AC 2011-2500: THE IDAHO SCIENCE TALENT EXPANSION PROGRAM: FRESHMAN ORIENTATION FOR STEM MAJORS

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The Idaho Science Talent Expansion Program:
Improving Freshmen Retention for STEM Majors

Abstract

During summer of 2010, we conducted a series of freshman orientation programs that were held for new science, technology, engineering and mathematics (STEM) majors at Boise State University. Approximately 320 students were advised in this manner, during seven summer orientation sessions. This was a significant change from previous years, which used a college-specific approach to advising, thereby limiting various retention programs and opportunities designed and promoted by the College of Engineering to engineering majors. The motivation for these changes was a Science Talent Expansion Program award from the National Science Foundation, and the fact that the retention rates for freshmen engineering majors is approximately 10% higher as compared with science and mathematics majors. The grant proposed to (1) integrate the science and mathematics majors with the engineering majors during summer orientation, (2) expand student learning community offerings to STEM majors, (3) create a General Sciences course for STEM students who are underprepared in mathematics, and (4) offer an elective, non-credit bearing mathematics online review course, free of charge, to students entering the university in STEM majors. An underlying and important rationale for widening the advisement base to include all STEM majors in an inclusive manner is the fact that many freshmen are unsure of their major. Therefore orientation materials were prepared that emphasized the commonalities between majors and the underpinning courses and their prerequisites. The results of these four activities, to date, will be presented together with strategy revisions planned for summer 2011.

Introduction

Boise State University, with the largest enrollment and highest academic admission standards among Idaho's public universities, is the state's comprehensive metropolitan research university. The university has been experiencing, year after year, exceptional growth to meet the needs of the area's emerging technology economy. The Boise metropolitan area has recently earned national Top 10 rankings for overall patents, high-tech output, business and career climate, livability, and engineers per capita.[1-5]

The College of Engineering was formed in 1997 as a result of the university's steady growth and diversification coupled with the state's technology boom. Since its inception, the college has grown explosively with more than 60 new faculty, and a 16th place U.S. News & World Report 2010 ranking among public masters level engineering colleges. Since 2000, the college has added one doctorate, six masters and one new undergraduate program, Materials Science and Engineering (2005). In the College of Arts and Sciences, a new masters program in Mathematics was added in 2005, a doctoral programs in Geosciences was added in 2006, and a masters program in Chemistry began in 2010. Two additional doctoral programs are in progress at the university, in Biomolecular Sciences and in Materials Science and Engineering.

Table 1: B.S. STEM degree offerings

College of Engineering	College of Arts & Sciences
Civil Engineering	Biology
Computer Science	Chemistry
Electrical Engineering	Geology, Geophysics
Materials Science and Engineering	Mathematics
Mechanical Engineering	Physics

The undergraduate degree offerings in STEM majors are listed in Table 1. The undergraduate enrollment trend in STEM majors at Boise Stateuniversity since 2004 is shown in Figure 1. Geosciences consists of two majors, Geology and Geophysics, which are grouped together. Mathematics comprises Applied Mathematics (a B.S. degree), the Bachelors of Arts in Mathematics and also the B.S. in Mathematics. There has been a positive trend in enrollment for a number of years.

