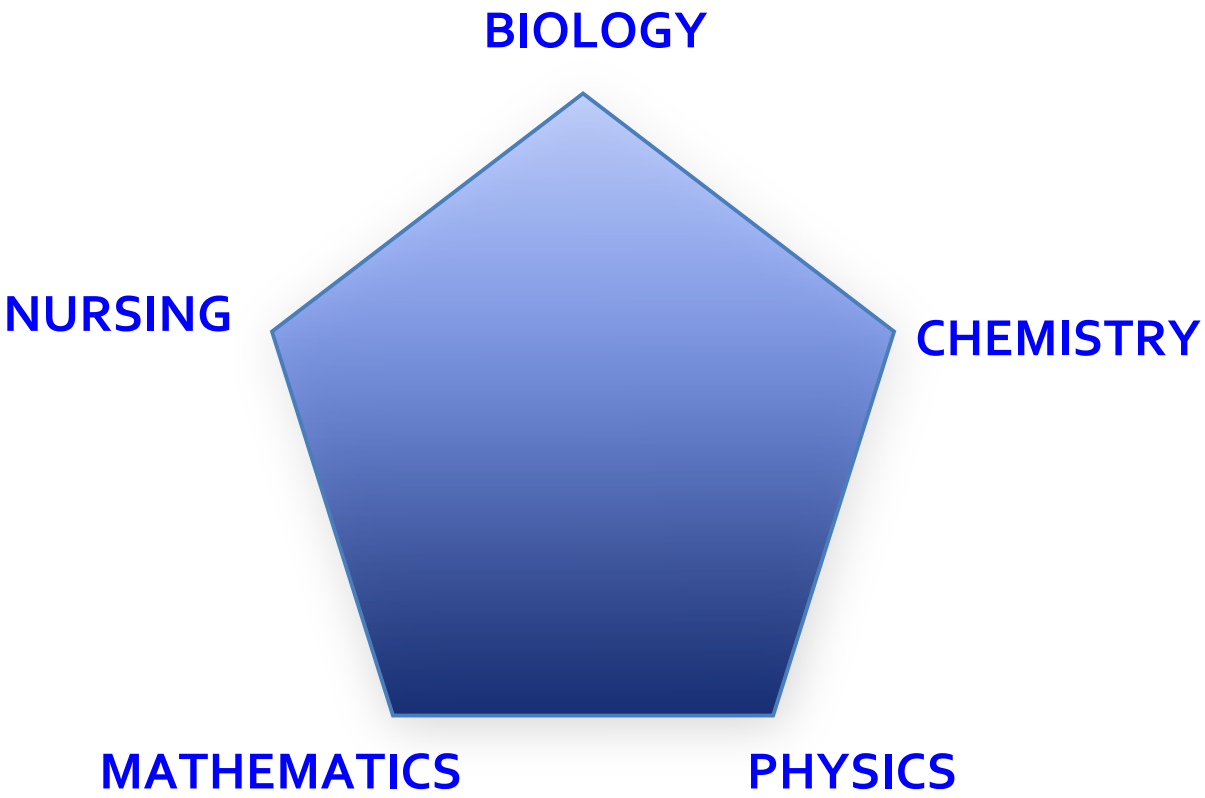
Division I Self-Study



Berea College
9 August 2013

TABLE OF CONTENTS

TOPIC	PAGE(S)
Preface To Division I Self-Study: The Process	P. 7
Question 1: What is the mission (and vision) of your Division?	
Mission Statement:	P. 10
Vision Statement:	P. 10
Question 2: What college-wide learning goals (e.g., the four paired learning goals as well as the Aims of General Education) is your Division particularly well suited to address, and in what various ways does your Division and curriculum currently support or contribute to these learning goals?	
Learning Culture:	P. 11
Divisional Strengths:	P. 11
Areas for Divisional Improvement:	P. 16
Question 3: What opportunities (e.g., courses, undergraduate research, study abroad, internships, service learning, independent studies, etc.) are currently available in your Division?	
Course Structure, Design & Pedagogy:	P. 18
Undergraduate Research:	P. 19
Undergraduate Research – Alumni Feedback:	P. 20
Internships & Practicum Experiences:	P. 21
Study Abroad Opportunities:	P. 21
Career Development – Division I Labor Program:	P. 22
Career Development – Career Preparation:	P. 23
Alumni Interaction:	P. 24
Community Building Opportunities:	P. 24

Question 4: What opportunities for inter-disciplinarity, multi-disciplinarity or other forms of collaboration (e.g., scholarship, shared learning spaces, team taught courses, community outreach, shared curriculum, faculty development, etc.) have arisen within your Division?

Intra-divisional & Inter-divisional Course Collaborations: P. 26

Intra-divisional & Inter-divisional Programmatic Collaborations: P. 26

Intra-divisional & Inter-divisional Collaborative Research/Grant Opportunities: P. 26

Intra-divisional & Inter-divisional Administrative Collaborations: P. 26

Future Opportunities for Inter-/Multi-disciplinarity: P. 26

Question 5: In what ways are your Division's currently available resources (e.g., faculty, technology, budgets, spaces, equipment, etc.) able to support your individual learning goals and mission?

Question 7: What are the areas of strength and weakness within (your) Division as each pertains to supporting and enhancing student learning?

Faculty Strengths: P. 29

Faculty Challenges – Faculty Staffing: P. 29

Faculty Challenges – Faculty Development: P. 31

Teaching and Learning Spaces – Challenges: P. 31

Equipment – Strengths: P.33

Technology – Strengths: P. 33

Technology Challenges: P. 33

Division Teaching Assistant – Strengths & Challenges: P. 34

Student Needs – Challenges: P. 34

College Support Services – Strengths & Challenges: P. 35

Question 6: What areas and specific plans for refinement, improvement or new direction have been identified by your Division, and how will these plans be implemented before the next review?

New Natural and Health Science Building (NHSB) Initiative:	P. 37
NHSB – Learning Spaces Workshop:	P. 37
NHSB – Learning Spaces Initiatives:	P. 38
NHSB – Alumni Survey:	P. 41
Community Outreach Initiative:	P. 44
Community Outreach Initiative – Current Outreach:	P. 44
Community Outreach Initiative – Alumni Survey:	P. 45
Community Outreach Initiative - Current Outreach Initiative Efforts:	P. 47
Supplemental Instruction (SI) – A Student Success Initiative:	P. 48
Summary Points:	P. 51

APPENDICIES

Appendix I:	Some Initial Thoughts on a Divisional Review Process	P. 54
Appendix II:	Division I Natural & Health Science Retreat (2012)	P. 58
Appendix III:	Division I Alumni Survey Questions	P. 64
Appendix IV:	College-Wide Paired Learning Goals	P. 65
	Relevant Aims of General Education	P. 66
	Division I College-wide Learning Goals and General Education Aims Commonalities / Differences	P. 67
Appendix V:	Division I Faculty Sample GSTR Course Descriptions	P. 68
Appendix VI:	Scale-Up Project Description	P. 69
Appendix VII:	Division I Courses Rated (Students) in Comparison to All Other Berea College Courses	P. 70
Appendix VIII:	Alumni Survey: "Classroom Pedagogies by Program that Support Effective Learning"	P. 73
Appendix IX:	Alumni Survey: "Experiences in a Division Program/Major in Which You Engaged While a Student at Berea College"	P. 74
Appendix X:	Post-Summer Research/Creative Project Survey Questions	P. 75
Appendix XI:	"A Major In Science? Initial Beliefs and Final Outcomes for College Major and Dropout" Ralph Stinebrickner and Todd R. Stinebrickner	P.76
Appendix XII:	Examples of Active Learning Strategies Used in Division I Programs	P. 77
Appendix XIII:	URCPP Projects in Division I (2003—2013)	P. 78
Appendix XIV:	Off-Campus Summer Undergraduate Research Internships for Berea College Students (2010—2012)	P. 79
Appendix XV:	Number of Research Abstracts Submitted:	
	By Undergraduates in Division I and All Others Between 2010 and 2012	P. 80
	To the "Journal Of Undergraduate Research Abstracts" at Berea College (2010-2012)	P. 81
Appendix XVI:	Berea Undergraduate Research Symposium Program (2012)	P. 82

Appendix XVII: Number of Berea College Student Oral and Poster Presentations at the 2010-2012 Annual Meetings of The Kentucky Academy of Sciences P. 84

Appendix XVIII: Division I – Faculty Publications With Berea College Student Co-Authors (2003—2013) P. 85

Appendix XIX: Alumni Survey: "How Important is it that Division I Emphasize Preparing Students for the Following Careers?" P. 88

Appendix XX Health Science Independent Major (Iowa Inter-Departmental Studies Model) P. 89

Neuroscience Independent Major P. 90

Appendix XXI: Grade Distribution for Academic Years 2009—2010, And 2011—2012 Compiled (Biology, Chemistry, Physics, Mathematics and Nursing) P. 91

Appendix XXII: Division I Course Loads (Fall 2011/2012#) P. 94

Appendix XXIII: Division I Faculty Advising Loads (Fall 2012) P. 95

Appendix XXIV: Learning Spaces Collaboratory P. 96

Appendix XXV: Stem Learning Spaces from Planning to Designing P. 97

Appendix XXVI: Follow Up Thoughts from Stem Learning Spaces Workshop P. 99

Appendix XXVII: Technology Upgrades to Hall Science Room 306 P. 101

Appendix XXVIII: Uses of 306 Technology To Date P. 101

Appendix XXIX: Evening Science Library Usage 2012-2013 P. 102

Appendix XXX: Alumni Survey: "Rate The Physical Condition of Each of the Following While at Berea College" P. 103

Appendix XXXI: Alumni Survey: "What was the Nature of Your Community Outreach/Service Learning?" P. 103

Appendix XXXII: STEMN Outreach Retreat Report (June 2013) P. 104

Appendix XXXIII: STEM Education Statistics (www.nms.org) P. 105

Appendix XXXIV: The International Center for S.I. P. 107

PREFACE TO DIVISON I SELF-STUDY: THE PROCESS

With academic restructuring in 2011, six divisions were created. Division I is currently comprised of five academic programs including Biology, Chemistry, Mathematics, Nursing and Physics. The staffing of these programs is summarized below.

Table 1: Division I Programs and Staffing

Program	Tenured Faculty	Pre-Tenure Faculty	Contract	Total
Biology	5	1	1	7
Chemistry	4	1	1	6
Mathematics	5*	0	5	10*
Nursing	2	2	2 (+ 2 clinical)	6 (+2)
Physics	2	1	1	4
TOTALS	18	4	11	33

*Includes Jan Pearce from Division II

Our new academic structure has prompted a movement away from Departmental Self-Studies to Divisional Self-Studies. Division I accepted the challenge of being the first Division to conduct a Divisional Self-Study. This was primarily related to the planning of a new/renovated Natural and Health Science Facility, and the opportunity to explore how programs in Division I might increase collaboration in the future.

During the summer of 2012, each of the five programs in the division was initially asked to indicate how their respective programs lined up with the college's stated learning goals and aims of general education. They were then asked to respond to questions (listed below) generated from Lincoln Hall (i.e. Judith Weckman, Rob Smith and Chad Berry). (Appendix I)

Question 1: What is the mission (and vision) of your Program?

Question 2: What college-wide learning goals (e.g., the four paired learning goals as well as the Aims of General Education) is your Program particularly well-suited to address, and in what various ways does your program and curriculum currently support or contribute to these learning goals?

Question 3: What opportunities (e.g., courses, undergraduate research, study abroad, internships, service learning, independent studies, etc.) are currently available in your program?

Question 4: What opportunities for inter-disciplinarity, multi-disciplinarity, or other forms of collaboration (e.g., scholarship, shared learning spaces, team taught courses, community outreach, shared curriculum, faculty development, etc.) have arisen within your Program?

Question 5: In what ways are your Program's currently available resources (e.g., faculty, technology, budgets, spaces, equipment, etc.) able to support your individual learning goals and mission?

Question 6: What areas and specific plans for refinement, improvement, or new direction have been identified by your Program, and how will those plans be implemented before the next review?

Question 7: What are the areas of strength and weakness within a program (and/or its curriculum) as each pertains to supporting and enhancing student learning?

Programs subsequently submitted their responses by mid-August 2012 to Dawn Anderson and Anes Kovasevic. These responses were then organized so that they could serve as the major topic for discussion at our September 2012 Division I Retreat near Cincinnati. (Appendix II) Following this retreat, faculty from our various programs volunteered to serve on seven different working groups to address these same questions at the Divisional level, looking for areas of overlap and also areas unique to specific programs. These were submitted to the Division Chair prior to the end of the fall 2012 semester. During the late fall (2012) and early spring (2012), each of these groups was also asked to submit questions for a Division I alumni survey. (Appendix III) Questions were compiled and then reviewed by the Division I Chair, Program Coordinators and IR staff (Judith Weckman and Clara Chapman). The alumni survey was administered (e-mail and snail mail) just after spring break 2013, and by early June 2013, 126 responses had been received. Using all this information, Program Coordinators met in early May to plan for the writing of the Divisional Self-Study during the summer of 2013. Each Program Coordinator, the Division Chair as well as one additional faculty member volunteered to assess one of the following pieces of information that we deemed relevant to our self-study:

1. Responses to the seven "Lincoln Hall" questions from the seven working groups – this has served as the backbone of this Self-Study
2. Responses from the alumni survey
3. Berea College Undergraduate Research Abstracts and Pre-and Post Survey
4. Experimental Learning Spaces in the Science and Nursing Buildings
5. Supplemental Instruction (SI) initiative
6. Outreach Initiative

The Dean supplied a small stipend to each Program Coordinator and an additional faculty member for this summer work. We also consulted various reports such as the Berea College Fact Book and the Division I Assessment from IR. Embedded within this effort were on-campus workshops regarding building planning, visits to science and nursing educational facilities around the country, meetings with various architectural firms (we are currently working with the selected firm, Ballinger, from Philadelphia), an Outreach meeting with faculty from local school systems (June 2013), and the writing of several Divisional grants.

Program co-ordinator reports were received in early July 2013 and integrated & drafted by Dawn Anderson in response to the seven questions to complete this self-study, with text contributions from Matt Saderholm (New Natural and Health Sciences Building and Outreach Initiatives), Tracy Hodge (Supplemental Instruction), Ron Rosen & Carol Kirby (Alumni Survey) and

James Blackburn –Lynch (Research Abstract Journal data summary). Editing assistance was provided by Ron Rosen and Megan Hoffman.

A self-study draft was sent to all Division I faculty for initial comment in mid-July 2013 and a working final draft for additional comment on 29 July 2013. The final document was submitted to Ron Rosen, Division I Chair, on 9 August 2013. The nature of the assigned questions directed Division I faculty to define where we currently are as a Division and where we envision our Division going. It will provide a baseline for future self-studies. A certain level of response redundancy will be noted throughout this document due to the nature of the questions the Division was asked to address. What follows is a synthesis of the contributions of all Division I faculty members over the past year and a half. At the end of this document, we have highlighted three major goals based on Questions 6 and 5/7 for our Division.

DIVISION I SELF-STUDY

Question 1: What is the mission (and vision) of your Division?

MISSION STATEMENT: "The Mission of Division I is to serve and provide students of great promise and limited economic means from the Appalachian region, women & men, black & white, with the opportunity to learn, explore and investigate the complexity, diversity and inter-relatedness of the Natural Science and Health disciplines within the context of a high quality liberal arts foundation and outlook. We seek to provide students with a rigorous, comprehensive and integrated curriculum that enables them to develop the collaborative, creative problem solving and critical/analytical thinking skills so essential for scientific study and discovery in the Twenty-first Century. We seek to develop in our students the power to make meaningful and integrated connections within and between the science and health disciplines as well as with others disciplines in the liberal arts. We strive to provide inter-/multi-disciplinary and innovative active learning experiences for our students in the research laboratory, in the clinical laboratory and in the field. We seek to provide opportunities for learning and serving the Berea community and beyond through the College Labor Program. We are committed to mentoring students in the exploration of scientific & clinical literature and to aid them in developing their skills in written, oral and visual communication. We strive to encourage each student to develop and maintain the highest standard of personal and professional ethics, to cultivate a life characterized by a zest for learning and to take pride in labor well done. We seek to encourage each student to understand his/her role as a scientifically literate global citizen and professional in the Twenty-first Century."

VISION STATEMENT: "The Programs of Division I seek to educate a new and diverse generation of scientists, STEM (Science, Technology, Engineering and Math) educators and healthcare professionals grounded in the liberal arts and centered on a life of labor, learning, and service. This vision builds upon a foundation of excellence that has produced a Nobel laureate and internationally recognized leaders in the fields of science and health care. Students who have great promise but limited economic resources will be nurtured by a rigorous, integrated, innovative and comprehensive science and health curriculum characterized by high impact practices including classroom & laboratory technology utilization, research, internships, Labor Program experiences and community outreach. We are committed to the development of creative thinkers and problem solvers from the Appalachian region and beyond who are not constrained by traditional academic boundaries. Our students will leave Berea College prepared to work collaboratively to meet the many and multi-faceted global challenges of the 21st century, always striving to make their local community, and thus the world, a better place for all to live."

Question 2: What college-wide learning goals (e.g., the four paired learning goals as well as the Aims of General Education) is your Division particularly well-suited to address, and in what various ways does your Division and curriculum currently support or contribute to these learning goals?

The Faculty of Division I aim to help students cultivate their imaginations and their ability to discern connections, consider alternatives and think about topics and issues from multiple perspectives. Such critical thinking skills are paramount if students are to become innovative problem solvers who will contribute to the discovery of solutions to the important regional and global challenges (i.e., energy, health care, education, the environment, food, etc.) facing our world. Division I believes this aim culminates in what is best described as a *practical* liberal arts education that students can apply to real world problems. As a whole, Division I sees itself as providing depth to the breadth of the College-wide Learning Goals and General Education Aims. (Appendix IV) This depth comes primarily in the form of the exploration of the natural world, but also includes methodologies and habits of mind that are consistent with practices that are current in the Division I disciplines. At the core of the activities within the Division is the ideal of producing independently thinking individuals capable of using the tools of their chosen discipline to address questions within and beyond the boundaries of that discipline.

