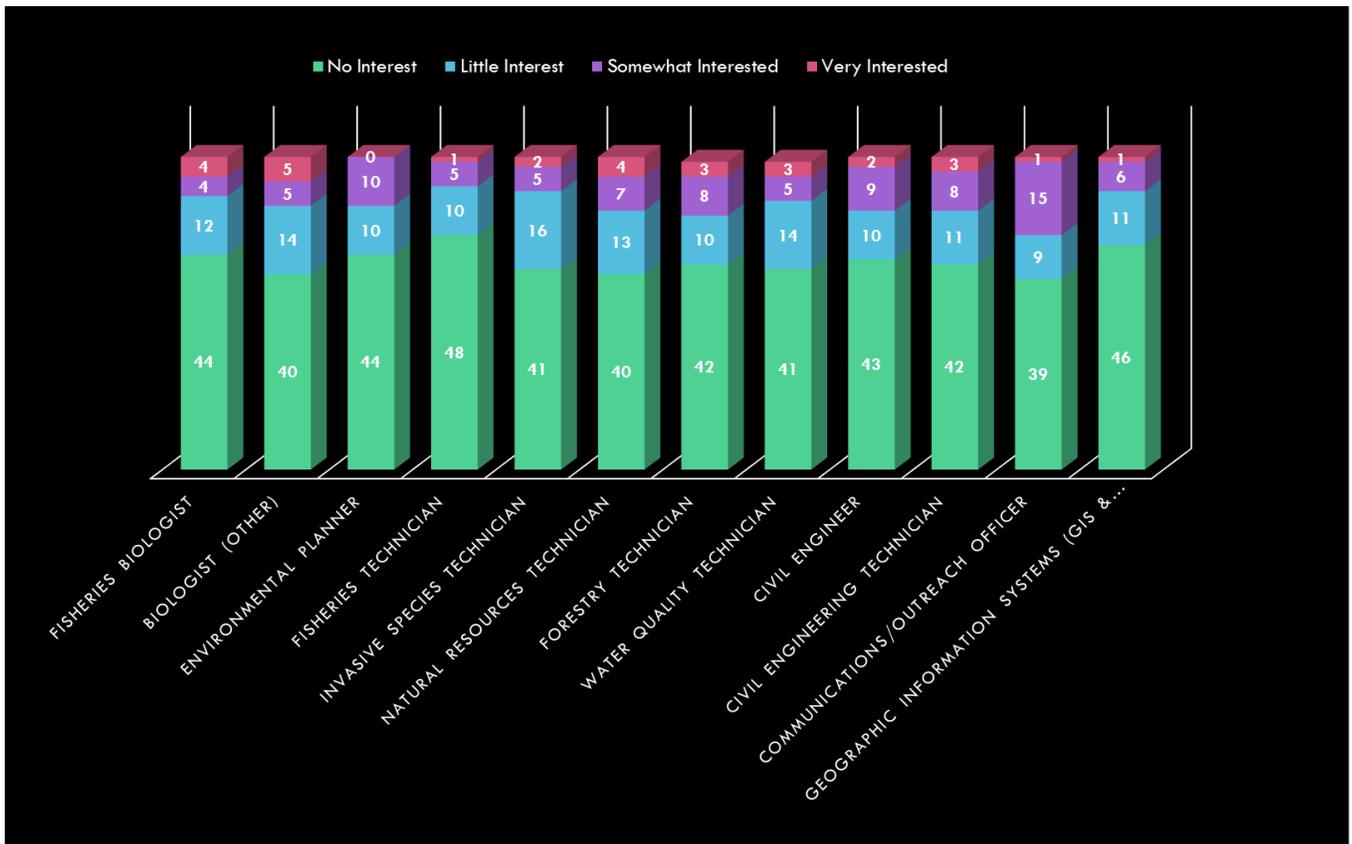


Figure 17. BMCC student interest natural resources careers. Students were provided 'very interested' (pink), 'some interest (purple)', little interest (blue)' or 'no interest' (green) as possible ranking responses to denote their interest in 12 natural resources related fields.