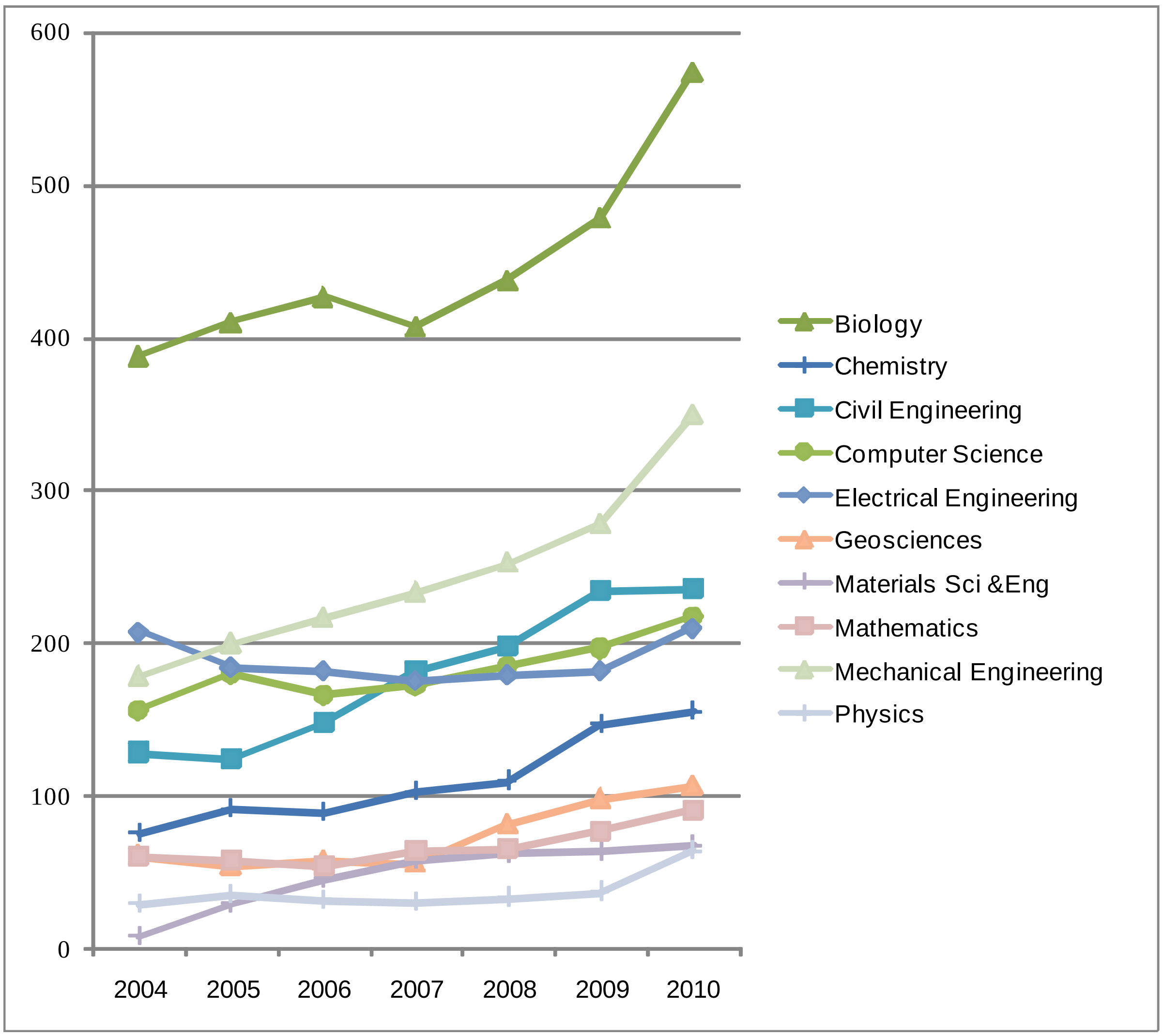

Figure 1: FTE Fall Enrollment

An analysis of STEM degrees awarded shows a total number of Boise State University graduates that has varied between a low of 161 in 2004-2005, and a high of just over 200, see Table 2.

Table 2: STEM graduates, six-year trend

Academic Year	2004	2005	2006	2007	2008	2009
Engineering and Computer Science	96	97	112	91	111	106
Science and Mathematics	65	106	89	73	78	95
Total STEM Graduates	161	203	201	164	189	201

One of the program outcomes of the Boise State University National Science Foundation Idaho Science Talent Expansion Program (STEP) is to increase the first year retention level of first-time STEM freshmen from a weighted average of 57% to a target level of 70%. This level was thought to be a good balance between what had been already achieved by COEN (63.3% in 2007-8) and what might be realistically achieved in a five-year time frame, recognizing that not all students will be retained in any major. This outcome was selected as a step along the path toward increasing the number of STEM undergraduate degrees conferred, which is the program's overarching objective. The focused attention on first year retention is based on the fact that the first-time full time freshman to sophomore retention for majors within the College of Engineering (COEN) is approximately 10% higher than the retention for STEM majors in the College of Arts & Sciences (COAS), see Table 3.

