CUR Focus

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Using Summer Research to Attract Pre-College Underrepresented Students to STEM Fields

In the fall of 2010, President Barack Obama announced a campaign to improve education in science, technology, engineering, and math (STEM) fields (White House 2010). His call to action renewed emphasis on a problem that first gained national attention in the 1970s—persistent underrepresentation of women and people of color in STEM fields. President Obama recommended expansion of STEM education and career opportunities for underrepresented groups through replicating and scaling up successful interventions

This article discusses three such potential interventions—programs at St. Cloud State University (SCSU) that introduce pre-college students from underrepresented groups to the scientific research process in a university setting. These programs originated in response to the early recognition of the problem of underrepresentation in STEM fields. I discuss how such programs can help high school students prepare for the collegiate experience and encourage them to experience research-oriented disciplines. A retrospective study of the programs has provided data on past participants' college enrollment and degree attainment in STEM fields, comparing program outcomes with state and national data for comparable groups. This article also discusses how college faculty members' involvement in precollege programs benefits college students, as well as the program participants

In light of the renewed national interest and possibility of funding for activities related to STEM underrepresentation, other institutions of higher education may find the St. Cloud State University experience helpful.

Pre-College Pipeline Programs

Over more than two decades, some 3,100 students from the second to twelfth grades have attended residential summer programs on the SCSU campus. The students were mostly from ethnic minority and immigrant backgrounds, low- or moderate-income families, and included a high proportion of females. The Math-Science-Computer Camp (MSCC), founded in 1987, is geared towards elementary and middle-school students and is the origin and foundation of the high-school programs. The two high school programs are the Scientific Discovery Program (SDP), created in 1991, now designed for 9th and 10th grade students, and the Advanced Program in Technology and Science (APTS), started in 2000, now serving 10th and 11th grade students. High school students work with university faculty who serve as research mentors and also with undergraduate and graduate students, some of whom are also members of underrepresented groups, to carry out research projects.

Students from the Math Science Camp doing a study of earthworms and their habitat at the Peck's farm with John Peck.

The three programs together constitute the Pre-College Pipeline Programs at St. Cloud State. They are designed to introduce students to scientific research activities at an early age and to provide opportunities for continuous involvement in educational pursuits with a research focus. Students are eligible to attend these program multiple times, except for the Scientific Discovery Program, which limits participation to one summer. About 28 percent of participants elect to return for two or more sessions of the same or a different program. Of the MSCC participants, 28 percent attended two or more of the MSCC programs—some up to seven programs. This program has provided 28 percent of the participants in the Scientific Discovery Program and 29 percent of the students in the Advanced Program in Science and Technology. Science Discovery participants go on to

make up 48 percent of the APTS cohort. Additional students are attracted to these programs by notices in state and national publications, mailings to schools, notices at science fairs and math contests, referrals by school personnel, word of mouth, and arrangements with community organizations.

One of the goals of these projects is to encourage college enrollment. Another is to promote interest in science and technology. Using follow-up data, both qualitative and quantitative, we are able to track student enrollment in higher education, the types of colleges selected, degrees earned, and fields of study. Results indicate that many students attended one or more colleges or universities, with sixty percent of those earning undergraduate and graduate degrees receiving them in STEM areas.

Our programs recruit participants from populations that are historically underrepresented in the STEM fields—students of color, especially black, Latino, American Indian, and students from recent Southeast Asian immigrant groups, such as the Hmong, that experience high rates of poverty. Other students from low-income groups, particularly females, are also targeted. A recent National Science Board (NSB) report calls for more attention to these groups as a source for the STEM workforce of the future and for STEM "innovators" (National Science Board 2010).

Details on the demographic make-up of the participants of these three programs are provided in Table 1 (in Supplemental Materials in the Spring 2011 edition of *CURQ on the Web*).

