Evaluation of the Douglass Houghton Scholars Program (DHSP):
Second Year, Executive Summary

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I used to complain about this class last semester all the time and I dreaded coming... It was my least favorite class and I almost dropped... now this semester it’s like the only class I look forward to coming to because everything, the fact that the [worksheets] are shorter and we actually get rewards for like doing the worksheets and I feel like there’s a lot more feeling of completion than last semester and I feel a lot better and less lost at the end of a worksheet now.

I feel like after we’ve done problems in this class, like types of problems, not specific problems but types of problems, I feel a little bit more confident explaining to other people if they ever ask me, like sometimes maybe not like what it means but like I feel more confident doing the problems, showing people how to do them and then I do feel a little bit more confident explaining what it means.

These two quotes from two students who took two semesters of the DHSP capture the essence of the development of the program this year. My charge in this project has been to take the necessary steps to document the impact of DHSP in order to determine whether the program should continue.

The Douglass Houghton Scholars Program [DHSP] program has been spearheaded by Bob Megginson, LSA Dean of Undergraduate Education at U-M, who received support from the Ford Foundation to start a program that would attend to the needs of underrepresented first year students with interest in the sciences. Modeled after the Emerging Scholars Program, DHSP consists of two courses, Math 145 and Math 146 that are taken concurrently with Math 115 in the Fall term and with Math 116 in the Winter term, respectively. Each course carries 2 credits and meets twice a week for two hours, and it is delivered to two sections each term to accommodate up to 40 students.

The evaluation of the second year of the DHSP reports on operational aspects of the program and on students’ outcomes. In this summary I highlight the main findings and the recommendations for the following year.

Questions addressing issues of organization include:

• What elements of the program are working well?
• What elements of the program need to be reconsidered?
• What elements of the program do DHSP students value the most?

Questions addressing impact on students include:
• Do Douglass Houghton Scholars realize their intentions of pursuing a STEM degree more frequently than students who are not in the program?
• Do Douglass Houghton Scholars earn better grades in their calculus courses than students who are not in the program?
• Do Douglass Houghton Scholars maintain better grade point averages (GPAs) than students who are not in the program?
• Do Douglass Houghton Scholars have a better understanding of calculus concepts than students who are not in the program?
• Do Douglass Houghton Scholars have a better attitude towards mathematics than students who are not in the program?

In addition to Bob Megginson, the following people have contributed to the operation of the program: Jeannette East, Marjorie Horton, Susan Perreault, Claire Sandler, and Paula Trail (LSA), and Mark Conger, Bert Ortiz, and Karen Rhea (Mathematics).

Main Findings, Second Year

The program started in Fall 2007 with 30 students distributed in two sections; fifteen students did not take the second term of the workshop.

1) Three areas are working specially well: overall goals of the workshop, advertising, data availability:

a) The interviewed faculty and staff associated with the program indicated that the program helps students in building their confidence, encourages them to take risks, and give them an opportunity to create strong relationships. In spite of the loss of students experienced from the Fall to the Winter term, the overall impression is that for the students who completed the full year of the program, the experience was quite valuable.

b) Program advertising worked smoothly; the brochure was revised to include pictures of the first cohort of DHSP, which added a personal touch to it.

c) Data (admissions, applications, course data) in various forms (excel, CTools) and at several stages was always available which facilitates the operation and the evaluation of the program

2) After a difficult start, the workshop delivery was comparable to what was done the previous year:

a) Mark Conger, who took over the facilitation of the workshop after Bryan Mosher left in Summer 07, did not receive appropriate support to transition smoothly into the instructor role that is favorable for the workshop. Some student losses were due to the instructional approach used in the Fall.
b) Mark introduced changes (e.g., shorter worksheets, mathematical competitive
games, speakers, classroom interaction) that dramatically changed the
dynamics of the workshop, resulting in a very rewarding experience for all
involved. Students in the second term felt that the workshop was very useful.