Table 3: First-time full time freshman to sophomore retention

Year	Group	Number in group	% retained at university	% retained in any STEM major	% retained in original STEM group (COEN or COAS)
2005-6	All majors	1755	63.4	NA	NA
	COEN	163	66.9	58.3	57.1
	COAS	77	68.8	51.9	46.8
2006-7	All majors	1867	63.8	NA	NA
	COEN	174	71.8	58.0	55.7
	COAS	97	67.0	47.4	46.4
2007-8	All majors	1900	66.4	NA	NA
	COEN	215	75.8	63.3	60.0
	COAS	90	71.1	52.2	51.1
Average over three years	All majors	1841	64.6	NA	NA
	COEN	184	71.9	**60.1**	57.8
	COAS	88	68.9	**50.4**	48.1

Although a first-time full time freshman to sophomore retention level of 60% is not tremendous, this higher level achieved by the engineering majors at Boise State University is likely a result of a set of initiatives that were put in place between 2002 and 2007 as part of $1M in funding from the William and Flora Hewlett Foundation's Engineering Schools of the West Initiative. This funding resulted in institutionalized practices within the College of Engineering, that comprise part of the basis for the STEP program's target outcome of increasing the first-time freshman to sophomore retention. [7-11] These practices include conducting or creating for all STEM majors: (1) summer orientation with a high level of engagement by faculty, (2) freshman learning communities, (3) coursework for STEM majors that are not yet calculus ready (and therefore not qualified for chemistry, or physics or engineering classes required by their majors) and (4) mathematics preparation and placement.

This paper reports on these program initiatives and discusses how they were expanded to include all STEM majors as well as on strategy revisions planned for summer 2011.

Results and Discussion

1. Summer orientation

For the first time, all incoming first year Boise State students majoring in the STEM disciplines were oriented to their curriculum requirements as a group during summer orientation sessions. This was a substantial change over prior orientation sessions which segregated students by college. This provided a framework which emphasized the commonality of the STEM curriculum between engineering, mathematics and science majors in lower division courses and the relative ease of moving between these majors in the freshman/sophomore years. This is important because many freshmen are unsure of their major – in engineering alone, fall 2010, there are 125 "undecided engineering" undergraduate students, comprising 11.3% of the engineering and computer science undergraduate students. All students were advised of the STEM core courses they must take in an overview presentation. Next, students were categorized by specific discipline for individualized course advising using peer advisors and STEM faculty (32 advisors over the summer). The objective was to help the students identify as a STEM major, begin connecting them with an advisor, and to identify the STEP project coordinator and other resources available to them.

The advisors assisted students in selecting the appropriate math course, promoted the use of ALEKS, a mathematics online learning module (described in part 4), and encouraged enrollment in Student Learning Communities (SLCs). To continue support and assistance, advisors accompanied the students to a computer lab to complete online course registration. Over 323 STEM students were advised and registered in seven sessions in the summer of 2010.
To emphasize cross disciplinary cooperation and build support, we presented a salary chart for STEM majors that grouped engineering salaries instead of categorizing them by specific discipline (chemical, civil, electrical, etc.). This communicates that other STEM fields are attractive options to students and faculty rather than the stark message: "engineering has seven of the ten top salaries." This is important in building university, cross-college and discipline cooperation because too often engineering is presented as the only high income career choice and may alienate faculty from math and the sciences. Table 4, below, depicts how the salary information was presented in the large group student briefing.

Table 4: Ten Highest Paying College Majors[12]

Major	Average first year salary	Average mid-career salary
Engineering	$59,000	$101,000
Economics	$50,200	$101,000
Physics	$51,100	$98,800
Computer Science	$56,400	$97,400
Statistics	$48,600	$94,500
Biochemistry	$41,700	$94,200
Mathematics	$47,000	$93,600
Construction Management	$53,400	$89,600
Information Systems	$51,400	$87,000
Geology	$45,000	$84,200

Lessons learned: The initial overview presentation contained more information than the students could absorb on day two of orientation. The time allotted for advising and registration of the freshmen did not provide sufficient time for the advisors to emphasize our new academic support tools including Student Learning Communities, the GenSci (General Science) class for pre-calculus ready STEM majors, and ALEKS; nor did the STEM students remain in a group when they moved to computer labs which made it difficult for the advisors to respond to their questions in a timely fashion.