Learning Culture

Members of Division I seek to establish a dynamic learning culture emphasizing the interconnections between the disciplines in Division I. Division I faculty aim to promote in students an understanding of the conceptual and practical nature of each discipline including the more abstract & specialized aspects of each area and also an understanding of interconnections among and between the various science and health disciplines. The misconception sometimes held by students that subject material can be mastered simply by memorization and compartmentalized within a specific discipline is one the Division faculty work strongly to dispel. Rather, we encourage students to think and learn deeply and to connect this learning across subject, disciplinary and program lines. Certainly, the cross-disciplinary collateral course requirements within almost all majors in the Division is evidence of this philosophy as is the cross-disciplinary content evidenced in many disciplinary courses (e.g. "Cell & Molecular Biology," "Neurobiology," "Biochemistry," "Mathematical Methods in Physics," "Pharmacology," "Pathophysiology," etc.). The Division also aims to promote a spirit of inquiry and of student-centered learning, with students actively participating in and guiding their own education. Division I faculty further acknowledge that collaborative work among students, among faculty and among students and faculty is an essential element within our culture of learning. Finally, collegiality both within and between Division I programs and among faculty and students is an important aspect of Division I learning culture. We seek to create an educational environment that develops the intellectual capacities of individuals while at the same time promoting a caring community founded on mutual respect, personal & shared responsibility and a common goal. (College-wide Learning Goals [CLG] 4.2; Aims of General Education [AGE] 1.1)

Divisional Strengths

The focus on **gaining knowledge and understanding of the natural world** (in all its forms) is a key strength of Division I in terms of contributing toward the College-wide Learning Goals. The focus of most disciplines in Division I is the exploration of the Natural World, which includes not

only empirical knowledge acquisition and theoretical understanding, but also the utilization of systematic methodologies to gain and synthesize new knowledge, comprehension and insight about the natural world and our place in it. Division I disciplines also seek to foster student learning through the cultivation of the intellectual qualities and practices that that allow students to confront and tackle unique situations and problems – so called "STEM habits of mind. " (STEM: Science, Technology, Engineering, Mathematics). Such habits of mind attributes would include, but are not limited to, curiosity; creative, original & flexible thinking; inter-/multi-disciplinary thinking & collaboration; systems thinking; quantitative analysis; skepticism; accurate and clear communication and openness to continuous learning. Division I aims for students to develop their ability to analyze situations and problems in the broadest of contexts from diverse perspectives – a holistic approach to problem-solving. (CLG2.1,2.2; AGE 1.1,1.4–1.6; Division Review Questions [DRQ] c)

Faculty of Division I also seek to help students think about and understand not only the workings of the Natural World, but also **what effect use and application of this knowledge might have on individuals, society and the environment**. Faculty members seek to help majors (& non-majors) understand and appreciate their roles as scientifically literate global citizens, which includes promoting the appropriate, efficient and sustainable utilization of scientific and technological innovations. The Programs within Division I approach this goal in a variety of ways. For example, technological innovation and application of 20th century physics research is discussed in the context of its benefits and ethical considerations in Modern Physics (*PHY 320).* Contemporary issues relating to infectious disease, stem cell research, genetic testing and science & religion are discussed in various Biology courses (e.g. *BIO110, 222, 330, 331, 494*). The Chemistry Program directly tackles impacts on environment through "green chemistry" experiments in multiple courses (*CHM131, 222*). The direct application of scientific ideas toward the "common good" is intrinsic to the Nursing Program and is covered throughout its disciplinary curriculum. In our roles as instructors of non-majors via the General Education Program, we also endeavor to make science relevant to everyday life, not only in how science explains how the Natural World functions (*GSTR332: Scientific Knowledge and Inquiry* [aka "Natural Science"]), but also on the benefits and/or consequences of the application of scientific discoveries (e.g. GSTR110"*Genes, Dreams and Reality"* (Anderson), GSTR110 "*The Good, the Bad and the Ugly"* (Hoffman); GSTR410 "*How the World Works*" (M. Saderholm). (CLG 1.2, 2.1, 2.2; DRQ c) (Appendix V)

Emphasizing the interrelatedness, interconnectedness and interdependence of the natural and health sciences are also strengths of Division I. The Division is composed of five interconnected and interdependent programs, highlighting that knowledge within one discipline is essential for a deeper understanding of the concepts in another. For example, an understanding of mathematical statistics is essential to analyzing experimental results in biology, chemistry, physics or nursing. Inclusion of courses from different Division I disciplines within major course requirements (e.g. *CHM345/270/371* in the Biology major [Molecular, Cellular & Systems concentration]) or as collateral courses (e.g. *CHM 131/221/222* in Biology*; BIO101/102/222, CHM113* in Nursing; *PHY 217/218* or *315/316* in Chemistry; *MAT 135,225,330* in Physics) further emphasize the Inter-dependence of the scientific disciplines represented in Division I. The interconnectedness of the disciplines in Division I gives prominence to the importance of broad contexts and diverse perspectives and that knowledge from many disciplines is often essential to addressing complex problems (e.g. issues in patient care require a knowledge of biology, chemistry, nursing, mathematics, physics; investigating nerve signal conduction in the brain requires biology, chemistry and physics). (CLG 1.1, 4.1; AGE 1.1)

Utilizing a variety of teaching and learning strategies to help students learn most effectively is a hallmark of Division I. In general, teaching/learning strategies follow a developmental model with early courses in the Programs emphasizing fact- and concept-based information with lecture-discussion being the primary, though not exclusive, mode of teaching. Later courses, including some 1st and 2nd year courses, emphasize more independent exploration by students including lab and field research, clinical experiences, student-initiated learning and group/cooperative learning. As much as possible, teaching methods in Division I courses *promote a non-rote activity-focused approach to understanding disciplinary and cross-disciplinary concepts*. For example, students may learn the processes of DNA replication, transcription and translation by physically "acting out" these processes for their classmates (*BIO110*) or the nature of bacterial fermentation pathways by performing carbon balance activities (*BIO222*). In the introductory Physics sequence (PHY315/316) students are required to solve context-rich problems in a co-operative group framework). In MAT201, mathematics students may determine the weight of a car by measuring the surface area of the tires in contact with the ground or calculate the height of Draper by walking a measured distance from the front doors and using trigonometry. (CLG4.1; AGE2)

The inclusion of ***open-ended investigative and experimental laboratory experiences*** is yet another strategy used to promote student learning. Many programs include such experiences beginning in the freshman year to the point where, in the junior or senior years, the lab experience may be primarily research-/experimentally-based. In the Biology program, first year students design and conduct group research projects *BIO113: Experimental Zoology*. *BIO222: Microbiology* provides many biology, nursing and chemistry majors with more independent lab research project opportunities. In Chemistry, students work on team synthesis projects in the Organic Chemistry (*CHM222*) lab, moving on to the Advanced Lab I-IV courses which are entirely experimental n nature (*CHM370,371,470,471*). PHY342: Advanced Lab provides students with the opportunity to conduct experiments using modern instrumentation. (CLG4.1; AGE2.5)

Some Programs in Division I utilize ***guided- inquiry learning*** methodologies to facilitate student learning. Some faculty have used these methods exclusively in teaching their courses (e.g. CHM 222), while others use a more hybrid model (e.g. BIO110, CHM101, MAT125, PHY111, PHY217/218).

Problem-based learning has also been utilized in every Program to a greater or lesser extent. For example, the introductory Physics with Calculus sequence (PHY 315/316) uses context-rich group problem solving that helps students develop a more sophisticated approach to solving physics problems**.** ***Case study methodologies*** have been effectively utilized by several Programs (e.g. biology, nursing) to promote student learning. ***Project-based learning (non-research)***, both individual and group-based, is yet another strategy utilized by almost all Programs in Division I (e.g. pathogen teaching projects in BIO222; parasite and histological slide preparation projects in BIO324 and 386, respectively; protein structure/function projects in CHM345) (AGE2.1)

Recently (July 2013), an NSF grant was submitted proposing a three-year program of faculty development and course implementation aimed at transforming introductory STEM courses at Berea College into **high-engagement, active-learning, studio environments** following the SCALE-UP classroom model (SCALE-UP – "Student-Centered, Active Learning Environment-Upside-down Pedagogies," Bob Beichner, Department of Physics, North Carolina State University). Introductory courses in biology, chemistry, physics, and computer science will be targeted. The studio courses will be supported by the inclusion of undergraduate Teaching Associates (Berea

College Labor Program), who will act as peer instructors in the classroom, as well as offering peer-led supplemental instruction outside of class. The objectives for this proposal are three-fold: to promote and support a faculty-led initiative to implement substantive changes in the introductory STEM courses; to deepen knowledge among the faculty about evidence-based practice in general and the SCALE- UP model in particular; and to improve student learning and retention in the first year STEM courses. (Grant P.I. – Tracy Hodge) (DRQ e; AGE2.1,2.2,2.4,2.5) (SCALE-UP - www.scaleup.ncsu.edu) (Appendix VI)

Each Program in Division I requires students to complete a ***capstone course/experience***. These courses encourage a synthesis of ideas from multiple areas and disciplines as well as research problems that require students to think independently. The Biology and Mathematics Programs offer a seminar-style capstone, *BIO494: Evolution* and *MAT492: Math Literature: Readings and Communication*, as their capstone experiences. The Chemistry and Physics Programs both use a research-based experience in their capstone courses, *CHM471: Advanced Lab IV* and *PHY492: Physics Seminar*. The Nursing Program capstone, NUR 450: Synthesis in Nursing Practice, involves integration and application of nursing knowledge and skills. (CLG 4.1;AGE 2.1, 2.2, 2.4)

In addition to employing a wide variety of teaching styles and strategies to engage students and promote learning, faculty in Division I utilize *a* ***wide variety of assignments*** to enhance and deepen learning. A wide variety of ***reading*** is assigned across the Division I curriculum including textbooks, primary literature, review literature, scholarly texts, historical papers, popular press books (non-fiction & fiction) and case studies. Recognizing that excellent ***written and oral communication skills*** are essential for every science and health professional, significant writing and oral presentation experiences are included in all Division I Programs. Written assignments range from laboratory notebooks, research notebooks, research project proposals, mock research grants, research project posters, primary literature summaries & reviews, formal papers, reflective journals and responsive essays to patient care plans. (AGE 2.1, 2.2) Oral presentation assignments include primary research literature presentations (e.g. course "Journal Club"), research presentations (e.g. courses, Berea Undergraduate Research Symposium, Kentucky Academy of Science, etc.), internship presentations and course teaching presentations (e.g. *Microbiology* - "Pathogens," Developmental Biology, *Fundamental Concepts in Mathematics* - "Infinity" (AGE 2.1, 2.2). Many students also gain substantive experiential learning through their Division I ***labor assignments***. In these positions, students serve as teaching assistants, tutors, supplemental instruction group leaders, laboratory technicians (e.g. media/reagent preparation, lab set-up/take-down, etc.), animal caretakers and special projects assistants. (AGE2.1, 2.3, 2.4, 2.5)

When Division I students are asked to rate each of their Division I discipline courses compared to all other courses (IEQ question; 2009-2012), 66% of all respondents rated their Division I courses as Excellent or Very Good (Biology 73.6%, Chemistry 59.9%, Physics 69.4%, Mathematics 64,2%, Nursing 62.2%). (Appendix VII)

In a 2013 Division I Program Alumni survey, alumni were asked to "indicate which classroom pedagogies helped you effectively learn in each major/program." (Appendix VIII) Interestingly, the top preferred pedagogy among almost all Division I Program alumni (with the exception of nursing) was traditional lecture. In general, the alumni who responded in the 2013 survey tended to prefer pedagogy styles which included chalkboard/whiteboard lectures, hands-on labs, case studies, research projects, field experiences, exposure to and understanding primary articles and "lectures interspersed with practical application." They also like supplements that made the concepts "come alive," particularly video & movie clips and animations. Also rated highly were student-led study

groups and involvement with professors. What pedagogy alumni tended to dislike included group work, PowerPoint-driven lectures, discussion-based class work and lectures with no practical application highlighted or integrated.

Student participation in summer undergraduate research and internship experiences, both on- and off-campus, is another Divisional strength and further facilitates learning by allowing students to "learn science by doing science." Division I Programs strongly encourage each student to complete a research, clinical or internship experience during the completion of their degree. These experiences not only reinforce classroom / teaching lab learning in a direct physical way, but also allow students to deepen their scientific knowledge and understanding. These experiences further allow students to develop the critical thinking and analytical skills necessary to become self-directed learners. Students also gain valuable experience developing their team-work skills as most of these research experiences require students to work and collaborate with other students (undergraduate / graduate), post-doctoral fellows and research mentors. Participation in summer undergraduate research, on-campus via the URCPP program or off-campus (e.g. Vanderbilt University, Mayo Clinic, University of Colorado - Boulder, Kentucky Biomedical Research Infrastructure Network [KBRIN] Summer Undergraduate Research program [University of Kentucky / University of Louisville], etc.) is strongly supported and encouraged. (CLG4.1; AGE 2.3, 2.4) (Appendix IX) Research or clinical experiences are also an integrated part of a number of courses within the Division (e.g. BIO113, 222; CHM 222; PHY 492).

Undergraduate research includes not only significant collaboration between faculty and students but also between students themselves. The connection to the fourth Learning Goal of the College to "***educate students, faculty, and staff to be creative, independent thinkers and encourage collaboration and teamwork in learning and working***" (CLG4.1) and the General Education Aim to "***work effectively both independently and collaboratively***" (AGE2.5) is clearly apparent. Based on data collected from a 2012 post-experience survey (Appendix X) for Division I students, 9.5% of the students "worked closely with my faculty mentor," 42.9% of the students "worked with several other students and my faculty mentor" and 28.6% of the students "worked mostly alone with occasional assistance." While 71.4% of the students thought this situation worked "okay" or "perfect for me," 19% of the students would have "liked a bit more attention/direction" and 4.8% "would like a bit less attention/direction." Considering the open-ended nature of most summer undergraduate research projects, that less than one in five students felt like they needed more "direction" highlights the level of independence acquired by undergraduate research students. The survey also attempted to assess whether the students had become confident in their ability to "work as part of a research team." Eighty five point seven percent (85.7%) of responding Division I students described themselves as a 4 or 5 on a scale post-research, where 5 means "very confident" and 1 means "not confident at all."

Another of the College Learning Goals that undergraduate research experiences frequently address is to ***develop the critical intellectual ability to address complex problems from multiple disciplines & perspectives and nurture moral growth with a commitment to service***. (**CLG1.1,1.2**) For example, one abstract (*Chemical and Phosphorus-31 NMR Characterization of Phosphorus in a Swine Facility Waste Stream*) summarized a summer undergraduate research project that examined the implications of "excessive" phosphorus as a result of swine waste processes at the Berea College Farm [Smithson (Chemistry); 2010]. This kind of scientific study of a complex environmental problem that impacts the local area is precisely the kind that illustrates "a commitment to service." Virtually all undergraduate research projects "address complex problems"

and most projects require "multiple perspectives." While not all of the research projects can be said to "nurture moral growth with a commitment to service" directly, some do this as well. Most undergraduate research students write a paper or research poster (of which the abstract, of course, is a small piece) and do a presentation at a relevant local, regional or national conference. This allows the student to grow with respect to the General Studies Aim of the "Skill: "***to read and listen effectively; write and speak effectively, with integrity and style***." (AGE 2.1,2,2)

Areas for Divisional Improvement

There are several areas Division I faculty have identified in which improvements would be desirable. One area focuses on better communicating the expectations of the Division I Programs and faculty for incoming students. There is a noticeable disconnect between the expectations of incoming students toward their academic experiences and performance as compared with that of Division I faculty. These issues seem largely reflective of differences in the expectations and workload between high school and college. Students who rarely if ever took reading or assignments home are often surprised that class time is not set aside for the completion of such work. Students accustomed to reviewing for exams from test-specific, teacher-prepared study guides are often caught off guard when they are expected to actually study and to manage their own study time. There also seems to be a general misconception on the part of incoming students about what "science " is (and isn't) and on how College-level science learning differs from high school. While this disconnect is generally remediated by the time students reach their junior year, the Division I Programs plan to work on ways to address this disconnect issue more directly and systematically. In a recent report of 652 Berea students (Stinebrickner & Stinebrickner, http://papers.nber.org/tmp/17674-w19165.pdf), it was found that "students enter school quite optimistic /interested about obtaining a science degree, but that relatively few students end up graduating with a science degree. The substantial over-optimism about completing a degree in science can be attributed to students beginning school with misperceptions about their ability to perform well academically in science." (Appendix XI)

Division I faculty also feel that additional assessment of utilized teaching methods (both traditional and non-traditional) is needed to determine if our current methodologies are accomplishing stated course, Program and Division goals. Assessment of the impact on learning of innovative teaching strategies versus traditional strategies is currently being conducted in the BIO110 introductory majors biology course by Megan Hoffman. The assessment project started as a summer undergraduate research project by Dr. Hoffman and two student researchers (Summer 2013). Additional data collection and analysis is planned through the 2013-14 academic year.

A third area for Division I improvement lies in increased ability to contribute more broadly to the General Education Program. Although faculty members of Division I are the main contributors to *GSTR332: Scientific Knowledge and Inquiry* staffing, contributions to other courses in the core such as GSTR110, 210 and 410 have been limited due to Program course teaching obligations. While it is acknowledged that many Program courses may be used to meet the GSTR332 core requirement, current Program teaching obligations do not allow Division I faculty to make greater contributions to the General Education Program in spite of a strong desire to do so. That greater contribution and participation would be desirable for not only introducing more contextual natural science and health topics and perspectives into the General Education curriculum, but also for expanding the experience base of Division I faculty. Integration of the science/health curriculum with the General Education curriculum would be enhanced with more individuals having experience in both areas. The nature of the current General Education

Perspectives (i.e. Arts; Social Science; Western History; Religion; African American, Appalachian, and Women's; International) make it difficult for Division I faculty to design the majors courses they must teach to meet the guidelines of the approved Perspectives, thus further limiting Division I faculty participation in the General Education Program. Absence of a Science as a Perspective Area is a serious weakness in our current General Education curriculum.

A Supplemental Instruction project is being piloted by several faculty in Division I as a means to improve student learning and performance (See Supplement Instruction Student Success Initiative, P. 48). Informal weekly study sessions for specific courses (e.g. BIO101, BIO222, PHY 217) led by trained peer leaders are held to help students review and integrate course material and develop better reading, analytical and study skills. If this project proves successful, it might easily be exported to other courses across the larger College curriculum.

Question 3: What opportunities (e.g. courses, undergraduate research, study abroad, internships, service learning, independent studies, etc.) are currently available in your Division?

A wide variety of learning opportunities are available in the Division to help students achieve College-wide learning goals and General Education Aims. In the recent survey (2013) of graduates from current Division I programs, alumni note many experiences within their chosen major and indicate that it "would not have been the Berea experience without all of these opportunities." Alumni report that these learning experiences make them "well rounded" and help them "stand out," not only as "scholars" but also as "individuals." One alumnus indicated he would not be where he is today without *all* of the experiences.

1. Course Structure, Design & Pedagogy

Many opportunities exist in the wide variety of course structures, design and pedagogy in the various Programs of Division I. Division I faculty believe the diversity of course structure and teaching/learning pedagogies within and across Programs provides a richer learning experience for students.

Many Division I faculty utilize an ***active learning model*** in their courses (some totally, some hybrid) in which the focus of and responsibility for learning is placed on the student with the instructor providing guidance. Examples of active learning strategies used within the Division are listed in Appendix XII.

Many Division I faculty have incorporated the use of various ***computer technologies and software*** into their courses. A large number of faculty take advantage of the Moodle course management system for posting announcements, readings, lab manuals, assignments, Power Point presentations, threaded discussions, web links, messages, blogs, quizzes, etc. Others have utilized "clicker" technology in their courses, providing students and instructors with instant feedback (e.g. *BIO 110, 114*). A number of instructors have specifically incorporated iPad use into their courses (e.g . CHM 451 Kovacevic; NUR342). Most recently, a number of faculty have been experimenting with new iPads and Mondo boards (Science 306) in their courses to increase active student learning (e.g. *CHM 121, 134, 221, 222, 341*, MAT125).

Many, if not most, courses in the Division (other than Mathematics) have *designated* ***laboratory or clinical experiences*** as part of the course. These experiences allow students to put into practice what they learn in class or allow students to extend or broaden their course experiences or practical skills. In addition to helping students develop hands-on practical knowledge, many of these experiences require students to work in pairs, teams or small groups, thus allowing them to develop their interpersonal and collaboration skills.

A number of courses in the Division are specifically ***"research-rich" or "highly investigative"*** as part of their course design. As examples: The *BIO102* course (Anatomy and Physiology II) has students using the PowerLab system to investigate physiological effects of environmental stimuli by collecting and analyzing class data. The "Advanced Lab I – IV" courses in Chemistry (*CHM370, 371, 470, 471*) are solely lab-based and require students to successfully complete multiple investigation-based labs. The *BIO113* course, *Experimental Zoology*, is almost totally lab-based and contains both a class and a small group research project. *BIO222: Microbiology* (BIO, CHM & NUR students) also requires that students design, complete and present

an original lab research project, and the *BIO441* course (Cellular & Molecular Biology) has students working on aspects of an active faculty research project. The Physics senior capstone seminar, *PHY492*, has students design, conduct and present an independent research project.