These summer residential programs are designed to inspire interest in STEM fields by focusing on scientific research as an introduction to the ways of science. In the Math-Science-Computer Camps, over a five-day period students are engaged in the study of math, science, technology, computers, the environment, and the application of science and technology to culture through a variety of inquiry-based, hands-on, experiential activities and classes. The activities are integrated to help students see the relationship among these different disciplines. A special feature of this program is the use of a farm for science-based activities and scientific research projects. Field experiments and data collection depend on the age of students and generally entail experiments with earthworm populations in various soils, insect diversity in different habitats, and location of barn swallow nests in the barn. The data collected are brought to campus and used in math and computer classes for analysis, graphing, and discussion of the scientific meaning of the results.

The Scientific Discovery Program is a four-week residential program targeting 9th and 10th graders, where students experience chemical, biological, mathematical, statistical, social, and computer sciences through laboratories, special demonstrations, presentations, lectures, simulations, and field trips. SDP participants take classes in statistics, computer applications, and environmental issues. Many activities focus on water quality and solid-waste management.

The Advanced Program in Technology and Science is a three-week residential program for 10th- and 11th-grade students. APTS students are organized in small groups and given topics of contemporary scientific and technical concern. They make presentations in research seminars attended by peers in APTS, SDP, faculty, and staff. Both the APTS and SDP programs require students to conduct a research project and prepare a research report.

Research projects are designed by faculty members and are often a part of their ongoing research activities. In addition, some of the projects are carried out in field sites under the auspices of state and federal agencies and their professional scientists. High school students have taken part in research on cancer, diabetes, water quality, DNA sequencing, weather patterns and predictions, racial and gender disparities in the STEM labor force, racial differences in wealth and economic well-being, natural resource management, engineering and mathematical modeling and simulations, international economic issues, and a host of other topics. Upon completion of the program, some students have maintained contact with professors from St. Cloud in order to continue their research back at their schools.

Undergraduate students, including past participants in the pre-college programs, work with faculty and staff as research assistants, counselors, and project staff. In these roles, undergraduates are in constant contact with the younger students during their stay in the program. The undergraduate staff is diverse in terms of majors, racial and ethnic makeup, geographic backgrounds, gender,

and classification (lower-and upper-classmen). Thus program participants see and work with college students who are similar to themselves and who thus can serve as role models.

Field trips to sites of scientific and cultural interest are other aspects of the program. During the field trips, practicing scientists and engineers talk about their work, education, and how they became involved in their profession. The Science Museum of Minnesota hosts annual programs highlighting and displaying the work, contributions, and inventions of ethnic minorities. As part of follow-up activities of these projects, excursions are organized for students from the central Minnesota and the Twin Cities areas to attend the Science Museum of Minnesota's annual African Americans in Science program. There, students have the opportunity to interact with and learn about the work of scientific and technical professionals involved in technology, education, health care, and innovation.

Other culturally related field trips of scientific interest include an all-day trip to Lake Itasca to view the headwaters of the Mississippi, Indian burial mounds. and the oldest and tallest pine trees in Minnesota. An annual visit is also made to the Mille Lacs Band of Ojibwe reservation where staff members of the Mille Lacs Water Treatment Plant explain the processes of treating wastewater, and where the representatives of the Mille Lacs' Department of Natural Resources discuss their management of natural resources, including lakes, birds and other wildlife, and land. Another annual field trip is taken to the University of Minnesota's TRIO McNair Scholars Program Poster Presentation so that program participants can see undergraduate and graduate students of color present their research projects, setting the stage and preparing our students for their own poster presentations.

The Pre-College Experience as Preparation for College-level Research

Our precollege programs offer a variety of experiences to help participants prepare for undergraduate studies and college life. These include:

- an opportunity to experience campus life, including residential halls, on-campus dining, and recreational facilities;
- regular contact with faculty and undergraduate and graduate student assistants;
- interaction with peers, counselors, faculty, and program administrators from diverse cultural backgrounds and different geographic areas;
- introduction to the nature of science—the creation of knowledge through empirical investigation;
- exposure to the "workings" of scientific research, with an emphasis on learning research methods and lab procedures and techniques as means of engaging in the process of discovery and inquiry;
- active engagement in data collection and analysis;
- the opportunity to work on real research problems and issues;
- access to well-equipped labs and state-of-the-art equipment;
- preparation of a research report based on primary research and analysis of data; and
- work with the same materials and technology, and in the same facilities, as undergraduate and graduate students.