New actions: We have requested time on day one in summer 2011 to do the majority of advising followed by a time on day two to address problems such as missing course placement data (SAT scores, AP credits) or other student records. We are also developing a training tool to educate our advisors about our STEM academic support tools, tips for positioning the tools and better articulating the benefits so they are able to succinctly advise the students. Advisors will attend a short training session on the registration system from the student perspective to enhance their skills on the system. We have requested and confirmed a dedicated computer lab for all STEM majors during registration to allow advisors to address registration issues in real time. Finally, increased communication between summer orientation and the Registrar's office is planned, so as to ensure students' ACT, SAT and AP scores are in the system prior to course registration. This will ensure that the system recognizes that the student has achieved appropriate prerequisites for the critical math and science courses in which they need to enroll.

2. Freshman learning communities

STEM major focused Student Learning Communities (SLCs) based on math learning readiness for first term freshman are designed to encourage a diverse group of learners to become engaged with STEM faculty and other SLC members. This practice has worked well for the engineering majors and has now been expanded to all STEM majors. Additional benefits to SLCs are 1) experienced faculty who are committed to student success are assigned to these classes, and 2) SLCs provide guaranteed enrollment in high demand core science courses (which often become oversubscribed) and provide a pool of potential study group members. Eleven sections of academic STEM and two engineering SLCs were formed for Fall 2010 entering freshman and sophomore continuing students to foster connections, form study groups, and learn core knowledge. Over 204 students representing all 11 STEM disciplines were enrolled.

We distributed the listings of these SLCs to our STEM advisors prior to beginning summer orientation for incoming new and transfer STEM students. At summer orientation, we used time during our STEM orientation presentations to explain and emphasize the advantages to students of enrolling in SLCs. Following the presentations, students were advised in groups related to their disciplines; in these discussions the benefits of enrolling in SLCs were again emphasized. In addition, we pointed out that in many cases, the only path to registering for STEM service classes such as mathematics, chemistry, and physics was to select a SLC. Finally, during the actual registration portion of orientation, when students were confronted with the reality of selecting the classes, we once more emphasized that perhaps the best (and sometimes only option) to register for their required classes was to select an SLC which contained the classes they needed.

The structure of the first year SLCs is listed in Table 5. For Spring 2011, we designed seven sections of SLCs and are updating advisors of the availability. We have been particularly aware of the rapid enrollment in the STEM calculus sequence, and calculus based chemistry and physics which nine of the 11 STEM majors must take.

Table 5: First Year Fall Student Learning Communities (SLC)

Level	Math Course Name	Math Credits	GenSci Credits	Suggested General Education Course	Total LC Credits	LCs (section size 20-25)
C2	Calc II	4	5	--	9	1
C1	Calc I	4	4	Comm	11	2
PC	PreCalc	5	2	Comm	10	2
PC	PreCalc	5	--	Comm	8	2
A-II	Alg. II	4	2	Comm	9	2
A-II	Alg. II	4	--	Comm	7	2

Lessons learned: Although engineering advisors understood and supported SLCs, other STEM advisors were unfamiliar with them and did not fully realize the advantages to the students. We included a communications (Comm) course, which is required for engineering majors but a social science elective for other STEM majors, so students did not perceive that course to be required. Demand for SLCs containing calculus, chemistry and physics exceeds course availability. Science courses with labs do not have wait lists; this is due to limitations in the software system used by the university which makes it difficult to quantify the additional slots needed. Course additions are tightly controlled due to resource limitations that include both funding and difficulty in securing qualified instructors.