Students in Division I also have the opportunity to work with faculty members on **Directed Studies, Independent Studies and Special Topics courses.** The Mathematics Program generally offers 1-2 *Directed Studies* each term. These courses are often too difficult to be offered regularly, may have a low number of students ready for or interested in participating or are difficult for faculty to add to their teaching duties as these courses do not count in faculty teaching load calculations. Some Directed Studies are offered to address the specific educational needs of a specific student (e.g. investigating learning in inquiry-driven classes with a BIO major interested in secondary education, Hoffman). A number of faculty have also offered students *Independent Study* opportunities. These independent studies range from a student-initiated project to students conducting faculty-mentored research to developing new investigative teaching labs. *Special Topics* courses have been offered as student interest/demand has required. Several courses initially offered as Special Topics courses (e.g. BIO 324: Parasitology; BIO 327: Herpetology; BIIO 386: Histology/Histotechnique) have become regularly offered courses.

Each Program in Division I also offers students a unique **capstone course experience**. Biology majors take *BIO494: Evolution*, an integrative seminar-based course covering all aspects of biological evolution. Chemistry majors, as part of *CHM 471: Advanced Lab IV,* must present a completed advanced laboratory portfolio and evidence of research completion. Physics students design and conduct an independent research project in their capstone course *PHY 492: Physics Seminar*. Nursing students are expected in their capstone course (*NUR450: Synthesis in Nursing Practice*) to synthesize content from previous courses and to focus on "the delivery of nursing care to a variety of clients with multiple, complex health problems." The Mathematics Program offers its students *MAT492: Senior Mathematics Seminar* as a capstone experience in which students develop a project based on a lead paper provided by a supervising Mathematics faculty member, while the preferred option of MAT 426 requires students critique several papers in a group and as individuals.

In addition to offering many courses within their specific discipline, many Division I faculty teach in the **General Education Program**. Some faculty offer opportunities for non-science majors to gain an appreciation for historical and modern science and its processes in the *GSTR332: Scientific Knowledge and Inquiry course* (i.e. Adams, Baltisberger, Douglas, Hodge, Hoffman, Kovacevic, Lahamer, Rowley, M. Saderholm, Scudder-Davis, Smithson, Veillette). Other faculty contribute to the General Education Program by teaching other courses in the GSTR core – *GSTR110: Writing Seminar* (Anderson; Gratton; Hoffman), *GSTR 210: Writing Seminar II* (Hoffman) and *GSTR 410: Contemporary Global Issues* (M. Saderholm).

2. Undergraduate Research

Research Opportunities

An important and key opportunity that enhances Division I student learning is participation in **undergraduate research.** Many opportunities for direct student engagement in active research exist both on- and off-campus. Many faculty across Division I participate in the summer Undergraduate Research and Creative Projects Program (URCPP). Division I faculty direct and mentor undergraduates, from rising sophomores to rising seniors, in active primary research projects. Other on-campus students are supported in primary research experiences by external

grant sources (e.g. National Institutes of Health (NIH); National Science Foundation (NSF); American Chemical Society; Research Corp; KBRIN; Appalachian College Association). Students are able to share their research with other on-campus summer URCPP participants in a weekly "work-in-progress" summer lunch seminar. This weekly lunch event also includes one panel discussion involving recent Berea College graduates currently in graduate school, in professional school or in the workforce. (Appendix XIII)

In addition to the URCPP program, many Division I students participate in summer undergraduate research programs located at other universities or research institutes. Some of these summer research programs are the result of an articulated agreement between Berea College and the participating institution (e.g. the Harold Moses /Aspirnaut Summer Undergraduate Research Program at Vanderbilt University; Mayo Clinic/Graduate School program - Dr. Chella David, Dept of Immunology; Oak Ridge National Laboratory; University of Colorado - Dr. Dennis Roop). Other externally-funded summer undergraduate research programs such as the Berea College-administered KBRIN- [UofL/Berea - NIH]) Summer Undergraduate Research Program routinely provides research opportunities at the University of Louisville and the University of Kentucky for Berea College Division I students. Physics and Math students have also participated in undergraduate research experiences at the Fermi National Accelerator Laboratory, Williams College, NASA and IBM. A large number of Division I students participate in many other summer undergraduate research programs at other major research universities and research institutes (2010-2012). (Appendix XIV)

Research Abstract Journal & Conference Presentations

The annual *Berea College Journal of Undergraduate Research Abstracts* has detailed some of the undergraduate research conducted on- and off-campus (Division I and others). Since 2006, approximately 200 on-campus Division I summer research students have submitted abstracts for research they performed on campus with Berea faculty members. (Note: Abstract submission is voluntary and not all groups submit.) One hundred twenty six (126) Division I students submitted abstracts from research they performed in off-campus research internships. (Note: These participant numbers count the same student multiple times if they submitted abstracts over multiple years.) (Appendix XV)

Division I student researchers have many venues in addition to the Berea College research abstracts journal to publically present their research results. Every autumn for the past 10 years, the Berea Undergraduate Research Symposium has allowed all Berea undergraduate researchers to present a poster or oral presentation of their research. Roughly 40 students participate in this event annually, which also includes a plenary talk by a prominent, active university researcher. (Appendix XVI) Many Division I students then go on to regional and national meetings and conferences to present their research results. The Annual Meeting of the Kentucky Academy of Science (KAS) has, over the years, been a key forum for Berea College Division I student research presentations (both posters and oral presentations). (Appendix XVII) Roughly 30-40 Division I students attend and present at the KAS meeting annually. Seventy five (75) of these KAS presentations (poster or oral presentations) have won awards. The research presentation experience is one of the most valuable experiences Division I students can have while at Berea, in terms of introducing them to an entire culture of science and giving them the confidence to know they belong in that culture.

Other Division I students present their research at discipline-specific meetings and conferences including the American Astronomical Society national conference, the American Chemical Society (regional meeting), American Geological Society, Experimental Nuclear Magnetic Resonance Conference, and the Math Conference at Miami of Ohio University (concurrent with the annual meeting of Pi Mu Epsilon, the U.S. honorary National Mathematics Society). In addition to presenting at regional meetings, Mathematics students also participate in many mathematics competitions including the Virginia Tech University Regional math Competition and the Lowell Putnam National Math Competition. Nursing students present their research or internship results at meetings sponsored by the Kentucky Board of Nursing and the Kentucky League of Nursing.

A number of students participating in undergraduate research experiences have been fortunate enough to have their research published in regional, national and international scientific journals as co-authors with Berea Division I faculty. (Appendix XVIII)

Undergraduate research – Alumni feedback

Alumni from Division I Programs report that a research experience was valuable whether on campus (67.5%), off campus (44.7%) or outside the major (19.5%). Research was very important in tying together what was learned in the classroom, which made alumni appreciate the time spent in the classroom. Participation "allowed me to see what it was like to be a research scientist in a way that you can't understand by just reading about it." Research was empowering to alumni and made them understand they "are capable of things that seemed very far-fetched." Research was a break-through to "new truths and (helped) gain greater insight." It showed the "practicality of science" and alumni were able to "see my science for what it really is." Research promoted inter-disciplinary interaction, presentation skills, knowledge and motivation. Research was also a way to work with a mentor ("life-long"), but also do some independent work to improve critical thinking

Research was seen as a vehicle for improving communication and developing team-work/leadership skills. Alumni also felt doing undergraduate research made them more competitive when looking for graduate placement or jobs. One alumnus recommended research be "encouraged for all students interested in continuing on to grad school." Symposium or conference participation was completed by 43.1% of alumni who responded to the 2013 survey. This experience was a way to "translate my summer work into something those outside my field could understand," according to one recent alumnus. Alumni reported looking forward to these presentation opportunities because those experiences helped build speaking and presentation skills.

3. Internships & Practicum Experiences

Another learning opportunity for Division I students comes in the form of faculty-sponsored internships and practicum experiences. Many internships allow students to apply the skills they have learned in class or in the lab and to gain experiences that might help them decide on a specific career path (or not) and/or to gain critical hands-on career skills. Many pre-professional students (e.g. pre-med, pre-dent, pre-vet, pre-pharm) and pre-allied health students (e.g. physician assistant, physical therapy, public health, occupational therapy, etc.) engage in shadowing internships to gain direct patient experience. Such opportunities are essential as students prepare for professional or graduate school programs. Many of these internships and practicum experiences are arranged on an individual student basis, but many students have also completed internships through formal programs like the Shepherd Poverty Alliance Program (in association

with Washington and Lee University) or the Clinic for Rehabilitation of Wildlife Program Internship (CROW; Sanibel, FL). Other students have completed internships through various non-profit agencies (e.g. Kentucky Environmental Foundation, Madison County Health Department) and in conjunction with the Bonner Scholars and Entrepreneurship for the Public Good (EPG) Programs.

Thirty-nine percent (39%) of alumni who responded to the 2013 Division I alumni survey participated in internships. These experiences were described as "phenomenal" and a "real" application of classroom knowledge. These experiences sometimes led to job offers, and one alumnus reported that he "should have done one every year."

4. Study Abroad Opportunities

A significant number of Division I students have taken advantage of opportunities to study abroad and have worked with the International Center to arrange a term abroad over the past 10 years. Students have studied in Ireland, England, Scotland, Holland, Spain, Austria, Australia, New Zealand, Japan, Thailand, Costa Rica and Morocco to name just a few. Students work with academic advisors to select the courses abroad that best fit their interests and needs. Many of the selected courses can be used to meet major course requirements. While studying abroad, many students take advantage of direct experience courses that Berea College cannot practically offer such as "Tropical Rainforest Ecology" or " Ecology of the Great Barrier Reef." Most Division I Programs (e.g. BIO, CHM, PHY, MAT) directly transfer courses taken abroad as meeting major academic requirements that allow students to graduate within the four year goal. The Biology Program has been acknowledged on numerous occasions by the International Center as being the academic program that sends the most number of its majors to term abroad programs.

Other students take advantage of the Kentucky Institute for International Studies (KIIS) Program offerings or other international studies opportunities. Many of the opportunities have occurred during the four-week May Term when students have traveled to Paris, Honduras, Mexico, and Ghana. Additional students have taken advantage of other opportunities to volunteer internationally (e.g. Peru, Mexico, Ghana, Zimbabwe).

5. Career Development

Division I Labor Program

Roughly 72 students (on average) hold Labor Program assignments (full and part-time) in Division I Programs each year [Biology 19; Chemistry 15; Physics 12; Mathematics 20; Nursing 6). Most of these students serve as teaching or laboratory assistants. These students assist faculty in class and in lab, help with grading, run tutoring/review sessions, monitor open lab hours, assist students with research projects, prepare and maintain laboratories and sustain media/reagent/culture stocks. More experienced teaching assistants also assist faculty members in developing or testing new laboratory experiments or classroom activities/projects. Some senior teaching assistants are given the responsibility for directing a classroom activity or a pre-lab session (under faculty mentorship and supervision). Students serving as teaching assistants not only reinforce the knowledge and skills learned previously in their science coursework, but also develop and improve these skills while gaining additional expertise. Teaching assistants also develop and improve their interpersonal and communication skills as they interact with their peers, other teaching assistants and faculty.

In the recent Division I Alumni Survey, 70.7% of the respondents (87 of 123 respondents) held a Labor Position within their major. Alumni report that skills learned in labor enhanced those from the classroom, which were then fine tuned as they taught others. Labor within the major was "valuable", and laid the foundation for how to function within a workplace. The experiences in labor "helped open the doors to many … possibilities," according to one alumnus. Labor within Division I helped alumni become more focused on their major. It taught them how to be accountable and "realize the gifts I didn't know I had." Labor was thought of as "a lot" of responsibility, but they appreciated getting to "see what the academic life is like." Alumni enjoyed seeing the teacher's point of view and what were the sources of student misunderstandings and errors. One alumnus who had a labor position outside of the major thought of labor as a stress reliever. Labor was considered "valuable" and taught students how to work under pressure. The experience seemed to boost confidence and made alumni value "preparedness." One alumnus reported that labor "allowed me to address my own deficiencies in the classroom" because "as I was assisting in the learning process, I was also learning." Labor was seen as a way to train for "adulthood." Labor made one alumnus "feel more accomplished upon graduation, … that I had to work my way through." A few, however, thought they spent "too many hours" in the labor position, and one thought labor "made it difficult to perform as I would have liked to." Yet another noted that it was "de-motivating" to see (other) TAs slacking and not maintaining the labs or building." (Alumni Survey 2013)

Areas of improvement in the Division I labor programs were suggested by a number of alumni. Some of these suggestions included emphasizing the importance of the position as career development; the importance of the evaluation process (a dominant feature in the workplace); a need for more T.A. training including professional standards and expectations; appropriate conduct responsibility and accountability; greater T.A. involvement in lab prep and set-up; and increased T.A. pro-activity in tutoring/learning sessions (Alumni Survey 2013). Division I faculty will be addressing several of these suggestions in the near future (e.g. teaching assistant training, student involvement in pedagogy research, etc.)

More recently, selected Division I Labor students have served as Supplemental Instruction (S.I.) Peer Leaders. These students, mentored by faculty trained at the Center for Supplemental Instruction at the University of Missouri – Kansas City, facilitate Supplemental Instruction sections for specific courses (e.g. BIO222: Microbiology, PHY 217/218: General Physics I & II, PHY225: Mathematical Models in Physics, PHY315: Introductory Physics with Calculus and, beginning in Fall 2013, BIO101: Anatomy and Physiology I). In these sessions, Peer Leaders direct student-focused group learning activities. These meetings are facilitated study sessions - unlike tutorials or reviews, and Peer Leaders develop activities and experiences to assist students in directing their own learning.

Taken as a whole, labor program experiences serve Division I labor students well during their Berea College years and also allow them to develop skills and attributes critical for success in graduate/ professional school or in the workplace. Teaching assistant are invaluable to faculty; without them, Division I courses and labs would not be as highly hands-on and active as they are.

Career Preparation

Collectively, alumni from the five programs in Division I routinely pursue post-undergraduate work. Of the 123 respondents including 10 African-American, 90 Domestic and 23 International alumni, (63 Biology, 20 Chemistry, 20 Mathematics, 21 Nursing and 5 Physics –roughly

95% (116 of 123 respondents) complete a second Bachelors, Masters, Ph.D., Ed.D. or M.D./D.O. degree [Note: Some double majors result in a number higher than the 123 total.] Several trends are apparent when these programs are considered separately. Most M.D./D.O. degrees seem to be associated with alumni who majored in Biology; second Bachelors degree students were proportionately greater in Biology than those in the other programs with the secondary degree primarily being a post-baccalaureate Nursing degree. Pursuit of Masters and Doctoral degrees is common in all the programs with the exception of Nursing, likely owing to greater employment opportunities immediately available post-graduation for students in the latter program.

Approximately one-third (1/3) of responding Division I alumni report having jobs that can be classified as medically related, followed by jobs in graduate school/research and teaching. By program this ranged from practically no medically related employment in Mathematics to close to 100% in Nursing. Research, teaching and graduate school-related jobs were common occupations for alumni from all programs with the exception of Nursing. This was further supported by alumni responses to the question, "How important is it that Division I emphasize preparing students for the following careers." Collectively, both Medical/Nursing/Health Fields and Basic Research received the highest ratings; interestingly, Chemistry and Mathematics alumni also indicated fine preparation for careers in industry. (Appendix XIX)

Some take-home messages can be derived from these alumni survey career-focused questions. The majority of respondents to this survey have pursued some sort of post-undergraduate education with many obtaining advanced degrees. Division I Programs are currently doing a very good job in preparing students for careers in medically related fields and research. Though teaching preparation and careers are rated relatively high by alumni in four of the five Division I programs, these appear to be more focused on college and university teaching and less on K-12. *This is an area of opportunity for expansion given the need for quality STEM education in our schools.*

6. Alumni Interaction Opportunities

Recently graduated alumni have returned to Berea College to participate in Alumni Panels during Homecoming (e.g. Mathematics), the Berea Undergraduate Research Symposium and URCPP lunch events to speak with current students about their transition into graduate/professional school and into the workforce. These panels have provided current undergraduates with a current and unique perspective as they plan their future career paths.

7. Community Building Opportunities

Building a strong and vibrant community among students, among students & faculty and among faculty is an important goal within the Division. A number of opportunities exist to promote a sense of Divisional community.

A number of disciplinary- or interest-based clubs bring students together such as the Math Club, Pre-Med/Dent/Allied Health Club, Society of Physics Students, Student Affiliate (Club) of American Chemical Society, Beta Beta Beta (Biology Honor Society) and the Berea Student Nursing Association. Students in these clubs arrange activities, speakers, field trips, volunteer opportunities and projects based on group interests. These clubs also provide important leadership opportunities for students.

Student and faculty community-building occurs in many venues. The Berea Undergraduate Research Symposium fosters professional community building between students and faculty. The Annual Meeting of the Kentucky Academy of Science, at which many student present their summer undergraduate research results, provides an important Division I student-faculty building event. A more informal type of community building occurs at the annual Division I picnic for students, faculty and staff. This event, traditionally held at the farm of the late Dr. Tom Beebe (Chemistry) each Spring, is now held on campus early in Fall Semester to welcome both new and returning students. The annual URCPP pool party also serves to promote a sense of community between students and faculty. And the highlight of every year is, perhaps, the annual Division Christmas Party with the infamous Secret Santa gift exchange. Many other informal opportunities that promote a sense of community between Division I students and faculty occur throughout the year including participation in College events such as Mountain Day, Labor Day, etc. Perhaps the most special student-faculty community building events are those that center around annual graduation activities. Each Program in Division I hosts a special event that celebrates the achievements of its graduating seniors, ranging from celebratory dinners at faculty homes to special pinning ceremonies in Nursing.

Note:

Interestingly, it was noted in the recent 2013 survey that not all alumni knew about the wide-range of opportunities available. The Division will need to consider better ways to "advertise" the opportunities that are available to students. One alumnus "would have liked to know more about research and internship" opportunities earlier. As stated above, these opportunities offer a wealth of experiences to those in the majors within Division I. It would be advantageous to provide more information and direction to all students as early as possible regarding available opportunities. Direct access to Division I Program web sites by Program faculty would make it easier to post such information in a timely fashion. Having a dedicated a Division I Research/Internship contact person might also be useful. As Division I faculty continue to discuss ways to retain students in sciences programs, participation in research/internship/service opportunities may just be that opportunity.

Question 4: What opportunities for inter-disciplinarity, multi-disciplinarity or other forms of collaboration (e.g. scholarship, shared learning spaces, team-taught courses, community outreach, shared curriculum, faculty development, etc.) have arisen within your Division?

A large number of inter-/multi-disciplinary and other collaborative learning opportunities exist within Division I and with Programs in other Divisions.

Intra-divisional & Inter-divisional Course Collaborations

Division I faculty members routinely collaborate with other faculty both in and outside the Division in terms of coursework. Strong and intentional interdisciplinary course interaction occurs between a number of courses within (& outside) the Division such as: Biology & Chemistry, Biology & SENS; Chemistry & SENS; Chemistry & Physics, and Physics & Education Studies. There is also significant collaborative communication between faculty teaching collateral courses required by Programs both in and outside of Division I such as: Biology and Nursing & Physical Education (BIO101/102); Physics and Biology (*PHY217/218*, Chemistry & Biology (*CHM101/131/221/222/345),* Mathematics and BIO/CHM/PHY (e.g. *MAT115, 135*).

Division I faculty (and others) also routinely collaborate in the teaching of *GSTR 332: Scientific Knowledge and Inquiry*. Some of this collaboration is in the form of mentoring faculty new to the course (Rowley, Hodge, Hoffman, Baltisberger) and others in the form of formal team-teaching (e.g. Hoffman). Division I faculty have also collaborated with faculty from other Divisions in team-teaching *GSTR 410: Global Issues* (M. Saderholm, Douglas).