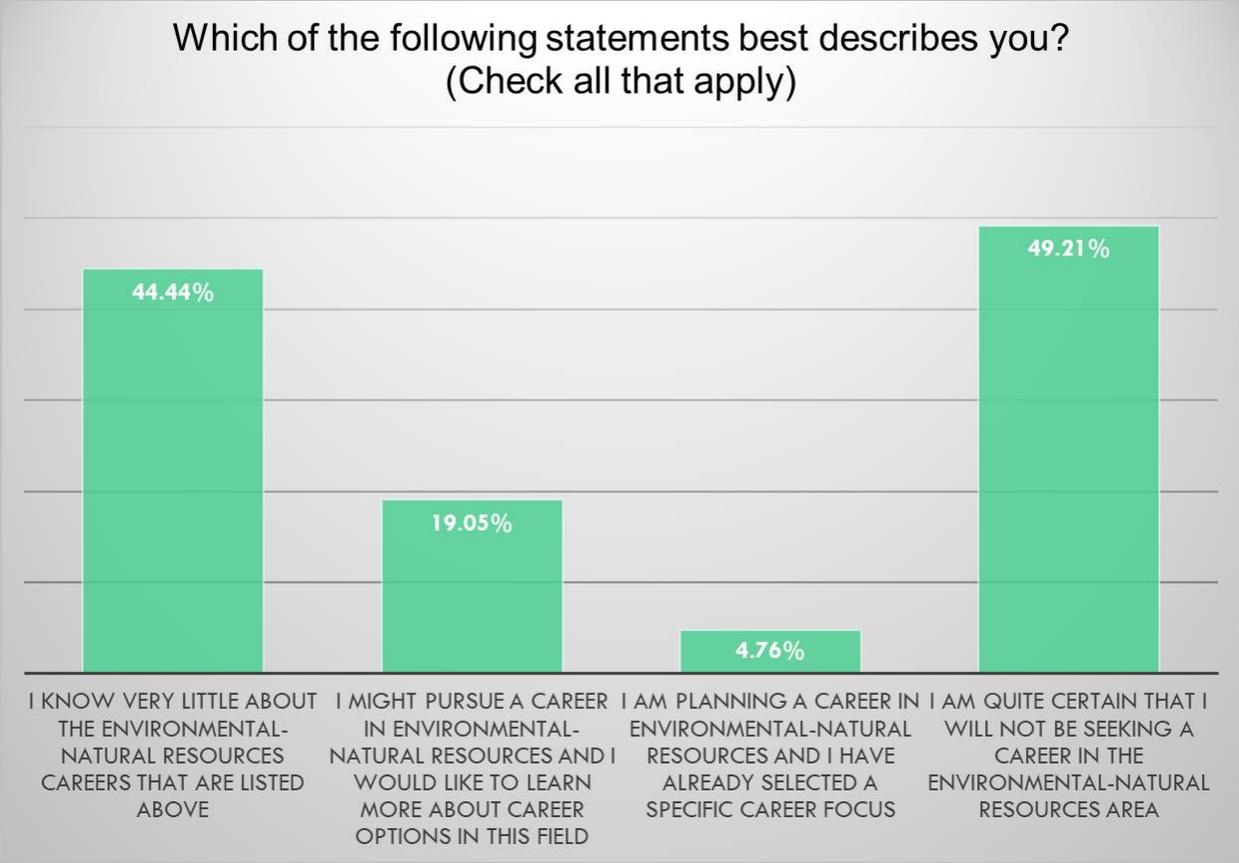


Figure 18. Percentage of BMCC students reported to know little about natural resources careers, that would like to learn more about natural resources careers, have selected a career with a focus in natural resources, and that are not planning to pursue a career in natural resources.