New actions: We are developing a SLC tutorial with tips for advisors to ensure they understand the benefits for the students. We will structure the SLCs with greater care to ensure we provide the most benefit from the offerings. We are developing guidelines for instructors on SLCs, which contains tips such as encouraging them to stagger the course test dates between classes in the SLC. The need for more seats and the issues associated with not really knowing what the unmet need for math and science course seats has been brought to the attention of the appropriate people at the university. Measures are being taken to step ahead of the need to avoid shortfalls in math and science course offerings.

3. Coursework for STEM students who are not ready for calculus.

To improve STEM freshman retention by increasing engagement, as well as improving scientific reasoning skills, *GenSci 197 (Scientific Thought and Reasoning)* was developed for the students who are not ready for calculus. From an effort to understand the STEM population at Boise State University, and where to focus our efforts, an analysis was done of first time STEM freshmen who first enrolled in fall 2007, 2008 or 2009. The student math level enrollment shows that the majority of STEM students, 65%, enroll in math courses at levels below calculus. These 567 students show a STEM major retention level of 72%, one year later. By contrast, 35% of students enroll in math courses at calculus level or higher, and are retained in STEM majors one year later at a level of 84%. This indicates that the students not ready for calculus have a greater chance of leaving their programs. Thus, attention and grant resources were directed toward this majority of students who have selected a STEM major but who are not mathematically prepared for calculus. In an effort to improve student engagement by giving them a science class to take and at the same time improve their reasoning skills, *GenSci 197* was developed and offered in fall, 2010.

The goal of the *Scientific Thought and Reasoning* class is to improve students' scientific reasoning skills through explicit instruction in the areas of the nature of science, observations vs. inference, measurements including precision and accuracy, unit conversion and analysis, identification and control of variables, hypothetico-deductive reasoning, probability, interpreting graphical and tabular data, and lab report writing. This course is based on a course at Wright State University (SM101), developed and taught by Dr. Kathy Koenig, which has succeeded in increasing reasoning skills of students.[13] We are using the same workbook.

The goals of many STEM courses include problem solving procedures. It has been suggested that Piagetian Formal reasoning skills are required for solving problems.[14] Piagetian reasoning is a developmental theory which describes that students start as children with less sophisticated reasoning skills and develop toward Formal reasoning. The aspects of Formal Operational reasoning as suggested by Piaget are combinatorial reasoning, separation and control of variables, proportional reasoning, probabilistic reasoning, correlational reasoning, and hypothetico-deductive reasoning. When some of the formal schemes are absent or not fully developed, they may only be applied to familiar situations and not systematically.

"*One can be said to be reasoning at the Formal operational level when Formal operational schemes have become explicit and useful as general problem solving procedures.*"[14]

On the basis of this developmental reasoning theory, it has been suggested that classroom activities may play a significant role in the development of student reasoning.[15] From the results of their study to enhance the development of student reasoning, Karplus and his team devised a strategy referred to as a *Learning Cycle*.[15] This learning cycle consists of an exploratory activity upon which later conceptual understanding can be built, referred to as the *Exploration* phase, which confronts the student with questions that cannot be answered with their familiar pattern of reasoning. The *Invention* phase starts with the students speculating about possible explanations for the questions raised by the exploration in order to develop a new reasoning pattern. During the last phase, *Application*, the students apply the new reasoning pattern to additional examples. All three of these phases contribute to the development of formal reasoning skills. The text used for GenSci 197 utilizes this Learning Cycle, which is evident in the sequence of the workbook activities and the experiments performed.[13] Students working through the course activities are placed in situations where formal reasoning is purposefully being encouraged.

The research method used and preliminary results obtained from the first semester's offering are presented below.

Method

Research Question: The study aimed to begin to answer the following research question: What is the effect of explicit reasoning instruction upon student scientific reasoning? This research question was answered by testing the following null hypothesis:

> H01: There is no statistically significant change in student reasoning after engaging in explicit reasoning instruction.

Population: Subjects participating in this study were 55 first semester freshman STEM students enrolled in two sections of *Scientific Thought and Reasoning* during the fall semester of 2010. It was a two credit class which met twice a week for 50 minute classes. The same textbook and course topics were used for both sections. 43 students (78%) were male, and 12 students were female. This group of students were not calculus-ready, with 23 students entering intermediate algebra and 32 students entering pre-calculus.