Intra-divisional & Inter-divisional Programmatic Collaborations

A number of curricular programs such as the pre-professional curricular programs (i.e. Pre-Medical, Pre-Dental, Pre-Pharmacy, Pre-Veterinary Medicine) are composed of courses that cross many disciplinary and Divisional lines. Students participating in these programs complete coursework from Biology, Chemistry, Physics, Mathematics, Agriculture & Natural Resources as well as courses in the social sciences and humanities disciplines (e.g. Psychology, Sociology, Child and Family Studies, Communication, Philosophy, etc).

Inter-/multi-disciplinary independent majors are also an example of cross discipline collaborations in the Division. Independent majors in Neuroscience and in Health Sciences have been completed by Division I faculty-mentored students. Both types of majors contained course work from many disciplines within Division I (e.g. Biology, Chemistry, Nursing) and also from other Divisions (e.g. Child and Family Studies, Psychology, Sociology, Women's Studies). (Appendix XX)

Intra-divisional & Inter-divisional Collaborative Research / Grant Opportunities

Collaboration within Division I also occurs in terms of research and grant writing. The URCPP Summer Research Program provides an opportunity for not only actual research project collaborations between faculty & students, but also a lunch seminar forum for participants to share and discuss their research. Further faculty – student collaboration occurs during the annual Berea Undergraduate Research Symposium.

Division I faculty have also directly collaborated on undergraduate research projects (e.g. National Institutes of Health-funded KBRIN grant – Biology [Anderson] & Chemistry [Saderholm]) and in the writing of various grants supporting student learning in terms of research opportunities, shared learning spaces, planetarium equipment enhancement, teaching assistant professional development, etc. (e.g. National Science Foundation [Division I - Mathematics /Education Studies] National Science Foundation [Chemistry/Academic Services], National Science Foundation [Division I – Physics, lead], Howard Hughes Medical Institute {Submission by HHMI Invitation only} [Division I], Work College Consortium [Physics]).

Intra-divisional & Inter-divisional Administrative Collaborations

Division I mentoring and tenure teams, established to guide junior faculty through the tenure process, are composed of faculty from multiple disciplines within Division I (and some from other Divisions as well). These teams provide a unique forum for collaboration between the junior faculty member and the team as well as between team members.

Numerous Division I faculty members collaborated in shared learning space renovations/modifications within the Science Building (e.g. Science Library, Room 306, Science Lobby). Changes to Room 306 have allowed faculty members to not only test new, innovative teaching strategies but also provides a "test-bed" for learning space design in a renovated Science building. Changes to the science library similarly provide students with new and more comfortable learning spaces while allowing different designs to be tested prior to new building design.

Collaborations that support students across campus also arise from Science Building staff who work closely with various Division I faculty [e.g. science technician (Dan Brewer), Environmental Health & Safety (Lesley Kaylor, Mike Morris), science library (Alice Hooker)].

Future Opportunities for Inter-/Multi-disciplinarity

A wide variety of future inter-/multi-disciplinary opportunities have been discussed by Division I faculty as ways to improve student learning. The development of formal interdisciplinary majors such as Neuroscience, Molecular Biology & Biochemistry, Health Science and Environmental Science have been actively discussed. Some of these are in development through other avenues (e.g. Health Science Curriculum Committee [XXXX] for the Health Science major), while others reside within the Independent Studies rubric or are yet to be developed.

Another opportunity which Division I faculty are interested in pursuing focuses on interdisciplinary research opportunities for students. There is significant interest in further developing on-campus summer interdisciplinary research opportunities and in developing embedded research projects that span courses in multiple programs, thereby allowing students to connect on a single research project across disciplines.

A number of Division I Programs are also interested in increasing the opportunity for students to participate in multi-disciplinary summer travel/study/service opportunities from within the Division, but also possibly including faculty from other Divisions as well.

Several Programs also expressed interest in developing additional collaborations with faculty in Sustainability and Environmental Studies and with the Berea College Forestry staff in terms of coursework and research opportunities.

Several Division I Programs are interested in promoting stronger Division I interdisciplinary ties and increasing the interdisciplinary "face" of the Division through intra-Divisional guest lectures, Divisional seminar series, resurrection of Brown Bag lunch discussions and the creation of Division I web and/or Facebook page.

Questions 5/7: In what ways are your Programs'/Division's currently available resources (e.g. faculty, technology, budgets, spaces, equipment, etc.) able to support your individual learning goals and mission? What are the areas of strength and weaknesses ("*challenges*," *our wording*) within your Division as each pertains to supporting and enhancing student learning?

Faculty- Strengths

The Faculty of Division I have a wide diversity of training, expertise and experience. The majority of Division I faculty have earned terminal degrees in their field with some Programs at 100% (Biology, Chemistry & Physics). Many, if not most, have significant post-doctoral training or clinical experience as well.

Approximately 86% (19 of 22) of Division I tenured/pre-tenure faculty have active, continuing undergraduate research programs. This research has been supported by URCPP funds and foundation/governmental undergraduate research grants. Many faculty in the Division collaboratively seek external funding to develop and improve Program and Divisional learning opportunities and academic support for students. Almost all Division I faculty also seek out and participate in professional development opportunities, both disciplinary and pedagogical.

Division I faculty are committed to student learning in all its forms. Student learning is at the center of what we do. Division I faculty strive not only to keep current with their disciplinary specialty, but also with curriculum and teaching and learning methodologies in higher education. Division I faculty utilize a diversity of teaching styles and environments (when possible, given building classroom/lab constraints) to meet the learning needs of an academically and culturally diverse student population. The Division is also committed to maintaining high academic and professional standards. (Appendix XXI) Setting and maintaining these high standards has not only helped students gain admission to some of the best graduate and professional schools in the nation (and abroad), but also to find excellent positions in the workplace. These rigorous standards do present some additional challenges, however, in light of increasing pressures to raise retention and graduation rates.

Faculty – Challenges

Faculty Staffing

As enrollment has increased and shifted in Division I, many Programs are stressed in terms of sufficient faculty to cover curricular demands and student load, especially at the introductory course level. Faculty positions are needed for the programs to efficiently and effectively offer the personal instruction so highly valued at Berea College. Many of the courses offered in Division I exceed the 15-18 students /instructor goal ratio set for General Education courses. (Appendix XXII) This faculty crunch is felt in all Division 1 programs. However, with the push to increase enrollment and the possibility of additional major programs (i.e. Health Science, Geology), enrollment pressure and class size will likely become an issue for many Programs in Division 1. As an example, Biology and Chemistry have both seen a growth in the number of students in their introductory courses (BIO101, 110 & CHM101, 131), however, there has been no (CHM) to limited (BIO) growth in the past 10 years of the number of faculty to teach these incoming students. Many of these introductory courses not only serve students in that major but also many students from a variety of other majors.

The introductory Chemistry courses, for example, are typically comprised of ~90% non-Chemistry majors.

The fact that most Division I courses are laboratory courses also complicates the staffing issue. Laboratories generally have fewer seats available than the large classrooms for both practical and safety reasons. This often results in the necessity for multiple laboratory sections for a given course. This increased pressure for lab space also makes course scheduling difficult as most laboratories are used by multiple courses. Splitting up large courses (e.g. Anatomy and Physiology, General Physics with Algebra, etc.) into individual sections would either increase the teaching load of the affected faculty member or would lead to a faculty shortage in the affected program. Add to this the fact that faculty and student teaching assistants are generally responsible for the set-up, take down and maintenance of the laboratory for their assigned courses. Teaching assistants are not always available to assist. Further complicating the situation is the limited time available to set up lab between sessions.

Insufficient faculty numbers impacts not only the ability to offer individualized student instruction in introductory & advanced courses, but also impacts the ability to offer a wide diversity of courses, including interdisciplinary and team-taught courses due to maximized faculty teaching loads. A number of Division I courses must be offered only every other year in order to provide the courses students need to be successful in graduate and professional school and in the workplace. This alternative year scheduling can make curriculum planning difficult for students and, at times, may impact a student's ability to graduate in eight terms.

It is also significantly more difficult to implement major pedagogical changes when course enrollments are high, especially since the recommended student-centered learning approaches require significant time and effort by the instructor. In addition to allowing for pedagogical innovations, additional faculty may also allow space and time to learn and adopt new technologies more widely across Division 1. On a different note, limited time exists during the academic year to maintain undergraduate research projects beyond the occasional Independent study (which does not count toward teaching load). Additional faculty might allow Division I Programs the ability to offer an undergraduate research course during the academic year.

The faculty staffing issue also severely limits the ability of Division I faculty to participate more fully in the General Education Program. When faculty are needed to cover essential disciplinary courses within the major, they are unavailable to take on General Education course responsibilities in spite of a desire to do so. Division I faculty see increased participation in the General Education Program (beyond GSTR332) and interaction/collaboration with other Gen Ed faculty across campus as a great benefit to the Division (students & faculty). There would also be the benefit of reaching out more to the general student population and involving them in the learning opportunities Division I can offer, not to mention increased exposure to critical science, math and health fields.

Division I faculty are committed to student learning and value and promote the faculty-student interactions that occur in the classroom and outside. Interaction with students is impacted by the number of faculty available both as instructors and advisors. Some Division I faculty routinely carry some of the highest advising loads on campus (e.g. Biology). Primary advising loads in Biology typically are 15-33 students, in Chemistry 9-12, in Mathematics 3-19, in Nursing 9-24 and in Physics 8-14. (Average advising load is ~12 students). These advisee numbers do not take into

account the numbers of unofficial advisees (e.g. pre-med/dent/vet, undeclared majors, minors, secondary advising) (Appendix XXIII)

Insufficient faculty staffing could also negatively impact retention of students. The expansion of permanent faculty is a real need for several Programs in Division I. Programs would like to see a decrease in the use of adjunct faculty, rather having these positions transitioned to permanent tenure track positions. This change would promote accountability and investment in the Divisional Programs by all instructors.

Faculty Development

Science and health fields have a tendency to change and advance rapidly as do teaching & learning paradigms associated with the various disciplines. Ever increasing time and funding is required in order to keep up with new developments in one's discipline, in one's area of specialty and with new and innovative teaching/learning pedagogies/methodologies. Limited professional development funding makes it difficult for Division I faculty to attend disciplinary and science pedagogy meetings and workshops due to the high cost of regional and national meetings. Registration costs alone frequently are $250-450. Housing, transportation and meals often must be covered by faculty personal funds. (Limited professional development funds can sometimes, when available, defray a small portion of these unmet costs.)

Within the Division, there is already a high level of involvement in scholarly activity, including undergraduate research (see previous sections). There are, however, still opportunities for improvements and new directions. As an example, new pedagogies developed by Division I faculty for their courses may be developed into scholarly projects (e.g. Hoffman – POGIL in Introductory Biology, Garrett – Project-based organic chemistry lab (submitted to the Journal of Chemical Education). Division I would benefit from the creation of a position dedicated to assisting Division I faculty in formulating, funding and publishing scholarly projects of all kinds. This Natural and Health Sciences grant specialist would work closely with groups of faculty throughout the grant development process during the academic year. Tasks would include assistance in the following: formulating and refining project ideas, locating appropriate funding sources, drafting competitive applications, identifying appropriate forums for disseminating results and engaging the peer review process.

Teaching and Learning Spaces - Challenges

A fundamental resource needed to achieve Division I learning goals and mission is the availability of classroom, laboratory and equipment space that promotes inquiry-based learning, problem solving, group work and investigative labs and undergraduate research. Office spaces, informal learning spaces, conference room(s), a designated faculty lounge and designated teaching assistant spaces are also important, though generally absent or lacking in our current Science Building.

Classroom space & availability is currently an issue for some but not all Division I Programs. Lack of space and inappropriate space is a significant problem for the three Natural Science Programs (Biology, Chemistry & Physics). The Science Building contains five formal classrooms: (two large lecture halls (seating 120 (Rm106) & 60 students (Rm 101) with theatre seating; a small classroom (28-30 students) with movable seating (Rm 401), a small classroom with bench tables in rows bolted to the floor (Rm 17) and the most recent addition this year of an experimental teaching

classroom (Rm 306). With current space, Program Co-ordinators have difficulty scheduling courses so that faculty may use best practices to conduct teaching experiences. Some laboratories have had to fill in for classrooms (Rm 27, Rm 212 and formerly Rm 306) and are poorly designed for this purpose. The available space [with exception of Rm 306] is less than sufficient for the number of courses needing to be scheduled and is often inappropriate for more modern teaching strategies and pedagogies. Group work, for example, is very difficult to manage in Rooms 101 or 106. Ideally, classroom space should be flexible enough to accommodate short lecture, discussion, lab and small group work. There should be dedicated space for advanced learning, which could be a combined undergraduate research lab. While the classroom availability issue is not critical for the Mathematics and Nursing Programs, there are issues with the types of spaces available, particularly in regards to group work.

Laboratory space is at a premium in the Science building where overlapping laboratory sessions must be scheduled at times due to lack of space. The sizes and static bench format of current labs also limit the number of students who can be comfortably and, more importantly, safely accommodated. Equipment space and supply storage is also an issue. Some lab space has become *de facto* equipment bays (e.g. Biology Rm 211D). In some cases, large and noisy freezers have to be housed in the lab because of power supply backup demands (e.g. Rm 204). Physics has to store a significant amount of teaching lab equipment in a lab that also doubles as a classroom. This causes interruptions in class time when equipment must be removed from the "storage" area within the classroom. The animal facility is also too small, not to code and inadequate. The main space issue is that the three Natural Science Programs have simply outgrown and overwhelmed their current building. Personnel in the Science Building (faculty & staff) have almost doubled in size since the last building renovation in 1985. Almost all courses taught in the Biology, Chemistry and Physics Programs include laboratory sessions, and as we move to follow best practices by including more integrated and complex lab activities, the need continues to grow.

One resource particularly lacking is office space for faculty, including visiting and limited-term appointments. In the Science Building there is a decided shortage of office space and of appropriate space. In recent years, the Chemistry program has had to house a faculty member in a research space while Physics has had to convert a storage space into an office. The Biology Program has also had to convert two building storage areas into offices for full-time faculty (further exacerbating storage problems). In Draper Hall and the Nursing Building, the Mathematics and Nursing programs, respectively, have sufficient space to meet existing faculty needs.

The Science Building houses the Environmental Health and Safety officers (Leslie Kaylor, Mike Morris) as well as a Science Technician (Dan Brewer) who all provide invaluable support to the entire Division as well as campus as a whole. Dan Brewer, in particular, has been critical for teaching and research efforts and has kept equipment running, built needed laboratory pieces, repaired/re-engineered laboratory equipment and provided absolutely essential laboratory and research support. He may be one of the most valuable resources in the Science Building and beyond (e.g. Technology and Applied Design). And while the Physics Shop is generally well-stocked and supplied with sufficient space, Dan Brewer's office space is woefully and embarrassingly inadequate – very small, cramped, poor climate control, etc.)

A final physical space challenge is that of non-traditional learning/lounge spaces for students to gather and study. The Natural Science and Nursing programs all have newly configured lounge areas that serve our students much better than those spaces did previously and receive

much use. More intentionally designed spaces in a new building being proposed for Division I should address the shortcomings described. The new informal learning space in the former Science Library appears to be very popular and successful based on a formal and informal account of space use. Lack of informal learning spaces was a serious design flaw in Draper Hall renovation that has very limited options beyond one very dark lounge on the 2nd floor and the former Teaching/Learning center on the 1st floor.

A critical space also lacking is that of a designated Faculty Lounge/Conference area. Division I faculty members have no location in which to meet as a group (apart from students) to work or to conduct sensitive or confidential business/discussions or just to take a minute to themselves. Such a space is essential in the remodeled Science Building.

Equipment – Strengths

One positive feature for all of the Programs in Division I is an excellent diversity and quality of laboratory equipment including an NMR spectrometer, mass spectrometer, fluorescent and interference contrast/fluorescent/phase research microscopes, classroom sets of microscope (oil immersion & dissecting), high speed centrifuges, PCR thermocyclers, a small DNA sequencer, large environmental chambers, anatomical models, simulation equipment, patient dummies, mass spectrometers, x-ray diffractometer, magnetometer, Mossbauer device, CCD camera, etc.). While there are some equipment needs and some of the current equipment needs upgrading, overall availability is relatively good except for equipment needed but not able to be housed in the current building (e.g. cell/tissue culture biosafety hoods). In general, the Administration at Berea College has been very supportive of a long-term capital plan to acquire new laboratory equipment as needed, and the Kresge Fund is available for equipment repair and replacement.

Technology - Strengths

Faculty in Division I have incorporated computer and Internet technologies into the curricula as appropriate for their courses and preferred teaching styles. For instance, MOODLE is utilized by many Division I faculty members to post course materials, form discussion boards, communicate with students, etc. PowerPoint and PREZI are used in class and in student presentations in many courses across the Division. Several faculty routinely use clicker technology to get and give immediate learning feedback. On-line electronic journal searches and research article acquisition is required in many courses. In addition, two faculty members of the Mathematics program are using I-pack to record and share their lectures on-line. Various graphing programs are used in graphing a mathematical function or in depicting a data set collected from a scientific experiment or simulation.

Technology - Challenges

In general, Division I faculty feel that IS&S has provided valuable support to the Division in regards to computer and Internet technologies. Better support of the Mac platform is needed, and there are still significant issues with Internet band-width as many faculty find it nearly impossible to stream video in classes scheduled later in the day (2:00 p.m. or later). Dedicated support for the Nursing computer and simulation labs would also be desirable.

To better support Division I learning goals and mission in the area of computer and Internet technologies, a number of improvements are suggested. Each Program should be given full control over the contents of its web page, and a Divisional web page should also be developed. A shared computer-testing facility should be established. The clinical simulation learning lab in Nursing needs to be upgraded as does the neurobiology/human physiology PowerLab software, equipment and computers (Biology/Psychology). Additional funds to support purchase of student learning software are needed.

Division Teaching Assistants – Strengths & Challenges

All of the programs in Division I feel strongly that the undergraduate Teaching Assistants are extremely critical and significant in the success of Division I programs. The support these students provide both the faculty and the students is invaluable in terms of directly assisting the faculty member with assignments, grading, course development, lab preparation, tutoring, research assistance, open-lab monitoring and, most recently, supplemental instruction (S.I.) As Berea moves toward a future with increasingly active, investigative teaching pedagogies and higher enrollments, the need for additional well-trained teaching assistants to help Division I faculty manage more intensive and additional or larger classes will become critical. These teaching assistantships also greatly benefit the participating students by providing them with experience that they can build upon as they leave Berea and go into the professional world or choose to continue their education.

Almost every Program cited the need for additional formal and continuous Teaching Assistant training. In the 2012-13 academic year, Tracy Hodge (Physics) received a Work College Consortium grant that allowed her to pilot a year long teaching assistant workshop. Prior to the beginning of the year, Tracy and selected T.A.s from across the Division had a one-day training session. At the beginning of the session the students took a standard survey (CLASS Colorado Learning Attitudes about Science Survey) that measured how close their attitude about learning science matched with experts. This was followed by a discussion about issues of academic honesty, FERPA, etc. During the second half of the workshop, they discussed different kinds of activities they could do during a study session, besides just solve problems for the students. Each group chose one activity from the SI manual and discussed it for about ½-hour, then held a mock SI session. For the rest of the year, they met regularly during the labor hour (about 1 per month). The group talked about different issues they were having in the classes they TA'd, what would help them be more effective TAs, etc. The year ended with each student giving a demonstration lecture about some topic from the major course they TA'd for during the year.

Tracy's experiences have provided a solid idea as to what a Division I T.A. training program might look like in the future, and she noted that the participating T.A.s had some good suggestions as to how to make their experience better.