3) Areas that need attention are recruitment, retention, and administrative
oversight:

a) Recruitment: This activity is very labor intensive, as it involves face-to-face
interviews, e-mail follow-ups and phone conversations during all summer.
Karen Rhea did most of this with assistance from the advising office.
Students indicated receiving conflicting information from different sources
(brochure, advising, class) about what the workshop was about and felt
dissatisfied by the discrepancy. Additionally, because the program is designed
only for students eligible to take Math 115 in the Fall, students who do not
place in or who place out of Math 115 become ineligible for the program.
This means that efforts that are invested in reaching out to potential students
do not come to fruition because students can’t enroll in the program. In the
third year, out of the 160 students who were sent invitations to participate in
the program, 35 students were recruited.

b) Retention: The high proportion of students who did not return for a second
term was due in part to student dissatisfaction with the program (stemming
mostly from the perceived mismatch between information describing the
program and what it actually delivered). Conflicting schedules were the
second reason for dropping the second term.

c) Lack of consistent administrative attention: As anticipated in last year’s
report, the lack of a workshop director, responsible for overseeing the
operative aspects of the program and the communications between the
different people might have been in part responsible for some of the
difficulties that were experienced. Such person could have alleviated the
impact of Bryan’s departure in June, assisted Mark in the transition into the
program, and provided early alerts that things needed to be reconsidered at
the implementation level. Each of the individual aspects of the program
seems to be working well, as all the necessary tasks were accomplished but
the impression is that there is not enough attention to the overarching
operation of the program, with communications occurring sporadically
among participants.

4) In spite of a difficult first term, students were able to develop a sense of
community in the second term, appreciated having the program as it offered
‘extra assistance,’ and acknowledged that the program challenged them
intellectually:

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1 At the time of the writing of this report, 30 students were actually in the program, due to various scheduling conflicts.
a) At the end of the year, students said they developed an appreciation for their classmates, a feeling that contrasted highly with the negative attitude of the first semester. I include four quotes, two from the first term and two from the second term, so the reader can appreciate the magnitude of the change:

Fall:

I think that not only should we do more work in class that has to do with 115, but when the advisors and when whoever sponsors this class sends out the pamphlets they should tell you exactly what it is and not lie. (Male student, Section 1)

I had no idea that we could do that [ask other groups how they are solving a problem] and I think it would be nice if at the beginning of the course we were told that we could. We would have asked to. (Female student, Section 2)

Winter:

M: I think we’re deviating from the subject here.
KJ: Yeah I think we totally got away.
BC: All right King James.
KJ: All right Big Cactus. (laughter)
M: That side of the table’s pretty quiet.
MS: See? This would never happen with my team homework group.
Vilma: No?
M: They don’t have a sense of humor?
MS: They actually don’t.
M: There’s no laughing?
MS: There’s no laughing.
M: It’s not allowed.
MS: They would just like stare at you.
BC: And Big Cactus says laughing breeds learning. (laughing) (Exchange between two female and two male students)

It allows you to ask questions more and... you’re kind of in more (sic) environment where you’re expected to participate and that’s better because in the regular classes you just sit there, you don’t really have a relationship with the teacher and I think that’s a big thing because in high school I had really strong relationships with all my teachers. Here it’s hard to in college and in this class it’s kind of nice that you can have that. (Male student)

b) Students in all focus groups indicated that having the workshop was beneficial because they received extra assistance, in the form of a second mathematics professor who cared about them. Several students highlighted how Mark was available and concerned for how they were performing in their math class.

c) Students indicated that in the workshop they were expected to participate and that they learned more complex and abstract material, which allowed them to reinforce what they were learning in the regular math course. In addition, students felt that in the workshop they were learning to explain ideas to each other and that they were encouraged to do demanding work.
Students felt a great sense of accomplishment when they were able to solve difficult problems on their own.