Students from minority groups have the opportunity to work with faculty, staff, and students from racial and ethnic backgrounds similar to theirs. White students from racially homogeneous communities have an opportunity to work and play in a culturally diverse setting. All students get to witness both people of color and whites in leadership roles. Through all these experiences, the precollege programs enable many students to clarify their interests and career goals. Some decide that they do not want to pursue a scientific field or profession after an intense summer experience. Many students report that the pre-college residential experience helped to ease the fear of going to college since they were first-generation college students and otherwise would not have known what to expect of a college campus.

Some participants enroll at St. Cloud and work in the labs of their summer faculty mentors. Several of the students have made presentations at the annual campus-wide student research colloquium. One young woman,

an alumna of all three pipeline programs, is actively involved in the research activities of her faculty mentors, presenting not only at the campus colloquium but also at national and international professional meetings. This student also serves as a lab assistant to one of her faculty mentors. Other program alumni play prominent roles with the pre-college programs after matriculating at St. Cloud, working as student assistants, office workers, counselors, teaching and research assistants, tutors, and peer mentors.

A major experience that many students gain from program participation is writing a research report. For many students this is the first time that they have been required to produce an original document. The quality of work varies, but about 99 percent of participants in the two high school level programs complete this requirement. As noted in the comments below some students use this product and the program experience to earn scholarships, gain college admission or entry to other programs, and earn additional high school credits in science and mathematics.

The impact of the pre-college programs is partially captured in the comments below of two past female participants who happened to contact me while I was writing this article. Following are excerpts from their email communications:

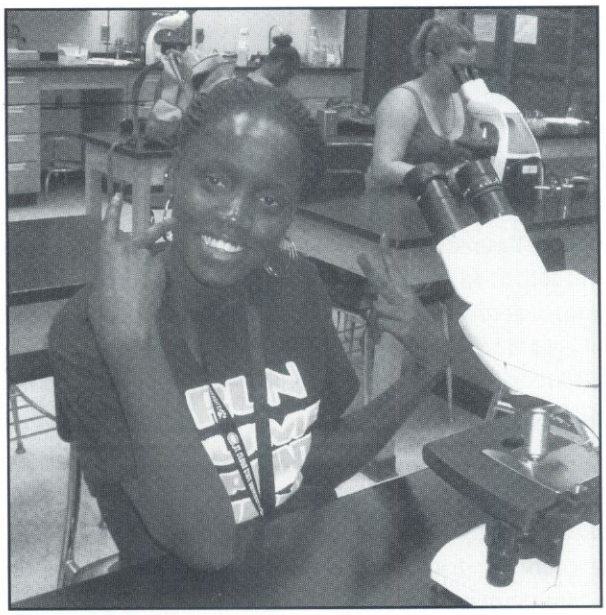
> *I was a participant of your Scientific Discovery Program back in 1991. Since that time, I have gone on to do many other things, including earning a doctorate in environmental health. I still remember, however, my summer at Saint Cloud State. I clearly recall being guided by thoughtful faculty mentors and graduate students to develop, set up, and stage my grand experiment: 'The Effects of Sodium Chloride on Freshwater Environments. It involved minnows from the local bait shop as my test subjects, and six fish tanks with varying levels of salt concentration. I wanted to consider how the run-off from road salt might affect fish in our many lakes. Granted this first research project was quite simple, but it had a profound impact on me. For the first time I understood what it meant to propose a research question, think critically about how to answer it, and then develop a research design to carry out the project. These are skills that I continued to build on as I went back to finish high school and then on to earn a bachelor's degree in biology and two advanced degrees in public health at the University of Minnesota.*
>
> – Starr Sage, PhD

> *...I am a graduate of the Pipeline Summer Programs: Math Science Computer Camp from 1997-2001 and Scientific Discovery Camp in 2002. I am a 2009 graduate of Northwestern University in Evanston, IL, where I majored in psychology and minored in global health. I am attending Washington University in St. Louis this fall, 2010, pursuing a PhD in cultural anthropology. ... I know how helpful Pipeline is in helping introduce students to the sciences and gaining a strong appreciation for them. Pipeline Summer Camp gave me a chance to encounter nature in a way I never had gotten the chance to before. I learned how to use computers, particularly Excel, work in a biology lab, follow the guidance of a principal investigator, and use my own creativity to tackle diabetes research. I was able to use this experience for my college applications, and it helped me immeasurably in getting admitted to a variety of colleges, as well as landing an internship with Mayo Clinic in Rochester, MN, the summer of my senior year of high school.*
>
> – Golda Kosisochi Onyeneho