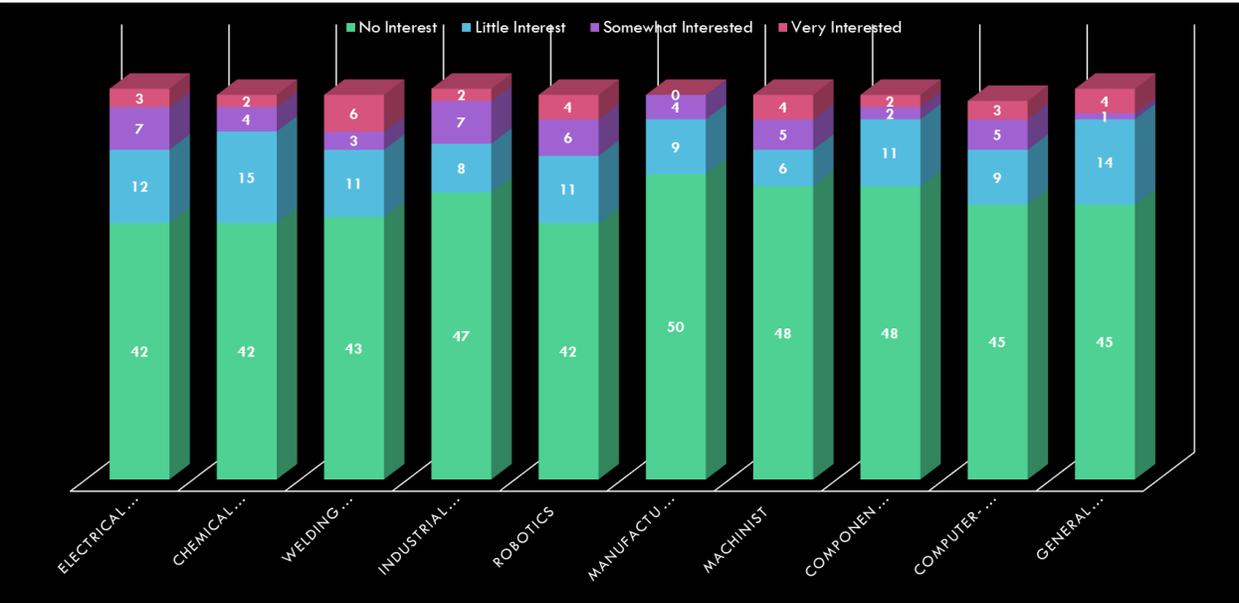


Figure 19. BMCC student interest engineering and manufacturing careers. Students were provided 'very interested' (pink), 'some interest (purple)', little interest (blue) or 'no interest' (green) as possible ranking responses to denote their interest in 10 engineering and manufacturing related fields.

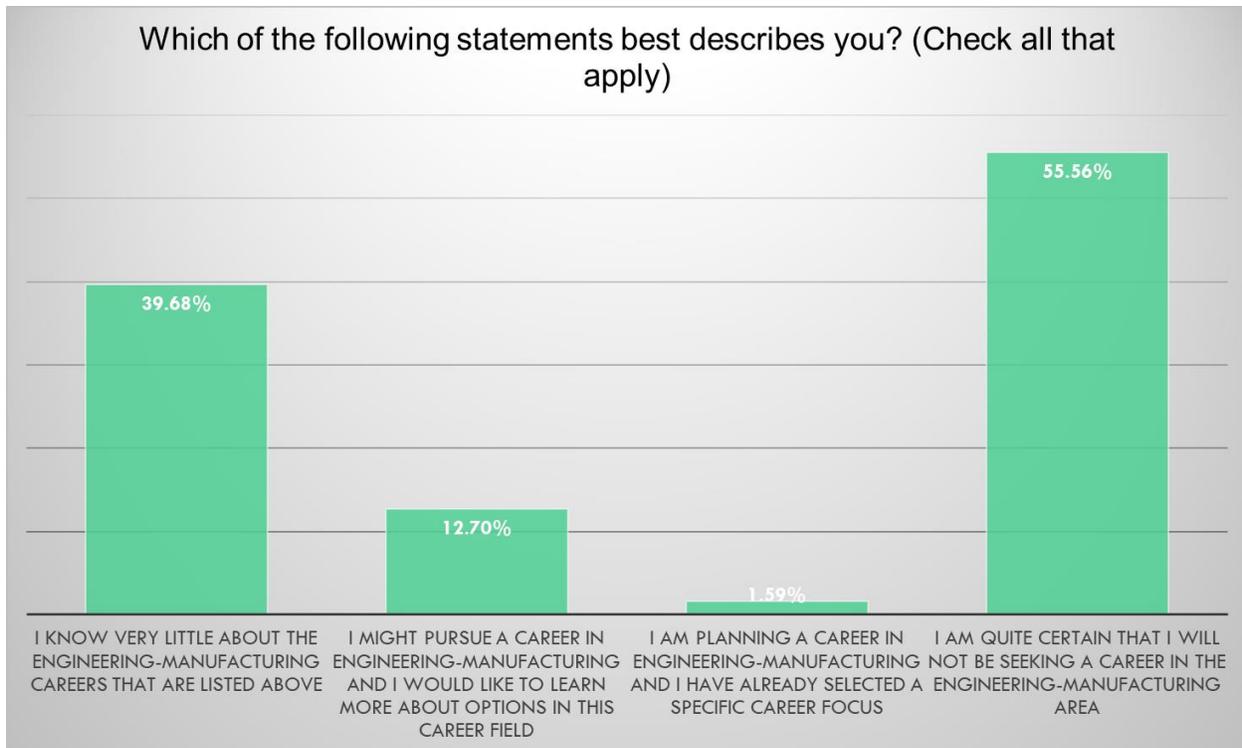


Figure 20. Percentage of BMCC students reported to know little about engineering and manufacturing careers, that would like to learn more about engineering and manufacturing careers, have selected a career with a focus in engineering and manufacturing, and that are not planning to pursue a career in engineering and manufacturing.