We talk about math like in a more abstract way as opposed to like just stuff that we learn out of the book. I think somebody already said that but I’m kind of like restating it. I guess I’m agreeing with them. (Male Student, Section 1, Fall Focus Group)

It helps you with your problem solving skills because we do problems that aren’t just like learn a step-by-step equation, use it. The problems that we use are more complex (inaudible). Which can really help for the exams, (Male Student, Section 2, Fall Focus Group)

I like using what we know or are familiar with in a context of more formal proofs and more abstract stuff (Male Student, Winter Focus Group)

Even during class, the group work, it definitely taught me how to explain math concepts in words because before that I really was clueless, so that was definitely a big help for me. (Female Student, Winter Focus Group)

5) One year after the program, the students have very favorable impressions of the impact of the workshop on their ability to do math and to study other subjects, but indicate the program did not influence their major selection:

a) Eight students from the first cohort of the program participated in a follow-up interview. The responses reflect the feeling of students who were available and willing to talk about the program and thus, theirs is an overall positive appraisal of the program. There were 7 female students; one of them had transferred to another Michigan university to pursue a secondary mathematics education program. At the time of the interview, one student was taking Math 116, another was taking differential equations, and two were taking linear algebra; one of these two students was also taking a mathematical proof class. Two of the other four students had taken Stats 350 (in their words, “not really a math course”). Four students had declared a major in sciences (biology, environment), two had declared social sciences majors (political science and economics and education), one had chosen a humanities major, and one had not decided, but was inclined towards biology. Three students said that they felt that they were not doing as well as they had expected when they first came to Michigan.

The most beneficial aspects of the program for these students were the emphasis on problem solving and the thinking process they developed as a consequence. They could transfer strategies onto other classes (e.g., physics, chemistry, mathematics, and economics). Students felt that the program gave them the opportunity to worked harder, have more time to think about mathematics, and practice it more. The program challenged them and prepared them for taking tests. And they liked returning to the same group of students. They mentioned these as reasons they had for taking the two semesters of the workshop; they did not mention that they had signed a ‘contract’ to take two semesters of math. A third benefit was the sense of
community, as most of them are still in contact with other students in the program. No disadvantages were mentioned. Only three students said the program was influential in helping choose a major. The other five students said they already knew what they wanted to do. Suggestions for improvement included having visitors during class time, having more social and sports events (volleyball and ultimate Frisbee), adding one hour in which the students check what they are doing in the regular math course or running the program three, rather than two days a week. Aspects they would like to see continuing were the group work component, the worksheets, the practice tests, the facilitator, and the diversity of the students.

**Potential Impact on Students' Success**

Two control samples were used for the comparison. The first control sample (Full-Control, F-Control) consisted of students who completed all applications of the knowledge and attitudes survey; the second control sample consisted of a matched sample of students (M-Control) who had background and grade data but not the responses to the surveys. This sample was selected because the DHSP and FC samples differed in terms of ACT scores and math placement scores (see Tables 1 and 2, p. 12).

1) The available data suggests that participation in DHSP may influence intentions to pursue a STEM degree, retention in mathematics courses, and grades in Calculus I and II:

a) Seventeen DHSP students (57%) indicated an interest in a science major at the beginning of the year and only 7 (23%) indicated an interest in majoring in a STEM degree (Biology, Chemistry, and Biochemistry) at the end of the year (Table 3, p. 12). This proportion is lower than the one third from the first year, which might be due to the high attrition in the second term. At the end of the year one DHSP minority student (3%) and four female students (13%) indicated an interest in pursuing a STEM major (Table 4, p. 13).

b) Nineteen DHSP students (54%) enrolled in a math course in the second term of their first year, compared to 9 of the students in the full control sample (45%) and 5 (13%) of the matched sample. The figure includes four students who did not take DHSP the second term but who enrolled in Math 116. The figure for the full control sample is higher than historical enrollment of LSA students in a second mathematics course in their second semester of their first year. The figure for the matched sample is lower than historical data. The difference between DHSP and control students is significant. There

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2 The absolute figure of ethnic minority students who took Math 115 and Math 116 in their first year and who are pursuing a STEM field is higher than historical data. In Fall 03, of the 36 students who took Math 115 and Math 116 in their first year and were majoring in a STEM program, 0 were ethnic minorities. In Fall 04 of the 31 students who took Math 115 and Math 116 in their first year and were majoring in a STEM program, 4 were ethnic minorities.