College Attendance and STEM Participation

Other students and parents have credited our pre-college programs with influencing decisions on college attendance, selection of a major, and career choices. In addition to personal and parental accounts of the impact of program involvement, a retrospective study has provided statistical data to examine these relationships.

For purposes of analysis, I have used the STEM fields identified by the National Science Foundation in its



Charity Bilal and Amanda Edwards, Science Discovery Program participants studying water quality as part of a research project.

reporting on workforce and education issues. The broad areas are agricultural sciences; biological sciences; computer sciences, earth, atmospheric and ocean sciences; engineering; mathematics; physical sciences; psychology; and social sciences (National Science Foundation 2009). Health and medical fields rely on knowledge and skills based in the physical, life, computer, and mathematical sciences. Therefore, this study will also delineate student participation in health-related areas.

For purposes of this analysis, Pre-college Pipeline participants were divided into three age groups: under 18, 18 to 24, and 25 and older. These age groups correspond to assumed educational stages— attending K-12 schools, attending higher education, and participating in the workforce, respectively.

The methodology to track past participants' college enrollment, courses of study, and graduation entails use of the National Student Clearinghouse (NSC), supplemented with information from former students or their parents about postsecondary education. Information on 881 former participants was obtained from the NSC database; reliable information on three students came from parents or the students themselves. Thus, a total of 884 students constituted the sample for examining post-program participation in higher education and STEM areas.

The National Student Clearinghouse requires the students' name and date of birth to locate an educational record. Prior to 1996 we did not request information on date of birth, just age. So, for many participants in the early years of the programs we are unable to determine their post-program status. Also, name changes, different spellings of names, or the use of the nicknames may also result in non-identification of participants.

Of the 3,110 students involved in Pre-College Pipeline Programs between 1987 and 2010, 22 percent are in the K-12 age group. Thirty-seven percent of our past participants are aged 18 to 24, the age group for traditional college students. NSC records were found for 47 percent of these students. For the group aged 25 years and older, only 25 percent were located by NSC. In sum, information on college participation and degree attainment is available for just 35 percent of those 18 years of age and older. Because of the incomplete nature of the data collected to date, the following findings should be considered as illustrative and not representative of the entire cohort of participants.

Information from the National Student Clearinghouse and other sources identified 213 former participants as having graduated from an institution of higher education, specifying credentials and fields of study for 210 of those individuals.

In comparison to national and state data on STEM participation and degree attainment, the Pipeline participants attain a higher percentage of their bachelor's in STEM fields than do their ethnic counterparts in the United States and in Minnesota. Using data from the National Science Foundation and calculating the average percentage of STEM fields represented among all baccalaureate degrees earned in the United States by students between 1997 and 2006 (NSF 2009, Table C-6), all ethnic groups in the Pipeline cohort, except American Indians, had higher proportions of STEM degrees than their peers.

Nationally, on average, STEM degrees represent 31 percent to 32 percent of the bachelor's degrees earned by whites, blacks, Latinos, and American Indians. Asian Americans average 48 percent of their degrees earned

in STEM fields. For the Pipeline participants, the percentages of baccalaureate degrees earned in STEM fields range from 46 percent for blacks to 68 percent for Asian Americans. For the state of Minnesota, 19 percent of the bachelor's degrees awarded in the 2007-08 academic year went to students of color in STEM fields and 15 percent of those awarded went to white students in the STEM fields (Minnesota Office of Higher Education 2009).

The results from this retrospective study tend to confirm the reports of students and parents that program participation influenced decisions on college participation, choice of type of institution, and field of study. In sum, a high proportion of past participants for whom there are data attended four-year institutions and earned credentials in STEM areas at rates proportionately higher than those for their Minnesota and national counterparts. As noted above, given the limitations of the methodology for identifying past participants' enrollment history, this group is not a randomly drawn sample of the entire group of past participants. Nonetheless, it appears that program participation is related to eventual college enrollment, choice of major, and degree attainment patterns.