Student Needs – Challenges

Undergraduate research is an important aspect of modern science and health career education. It is, however, an expensive endeavor. While URCPP funds are available to support student/faculty summer research, this limited funding constrains faculty and student participation and strongly influences the type and scope of many projects. The Chemistry Program is currently the only program with significant and dedicated student research funds. Biology has two small

funds that lately have been used to defray travel and some housing costs of off-campus research students (e.g. Mayo, Vanderbilt, CROW, etc.) Funds to support research projects in the context of regularly offered courses are more limited. Research-based labs are significantly more expensive than observational or "canned" labs. Increasing the amount of research funding available (academic year and summer) would mean more faculty and students could be involved in this very important learning methodology that promotes higher level thinking. Undergraduate research experiences also provide opportunities for students to explore and perhaps become interested in pursuing additional graduate science or professional education leading towards a science- or health-focused career.

Additional funding (and, of course, lab space) to incorporate more investigative laboratory experiences in the *GSTR332: Scientific Knowledge and Inquiry* would also be highly beneficial for Berea's non-science majors. Berea College may be the only opportunity these students have to "do" science prior to entering their chosen field or the workforce after graduation. Many non-science majors have limited to no prior experimental science education or experience. The fact that Berea College no longer requires a laboratory science as part of its General Education Program makes investigative, "hands-on" lab experiences in GSTR332 even more essential.

On-campus test preparation opportunities for students seeking to enter graduate school (i.e. GRE), professional school (e.g. MCAT, DAT, PCAT) or professional certifications (e.g. NCLEX) are currently limited and are becoming increasingly important for successful entrance to post-baccalaureate educational opportunities. Limited support is available in this regard from the Center for Transformative Learning (CTL). Funding assistance to help defray testing costs would also be beneficial. A regularly offered Summer I (May) course focused on standardized test-taking is being considered. This course could be taught by faculty from across the College and would be given teaching load credit. Making such training intentional seems warranted at this time.

Limited internship opportunities and support are a significant issue for students in Division I. Currently, Division I faculty have limited time to help students identify and locate internship experiences beyond the more traditional research-based internships. CTL resources have been of limited assistance in this regard, though their support has been steadily improving. Having a model similar to that of the Business Program where designated faculty receive release time to search out internship opportunities for Division I students may be a future desirable option. Development of a Co-op program, perhaps in collaboration with the Labor Program, might also help all students across the Division discover early what areas they like, or do not like, and if the sciences are really a potential career path. A Co-op program would help build our students resumes and give them needed experience highly desirable for post-graduate education and in the workplace. Funding would be needed to support the endeavors described above.

College Support Services - Strengths & Challenges

Hutchins Library

The campus library offers a wide range of support for Division I faculty and students. The Mathematics and Nursing Programs feel that the library supports their needs well. While the Natural Science Programs generally agree, many faculty feel that programs could use more library support concerning electronic journals. Because of the proprietary policies of many scientific

publishers, students & faculty in the Natural Sciences have difficulty accessing many key journals. Similarly, additional support could be provided in the purchase, use and support of program-specific software packages and websites. All faculty felt the library staff were exceedingly helpful and supportive.

Center for Transformative Learning (CTL)

A specific need that Division I faculty noted was the need for increased STEM/Nursing student support from the Center for Transformative Learning (CTL; formerly the "Learning Center"). The CTL is an important resource on Berea's campus for students, but that support primarily seems focused toward the humanities and social sciences. The Center for Transformative Learning has been primarily utilized by Division I faculty and students in regards to internships (administration, funding). This is a relatively new partnership, and issues that have arisen are slowly being addressed (e.g. increased internship paperwork, course credit, grade vs. pass/fail, academic standards, etc.). While many Division I students plan to pursue post-graduate educational opportunities immediately following graduation (i.e. graduate or professional school), many students plan on working first or plan to directly enter the workforce. There is a strong need for career education and support services for Division I students who may not be planning the traditional science or nursing path. There is also a significant need for graduate and professional school entrance exam support. Students have however taken advantage of CLT opportunities offered such as the Career Fair, the Cornell Weekend events and limited GRE prep. Closer collaboration between the CTL and Division I has been initiated and should address some of the aforementioned challenges.

Division I faculty routinely noted a need for more support for students with special needs and learning disabilities. Faculty noted that there is little to no support available in the CTL for Division I students who fall into this category. Faculty also noted that there is no/limited training &/or supportive services for Division I faculty who have special needs students or learning disabled students in their courses. Most Division I faculty have not had formal special needs education courses as part of their graduate training and often have to develop support and accommodations on their own. It is likely that other faculty across campus face similar difficulties. Faculty professional development in this area is required.

Question 6: What areas and specific plans for refinement, improvement or new direction have been identified by your Division and how will these plans be implemented before the next review?

Three main Division-wide improvement areas/ initiatives were identified by Division I faculty during the Fall 2012 Division I Retreat and by "Question VI" working group conversations and discussions: 1) New Natural and Health Sciences Building, 2) Community Outreach and 3) Supplemental Instruction Student Success.

New Natural and Health Sciences Building Initiative

Before Berea College committed to a new academic divisional structure in 2011, it was already considering changes to the Hall Science Building (known simply as "the Science Building"). The Charles Martin Hall Science Building was completed in 1927, had an addition in 1954 and then was modestly renovated in the 1984. While the 1last renovation helped by providing some research space, a planetarium and safer chemistry labs, it unfortunately did little to change the rooms in which learning really happened—the formal learning spaces (classrooms & labs) were left the same and informal learning spaces were not intentionally planned. Furthermore, the inflexible building layout has not been able to adjust to expansion, an increased emphasis on research, modern safety concerns, a commitment to sustainability and a desire to welcome in non-scientists (both Berea College and community members).

Learning Spaces Workshop

In November of 2010, a group of faculty (Matt Saderholm, Larry Gratton & Jon Saderholm) attended the first Learning Spaces Collaboratory (LSC) organized by Project Kaleidoscope (PKAL). (Appendix XXIV) During Berea on-campus discussions of the group's experiences, it became clear that in order to make any building project successful, Berea College's faculty and administrators needed to work together. A second team from the newly created Division I (Larry Gratton, Megan Hoffman, Matt Saderholm, Tracy Hodge, Teresa Villaran) attended the second LSC meeting (November 2011). The team's goals for the meeting were to "… learn more about creating spaces for learning that allow for innovation, collaboration, and above all, productive and active learning."

Former PKAL director and current director of the LSC, Jeanne Narum, facilitated an on-campus learning spaces retreat entitled "STEM Learning Spaces: From Planning to Designing" (May 2012) and was assisted by appointed Building Shepherd, Matt Saderholm. Faculty were challenged to think about 21st century STEM learning environments, how these are connected to the Berea Community and how to plan for assessing the impact of any changes proposed. (Appendix XXV). Current students were also invited to attend and were consulted regarding their opinions of ideal learning spaces. The two major outcomes of this retreat were the establishment of a "Natural and Health Science Building Planning Committee" which has been meeting regularly since Fall 2012 and a desire to connect new Natural and Health Science Building thinking with Division I Self-Study discussions. The annual Fall Division I Retreat (formerly the "Science Retreat") allowed faculty from all five Programs to continue in depth Division self-study conversations and implications for new Science Building design. Two major building-related outcomes came out of the Fall Science Retreat. The first was the generation of a Division I vision statement, which allowed the Division to develop a clear vision of itself and its aspirations (helpful not only to Division I members but also others who were not familiar with Berea College and Division I programs

including architectural and design firms). Secondly, in reviewing Berea College's Great Commitments, the Division I faculty reached consensus that a way for the Division to align its goals with the College's was to increase its outreach efforts. As successful outreach requires space resources unavailable in the current building, planning for outreach became part of the building initiative. (Appendix XXVI)

Learning Spaces Initiatives

While there are unique challenges with the Hall Science, Hafer-Gibson Nursing and Draper Buildings, one shared problem is that each has classrooms and learning spaces designed for teaching styles advocated decades ago. A common frustration among all programs in Division I is that the teaching or learning spaces are often not effective for either. STEM and Nursing learning space challenges run the gamut from inflexible seating to poor lighting (both natural and room) and acoustics. Good rooms are in high demand and rooms flexible enough to allow pedagogical experimentation are even more rare. Furthermore, none of these buildings were initially designed to contain informal learning spaces to facilitate student learning outside of class. Some informal learning spaces exist in each of these buildings, but only a few of these spaces are recognized by students as effective.

During the "STEM Learning Spaces" workshop, faculty members were asked to describe "Robust Learning Spaces." Some of the most common descriptions were flexible, comfortable, lit with natural light, good acoustics, safe and with effective instructional technology. A representative sample of science and nursing students when asked about the best learning spaces on campus identified spaces that were well-lit, had comfortable furniture, and room to spread out. The spaces mentioned in particular were the new lounge in Emery Hall, the Physics Student Room (Science 109), Kentucky-Talcott Annex, Hutchins Library study rooms and dormitory spaces (student rooms & common areas). Almost none of the spaces mentioned were in the Science Building. Students also reported that features like comfort, good lighting, whiteboard availability, large movable tables and electrical power availability are desirable characteristics of good learning spaces.

To gain some understanding about what works and what does not work, funds provided by the Administration/Board of Trustees allowed some modest changes to the Science Building lobby and the Science Library in order to make them more effective learning spaces (2012-2013). In the Science Building lobby, the non-descript, institutional furniture was not effective for anything but waiting on class changes, and dim lighting made it difficult for students to read, much less study. In consultation with CG Contemporary Galleries, the lobby space was broken up into three areas: an area for sitting with a comfortable and colorful couch and complementing ottoman-style chairs, an area for group work with a rectangular table and whiteboards and an area for solo study with high café tables and small white boards. The furniture was installed in Fall 2013 along with a second set of doors to keep the space more climate-controlled. New lighting is currently being installed.

The Science Library had a more substantial transformation. The modest collection of books was rarely used, with most books having not been checked out in the last 10 years. Except for a small number of books with particular value for science students, the collection was re-shelved in the Hutchins Library or recycled/discarded. This freed up substantial floor space for three group-study areas with tables & whiteboards and for a seating area with a colorful sectional couch, complementing ottoman chairs and a large coffee table. A small area rug and live plants were included as well. The room was also repainted, and new blinds were installed. Book shelves from the Science Library were repurposed into partitions and storage cubbies for student packs, coats,

books, computers, etc. The library also serves as an office for the Science Building office manager (Alice Hooker), so her desk was separated from the student space with a half wall. This room is now heavily used by students during the day as well as in the evenings for both group and individual study as well as an area just to sit, relax, chat, read or work. The SMART Board (originally located in Science 306) has been recently moved to the Science Library due to lack of space in Room 306. It has been used sporadically, but it is anticipated as more students learn to operate it there will be increased usage for tutorial or presentation practice..

A large donation from a longtime Berea College donor (Toni Stabile) allowed for learning space renovation in three buildings, one of which was Hall Science. Room 306 in Hall Science was re-created as an active-learning room, unlike any other space on campus. Previously, Room 306 was approximately two-thirds classroom and one-third lab. Thirty tablet-arm chairs were in the front and a bench for physical chemistry experiments was in the back. After the transformation, the bench was removed along with the tablet-arm chairs and all other furniture. Six "Dewey Six Top" tables were brought in with seating for 36. New blinds replaced the old dysfunctional ones. Several small rectangular tables were also placed in the room initially. In addition, the Stabile gift paid for a substantial technology upgrade (Appendix XXVII) The technology in Science 306 was finalized mid-March 2013. The potential value of the technology is substantial and will hopefully be more investigated in future semesters. A brief list of the uses to date is noted in Appendix XXIII.

A substantial increase in diversity of users of Room 306 will be seen in 2013-14. Previously, Room 306 had been used strictly by Chemistry with one Math class in Fall 2012 and in Spring 2013. In the Fall 2013, BIO 110 and PHY 111 are also scheduled for Room 306. A technology tutorial is being planned so that others can easily use the room's iPads in their teaching. Plans are also in the works to begin using apps on the iPads for specific uses other than simply as electronic whiteboards or web surfing for data. One challenge has been the lack of Java on the iPads. Many scientific tutorials are written in Java so most web-based scientific tutorials are not usable on the iPads.

Each space in the Science Building has only recently been completed so substantial assessment is difficult at this point. In regards to the Science Library, office manager Alice Hooker and faculty have noted substantial and increasing use of the Science Library space by students during the day. Evening (6-11 p.m.) usage of the Science Library was tracked by evening student library workers. Based on rough data, Science Library usage increased greatly after the renovation, from an average evening usage of 33 students per evening in Fall Semester 2012 to 63 students per evening in Spring Semester 2013. (Appendix XXIX). Faculty have also noted a significant increase in the number of students utilizing the re-designed Science Building lobby space for studying, group work, evening group study session and just "hanging out." It is anticipated that usage of the Lobby space will be even greater in the upcoming year as new lighting has been installed to brighten up a space with almost no natural lighting.

Independently, the Nursing Program observed similar problems with the informal learning spaces in the Hafer-Gibson building. The Nursing Program received Administration funding to upgrade one of their lobby spaces in order to make it a more appealing and effective space for students to gather and study. This "refit" included the addition of a study alcove with comfortable upholstered couch and chairs, a colorful bright blue & green "study bar," two café tables with chairs, a white board, a small coffee bar with microwave. Accent walls were also painted a matching bright blue. Nursing faculty report positive comments from Nursing students on the new arrangement.

As Building Shepherd (with authorization from Dean Chad Berry), Matt Saderholm organized multiple building-visit trips to assist with Natural & Health Sciences Building planning. Many Division I faculty (16) participated in six campus site visits to Eastern Kentucky University, St. Olaf College, the University of Minnesota - Rochester, Carleton College, University of Scranton, and Beloit College. Chad Berry, Matt Saderholm, and Derrick Singleton (Associate Vice President of Operations and Sustainability) attended the Tradeline Conference on College and University Science Facilities and attended presentations related to science buildings, science spaces, and aligning these with research-based teaching practices. An outcome of this meeting was that Bob Beichner, an internationally-renowned physics educator at North Carolina State University and creator of the SCALE UP approach to teaching college physics, was invited to campus to present a talk and workshop in November 2012.

What the Natural and Health Science Building Planning Team learned ,based on feedback from participating faculty, was the following: First, the visioning process for new spaces is critical. Without a clear vision for new spaces, the planning process would not succeed. Secondly, successful planning requires intensive collaboration and cooperation between faculty and administrators. All stakeholders need to be in agreement on major points before any ideas leave the campus. Thirdly, successful buildings require open and constructive relationships between architects/builders and college administrators/faculty, and, finally, that the PKAL process for building academic science buildings works. (Building Planning Team members: Chad Berry, Derrick Singleton, Matt Saderholm, Ron Rosen, Dawn Anderson, Tracy Hodge, Carol Kirby, &Dan Brewer)

In Fall 2012, a Campus Master Planning Steering Committee, (including Matt Saderholm as one of two faculty representatives) selected The Collaborative as College's new Master Planning Firm. The Collaborative is currently working on updating the campus master plan with a goal of presenting the final plan to the Board of Trustees in November 2013. The Collaborative has met with the Natural and Health Sciences Building Planning Team.

An RFP was sent to eight academic architecture firms with a track record of building undergraduate STEM and health science buildings in Spring 2013. Proposals were reviewed and the top four firms were brought to campus and interviewed. Following reference checking of two finalists firms, Ballinger (Philadelphia) was selected as the Natural and Health Science Building renovation architectural firm. While both finalist firms presented excellent proposals, Ballinger had more experience with liberal arts STEM buildings and also had an in-house engineering staff. Ballinger design staff began working at Berea this summer (2013) meeting with the Natural and Health Science Building Planning Committee and with individual Programs. Ballinger's initial proposal stated that they would work on the Visioning & Programming and Concept Planning/Building Recommendation Phases of their process this summer before moving on to the Schematic Design/Cost Estimating and Design Development/Cost Estimating Phases in the Fall.

Alumni Survey

The 2013 Alumni Survey was key in getting feedback and input from alumni regarding the physical Science and Nursing Building structures and what improvements might be made to improve student learning. Collectively, alumni from the five programs rated the following building "attributes" on a five point scale: (1) labs 3.26: range 3.00-3.40, (2) classrooms 3.36: range 3.19-4.12, (3) study areas 3.24: range 2.75-3.82 and (4) equipment: 2.90-3.75. (Appendix XXX) The Math Program rated higher in three of the four categories likely owing to their lack of need for lab space and equipment. Given that a number of these alumni have continued their education in various graduate schools around the country and/or have had access to cutting edge lab areas and

equipment in their professional occupations, it is striking that Berea College ranks fairly low by comparison. This certainly warrants support for a new or renovated facility for Division I programs.

In their response to, "What kind of spaces, resources and equipment should be part of the new spaces – those that would best enhance our students' learning?" several suggestions were often repeated. Alumni obviously felt the need for study areas of various types outside of the normal lab and classroom spaces. These included quiet areas for individual study, group study areas, areas dedicated to teaching assistants and spaces for clubs/organizations. It was suggested that these areas have adequate lighting, whiteboards, adequate resources for use of technology and comfortable seating. They noted that this was generally lacking when they were students. The following comments from alumni highlight some of these recommendations:

> *"Common areas that allow for isolation in that space- large comfy chairs that can allow a student to be in a common area but not have to sit in a large group type area. Studying near other students allows a mingling and conversation to form about a subject or when problems arise"*

> *"Quiet comfy study spaces, perhaps on one side of the building so that the labs can be locked up and the study spaces open a bit later would have been wonderful. Perhaps this space could even function as a meeting place for the T.A.s of all the Division I subjects. When I was in attendance the T.A.'s for different subjects were spread out through the building, and I know it was especially intimidating to students who did not spend a lot of time there to find a T.A. to get the academic help they needed"*

> *"There were very few student-friendly study spaces especially in the science building. This made it difficult to organize group meetings as the library was the only other option and noise levels had to be kept low. We, science students, had to compete with other students for space in areas such as the CPO, BBC and even the dorm study areas. This can be improved….the facility does not reflect the amount of knowledge and information available to science students and is not comfortable for studying because of the cramped space"*

> *"The giant windows were really nice to have all that natural light, but then it was hard to open "a window" without having the entire wall open to noise, wind, and bugs/birds. Plus many had no curtains so any PowerPoint or movies was a NO within the lab"*

Another often repeated observation was the need for updated equipment and technology in labs. This ranged from dummies for electronic simulation in Nursing, sterile fume hoods, cadavers and an adequate number of PCR thermocyclers and electrophoresis units in Biology, GC, LC-MS instruments in Chemistry, computer –based laboratory for all programs, and a Divisional Server. There were additional specifics, but alumni also made some general observations about the state of laboratories in Division I programs.

> *"Make sure there are labs for every teacher as well as a common lab area for community equipment. Most professors are performing some type of research that involves students working so they need space so everyone is not right on top of each other"*

> *"The nursing lab is woefully under equipped. There are not enough IV needles, start kits, or adequate and up to date dummies. Any one comparing a state university to our Berea lab would be dismayed by how out of date it is….I had a similar experience in my chemistry class. Bunsen burners were broken or rigged, rubber tubing was dry rotted; there was not enough equipment for each student. Instead of spending money on things like Fee Glade, the college should spend money on its main mission, the good and proper education of its students."*

"These ratings are based on comparisons with other institutions I have visited. The science labs, chemistry and biology especially could make use of some remodeling. Most instruments are rather old and time is wasted repairing these instruments"

With regard to classroom spaces, alumni were quick to point out the poor quality of the large lecture rooms. A number of faculty in Division I are currently experimenting with flipped classrooms making these old large lecture areas obsolete. Unfortunately, there is not much classroom space in the current Science Building, and the largest rooms conform to a dated tiered-seating arrangement without flexibility. The flip-down seats in these rooms often don't easily accommodate many of the larger students, making their classroom experience physically uncomfortable. This is borne out in the following alumni comments.