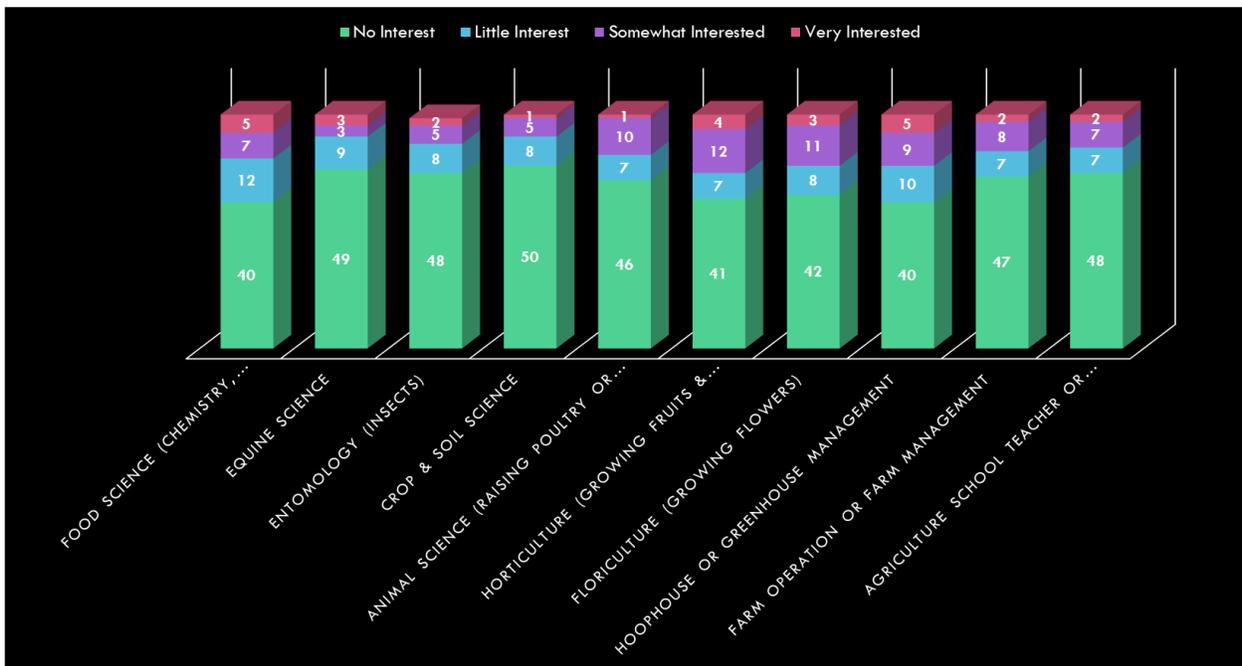


Figure 21. BMCC student interest agriculture careers. Students were provided 'very interested' (pink), 'some interest (purple)', little interest (blue) or 'no interest' (green) as possible ranking responses to denote their interest in 10 agriculture related fields.