3 Data from students entering in Fall 03 and in Fall 04, whose characteristics are comparable to the target population suggest that around 18% of LSA students take Math 116 in Winter, after taking Math 115 in the Fall.
were 10 female students (33%) and 2 (7%) ethnic minority students taking a second mathematics course. The figure for ethnic minorities is numerically (not proportionally) aligned with data from 2004 and 2005.

c) DHSP students obtained higher grades in their math courses than students in the other samples (Table 5, p. 13). Students who took DHSP for the year and who took both math courses, also had a higher GPA than the students in the control groups. The difference between the DHSP and the matched control sample is statistically significant at $\alpha = .10$. More DHSP students than control students earn grades higher than B-, and simultaneously, fewer DHSP students than control students earn grades below B- (Figure 1). The differences in the second term (Math 115) are statistically significant. Similar to the results in the first year, the proportion of DHSP students obtaining a grade of B- or higher was lower in Math 116 than in Math 115, but both proportions are statistically significant higher than the historical data\(^4\).

![Figure 1](image)

Figure 1: Distribution of grades for the three groups in (a) Math 115 and (b) Math 116.

Four of the 6 minority DHSP students who took Math 115 got a B- or more in the class whereas 2 out of the 3 minority students in the full control sample and 5 out of the 10 minority students in the matched sample did so. The numbers are small, but at least proportionally, the DHSP minority students fared better in terms of grades in Math 115 than students in the control samples. In math 116 one of the 2 DHSP minority students obtained a B- or more, and the 2 minority students in the full sample obtained a B- or more in Math 116. The three minority students in the matched sample who took Math 116 in the second term got a C or less in their final grade.

Twelve out of the 13 female DHSP students who took Math 115 obtained a B- or more, compared to 4 out of 7 in the full control sample, and 14 out of 19 in the matched sample. Proportionally, DHSP female students did better in Math 115. Three out of the six female DHSP students obtained a B- or

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\(^4\) In 2004-2005 39% of students obtained a B- or more in Math 115 and 28% obtained a B- or more in Math 116. In 2003-2004, 51% and 45% of students obtained a B- or more in Math 115 and Math 116, respectively.
more in the course, compared to 1 out of three in the full control sample; the three females in the matched sample got a C or less in Math 116.

2) Participating in DHSP improves substantially students’ performance in a non-course test of calculus learning. Participation in the program, however, did not affect students’ attitudes towards mathematics. Students in DHSP report studying mathematics a similar number of hours than students not taking DHSP.

a) DHSP students’ performance on an independent test of calculus learning (Epstein, 2005) improved significantly from the first to the mid-year application; the increment observed from the mid-year to the end-of-year was not significant (Table 6, p. 14). The effect size of the intervention on the DHSP group was .94, almost one standard deviation, which is very high for educational settings. The standardized gain, from pre- to end-of-year test was .43. Similarly to the results in the first year, the fall semester had the most impact on student’s learning of calculus for DHSP students. Males performed better than females in each test, but the difference was not statistically significant. Non-ethnic minority students performed better in each test than ethnic minority students, but the differences were not statistically significant. For the 8 control students who took both the pre- and the end-of-year test, the difference was not statistically significant ($M_1 = 7.63$, $M_2 = 8.13$; $N = 8$; $t(7) = .46, p > .65$). Comparison across groups is not warranted.

b) Students’ attitudes towards mathematics were measured through four distinct factors, Self-Concept & Anxiety, Mathematics is Interesting and Worthwhile, Group Sense, and Competitive Sense (Table 6, p. 14). There were no differences in any of these measures for the DHSP students.

c) DHSP students reported devoting about 21 hours a week, including DHSP time to different forms of studying and learning mathematics (doing homework, studying for an exam, working in groups, etc.). The figures for both groups were comparable (no statistical significant difference found, Table 7, p. 14).