"The fold –down wooden seating was miserable. It was a frequent distraction in lecture simply because it was so uncomfortable"

"Classroom structure does not allow for in-class group discussions. More flexible seating spaces versus lecture hall-type seating could improve the student experience."

Several alumni suggested the presence of a coffee/snack area where students could hang out and study as well. They also noted the need for student research areas where equipment and experiments did not have to be rapidly taken down to make way for other laboratories, etc., and the need for a greater number of small classrooms. Other things mentioned included adequate climate control, an auditorium for speakers and larger events, adequate storage areas, an adequate number of bathrooms, etc. Some comments relevant to these recommendations are given below.

"As I stated before, I would like the ability to see and learn about research performed by other disciplines. A large classroom /conference room where faculty research could be presented from all disciplines and get outside researchers to perform presentations"

"More accessible bathrooms would be soooooo nice! Biology students were always on the two floors that had no bathrooms"

"A small coffee stand with espresso is such an integral part of larger institutions in an area like that – that would be greatly utilized by students. Seems superfluous, but it fosters an atmosphere that is conducive to students gathering – something the current "Science Building" lacked immensely"

General observations regarding the possibility of a new/renovated building housing all five programs are provided below. Alumni certainly had different views regarding renovated vs. new and combined programs vs. the current status quo (i.e., programs housed in three different buildings). Many alumni viewed merging all Division Programs in one building positively:

"I think the science building should be kept because of its history"

"I think a new state of the art, multi-storied building needs to be built rather than renovating the science building….Classrooms could be all set up in the basement and 1st floor; 2nd, 3rd, 4th, 5th and 6th floors could work as research labs for chemistry, biology and physics. Mathematics and a couple of physics (?) could be housed in other buildings – Draper/CM Hall. Nursing should be housed in multiple places including the present Nursing Building"

"First off our current building just seems way too old, despite all of the hard work that is done there the building gives off a sense of boredom. The equipment in the chemistry and physics departments is particularly good, but are not well housed or showcased – they are located in run-down rooms that take brave students to work alone"

"I always thought Berea had a great Science Building. For those of us who spent many hours there, it was home. I can't think of anything that we lacked while I was there."

"I believe that a new modern facility would serve the students better and allow the department (division) to grow and expand in the future"

"The nursing and science buildings would greatly benefit from better, newer buildings (with) better lighting and better environment altogether"

"When I visited Berea for homecoming in 2012 I was impressed with the nursing building improvements"

"If you just renovate the two buildings (Science and Nursing), then how would they be intertwined? Also, isn't the Math Department in Draper? It might have moved since I left, but I personally would just build a new building so that everything could be housed in one area…I felt the entire (Science) building was just nothing but labs and a few classrooms on the 1st floor"

However, a majority of the Nursing respondents (4 of 5) and approximately half of the Physics respondents (2 of 3) graduating in the past five years were opposed to the idea, sometimes quite strongly.

"I feel nursing should be kept separate and either in a new or renovated building. The Division should work together to determine which classes would be more beneficial to nursing professionals in terms of practice."

"I think it would be difficult to have one building for all. Nursing needs a way different variety of things for a lab compared to Biology and chemistry for example. Nursing would need a floor of their own with a lab of their own due to the needs in the lab for beds, dummies, IV poles, IV start dummies and etc. This type of lab is not appropriate for use by other majors."

"Personally as a Nursing major, I would not have liked to be in a building with other programs. We really got close and were required to spend lots of time together and in the nursing building. I think this closeness would be compromised if we did not have our own building to learn and study in."

"I am not a supporter of putting nursing under the same umbrella. If you take my opinion, natural sciences can't collaborate with a specialized and applied filed such as Nursing."

All respondents were, however, supportive of interdisciplinary coursework and or new & improved facilities.

There was also repeated concern that there be enough space for all programs, classrooms and labs if all programs were to be housed together and that programs not be shrunk to accommodate the fit of all in a common building.

Community Outreach Initiative

Division I has a mission to serve the communities within Appalachia as noted in Berea College's Great Commitments. Division I currently strives to accomplish this through high-quality student education and excellent new teacher and nurse training. A more intentional outreach effort should be made to create direct and impactful connections to local communities. In addition to providing a service, this effort may help to attract high-quality students who might not otherwise

think of Berea as a school for science, mathematics and nursing and may provide those who do apply to Berea with a better understanding of the variety of opportunities available.

Berea College has a unique and powerful mission that is the envy of many other academic institutions. "We know why we are here." Conversation begun during the 2012 Division I retreat highlighted the need for a more intentional and practical connection between Berea's Great Commitments and Division 1, in particular, through commitments 3 & 8:

- *To provide an education of high quality with a liberal arts foundation and outlook.*
- *To serve the Appalachian region primarily through education but also by other appropriate services.*

While Division I Programs have always been committed to providing a high-quality liberal arts education, the collective programs have not had a coherent approach to serving the Appalachian region. In a time of rapid climate change and technological advances, those who don't understand the science & technology that undergird human society will get left further behind and be less well-equipped to handle challenges to both individuals and humanity as a whole. Expanding educational programs out into the Appalachian region would allow Division I Programs to actively participate in fulfilling this key Great Commitment.

Current Outreach

While a concerted and organized attempt at outreach is new to the Division 1 programs, each program has historically pursued outreach in different ways. These experiences are important to acknowledge going forward. In Biology, Megan Hoffman and Roy Scudder-Davis have hosted many hands-on experiences for students from local elementary schools and in the Berea community. In Chemistry, Matt Saderholm ran a short term course called "Chemical Magic" that brought chemistry demonstrations to a range of local public schools and home school groups. In its last iteration, Chemical Magic was a service-learning course that worked with fourth grade students to prepare their own chemical magic show for presentation to K-3 graders. Chemistry has also worked with local schools as the opportunity has arose, presenting demonstration shows to tutoring children and working with local high school students on required experiments for AP Chemistry labs. Dawn Anderson (Biology) has worked with middle school students from Berea Community School with science fair projects and accelerated student mini-research projects. The Nursing Program routinely organizes and participates in school and community health fairs. These outreach health education programs perform a vital educational role in the local region and provide hands-on experience for many Nursing students. Nursing students also routinely participate in annual influenza vaccination drives on campus, helping to significantly decrease the threat of flu outbreaks on campus. The Pre-Med/Dent Club has also participated in several health awareness projects on campus including HIV/AIDS and breast cancer awareness. In Mathematics, Judy Rector has annually worked for Berea Counts each summer to tutor K-12 students in mathematics. She has on multiple occasions run workshops for the teachers at the elementary, middle school and secondary levels to better enable them to teach mathematics. The Physics Program maintains an outreach program with the planetarium. Students from local elementary schools come and learn to identify common constellations and asterisms and their lore and mythology. In addition, the planetarium hosts a show for the general public the third Sunday of every month during the academic year (September through May).

Alumni Survey

The recent 2013 Alumni Survey indicated that students' experience with community outreach Division I Program has been primarily generated from within programs in the Division

(19.5%; e.g., coursework including community nursing, health fairs, chemical magic show, planetarium shows) and by their participation in extracurricular programs such as Bonner Scholars, CELTS, Save The Children, etc. (29.3%). The nature of this outreach has been dominated by tutoring of local students (20.3%) and service learning (18.7%). (Appendix XXXI) Alumni shared how this type of community outreach and service learning impacted learning in their majors and overall education. Several trends are apparent. Several alumni felt satisfaction with regard to giving something back to the community as seen in the following comments:

> *" I did one-on-one tutoring and refugee ministry (African Students Association collaboration with Kentucky refugee Ministry) because I believe in giving back to the community. I would not be where I am if someone had not taken their time to impart some knowledge and life skills in me. It was very fulfilling to be able to contribute in impacting change in the lives of those who were struggling. It made me realize I had been given an academic opportunity that I had to take advantage from. It helped me to be more involved in my school work so that I could continue (to) interest those I mentored in the prospects of higher education."*

> *"It gave me an opportunity to give back to the community that gave me so much. Since I came to this country with only $100, I try my best to find opportunities to make an impact."*

Others found such outreach to provide a deeper meaning to their lives:

> *"Community outreach experiences make Berea unique. I was very involved in these outreach programs not because I had to be, but because I wanted to be a part. No credit hours were gained from these services, yet the amount of knowledge and self-satisfaction gained through outreach service learning cannot be measured. They helped me grow and find meaning amidst my busy school schedule,*

> *"I love being able to show children the beauty behind knowledge, especially science. It's such a fascinating subject. Its fulfilling to guide others into understanding information and to showing them new concepts, whether its science, math, reading, English, etc."*

Some alumni found outreach initiatives to be pivotal in steering them towards career choices:

> *"I did outreach with a local school. It was very useful because it helped me realize I wanted to go into teaching. However, it should be useful for students because it helps you realize that you are part of a larger community."*

> *"Service learning really tied all the ends together, so to speak for me. It was a culmination of my knowledge as a student and experiences with my labor position. The health fairs/community events I participated in gave me a glimpse into public health, which has eventually become my career niche."*

One other attribute mentioned several times by alumni was that outreach allowed them to apply knowledge from their coursework to real life problems:

> *"My community experience helped me to put my heart into my learning. It gave meaning to the materials I was trying to cram into my head"*

> *"The most important part of my learning was the limitations of applying things I learned in class in a real world setting. This made me aware of the challenges in sustainability practices, and helped me be more critical of the applicability of what I learned in class."*

It is apparent from the responses collected that not all Division I alumni had outreach experiences while students at Berea College based on numbers responding to our questions.

Several responses were not particularly positive about the impact of these experiences on their lives. The following sample of responses highlight these feelings:

> *"I don't think it impacted me as a student. It wasn't until after I graduated that I realized I needed to do something that served my community in some way and I particularly loved teaching about injustice and health issues."*
>
> *"While service and community outreach is important in life, it was not beneficial to getting a job. So many graduates leave the college not prepared for the life outside Berea, where fairness and love are not always as present, and they fail in job interviews., etc. which I see (as a) boss now on a frequent basis."*
>
> *"Outreach programs were part of the community nursing courses. These courses during my time at Berea were a hindrance rather than an enhancement. There was entirely too much focus and coursework for classes that held such little credit and had little to do with nursing boards. The programs were enjoyable because we were teaching children about bicycle safety and that was a good experience. However, were too focused on the grade and failing a clinical experience to focus on what really mattered for that project – children's safety."*

The overwhelming number of alumni responses were, however, positive with regard to the impact of their outreach experiences. With this in mind, Division I programs see a real need to increase our involvement with local schools to enhance STEM and Nursing education and have made this aspect of community outreach a central part of our Vision Statement.

Agreeing in principal to increase the outreach efforts of Division I is, however, not a simple endeavor. Faculty are already overcommitted, and resources (e.g. expertise, supplies, space and time) are limited. Current planning for new academic spaces in a renovated or new Natural and Health Science Building provided the context for discussions about what would be required for the Division to successfully undertake and implement a community outreach program.

Stemming from discussions during the 2012-13 academic year, several points became clear:

1. Outreach efforts that connect Division I more intentionally to regional school teachers and children (K-12) are most aligned with Berea's educational focus and most likely to improve the quality of students eventually entering college;
2. If the Division is serious about incorporating outreach, additional staff support will be needed to coordinate/run activities as well as help with proposal writing to support activities;
3. Ways to help faculty align outreach activities with pedagogical research potentially leading to new scholarship through publications and grant proposals, should be explored;
4. Many resources already exist to make outreach successful such as:
    a. Student Labor Program
    b. Science education program through the Education Studies Program
    c. Center for Excellence in Learning Through Service (CELTS)
    d. Programs in local schools through the Externally-Funded Programs Office
    e. Faculty in the division with outreach experience
5. Current spaces on the Berea College campus are not well designed for intentional, long-term outreach programs.

Current Outreach Initiative Efforts

Members of the Division I programs (Biology, Chemistry, Physics, Mathematics, & Nursing) and also some Division II programs (Technology and Applied Design, Computer Sciences) held a retreat to engage educators and administrators from the schools in Madison County in discussing outreach and partnership opportunities between Berea College and the local schools in relation to STEMN education [Note: Traditional STEM terminology (science, technology, engineering& mathematics) is expanded to include Nursing program at Berea College]. The outreach planning retreat (10 June 2013; facilitated by the Brushy Fork Institute) was designed to gather input from the community educators about STEM education in the local school systems and to allow 18 community educators and 17 Berea College faculty and staff the opportunity to develop and discuss ideas for outreach programming. Retreat activities included: 1) an analysis by local community educators as to what was working well with STEM education in their schools, what was not and where shortcomings existed; 2) conversations with current Berea College STEM students; and 3) outreach project idea brainstorming, idea prioritizing and implementation requirements.

Four key outreach needs/ideas arose from the workshop and are as follows:

1. The need for a central location for outreach resources including a lending library with resources such as books, lesson plans, demonstrations, virtual lessons as well as a clearinghouse that would provide information about contacts and resource usage;
2. The need for teacher training and/or team teaching with interaction among faculty, teachers, college students and elementary, middle and high school students;
3. College students serving as mentors and teaching concepts to elementary, middle and high school students in person or through Skype or other technology;
4. STEMN Camps and Academies for middle, high school and college students, perhaps rolled into coursework or summer programs.

(Appendix XXXII- STEMN Outreach Retreat Summary. Full report accompanies as separate pdf.)

We are currently at a crossroads in STEM education within the United States. It is well recognized that these areas are in need of support with our future economic and environmental health at stake. The following statements are taken from the National Math and Science Initiative Website (*www.nms.org*) (Appendix XXXIII):

1. The United States is losing its competitive edge in math and science while the rest of the world soars ahead. Our knowledge capital, which fuels innovation and economic growth, is at risk.
2. U.S. students recently finished 25th in math and 17th in science in the world compared to 31 other countries.
3. The prestigious World Economic Forum ranks the US as No. 48 in quality of math and science education
4. In 2008, 31 percent of US bachelor's degrees were awarded in science and engineering fields compared to 61 percent in Japan and 51 percent in China

Given these concerns, it only makes sense that we develop close partnerships and communication with local schools to encourage more young people to pursue careers in STEMN fields and to provide the support to allow them to succeed.

Supplemental Instruction Student Success Initiative

Many students coming to Berea College face significant academic challenges, not the least of which is learning to study and learning to ask for help when needed. Traditionally students have been offered additional learning assistance in the form of Q & A sessions (professor & T. A.), tutorial sessions (T.A.), topic review session (professor, & T.A.) as well as professor and T.A. office hours. Utilizations of these services is often disappointingly low. In an effort to provide students with both studying and learning assistance, other avenues are being explored, one of which is Supplemental Instruction. *(International Center for Supplemental Instruction, http://www.umkc.edu/asm/si/overview.shtml).* (Appendix XXXIV)

In January of 2012 three Division I faculty (Dawn Anderson, Tracy Hodge, and Marc Rowley) and one in July 2013 (Sarah Blank) attended Supplemental Instruction (SI) Supervisor Workshops in Kansas City, Kansas. Ron Rosen and Sarah Blank also attended a Gateway Completion Conference in April 2013 at which supplemental instruction was discussed. Supplemental Instruction is a well-established, research-based tutoring model developed at the University of Missouri Kansas City (UMKC) that uses peer-assisted study sessions to improve student retention and success in historically difficult classes, including most introductory science and math courses. By targeting the course rather than individual students who may be struggling, SI removes the stigma that many students feel when asking for help in a difficult course. In an SI course, the instructor identifies a student who has already succeeded and demonstrated strong academic skills in the course to be a peer leader. The peer leader acts as a "model student," attending class, taking notes, and holding group study sessions several times a week. During the study session ("SI session") the peer leader guides students in working together to discuss course content, compare notes, predict exam questions, and working on example problems.

In many respects, the SI model seems ideally suited for adoption at Berea. Programs already have a tradition of using upper division science students as teaching assistants through the Labor Program. The SI model provides a more structured, formalized method of tutoring that is based on well-established learning principles derived from cognitive and behavioral science. In the past two years, both biology and physics have implemented SI, with varying degrees of success. In Biology, SI has been used in BIO 222: Microbiology. In Physics, SI has been used in PHY 225 Math Methods I, PH 217/218 General Physics I/II with Algebra, and PHY 315 Introductory Physics I with Calculus.

BIO222 has included an SI session for the past three semesters (Spring 2012 with 13 students, Autumn 2012 with 24 students, and Spring 2013 with 16 students). Attendance was voluntary and no extra credit was given for participating in the SI sessions. Each week, the SI leader reminded the students in class and lab when the SI session would be held, and highlighted some of the topics that might be included. On average, the peer instructor reported that 1-4 students attended the sessions, with attendance much higher during the session before an exam. The SI leader noted that most of the students attending the sessions were stronger students to begin with, and that attendance declined considerably as the semester progressed. The students who did attend SI reported that it was helpful to their studying, and that they got a lot out of the time spent in SI. When weaker students did attend SI sessions, they showed improvement on exam performance, but their performance dropped off if they stopped attending.

PHY 225 and PHY 315 included an SI session in the fall of 2012 (22 students) and spring of 2013 (19 students), respectively. Attendance was voluntary and no extra credit was given for

attending SI sessions. There were 4-7 students who attended regularly, and who were described by the course instructor as "maybe a bit weaker, but highly motivated." The impression of both the SI leader and course instructor was that these students both appreciated and benefitted from the sessions, and they were observed to form a study-cohort even outside the SI sessions. However, students did not appear to find the SI sessions as useful the following semester in PHY 315, and attendance was very low.

PHY 217 (42 students) and PHY 218 (18 students) held SI sessions during the 2012-2013 academic year, with the same SI leader and largely the same group of students for each course. The attendance was typically 2-5 students per session both semesters, and tended to include stronger students. The students who attended SI found it very helpful and were positive about the experience.

Some general observations about the initial experiences of Biology and Physics with the SI program:

- Attendance at SI sessions was statistically similar to the attendance reported nationally, at roughly 15-20%. However, the relatively smaller class size at Berea meant that SI attendance was as low as 2-4 students in many cases. At least one SI leader felt that this did not produce the "critical mass" necessary to have a dynamic study session.
- In three courses (BIO 222, PHY 225, and PHY 217), students reported that the SI sessions were very helpful to their learning and were a valuable use of time. However, the students who attended SI sessions tended to be the stronger students in all but one course (PHY 225).
- Although the tradition in SI is not to require attendance, we feel that because of our smaller class sizes it might be necessary to have a certain number of sessions required/incentivized each semester. The sessions are much more effective with a critical mass of students, and many of the students who need the most help are not taking advantage of the program. We may also wish to investigate whether holding evening sessions in a non-academic building would improve attendance.
- The individual SI leaders should meet regularly with their course instructors. Time needs to be built into their labor schedule to facilitate the development of activities and materials for the SI sessions.
- There needs to be a formal SI training program for TAs, which continues throughout the semester. There is a wealth of material from the SI center at UMKC that could be used to develop a one-day training seminar for TAs. It would also be useful for the SI leaders from different programs to meet together once a month or so, to compare notes and make suggestions on what works to motivate and interest students during an SI session. Finally, it may be fruitful to arrange an on-site visit from the UMKC group to facilitate training of both the SI leaders and course instructors.
- Overall, our experiences have been positive, and we feel that some variation of the SI program is likely to be of significant benefit for our students. Structured peer-learning sessions are known to be much more effective than open tutoring, and SI sessions can take advantage of high-engagement activities that do not always fit into a traditional lecture hour. With better training and coordination, SI could become a model for Labor Program tutoring across campus.

Supplemental Instruction will continue in a modified peer-assisted learning format (i.e. required attendance) in the courses noted above in the upcoming academic year and also for the first time in the BIO101: Anatomy and Physiology course.