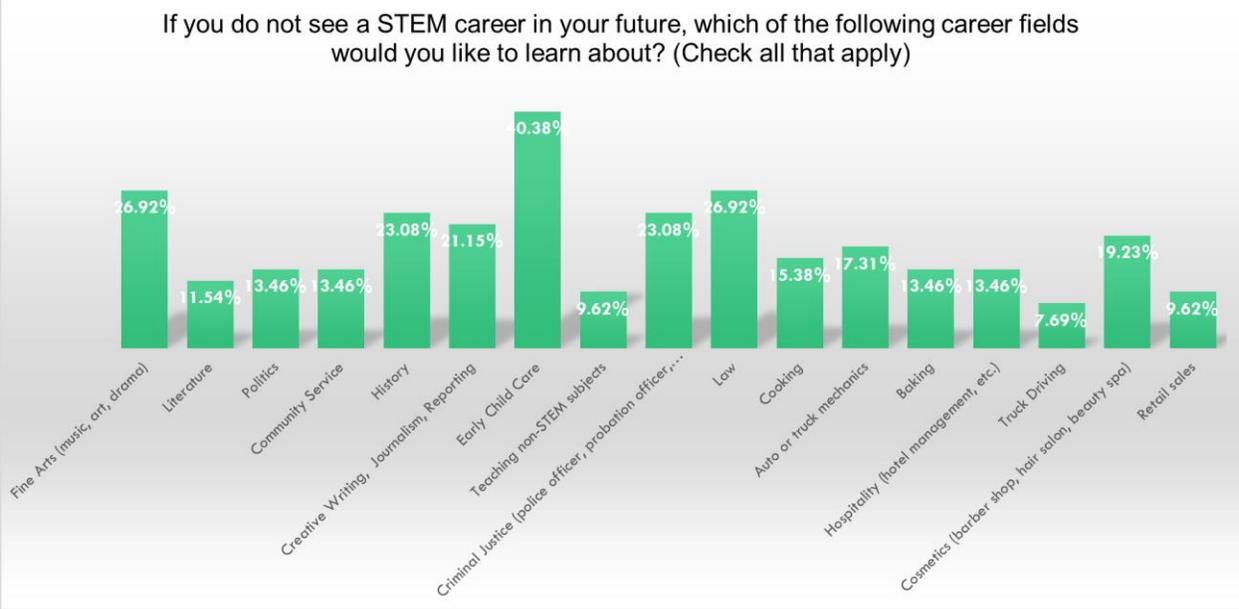


Figure 22. BMCC students were asked to rank interest in non-STEM careers. Among those of highest interest were early childhood care, fine arts, law, history, and criminal justice.

Appendix B- AAC&U Transforming STEM Higher Education Notes

AAC&U Conference
November 2-4, 2017

Transforming STEM Higher Education: Discovery, Innovation, and the Value of Evidence

Compelling Conference Message

The compelling message of this conference is that colleges and universities need to change the way they teach students.

This message was iterated at all conference levels: plenary sessions, workshops, and poster presentations

Foundational ideas -

- Responsibility for student drop out and/or academic failure lies first with the college/university.
- Exclusivity does not automatically embody superiority.
- A high fail rate by a professor does not equal superior knowledge or skill and should not raise that professor in collegial esteem or value to the institution.
- For practical and moral reasons, higher education institutions need to truly learn how to teach every student whom they choose to enroll.
- Enrolling students and then watching them drop out for academic or student living reasons and knowing they are now burdened with student debt is not okay.

Repeated premises -

- Once an institution accepts a student, it bears an obligation to understand that student as a learner.
- Understanding a student as a learner does not suggest a one-time first-week orientation test, but rather understanding that student in the varied contexts of different STEM, arts and letters, and social science courses.
- Understanding a student as a learner requires classroom-level analytical skills and tools.
- Faculty members must own those skills and have easy access to those tools.
- Faculty members must use those skills and tools, not with the intention of merely understanding students, but for the purpose of individualizing both instruction and approaches used during office-hour tutoring and mentoring sessions.

Receiving heavy emphasis throughout the conference -

- The fundamental moral responsibility for skillfully teaching all students who are enrolled lies first with the college or university administration and faculty leaders.
- They must seek knowledge about learner analytics at three levels:
 - What can be known about student learners?
 - What tools will best help faculty know their students as learners?
 - What should faculty do with their newfound understanding of their own students in their own classes?
- Faculty, as teaching practitioners, bear a responsibility to follow the lead of their administrators and peer leaders -
 - Learn to use analytical tools
 - Understand ensuing data
 - Apply teaching methods needed by the particular set of students present in each of their classes at that particular time
- Basic necessities for such a change
 - Time
 - Time for administrators and faculty leaders to develop an understanding of students as learners across all disciplines
 - Time to examine and select analytical tools
 - Release time for faculty to practice using analytical tools
 - Abundant professional development opportunities in which faculty learn how to redesign their teaching for all learners
 - Release from rigid course clock time; allowing students to complete a course in 7.5 weeks, 15 weeks, or 30 weeks according to that student's skill set and personal needs such as work and family

- Accountability
 - Clear retention and growth goals determined and articulated
 - Each and every institution employee accepting responsibility for those goals
 - Faculty accepting the concept of accountability and ensuing accountability practices
 - Administration and faculty leaders staying the course; always encouraging and supporting faculty, while never letting accountability drift away