The NSC data indicate that former participants in St. Cloud's pre-college programs attend or attended a wide variety of educational institutions. The 884 students for whom NSC has data attended 376 different institutions in 38 states (see Table 2, in Supplemental Materials in the Spring 2011 edition of *CURQ on the Web*). The highest percentage of students (29 percent) attended public two-year institutions, followed by public four-year institutions (27 percent), a combination of two- and four-year public colleges (12 percent), private four-year institutions (12 percent), a combination of two- and four-year public and private schools (10 percent), and a mix of public and private four-year schools (10 percent).

Enrollment patterns of this sample of past program participants reflect the mobility of college students reported by Adelman (2006). In general, 67 percent of those for whom we have NSC data attended only public colleges and universities. Another 20 percent went to both public and private colleges; and the other 13 percent attended only private colleges. While 30 percent of students attended two-year public schools, almost half of the participants (48 percent) had enrolled only in four-year colleges, whether public or private. Another 22 percent had experienced both two- and four-year schools. The large number of former participants going to public institutions underscores Bowen and colleagues' (2009) recent focus on the role of the public university in improving educational attainment in the United States among students of limited or moderate means.

While 71 percent of the 884 Pipeline participants located enrolled in Minnesota colleges, others enrolled in institutions across the country, including historically black colleges and universities, Ivy League colleges, small liberal arts colleges, and major public and private research universities.

Although Minnesota ethnic minorities were less likely to enroll in four-year colleges than white students, enrollment in higher education over all does not vary much by ethnicity for the Pipeline participants (see Table 3, in Supplemental Materials in the Spring 2011 edition of *CURQ on the Web*). Only American Indian students were less likely to enroll in four-year institutions than their counterparts. At the national and state levels, whites are less likely to attend two-year colleges than other ethnic groups and are more likely to attend four-year institutions. However, in our sample, the majority (over 60 percent) of all groups, except American Indian students, attended a four-year school at some point in their educational careers.

Among the 213 former participants identified as having graduated from an institution of higher education, students have earned credentials ranging from one-year certificates to professional and graduate degrees (including the JD, MBA, MD, PhD, and masters). The fields of study include many science and engineering areas and fields based on science or quantitative disciplines, including health sciences, medicine, accounting, and finance. In addition, many fields in the social and behavioral sciences are represented among degree holders. The leading areas of study for credential earners are STEM fields, as defined by the National Science Foundation (see Table 4, in Supplemental Materials in the Spring 2011 edition of *CURQ on the Web*). Thirty percent of the credentials earned were in the social, behavioral and psychological sciences; the life and physical sciences, along with engineering, mathematics, and technology, accounted for another 20 percent; and the health fields represented 10 percent of the credentials earned.

Ethnic differences are present in degree attainment among Pipeline participants. Asians, blacks, multiethnic, and white students are more likely to have attained one or more credentials, including advanced degrees, than are Latino participants or American Indian students. (Students of mixed Latino or American Indian heritage are represented in the multiethnic category.) A higher percentage of Asian participants (62 percent) earned their awards in STEM fields, compared to 54 percent and 44 percent for whites and blacks, respectively. Whites were more likely to earn awards in health fields than were members of other ethnic groups, whereas blacks had a higher percentage of award earners in the social sciences and business.

Females in our sample differed significantly from their male counterparts in earning STEM credentials overall, with 46 percent of females and 60 percent of males earning credentials in these fields. Within the STEM category, females were more likely to earn degrees in engineering and psychology than were males. Females were also more likely to earn credentials in the arts and communications and health fields than were males. Males were more likely to earn certifications in business, computer science, and social-science areas than were females.

Faculty Involvement and Impact on Undergraduate Research and Studies

As the nation continues to grapple with the long-standing issues of minority underrepresentation in STEM fields and the need for human resource development, programs of long tenure, such as our Pre-College Pipeline Programs, may have some beneficial insights and experiences for other institutions. In our experience, not only do K-12 students benefit from the programs, but so do undergraduates and graduate students because faculty mentors take lessons learned from the summer research activities back to the classroom and lab for use with their college students.