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5 The survey for the DHSP students had two questions, one that asked for hours devoted to math not counting DHSP activities, and a second one that asked for hours devoted to DHSP activities only. The variable used in the analysis aggregated the two questions and included workshop time.
Recommendations

Recommendation One: Appoint a Workshop Director/Coordinator responsible for all the operative aspects of the program.

During the second year of DHSP less attention was devoted to the program due to the lack of an individual in charge of monitoring its operation. The program was run with the ad-hoc contribution of each of the core members of the group, in particular Karen Rhea, Susan Perreault, and Paula Trail. Consequences of this lack of coordination were (1) less help and time for recruitment and training for Mark Conger (these were done reactively rather than proactively) and (2) few social activities, intended to create a sense of community among DHSP students.

The Workshop Director/Coordinator should be responsible for:

• Hiring the instructors for facilitating the workshop with advice from the Director of the Introductory Calculus Program (Karen Rhea);
• Training and inducting the facilitator(s) into the program;
• Determining and managing budget to ensure and ease the cooperation of the Math Department in providing support for the program;
• Convening regular face-to-face and electronic meetings and maintaining communication with all involved personnel in order to coordinate all the different aspects of the operation of the program;
• Establishing a sense of community among the participating students, beyond their academic work;
• Finding guest speakers for the class;
• Coordinating advertising, recruitment, and advising; and
• Keeping statistics about DHSP students’ progress.

In the second semester, besides the pizza parties prior to the exams, organized by Mark Conger and Paula Trail, Paula Trail and Susan Perreault organized a dinner that included graduate students who shared their impressions about graduate school. Students appreciated the dinner and it was clear they gained important information. A welcome dinner was organized in early October 2008 with the third cohort of students and included students from the previous cohorts; this was a successful event that will continue each fall.

Data keeping was also shared among several people and I secured most of this information for the evaluation of the impact of the program. Karen, Susan, and now Mark have a good system for tracking down students who were invited, who applied, who placed into Math 115, and who were admitted to the program. With this information it would be possible to monitor all these students’ progress for as long as they stay in the university, which would be fundamental to establishing the real
impact of the program on these students. Keeping this student information system should be responsibility of the Workshop Director/Coordinator; such a system would facilitate the labor of seeking funds to sustain the program, by keeping statistics of progress in key variables.

**Recommendation Two: Continue collecting data on students and a comparable sample of students who did not participate in the program.**

Similar to results from the first year, the observed trends are promising and continue to be better than expected given historical data. The lack of significance in some of the measures together with the difficulty of securing a good control group may raise questions about the real impact of the program. The comparison with a matched sample suggests that in standard measures of achievement DSHP students who take two courses of mathematics do better than students who do not. Although a matched sample of students has a comparable cumulative GPA than the DHSP students, we can speculate that the comparable GPA is because the students are not taking the more rigorous and challenging mathematics courses that might affect the GPA. When GPAs are compared between students who took two math courses, the difference is in favor of the DHSP students. Naturally, the small sample size limits the power of this assertion, but given that the trend was similar in the first year, we could expect that as a larger sample is created, the differences will be stronger.

Similar to the findings from last year, this year’s data do not support the notion that time spent on mathematics activities may account for the better performance of DHSP students. DHSP students and students taking 2 semesters of calculus in the control sample reported that they spend about the same time, between 19 and 21 hours per week, studying mathematics. These figures are high, which suggest a potential student bias in responding the question itself. The comparability of the figures between the two samples suggests that the bias is shared, however. A possible explanation for the similarity is the physical availability of time. With a course load of 15 credits, students must allocate their time so that they can fulfill their obligations in each class, and they do so independently of the setting. The availability of a control group is crucial for determining the extent to which the ‘extra’ number of hours devoted to the Workshop could be a factor for the slightly higher scores. From the data available it seems that this is not the case, that is, extra time does not seem to be a plausible explanation for the slight increase in grades in the math courses. Thus, what students do with that time seems to be what makes a difference.