Summary Points

Mission (Q.1)

The Mission of Division I is to serve and provide students of great promise and limited economic means from the Appalachian region, women & men, black & white, with the opportunity to learn, explore and investigate the complexity, diversity and interrelatedness of the Natural Science and Health disciplines within the context of a high quality liberal arts foundation and outlook.

Vision (Q.1)

The Programs of Division I seek to educate a new and diverse generation of scientists, STEM (Science, Technology, Engineering and Math) educators and healthcare professionals grounded in the liberal arts and centered on a life of labor, learning, and service.

Support of College Learning Goals and Aims (Q.2)

Focus on:

- Knowledge and understanding of the natural world
- Examining what effect use and application of knowledge on individuals, society and the environment
- Emphasizing the interrelatedness, interconnectedness and interdependence of the Natural and Health Sciences

Divisional Strengths

- Dynamic Learning Culture
- Open-ended investigative & experimental laboratory experiences
- Guided-inquiry learning
- Problem-based learning
- Case studies
- Capstone experience
- Undergraduate research

Divisional Improvement Areas

- Improved student expectation communications
- Additional assessment of teaching methodologies
- Increase ability to contribute more broadly to the General Education Program

Divisional Opportunities (Q.3)

Wide variety of course structure, design and pedagogy

- Active learning models
- Use of computer technologies and software
- Laboratory and clinical experiences
- Research –rich / Investigative course design
- Special Topics/Independent Study/Directed Study courses
- Capstone experience variety
- General Education courses

Undergraduate Research

- On-campus
- Off-campus
- Research Abstract Journal & Conference Presentations

Internships and Practicum Experiences

Study abroad

Career Development
- Labor Program
- Career preparation

Alumni Interaction
Community Building

Divisional Inter -/ Multi-disciplinary or Collaborative Opportunities (Q4.)

Intra- / Inter-divisional course collaborations
Intra- / Inter-divisional programmatic collaborations
Intra- / Inter-divisional collaborative Research / Grant collaborations
Intra- / Inter-divisional administrative collaborations
Future opportunities for inter- / multi-disciplinarity
- Undergraduate research
- Travel / study / service abroad
- Additional collaborations (e.g. SENS, Forestry, etc.)

Promote stronger inter-disciplinary identity of Division I (e.g. web site, Facebook, etc)

Division I Resources: Strengths and Challenges (Q. 5/7)

Faculty Strengths
- Diverse training, expertise, experience
- Terminal degrees plus post-doctoral /clinical training
- Active, continuing undergraduate research programs
- Commitment to student learning in all forms
- Variety of teaching styles and learning pedagogies
- Rigorous and high academic standards

Faculty Challenges
- Insufficient faculty staffing
- Course diversity
- Scheduling challenges
- Learning curve for new technology and pedagogy adoption/integration
- Undergraduate research time limitations
- General Education contribution
- Advising loads

Teaching and Learning Space Challenges
- Classroom space and availability
- Laboratory space
- Office space
- Non-traditional learning spaces
- Non-traditional student spaces
- Faculty lounge / conference room

Equipment
- Diverse and high quality
- Administrative support (e.g. capital plan, Kresge Fund, etc.)

Technology Strengths
- Availability and support
- Moodle, Clickers

Technology Challenges
- Increased Mac support, band-width,
- Upgrades for physiology/neurobiology, nursing simulation software and equipment

Division Teaching Assistants Strengths
- Provide essential supports for courses and labs

Division Teaching Assistants Challenges
- Increased training, course participation opportunities

Student Need Challenges
- Undergraduate research funding
- Needed investigative laboratory experiences GSTR332
- On-campus test preparation
- internship opportunities and support

College Support Services Strengths & Challenges
- Hutchins Library|
  - Wide range of support
  - Increased scientific electronic journal support
- Center for Transformative Learning
  - Increased internship support
  - Increased career education and support services
- Faculty support / training for special needs students

Identification of Areas / Plans for Division Improvement or New Directions (Q. 6)

Initiative I – New Natural and Health Sciences Building (NSHSB)
- Learning Spaces Workshop (Learning Collaboratory)
- Learning Spaces Improvement Initiative
  - Experimental teaching space (Science 306)
- Science Library transformation to informal learning space
  - Science Lobby as informal leaning space
  - Hafer-Gibson lobby as informal learning space
- Building planning conferences and visits
- New N SHS Building Shepherd and Building Planning Team appointed
- NSHS Building Architect Workshops

Initiative II - Community Outreach
- Current efforts (local schools, local community)

STEMN Outreach Retreat
- Division I faculty, community educators & administrators
- Identification of outreach needs

Initiative III - Supplemental Instruction Student Success
- Current pilot program
- Continuous peer –leader / TA training
- Expanded, revised program for future

APPENDIX I

Some Initial Thoughts on a Divisional Review Process

(Office of Academic Vice-President and Dean)
(Office of Institutional Research & Assessment)

Our recent efforts to restructure our academic programs have left us with a dramatically different institutional landscape. Among the several goals of this restructuring was the increased opportunity for interdisciplinarity

- Divisional structures allow for interdisciplinary thinking, learning, and action to greatly enhance student learning by incorporating a broader range of issues important to liberal education that prepare our students to be responsible global citizens of the 21st century.

- The purpose of the Divisional Review Process is to provide a vehicle for continual reflection and improvement at the division level and for Divisions to develop a culture of collegiality and collaboration that supports the types of interdisciplinary thinking, learning, and action we seek in our faculty.

- Each Division accomplishes this process over a one year period (occurring every six years) and culminates in a final report submitted to the Assessment Committee (or its designee) by the end of the academic year in which it is begun.

- During the Divisional Review process, individual programs within the Division may elect to engage in a comprehensive review of their curriculum and or programmatic identity and needs to be included as part of the final report from the Divisional Review.

- The final report would be completed in three sections.

    - The first section would ask Divisions to provide a brief statement about the common or shared identity of the Division, including relevant information about each Program's contribution to this identity.
    - The second section, or body, of the report would then focus on the actual functioning of the Division in terms of student learning, including opportunities for interdisciplinarity that enhance student learning and resources necessary to positively impact student learning.
    - The third and final section of the report would provide a space for individual programs to conduct and report on their curriculum and program review efforts.

- As part of the process, Division Chairs and individual programs within the Division are encouraged to seek out and utilize external reviewers where feasible.

- Divisions should keep the four paired learning goals of the College, as well as the Aims of General Education, at the forefront of their thinking, identifying areas or ways in which their programs contribute to those goals or how such contributions might be improved.

College-wide Paired Learning Goals

CLG 1.1 – We seek to develop in ourselves and our students the intellectual ability to enjoy a life of learning and the arts as well as the capacity to address complex problems from multiple disciplines and perspectives.

CLG 1.2 – We seek to develop in our students and ourselves the capacity for moral and spiritual development, and a commitment to service for the common or public good.

CLG 2.1 – We seek to understand the working of our natural environment and the consequences of human interventions.

CLG 2.2 – We seek to reflect seriously upon the benefits and limitations of scientific and technological creations.

CLG 3.1 – We must first seek to comprehend our distinct backgrounds as well as our common American culture.

CLG 3.2 – Because we live in an interdependent global community, we must actively seek to learn from cultures around the world.

CLG 4.1 – We seek to educate our students and staff to be independent thinkers and doers.

CLG 4.2 – We encourage all of our students and staff to understand the interdependence of all people and the need for collaboration and cooperation within a shared learning community.

Aims of General Education

1.1 – help students understand aesthetic, scientific, historical, and interdisciplinary ways of knowing (Knowledge)

1.2 – help students understand religion, particularly Christianity, in its many expressions (Knowledge)

1.3 – help students understand Berea College's historical and ongoing commitments to racial (traditionally black and white) and gender equality, as well as to the Appalachian region (Knowledge)

1.4 – help students understand the natural environment and our relationship to it (Knowledge)

1.5 – help students understand the roles of science and technology in the contemporary world (Knowledge)

1.6 – help students understand U.S. and global issues and perspectives (Knowledge)

2.1 – help students develop the abilities to read and listen effectively (Skills)

2.2 – help students write and speak effectively, with integrity and style (Skills)

2.3 – help students develop the abilities to think critically and creatively, and reason quantitatively (Skills)

2.4 – help students develop the abilities to construct research strategies and employ appropriate technologies as means to deepen one's knowledge and understanding (Skills)

2.5 – help students develop the abilities to work effectively both independently and collaboratively (Skills)

2.6 – help students develop the abilities to resolve conflicts nonviolently (Skills)

3.1 – help students deepen their capacities for moral reflection, spiritual development, and responsible action (Habits of Mind)

3.2 – help students develop an openness to and knowledgeable appreciation of human diversity, in terms of race, gender, class, religion, sexuality, language, and culture (Habits of Mind)

3.3 – help students cultivate their imagination and ability to discern connections, consider alternatives, and think about topics and issues from multiple perspectives (Habits of Mind)

3.4 – help students think and act in ways that promote peace with justice (Habits of Mind)

3.5 – help students develop habits leading to lifetime health and fitness (Habits of Mind)

4.1 – help students become independent learners through discussion and lecture (Learning Experiences)

4.2 – help students become independent learners through student-initiated learning (Learning Experiences)

4.3 – help students become independent learners through experiential learning (for example, service learning, travel, internships, etc.) (Learning Experiences)

4.4 – help students become independent learners through collaborative learning (Learning Experiences)

- Question 1:
  - What is the mission of your Program?
  - What previous work has been done by your program to improve or strengthen its identity and its impact on student learning?
  - What future work could be done to strengthen or clarify your Program's identity, including how that identity is reflected in and impacts student learning?

- Question 2: What college-wide learning goals (e.g., the four paired learning goals as well as the Aims of General Education) is your Program particularly well-suited to address, and in what various ways does your program and curriculum currently support or contribute to these learning goals?
  - How can/will your Program build on the history and internal strengths while enhancing and sustaining an (educational curriculum/experience) that will serve BC students and graduates into the future?
  - What do you want the culture(s) of learning to be in your Program?
  - How do these learning goals shape a vision for your Program and prepare students to become productive citizens in the 21st century?
  - What future opportunities will there be for your Program to contribute to and/or support these shared learning goals and purposes?
  - Are your Program goals for student achievement consistent with students' own goals and expectations?
  - Are the teaching methods in your Program successful in accomplishing the goals of the courses?

- Question 3: What opportunities (e.g., courses, undergraduate research, study abroad, internships, service learning, independent studies, etc.) are currently available in your program?
  - How can students master the learning goals in your Program?
  - What role should/do students play in Program governance?
  - What support does your Program provide to help students achieve their goals outside the classroom and laboratory?
  - Are we effectively serving students from other programs/divisions?
  - Are we effectively reaching out to every student at our institution who would enjoy/benefit and profit by substantial work in our Program?
  - How can your Program maintain its disciplinary integrity and the culture of excellence, while embracing new and robust cultures of learning in an inter – and multi-disciplinary context?
  - In a world of complex and intractable challenges, how can we require students to be holistic problem solvers through the integration of students' perspectives and knowledge?

- Question 4: What opportunities for interdisciplinarity, multidisciplinarity, or other forms of collaboration (e.g., scholarship, shared learning spaces, team taught courses, community outreach, shared curriculum, faculty development, etc.) have

arisen within your Program? How do we maintain the excellent opportunities already present in your Program while, at the same time, considering new pedagogies and curricular initiatives, as well as extending current programmatic opportunities into division wide efforts? And how do we ensure students are achieving the learning goals by integrating what they have learned at Berea College?

- What future opportunities for interdisciplinarity are on the horizon?
- How do you see the separate programs in Division I working together?
- What vision for your Program encompasses its internal strengths and historic programs while addressing the needs of our students who will study, work, and live in the world beyond?

- Question 5: In what ways are your Program's currently available resources (e.g., faculty, technology, budgets, spaces, equipment, etc.) able to support your individual learning goals and mission?
  - What resources are needed to better support your Program's learning goals and mission?
  - We may be in the midst of a cultural and educational revolution initiated by the information age. How has your Program engaged with this paradigm shift in planning for the future?

- Question 6: What areas and specific plans for refinement, improvement, or new direction have been identified by your Program, and how will those plans be implemented before the next review?
  - What resources (e.g. time, money, space, etc.) are necessary to undertake this planning and implement the proposed planned outcome?
  - What is the projected time-line for implementation?
  - How might your Program continue reaching as many students as effectively and sustainably as possible (including not only how/what faculty teach but also the learning spaces in which education happens)?
  - How can we continue to integrate excellent programs in natural science, math, nursing, and new health and sustainability programs around innovative pedagogy and curriculum in a dynamic 21st-century learning space?

- Question 7: What are the areas of strength and weakness within a program (and/or its curriculum) as each pertains to supporting and enhancing student learning?
  - What changes or improvements has the program already undertaken to enhance or improve student learning?
  - What significant opportunities or challenges lie ahead for the program to enhance or improve student learning?

APPENDIX II

DIVISION I NATURAL SCIENCE & HEALTH RETREAT 7-8 September 2012
Division Self-Study and New Building Planning

DIVISION SELF-STUDY QUESTIONS: PROGRAM RESPONSES AND QUESTIONS TO THINK ABOUT

QUESTION 1: MISSION & VISION

WHAT IS THE MISSION OF OUR DIVISION?

PROGRAM MISSION STATEMENTS

BIOLOGY: The mission of the Berea College Biology Program is to provide our students with the opportunity to learn, explore and investigate the complexity and diversity of living organisms & systems within the context of a liberal arts tradition. Excellence in teaching and research form the foundation of the Program. We aim to help our students discover, apply and integrate the fundamental concepts of biology in a disciplinary and an inter-/ multi-disciplinary context and to help them develop the ability to acquire, interpret and communicate scientific information. We strive to provide diverse and innovative laboratory, research and field opportunities for our students to actively develop their skills as practicing biologists. We are committed to vital mentoring of our students as they develop critical quantitative & analytical abilities as well as their written, oral and visual communication skills. We also seek to help our students understand and appreciate their role as scientifically literate global citizens and professionals.

CHEMISTRY: The mission of the Berea College Chemistry Program is to instill in its students an understanding of chemistry, the role of chemistry in the natural world, and its role in society. Besides providing a rigorous and technical chemical education, we have achieved this mission by supporting and integrating creative and critical thinking in our courses. We give students the tools to build collaborative problem-solving skills, explore the scientific literature, and pursue hands-on research. We plan on building on our program's strengths by adding research into introductory lab classes and making lab experiences more relevant by focusing on environmentally important (green) chemistry themes.

PHYSICS: The Department of Physics offers a rigorous, comprehensive curriculum that is designed to (a) prepare students to enter graduate schools or research laboratories en route to careers as professional physicists; (b) provide a liberal arts degree to students who will not become physicists but are interested in careers for which a background in physics is essential, such as engineering, medicine, computer science, and secondary teaching; and (c) provide service courses for majors in other sciences such as pre-medicine, mathematics, industrial arts and technology, and agriculture. In addition to specific departmental courses that are offered to serve these groups and instructional areas, our faculty members participate in the general studies program and provide classes for non-science majors for the larger college community.
Our courses introduce students to the nature of scientific inquiry, grounded in problem solving that calls on both practical and quantitative reasoning skills. We are committed to the idea that students should conduct research as part of their undergraduate curriculum, both on campus and at other research institutions.

MATHEMATICS: *included list bulleted goals for Mathematics major, Mathematics Education, Developmental Math Program and Service courses rather than a formal mission statement.*

NURSING: In accordance with the expectations of the nursing profession and the learning goals established by the college, the mission of the program of Nursing is to prepare students with great promise and limited economic resources for the practice of professional nursing in a variety of health care settings and to provide a foundation for graduate study in nursing.

Important Common Attributes: Relevance; in-depth/comprehensive program; co-operative/collaborative learning; creative/analytical/critical thinking; inter-/multi-disciplinarily; integration of concepts; research; communication; exploration; active; focus to career;

DIVISION IDENTITY

Division identity attributes vs. Program

How clarify / strengthen / expand (?)

Does identity impact student learning? Impact how?
Program vs. Division

QUESTION 2: COLLEGE LEARNING GOALS AND GEN ED AIMS

WHAT COLLEGE-WIDE LEARNING GOALS IS DIVISION I PARTICULARLY WELL-SUITED TO ADDRESS?

IN WHAT WAYS DO PROGRAMS & PROGRAM CURRICULA SUPPORT OR CONTRIBUTE TO THESE LEARNING GOALS? HOW MIGHT DIVISION I CONTRIBUTE IN THE FUTURE?

***SEE DIVISION LEARNING GOALS TABLE**

Program contributions

Division-based contributions

In what additional ways could / should Division I contribute?

HOW DO COLLEGE LEARNING GOALS/AIMS SHAPE THE DIVISION I VISION AND PREPARE STUDENTS TO BECOME PRODUCTIVE CITIZENS?

What is our Vision?

What do/will students need?

ARE DIVISION GOALS FOR STUDENT PREPARATION/ACHEIVEMENT/EXPECTATION CONSISTENT WITH STUDENTS' OWN GOALS?

What are our goals?

What are student goals? (Do we know? Do they?)

How do goals impact Programs? Curricula? Learning? Culture?

**The question of consistency between student – faculty goals & expectations was repeated brought up throughout the Program responses.

ARE DIVISION-WIDE TEACHING METHODS SUCCESSFULLY ACCOMPLISHING TEACHING/LEARNING GOALS & EXPECTATIONS?

What works well now? How do we know?

Role of technology? In classroom? Lab?

Role of the teaching lab? Teaching labs of the future?

Future directions?

Faculty development
- Time? Resources? Funds? Release?

WHAT SHOULD THE CULTURE OF LEARNING BE IN DIVISION I?

Specific attributes

How can Programs support?

QUESTION 3: OPPORTUNITIES

WHAT OPPORTUNITIES ARE CURRENTLY AVAILABLE IN THE DIVIISON FOR STUDENTS TO MASTER THE COLLEGE-WIDE LEARNING GOALS & AIMS?

OPPORTUNITIES CURRENTLY AVAILABLE IN DIVISON I PROGRAMS

most commonly cited

Undergraduate Research (summer, independent)
Student-initiated Learning
Active learning
Problem-solving
Academic minors (current; future plans)
Labor (teaching assistantships)
Tutorial/Supplemental Instruction sessions
Lab / Field work opportunities
Internships (e.g. shadowing, etc.)
Study abroad

Do these work? How well? How do we know?

Expansion of these opportunities? Can they be more effective? How?

Other opportunities?

Role of Advising/Mentoring
- Curricular
- Career

Role of Labor Program
- TA development/training
- Research as labor
- Community building opportunity

QUESTION 4: "INTER- / MULTI- /TRANS-"

WHAT OPPORTUNITIES FOR INTER-DISCIPLINARY, MULTI-DISCIPLINARY OR OTHER COLLABORATIONS ARE PRESENT WITHIN THE DIVISION?

Most commonly cited examples:

Courses
Collateral major requirements
Summer undergraduate research

FUTURE OPPORTUNITIES?

Most commonly cited:

Within Division:

Interdisciplinary majors

*Concerns: specialization too soon; dilution of current program/major identity; loss of "critical mass;" major *du jour* syndrome

Guest lectures
Teaching forum (Div I brown bag lunches)
Cross-listed courses within major
Interdisciplinary STEM major

Between Divisions:

Cross/Multi- Divisional majors (e.g. environmental science, health science, etc.)

*Concerns: depth? Loss of programmatic "home;" lack of community

Interdisciplinary undergraduate research
Interdisciplinary STEM major

*Desire for increased collaboration, collaborative learning, emphasis on relevance, increased communication between programs/divisions (noted by multiple Programs).

HOW MAINTAIN CURRENT EXCELLENT OPPORTUNITIES WHILE EXTENDING INTO & DEVELOPING NEW DIRECTIONS?