Faculty members from a number of departments are actively involved in our pre-college programs. Departments represented by faculty mentors include astronomy and physics, biological sciences, chemistry, computer science, engineering, environmental and technological studies, ethnic studies, information systems, mathematics, political science, sport science, sociology, and statistics. Active faculty involvement is the key to the success of the summer programs. Research activities, laboratory experiments, readings, pedagogical techniques, and classroom exercises employed by faculty for undergraduates are adapted for use in the summer programs with high school students.

Faculty involvement in the precollege programs enriches their work with undergraduates. Faculty members who participate in the pre-college programs report that their teaching and research experiences with undergraduates are informed by their involvement with high school students. For example, a professor of information systems writes, "camp student experiences helped me to understand the intricacies/potential issues college students are likely to encounter in conducting forensic examinations." An engineering professor explains why working with high school students is helpful to his college teaching: "I rarely see students before their second or third year of college. Seeing them before starting college helps give me a better feel for where they are starting." In other cases, materials and techniques that faculty adopted for use with the precollege program participants were introduced in undergraduate courses.

In a more extended comment on the summer participants, a chemistry professor notes:

> *This program has enhanced the research in our laboratory in two ways. First and foremost, the students involved in the program have been very capable of engaging in our work at a high level. Because of this, I began including these students in our yearly research agenda by designing experiments and projects that could be completed in a relatively short time. Because my undergraduate students are involved in developing these plans, it allowed them to analyze the flow of the project and design the best scenario for moving the projects forward. Second, the upper level undergraduate students are asked to assist the SDP and APTS participants with their experiments. This gives our undergraduate students valuable experience in teaching complicated concepts, as well as gaining scientific insight into their project. All of the undergraduate students working in my laboratory who were involved with the SDP and APTS program have recognized it as an important and*

worthwhile opportunity. Overall, the SDP and APTS programs have had a significant and positive effect on my undergraduate research program.

While there may be common ground between undergraduate research and teaching and involving high school students in scientific pursuits, working with high school students can be challenging for some faculty and staff without K-12 teaching experience. The relative immaturity of many high school students, their lack of familiarity with college norms, and the level of preparation of some participants are problematic for college professors. Having students from different cultural backgrounds or urban environments adds to the complexity of participant-faculty interactions.

The program administrators and student counselors play an important role in reducing, mediating, and resolving potential and actual problems. Clear articulation to both students and their parents, prior to and upon the arrival of participants, of our expectations and what constitutes appropriate behavior helps to address this issue. Reminding students of rules and policies and enforcing them when problems begin to occur are other effective means of reducing disciplinary problems and of maintaining the academic focus of the programs.

Conclusion

In addition to faculty and departmental support and involvement, other key factors in sustaining pre-college programs include institutional commitment and "ownership;" fund-raising; dedicated staff; innovative and interesting curricula, research activities, and programs; clearly articulated expectations for students; and meaningful collaboration with parents, schools, and community groups.

Institutional commitment means that the college or university invests in the program with financial, human, and capital resources. The program is not viewed as a standalone or add-on or disposable unit that must depend on external funding for its existence. Our Pipeline programs have a line item in the university budget. This funding provides a base of support, which is used to secure external funding by demonstrating the institution's commitment to this effort. It also serves as matching funds for state, federal, and private grants. In addition to funding, the university community views these programs as part of the university's regular operations. Many nonacademic departments and units are involved with the operations of the Pipeline programs, including campus housing, buildings and grounds, food service, public safety, the business office, and sports and recreation. These and other units include the Pipeline programs in their annual planning. Besides faculty and college students, other members of the campus community feel a sense of ownership of these programs.

In addition to funding from the university, the Pipeline programs have been started and supported with funds from state and national programs designed to address underrepresentation in STEM fields or in higher education (e.g., from the National Science Foundation, Department of Energy, the Minnesota State Colleges and University system, the Minnesota Office of Higher Education) and from foundations and private industry.