Research Design: A quasi-experimental pre-test post-test experiment design was planned for this experiment. The independent variable is the direct instruction in reasoning, and the control variable is the student scores on the Lawson's Test of Scientific Reasoning. The change in students reasoning may thus be measured and tested for statistical significance. Also the gain of the treatment students will be compared to published reasoning gains.

Instrument and procedures: The Lawson's test of Scientific Reasoning[16] is a well accepted and reliable assessment tool for measuring student reasoning.[17] While the Lawson's test covers all aspects of Piagetian reasoning, since our course only covered Control of Variables, Probabilistic Thinking, and Hypothetico-deductive reasoning, only these aspects were included in the scores for our students. A pretest was administered at the beginning of the course and a post-test at the end of the course. Of the 55 students in the course, 43 students (78%) completed both tests. The data was analyzed using SPSS 17.0 for Windows.

Results: A paired samples t test was conducted to evaluate to see if there is a relationship between the amounts of explicit reasoning instruction that STEM students receive and the students' scientific reasoning. For this test the student scores on aspects of interest were used. The test results indicated that the mean post-test score (M=9.95, SD=2.72) was statistically significantly greater that the pre-test score (M=8.86, SD=3.04), with t(42)=-2.85, p=0.007. To estimate the practical significance of this increase Cohen's *d* was calculated, *d*=0.38. This result supports the research hypothesis and the prediction. In a post-hoc analysis the items were analyzed by reasoning aspect to see if the students did gain reasoning ability in any one aspect. The students showed a statistically significant gain in Control of Variables, t(42)=-2.85, p<0.001. Cohen's d was calculated where d=0.58. The students also showed a statistically significant gain in Probabilistic Thinking, t(42)=-2.86, p,0.001. Cohen's d was calculated where d=0.37. There was no statistically significant difference for the aspect of hypothetico- deductive reasoning. Figure 2 and Table 6 show the student results for the total score on aspects of interest and the student scores for Control of variables.

Table 6: Descriptive statistics of pre- and post-test scores

	mean	SD
Pre-test	8.86	3.04
Post-test	9.95	2.72

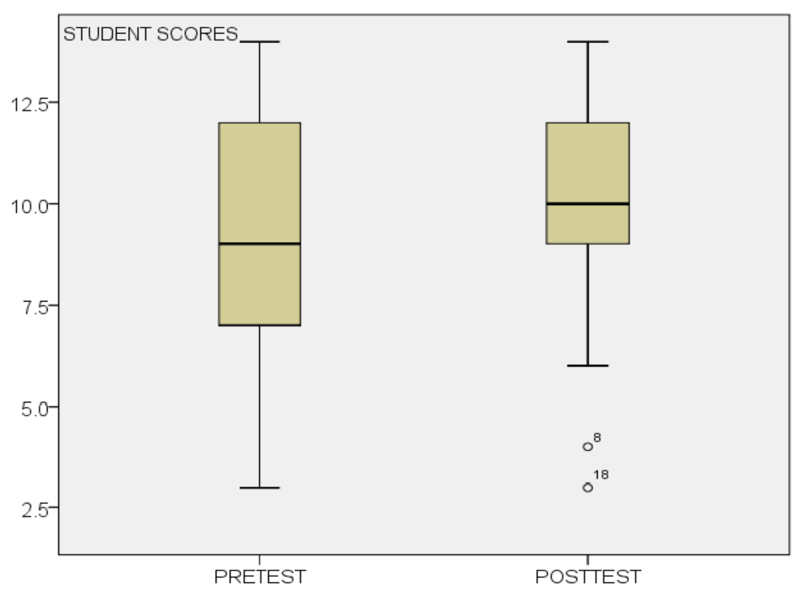

Figure 2: Student total scores, aspects of interest

Finally, it is noted that studies indicate a small change in student reasoning scores for students taking one semester of typical science classes. Maloney showed that students in a physics class can show an average gain as small as 0.31 on the Lawson's test.[17] In comparison the students in Gensci 197 showed an average gain of 1.1.