Self-selection is an important threat to the validity of these results. In this case, the students are invited to the program and it takes, as indicated above, a considerable effort to convince them that this is a right choice for them. In the absence of a

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6 Vos (1991) reported that when students report spending about 41 hours a week in in-class and out-class activity and that this number is maintained when contact hours are increased or decreased. The study was done with over 400 Danish first- and second-year students in five universities and 18 disciplines. The estimates for the US of hours students spend studying per contact hour is 1 (Brittingham, 1988)
sample of students that would be willing to take the class but elected not to take it\textsuperscript{7}, this bias must be controlled statistically, once the impact on key outcome variables is shown to be statistically significant. Working with the matched control sample that differed from the experimental sample on the participation in DHSP showed that there were advantages for the DHSP group. An ideal sample would match the DHSP students not only on prior characteristics, but also in the courses taken during their first year. Because in the 2008-2009 year all students enrolled in Math 115 took the Calculus Concept Inventory, and all students targeted by the program were sent the attitudes survey, we anticipate a better comparison sample for the third cohort.

The current data indicate that there were no changes in DHSP students regarding self-concept and anxiety, their perception of the value of group work, their competitive sense, or the belief that mathematics is worthwhile and interesting. This might be a consequence of the selection bias that exist in the sample. Students want to be in the program and thus participating in it does not necessarily change their interest in mathematics or sciences.

The students in DSHP are ‘required’ to take a second math course and are given a ‘contract’ that they sign at the beginning of the year. Not all students in the second cohort received or completed the contract, however. This makes the proportion of students in DHSP who took a second math course somewhat impressive (19 out of 30, 63%), even though it might not a good measure of the impact of the program because some students did sign the contract. Of the 38 students who matched most of the DHSP students’ characteristics only 5 (13%) enrolled in a second course. Taking a second mathematics course will increase the opportunities for, and eventually the likelihood that, students will major in a STEM program. One fourth of the original sample indicated an interest in a STEM major, which is higher than historical data has shown\textsuperscript{8}. But perhaps the most important impact regarding taking two courses is for minority students. The proportion of minority students taking a second mathematics course and majoring in a STEM field is higher than historical data. This is an important accomplishment that needs to be highlighted, as it puts in perspective the importance of the program for ethnic minorities at U-M.

Finally, it is important to continue with the original plan for data collection regarding impact on students. The plan includes interviews with the students one and two years after the program is completed and follow-up regarding their decision of selecting a STEM major. Other measures, such as degree completion rates and performance need to be obtained as well. This information will provide a better picture of the impact of the program in the long term.

\textsuperscript{7} In an ideal situation from the point of view of impact evaluation, there would be at least three times as many applicants as available spots in order to randomly assign students into the treatment, that is the program.

\textsuperscript{8} Of the 202 first year LSA students who took Math 115 in Fall 03, 36 (18\%) took a second math course and 23 (11\%) majored in a STEM field. Of the 168 first year LSA students who took Math 115 in Fall 04, 31 (18\%) took a second math course and 12 (7\%) majored in a STEM field.
### Appendix: Supporting Tables

#### Table 1: Frequency and Percent of DHSP and Control Students by Gender and Ethnicity

<table>
<thead>
<tr>
<th></th>
<th>DHSP (N = 30)</th>
<th>Full Control (N = 20)</th>
<th>Matched Control (N = 38)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>16 (53%)</td>
<td>13 (65%)</td>
<td>19 (50%)</td>
</tr>
<tr>
<td>White</td>
<td>21 (68%)</td>
<td>15 (75%)</td>
<td>20 (54%)</td>
</tr>
<tr>
<td>Black</td>
<td>2 (7%)</td>
<td>1 (5%)</td>
<td>4 (11%)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>4 (13%)</td>
<td>1 (5%)</td>
<td>4 (11%)</td>
</tr>
<tr>
<td>Asian or Native American</td>
<td>4 (13%)</td>
<td>3 (15%)</td>
<td>6 (11%)</td>
</tr>
</tbody>
</table>

#### Table 2: Mean and (Standard Deviation) for ACT, Math Placement Score, Number of Credits, and GPA for DHSP and Control Students.