St. Cloud State's experience with pre-college programs demonstrates how such an undertaking can address a national need, benefit participants, and contribute to the undergraduate research and teaching enterprise throughout an institution of higher education.

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Supplement to Using Summer Research to Attract Pre-College Underrepresented Students to STEM Fields

Table 1. St. Cloud pre-college programs and participants' demographic profiles.

	Math-Science-Computer Camps	Scientific Discovery Program	Advanced Program in Technology and Science	All Programs
Inception	1987	1991	2000	
Years of Operation (Between inception and 2010)	24	18	10	
Grade Levels Served	2nd to 8th	9th, 10th	10th - 12th	
Demographic Profiles				
Total Number of Participants	2,798	374	113	3,110
Gender	(in %)	(in %)	(in %)	(in %)
Female	58	61	53	58
Male	42	39	47	42
Ethnicity	(in %)	(in %)	(in %)	(in %)
African/African American	47	46	52	46
American Indian	5	2	1	4
Asian/Asian American/Pacific Islander	11	16	15	11
Latino	5	5	8	5
Multiple Heritage	14	5	6	13
White	18	24	18	20
Other/Not Reported/Unknown	1	1		1
Participant Income Levels	(in %)	(in %)	(in %)	(in %)
Low	56	26	32	54
Medium	26	25	36	14
High	9	17	29	19
Not Reported	10	32	3	13
Geographic Information	(N)	(N)	(N)	(N)
Cities and Towns	210	113	51	264
States Represented	21	22	10	30
Countries	1	3	3	5
Percent Minnesota Residents	98%	93%	83%	96%
Participation Rate	(in %)	(in %)	(in %)	(in %)
Once	72	100	84	72
Two or more times	28	Not Applicable	16	28
From		**To**		
# from Other Pipeline Programs	MSCC	SDP	APTS	
MSCC		104	33	
SDP			54	
APTS				
From		**To**		
% from Other Pipeline Programs	MSCC	SDP	APTS	
MSCC		28%	29%	
SDP			47%	
APTS				

Table 2. College enrollment of pipeline participants by control and level of institution.

All Students (N = 884)	Control (% of Students Attending Public, Private Institutions, or Both Types)			
Level (% of Students Attending 2-Year, 4-Year Institutions, or Both)	Public Only	Private Only	Both	**Total Level**
2-Year Only or Less*	29%	1%	1%	30%
4-year Only	27%	12%	10%	48%
Combination of 2-Year and 4-Year	12%		10%	22%
Total Type of Control	67%	13%	20%	100%
*Two students enrolled in one-year programs. One of them also attended a two-year institution.				

Table 3. Undergraduate enrollment by race/ethnicity and institution type (in percentages).

	Pipeline Sample				Minnesota*		National**	
Racial/Ethnic Group	N=	Only 2-Year or Less	2-Year and 4-Year	Only 4-Year	2-Year or Less	4-Year	2-Year or Less	4-Year
American Indian	16	69	12	19	60	40	50	50
Asian	101	28	25	47	47	53	46	54
Black	416	31	20	49	69	31	46	54
Latino	27	33	22	44	53	47	51	49
White	218	25	23	51	44	56	40	60
Multiple Heritage	104	36	22	42	Not Available		Not Available	
*** Source: (Minnesota Office of Higher Education 2009, data for fall 2007)**								
****Source: (National Science Foundation 2009). Data from Tables B-3 and B-4 used to calculate the mean percentage of total enrollment between 2-year and 4-year institutions between 1998 and 2006.**								

Table 4. Fields of study of pre-college pipeline participants with earned academic credentials*.

	N=	Percent
Non-STEM		
Arts, Humanities, Communications	42	20
Business	29	14
Education	11	5
Vocational-Technical	2	1
STEM and Related		
Computer Science, Engineering, Technology, Mathematics	12	6
Life or Physical Sciences	29	14
Psychology, Social or Behavioral Sciences	64	30
Health, Medicine, Nursing	21	10
	210	100

***If a person holds more than one credential and one is in a STEM or health-related field, the person is counted in that category. For example, a person holding a B.S. in chemistry and a master's in education is counted in the Life-Physical Sciences category. Otherwise, the field of the highest degree is used to classify participants.**