Discussion: The analysis of the data supports the hypothesis that there is a relationship between the amounts of explicit reasoning instruction that STEM students receive and the students' scientific reasoning. When students were given a semester's worth of explicit instruction in scientific reasoning their scores on a reasoning test increased. The effect size for this overall increase was small (d=.38), indicating a small gain in practical terms. This is a disappointing result. All aspects of the course will be reviewed in an effort to increase the gain in future sections of this course.

The item analysis indicated a larger practical gain (d=.58) for the aspect of control of variables. This is not surprising as a significant portion of the course dealt with this topic, and the students had multiple tests covering this topic. It is noted that the hypothetico-deductive reasoning did not increase, even though this was covered significantly during the course. Looking back at the theory behind hypothetico-deductive reasoning it is noted that Fuller *et. al.*[14] indicate that hypothetico-deductive reasoning uses all aspects of scientific reasoning in concert. Since in our course we did not have time to address proportional thinking, combinatorial or correlational thinking, it is possible that the lack of these reasoning skills prevented the students from excelling at hypothetico-deductive reasoning. In the future we plan to increase the contact time of this course from 2 hours/week to 4 hours/week, so that we may include proportional, combinatorial, and correlational thinking.

The preliminary results of this study show a practical gain in the aspects of student reasoning that were taught. The trial run of Gensci 197 focused primarily on control of variables, and yielded a student gain in this aspect of reasoning. This suggests that the class has the potential to improve student reasoning. We are suggesting that future offerings on Gensci 197 include more time to allow other aspects of reasoning to be addressed. The correlation between improved student reasoning and retention will be explored in a future longitudinal study.

Lessons learned; limitations: Several limitations exist in this study. There is a need for a control group, in order to conduct a complete experiment where the control variable of reasoning instruction can be explored. Also, as is a common practice in educational research settings, students were asked to participate in the study on a voluntary basis. Some students did not complete both the pre-test and the post-test. Of the 55 students in the course, complete data was obtained from 43 (78%) of the students and used for data analysis. Therefore the findings should be generalized with some caution.

4. Mathematics preparation/placement

It is well understood how critical the role of mathematics is to the success of STEM majors. A number of efforts have been undertaken at our institution to investigate ways to use mathematics placement and instruction to help STEM students succeed.[8,10,11] Some of these efforts have included using the online mathematics learning system, ALEKS, marketed through www.aleks.com. These efforts over the past several years have included using the system as a math placement tool (since abandoned), using ALEKS as part of an introductory engineering course, using ALEKS as part of or even all the homework for Precalculus classes, and requiring that students who enroll in either Precalculus or Calculus I, demonstrate a minimum competency defined by mastery of a percentage of "knowledge space" in the ALEKS course termed: "Preparation for Calculus." This percentage is presently enforced at 40% for Precalculus and at 70% for Calculus I. The method of enforcement is that it is treated as a take home exam (unproctored, repeatable, and due during the first week of class), worth approximately 10% of a student's total course grade.

This paper reports on a new initiative that commenced in Fall, 2010 as a result of the NSF STEP grant. The grant budgeted for the purchase of online learning licenses from ALEKS, Inc.,[18] as well as for bookstore awards. The licenses were for 77 days of learning, a $47 value. The intent was to use summer orientation as an opportunity to inform students of these mathematics learning subscriptions, and to incentivize student participation in embarking upon this personal review/learning effort by advertising that students were eligible to be considered for $100 bookstore awards if they achieved 15 hours or more of active online learning.

It was hoped that students would use the free access to begin work on ALEKS shortly after their orientation sessions and continue to work across the summer. The expectation was that students who put in significant time would be more likely to succeed in fall semester math courses.