<table>
<thead>
<tr>
<th></th>
<th>DHSP (N = 30)</th>
<th>Full Control (N = 20)</th>
<th>Matched Control (N = 38)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACT</td>
<td>28.7 (2.30)</td>
<td>25.8 (1.54)***</td>
<td>28.8 (2.19)</td>
</tr>
<tr>
<td>Math Placement Score</td>
<td>19.2 (2.85)</td>
<td>17.2 (4.02)*</td>
<td>18.7 (3.01)</td>
</tr>
<tr>
<td>Num credits</td>
<td>30.53 (2.7)</td>
<td>29 (2.85)</td>
<td>28.84 (3.58)</td>
</tr>
<tr>
<td>GPA</td>
<td>3.02 (.39)</td>
<td>3.00 (.43)</td>
<td>3.08 (.54)</td>
</tr>
</tbody>
</table>

Notes: * ACT scores available for 27 DHSP students. ** The difference between DHSP and Full Control scores is statistically significant at $\alpha = .05$. *** The difference between DHSP and Full Control scores is statistically significant at $\alpha = .001$.

#### Table 3: Frequency and Percent of DHSP and Control Students Interested in a STEM Major and Taking Math Courses.

<table>
<thead>
<tr>
<th></th>
<th>Fall Term</th>
<th>Winter Term</th>
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<tbody>
<tr>
<td></td>
<td>DHSP (N = 30)</td>
<td>F-Control (N = 20)</td>
</tr>
<tr>
<td>STEM interest</td>
<td>12 (40%)</td>
<td>-</td>
</tr>
<tr>
<td>Math Course</td>
<td>30 (100%)</td>
<td>20 (100%)b</td>
</tr>
</tbody>
</table>

Notes: a. Students who had declared a STEM major at the end of the term. b. The figure includes two students who transferred to Math 110 after the first midterm. c. Includes 6 students who took Math 116 but did not enroll in a second semester of DHSP. d. Includes three students enrolled in Math 115. e. Includes one student who withdrew the course.
Table 4: Frequencies of Intended Major by Group for Minority and Female Students.

<table>
<thead>
<tr>
<th></th>
<th>End of First Term Major in Science?</th>
<th>End of Second Term Major in Science?</th>
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<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Minority Students</td>
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<tr>
<td>DHSP (N = 30)</td>
<td>5</td>
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<tr>
<td>F-Control (N = 20)</td>
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<td>3</td>
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<tr>
<td>M-Control (N = 38)</td>
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<td>NA</td>
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<tr>
<td>Female Students</td>
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<td></td>
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<tr>
<td>DHSP</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>F-Control</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>M-Control</td>
<td>NA</td>
<td>NA</td>
</tr>
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</table>

Table 5: Mean and Standard Deviation of DHSP and Control Students by Grade in Course and by Cumulative Math GPA, by Term.

<table>
<thead>
<tr>
<th></th>
<th>Fall Term</th>
<th>Winter Term</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DHSP (N = 30)</td>
<td>F-Control (N = 20)</td>
</tr>
<tr>
<td>Final Grade in Math Course</td>
<td>2.79 (.72)</td>
<td>2.07 (.80)**</td>
</tr>
<tr>
<td>Term GPA</td>
<td>3.02 (.39)</td>
<td>3.00 (.43)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>DHSP (N = 19)</td>
<td>F-Control (N = 6)</td>
</tr>
<tr>
<td>Final Grade in Math Course</td>
<td>2.84 (.64)</td>
<td>2.51 (.54)</td>
</tr>
<tr>
<td>Year Math GPA</td>
<td>2.94 (.53)</td>
<td>2.43 (.60) †</td>
</tr>
<tr>
<td>Term GPA</td>
<td>2.96 (.54)</td>
<td>2.83 (.25)</td>
</tr>
<tr>
<td>Cumulative GPA</td>
<td>3.02 (.42)</td>
<td>2.88 (.30)</td>
</tr>
</tbody>
</table>