Results: Over 75 students took advantage of the free subscriptions. In some cases students used both the "Preparation for Precalculus" and "Preparation for Calculus" ALEKS courses to build their skills for entering fall math courses. Table 7 differentiates the students who were enrolled only in Preparation for Precalculus with a cell color that is blue. Because a specific assessment score was a partial requirement for taking MATH 147 and 170, many students only chose to use the learning tool until they obtained the target score. Table 7 presents summary data showing the time spent by each student who used a free subscription and spent two or more hours learning mathematics online. The grade each student earned in their subsequent university math course is shown in conjunction with the university math course in which they enrolled. MATH 25 is Elementary Algebra; MATH 108 is Intermediate Algebra, MATH 147 is Precalculus, MATH 170 is Calculus I and MATH 175 is Calculus II.

The publicized bookstore award eligibility criterion was spending 15 or more hours online learning ALEKS. Of particular note are the 12 students who did so, indicated in bold in Table 7. All these students passed their mathematics class; 3 earned grades of A, 7 earned grades of B, and 2 earned grades of C. The average amount of time these students spent was 30.4 h, with a standard deviation of 8.0 h. Of these students, 7 of them completed 100% of the knowledge space for the course they enrolled in (6 were in Prep for Calc, and 1 in Prep for PreCalc, which is the suitable course for those who enroll in Intermediate Algebra, Math 108).

Table 7: Hours spent in math preparation in online learning (ALEKS) with grade earned in subsequent math class

	grade	*Math course*																
		25	**108**			**147**					**170**						**175**	
Combined ALEKS preps courses	A	4.6	7.7	**26.1**	**18.2**	11.6	7.7				11.3	11.8	13.4	**35.4**				
	A-					10.6	10.7											
	B+		4.2			**38.3**					3.2	10.4						
	B		10.6	**18**							2.3	4.5	6.1	8.6	**30.2**	**32.1**		
	B-										**26.4**	**26.8**	**43.1**					
	C					3.5	6.9	7.3			2.3	2.7	3.6	**29.3**				
	C-										5.5	12.4	**40.5**					
	D					2.7	3.9											
	F					2	2.2	2.5	3.3	11.9	2	8.6					9.2	9.9

Lessons Learned: Summer orientation sessions are crowded with information and hectic. In the scramble to register for classes, advising on how to use ALEKS was not always clearly communicated. Data on the start date and total hours worked indicate that a significant number of students did not use the software in the manner that we had intended. This is also reflected in the numerous queries about how to use ALEKS that the Math Department received in the last few weeks of the summer. It appears that both better advising techniques and stronger incentives will be needed.

New Actions: (1) Restructure orientation sessions as described in Section 1. The two day format should reduce the concentration of information flowing at students in the short advising window currently available. It is also possible that students could use computer facilities on campus to begin their ALEKS work under our supervision. (2) Track our success rate for inducing appropriate use of ALEKS. Collect data on how many students are advised about ALEKS in summer orientation and compare that number to the number that end up using the software for a suitable amount of learning over the summer. (3) Add incentives; showcase student success. Grant funds do not allow for more than the free license and the bookstore award. However we can provide data on the performance of students who used ALEKS appropriately in Summer 2010. We also plan to feature profiles, with permission, of certain students on the Idaho STEP website with their photos and 'words of wisdom' they would like to pass along to future students. (4) Begin a longitudinal study of the performance of the students who used ALEKS appropriately in Summer 2010. As longitudinal data builds this may provide us with stronger evidence that can be used to incentivize students in Summer 2011 and future years. (5) Add a third group of students for comparison. The current protocol is to offer the ALEKS software to all declared STEM majors passing though orientation. The result is that all STEM majors self select into those who use the software appropriately and those who do not. The protocol can be modified to collect performance data on students who are not STEM majors.

Summary

Retention of qualified students at all universities is a common goal, one of particular importance as universities strive to maximize efficiency in face of reduced resources. This study reported on four program activities that were targeted toward first-year success for undergraduate STEM majors. These pilot studies have resulted in numerous lessons learned that are informing this program's second year activities. Creating a STEM freshman learning cohort instead of one that is discipline-based has provided a stronger sense of belonging to the STEM community as a whole. This approach has engaged not only the students, but also has helped the university as a whole to appreciate the commonalities among STEM majors as well as the challenges that STEM majors face.

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