Notes: a. Includes students who took Math 110. b. Includes students who took Math115. c. Excludes one student who withdrew the class. †. The difference between the control and the DHSP group is statistically significant at $\alpha = .10$. * The difference between the control and the DHSP group is statistically significant at $\alpha = .05$. ** The difference between the control and the DHSP group is statistically significant at $\alpha = .01$. *** The difference between the control and the DHSP group is statistically significant at $\alpha = .001$. 
Table 6: Means and Standard Deviations of Measures of CCI and Attitudes for DHSP and Full Control Sample.

<table>
<thead>
<tr>
<th></th>
<th>DHSP (N = 14)</th>
<th>F-Control (N = 20)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-Test</td>
<td>End of Year</td>
</tr>
<tr>
<td>Calculus Concept Inventory</td>
<td>8.70 (3.29)</td>
<td>13.57 (3.90)</td>
</tr>
<tr>
<td>Self-Concept &amp; Anxietya</td>
<td>2.26 (.54)</td>
<td>2.54 (.64)</td>
</tr>
<tr>
<td>Mathematics is Interesting and Worthwhile</td>
<td>3.56 (.56)</td>
<td>3.23 (.78)</td>
</tr>
<tr>
<td>Group Sense</td>
<td>3.49 (.30)</td>
<td>3.40 (.93)</td>
</tr>
<tr>
<td>Competitive Sense</td>
<td>3.50 (.67)</td>
<td>3.47 (.87)</td>
</tr>
</tbody>
</table>

Notes: a. All the items in each scale were measured on a 1-5 scale, with 5 indicating strong agreement. **: The difference between Control pre- and end-of-year test was statistically significant at \( \alpha = .01 \); ***: The difference between Control pre- and end-of-year test was statistically significant at \( \alpha = .001 \).

Table 7: Means and Standard Deviations for Time Measures for DHSP and Full Control Sample.

<table>
<thead>
<tr>
<th></th>
<th>DHSP (N=33)</th>
<th>End of Year (N=15)</th>
<th>F-Control (N=20)</th>
<th>End of Year (N=20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time Workinga</td>
<td>1.81 (.67)</td>
<td>1.22 (.32)</td>
<td>1.36 (.39)</td>
<td>1.55 (.56)</td>
</tr>
<tr>
<td>Time Leisured</td>
<td>2.20 (.91)</td>
<td>2.28 (.88)</td>
<td>1.86 (.55)</td>
<td>2.22 (.67)</td>
</tr>
<tr>
<td>Time on Mathc</td>
<td>10.28 (5.22)</td>
<td>20.63 (8.80)**</td>
<td>9.68 (71.5)</td>
<td>18.87 (12.34)**</td>
</tr>
</tbody>
</table>

Notes: a. Measured in a 1-5 scale indicating the number of hours per week students devoted to working; 1: less than 5 hrs; 2: between 5 and 10 hours; 3: between 10 and 15 hours; 4: between 15 and 20 hours; 5: more than 20 hours. Pre-test is their expectation for their first term. b. Time spent working during Fall. c. Time spent working during Winter. d. Measured in a 1-5 scale indicating the number of hours spent on extracurricular activities that involved recreation. e. Number of hours spent on mathematical activities; pre-test refers to time during high-school; End of term 1 and 2 refer to Fall and Winter respectively, including DHSP time. ** The difference between the pre- and end-of-year test is statistically significant at \( \alpha = .01 \).
References