QUESTIONS 5/7: "STRENGTHS AND CHALLENGES"

Q5. IN WHAT WAYS ARE OUR PROGRAM'S/DIVISION'S CURRENTLY AVAILABLE RESOUCES ABLE TO SUPPORT OUR LEARNING GOALS AND MISSION?

Q7. WHAT ARE AREAS OF STRENGTH AND (CHALLENGES) WITHIN THE DIVISION/PROGRAMS AS EACH PERTAINSTO SUPPORTING AND ENHANCING STUDENT LEARNING?

Program-identified Strengths*

Uber-committed faculty
Teaching assistants/Labor program (help improve student learning - class and theirs)
Instrumentation/equipment (teaching/research)
State of the art clinical simulation learning labs
Student-teacher ratios
Active learning (lab, classroom, research)
Rigorous/consistent/high standards; controlled grade inflation
Reputation of excellence
Student-faculty interaction
Sense of community
Pedagogy variety
Not change-averse
Strong commitment to advising (academic, post-grad edu, career)
Commitment to majors and non-majors
Promote student professionalism development
Research opportunities (on-/off-campus)
Access to technology resources / technology support
Equipment maintenance
In-house science technician (equipment/technical support)

*random order; not necessarily in order of frequency or importance

Program-identified Challenges*

Uber-committed faculty
Increasing use of adjunct faculty (short term, renewable contracts)
Time, time, time (not enough)
Student-teacher ratios
Class sizes (esp. introductory, service)
Faculty loads (teaching/advising)
Student class/course credit load (lab courses vs. non-lab courses; credit hour system)
Equipment replacement

Equipment purchase (new)
Increasing student/parent/administration expectations

Disconnect between student & faculty expectations (high school vs. college; student skills)
Deteriorating building infrastructure
Static classroom/lab configurations
Technology limitations (pedagogy limitations/restrictions; hardware)
Space (lack of)
Outdated teaching labs
Lack of student research lab / work space
Limited full-time faculty (increasing use adjuncts; limited contract)
Increasing introductory/service course enrollments
Strained facilities (space, infrastructure, laboratory space)
Lack of informal learning spaces
Advising loads (high)
Student preparation/attitudes/engagement
Student career planning/advising
Lack of student computational skills
Reach beyond science/health majors; broaden campus reach; expand GSTR offerings)
Certifications (NCLEX, ACS)
Undergraduate research support (numbers, space, time)
Time and resources for faculty/curriculum development

Q5: What types of resources will be needed to support our Division's mission and learning goals into the future?

Q5: (Reworded) It has been suggested that we are in the midst of a cultural/educational paradigm shift precipitated by the increasing presence of technology. A paradigm shift or just an ever-changing new norm? How do we respond to best support student learning? (How do we avoid just joining the crowd or becoming the squirrel chasing the shiny nut?)

Q7: How can strengths be used to enhance student learning now and into the future? What changes have worked?

Q7: How do we realistically address the identified challenges we face as a Division? As individual Programs within Division I? In the near term? For the future? Which challenges pose the greatest impact for student learning?

QUESTION 6: "TARGETS FOR IMPROVEMENT"

(REWORDED) WHAT ARE AREAS FOR REFINEMENT, IMPROVEMENT OR NEW DIRECTION THAT WE MIGHT WANT TO SPECIFICALLY TARGET FOR IMPROVEMENT AS A DIVISION?

Current initiatives update

Future initiative suggestions

APPENDIX III

DIVISION I ALUMNI SURVEY QUESTIONS (2013)

1. Please update the following information, if incorrect or missing.
2. Please answer the following about any continuing education that has occurred since your graduation from Berea College.
3. Current employer/Job Title, if applicable
4. How important is it that Division I emphasize preparing student for the following careers? Other, please list.
5. Briefly describe one of the most rewarding experiences (e.g., labor position, internships, classroom, study abroad, clinical, independent studies, etc.) you had within your major at Berea College.
6. A current proposal is to house all five programs (Biology, Chemistry, Mathematics, Nursing, Physics) in a new and/or renovated Natural and Health Science Facility to increase interaction between faculty members and promote an increase in interdisciplinary work (classes, research, etc.). Based on your experiences, what suggestions might you recommend for future interdisciplinary interactions (e.g., coursework, research collaborations, etc.) within Division I?
7. Based on your experiences, what suggestions might you recommend for future interdisciplinary interactions (e.g., coursework, research, collaborations, etc.) within Division I?
8. Indicate which classroom pedagogies helped you effectively learn in each major/program. Choose all that apply. Other, please list.
9. Please elaborate on your responses regarding classroom pedagogies.
10. Mark the experience in a Division I program/major in which you engaged while a student at Berea College. Research on campus outside my major, please list department.
11. Describe the impact these experiences had on your learning.
12. How did your labor experiences impact your learning in your overall education?
13. In particular, if you were a T.A. in a Division I Program, how was that experience beneficial to you? What suggestions do you have for future T.A.s?
14. What was the nature of your community outreach/service learning? Choose all that apply. Other, please specify.
15. Describe how your community outreach/service learning experience impacted your learning in your major and your overall education.
16. We are in the planning stages for either a complete renovation of the Science and Nursing Buildings or construction of a new building that will house all of these programs in some kind of natural and health science facility. Please help us think what kind of spaces, resources, and equipment should be part of the new spaces – those things that would best enhance our students' learning.

Please help us think of what kind of spaces, resources, and equipment should be part of the new spaces – those things that would best enhance our students' learning

APPENDIX IV

(1 of 3)

College-Wide Paired Learning Goals

1. We seek to develop mature and critical thinkers who also have the capacity for moral reflection, personal growth and thoughtful action.

    1.1: We seek to develop in ourselves and our students the intellectual ability to enjoy a life of learning and the arts as well as the capacity to address problems from multiple disciplines and perspectives.

    1.2: We seek to develop in our students and ourselves the capacity for moral and spiritual development, and a commitment to service for the common or public good.

2. We seek to understand the interconnectedness of our natural, fabricated, and human worlds.

    2.1: We seek to understand the working of our natural environment and the consequences of human interventions.

    2.2: We seek to reflect seriously upon the benefits and limitations of scientific and technological creations.

3. As citizens of a global world, we seek to develop an understanding of an appreciation for "all peoples of the earth" to promote peace and non-violence in the world.

    3.1: We must first seek to comprehend our distinct backgrounds as well as our common American culture.

    3.2: Because we live in an interdependent global community, we must actively seek to learn from cultures from around the world.

4. We seek to create an educational environment that develops the capacities of individuals while forging a caring campus community of mutual respect and collaboration.

    4.1: We seek to educate our students and staff to be independent thinkers and doers.

    4.2: We encourage all of our students and staff to understand the interdependence of all people and the need for collaboration and cooperation within a shared learning community.

APPENDIX IV
(2 of 3)

(Relevant) Aims of General Education

KNOWLEDGE

1.1: Help students understand aesthetic, scientific, historical and interdisciplinary ways of knowing.

1.4: Help students understand the natural environment and our relationship to it.

1.5: Help students understand the roles of science and technology in the contemporary world.

1.6: Help students understand U.S. and global issues and perspectives.

SKILLS

2.1: Help students develop the abilities to read and listen effectively.

2.2: Help students write and speak effectively, with integrity and style.

2.3: Help students develop the abilities to think critically and creatively, and reason quantitatively.

2.4: Help students develop the abilities to construct research strategies and employ appropriate technologies as means to deepen one's knowledge and understanding.

2.5: Help students develop the abilities to work effectively both independently and collaboratively.

HABITS OF MIND

3.3 Help students cultivate their imagination and ability to discern connections, consider alternatives and think about topics and issues from multiple perspectives.

LEARNING EXPERIENCES

4.1 Help students become independent learners through discussion and lecture

4.2 Help students become independent learners through student-initiated learning

4.1 Help students become independent learners through experiential learning

4.1 Help students become independent learners through collaborative learning.

APPENDIX IV

(3 of 3)

Division I College-wide Learning Goals and General Education Aims Commonalities / Differences

LEARNING GOALS

Progrm	1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2
BIO	xxxxxxx	xxxxxx*	xxxxxxx	xxxxxxx			xxxxxxx	xxxxxxx
CHM	xxxxxxx		xxxxxxx	xxxxxxx			xxxxxxx	xxxxxxx
MAT	xxxxxxx		xxxxxxx	xxxxxxx			xxxxxxx	xxxxxxx
NUR	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx
PHY	xxxxxxx		xxxxxxx	xxxxxxx			xxxxxxx	

AIMS OF GENERAL EDUCATION

Program	1.1	1.2	1.3	1.4	1.5	1.6	2.1	2.2	2.3	2.4	2.5	2.6	3.1	3.2	3.3	3.4	3.5	4.1	4.2	4.3	4.4
BIO	X			X	X	X	X	X	X	X	X		X	X				X	X	X	X
	X			X	X	X	X	X	X	X	X		X *	X				X	X	X	X
CHM	X			X	X	X	X	X	X	X	X				X			X	X	X	
	X			X	X	X	X	X	X	X	X				X			X	X	X	
MAT	X			X	X	X	X	X	X	X	X	X			X			X	X	X	X
	X			X	X	X	X	X	X	X	X	X			X			X	X	X	X
NUR	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
PHY	X			X	X	X	X	X	X	X	X				X			X	X	X	X
	X			X	X	X	X	X	X	X	X				X			X	X	X	X

* change "moral" to "ethical"

Yellow Highlights – at least four of the five programs in Division I indicated that this was a learning goal or aim of general education of their particular program. This is not to say that individual programs have other learning goals and address aims of general education in valuable ways, but it does show where we intersect/overlap in our thinking.

APPENDIX V

Division I Faculty Sample GSTR Course Descriptions

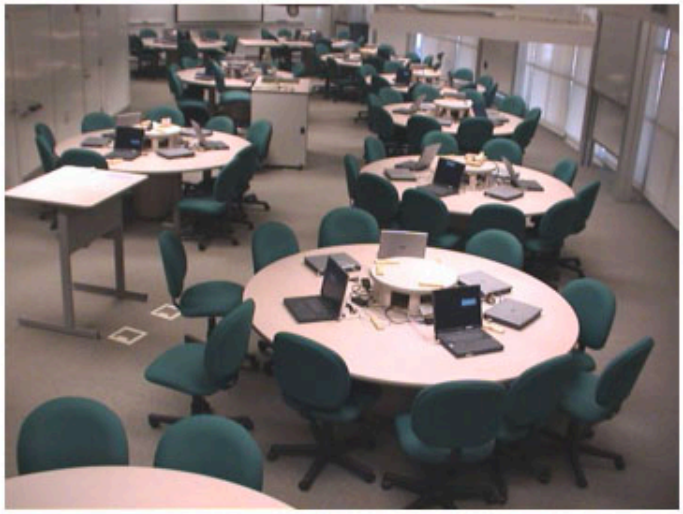
GSTR 110. Anderson, Dawn: "*Genes, Dreams and Reality (Past, Present & Future)* - This course will explore the nature of what it means to be human and the concepts of identity and diversity (especially in light of what we have learned via the Human Genome Project). We will explore these subjects from historical, modern and futuristic perspectives by reading essays & short stories, a cultural biography, a futuristic novel, on-line source material and by viewing selected film & video clips. We will use discussion and several forms of writing to thoughtfully consider and evaluate the concept of "humanity" as we understand it the modern "genomics" era and how that shapes how we view our past and our future. Note: This is not a formal "science class," but rather a class that will look at how science is shaping how we view and understand the very nature of that it means to be a human being. Readings will include *Abraham Lincoln's DNA, The Immortal Life of Henrietta Lacks, & Requiem of the Human Soul* plus other short text and essay readings."

GSTR 110. Hoffman, Megan: *The Good, The Bad, and The Ugly.* Is modern science leading us toward a better way of life, or down the pathway to destruction? Is science a hero or a villain; a savior or a demon? In this class, we will investigate the role of science in our daily lives and in our liberal arts education. We will look at the misuse and misunderstandings of science present in our society, and will explore some of the political and societal arguments that surround science in the real world: global warming; stem cell research; the teaching of evolution; measures of intelligence; what it means to be human. We will read a variety of different types of writing, including fact, fiction, and opinion. Through reading, discussion, and writing, we will explore how to see both sides of an issue, how to make and substantiate strong arguments, and how to find our own stances and voices on controversial issues.

GSTR 410: Saderholm, Matthew: *How the World Works.* Each of us has a calling, a way to do and be in the world, a path we make or take through life. The journey toward finding and claiming our calling is a journey of deepening knowledge of ourselves, other people and our environment. We'll explore vocation both locally and globally, through reading and reflecting on the life stories of people in various fields, researching the ecological, economic, and social impact of work; and examining ethical and spiritual dimensions of career choices.

Appendix VI

SCALE-UP Project Description



About the SCALE-UP Project...

This research was supported, in part, by the U.S. Department of Education's Fund for the Improvement of Post-Secondary Education (FIPSE), the National Science Foundation, Hewlett-Packard, Apple Computer, and Pasco Scientific. Opinions expressed are those of the authors and not necessarily those of our sponsors.

The primary goal of the Student-Centered Active Learning Environment for Undergraduate Programs (SCALE-UP) Project is to establish a highly collaborative, hands-on, computer-rich, interactive learning environment for large-enrollment courses.

Educational research indicates that students should collaborate on interesting tasks and be deeply involved with the material they are studying. We promote active learning in a redesigned classroom of 100 students or more. (Of course, smaller classes can also benefit.) We believe the SCALE-UP Project has the potential to radically change the way large classes are taught at colleges and universities. The social interactions between students and with their teachers appears to be the "active ingredient" that make the approach work. As more and more instruction is handled virtually via technology, the relationship-building capability of brick and mortar institutions becomes even more important. The pedagogical methods and classroom management techniques we design and disseminate are general enough to be used in a wide variety of classes at many different types of colleges.

Classtime is spent primarily on "tangibles" and "ponderables ". Essentially these are hands-on activities, simulations, or interesting questions and problems. There are also some hypothesis-driven labs where students have to write detailed reports. (This example is more sophisticated than most, but shows what the best students are capable of doing.) Students sit in three groups of three students at 6 or 7 foot diameter round tables. Instructors circulate and work with teams and individuals, engaging them in Socratic-like dialogues. Each table has at least three networked laptops. The setting is very much like a banquet hall, with lively interactions nearly all the time. Many other colleges and universities are adopting/adapting the SCALE-UP room design and pedagogy. Engineering schools are especially pleased with the course objectives, which fit in well with the requirements for ABET accreditation.

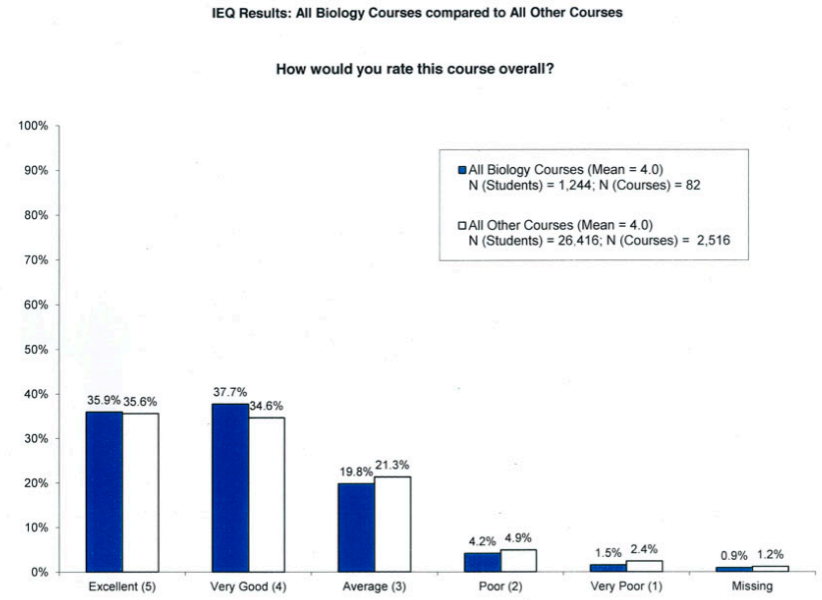
Materials developed for the course were incorporated into what became the leading introductory physics textbook, used by more than 1/3 of all science, math, and engineering students in the country.

http://www.ncsu.edu/per/scaleup.html

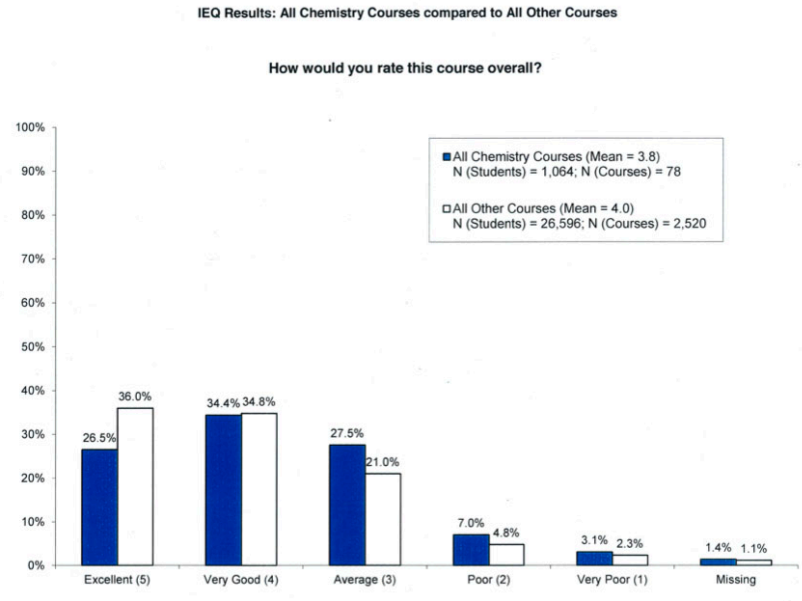
APPENDIX VII

Division I courses rated (students) in comparison to all other Berea College courses

(1 of 3)



Based on Fall Term 2009 through Summer Term 2012 courses (Includes Short and Summer Terms).

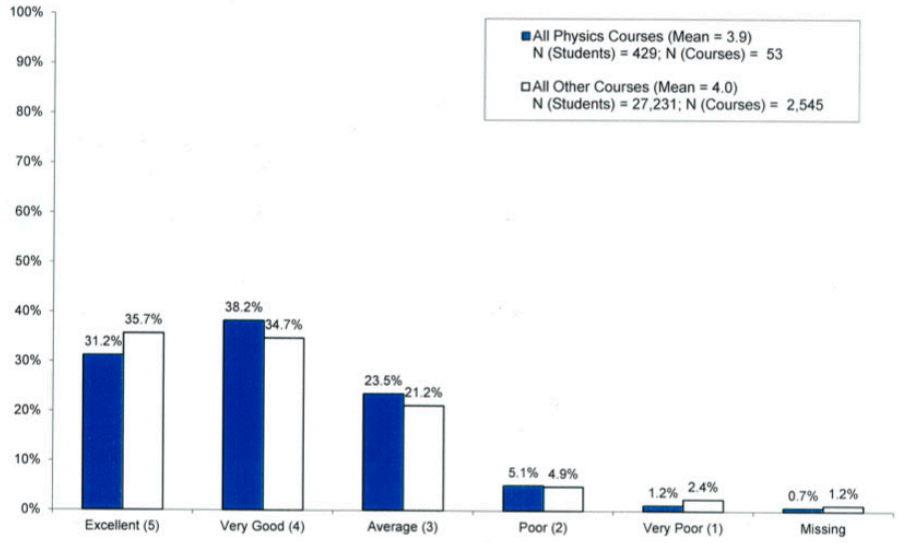


Based on Fall Term 2009 through Summer Term 2012 courses (Includes Short and Summer Terms).

APPENDIX VII
(2 of 3)

IEQ Results: All Physics Courses compared to All Other Courses

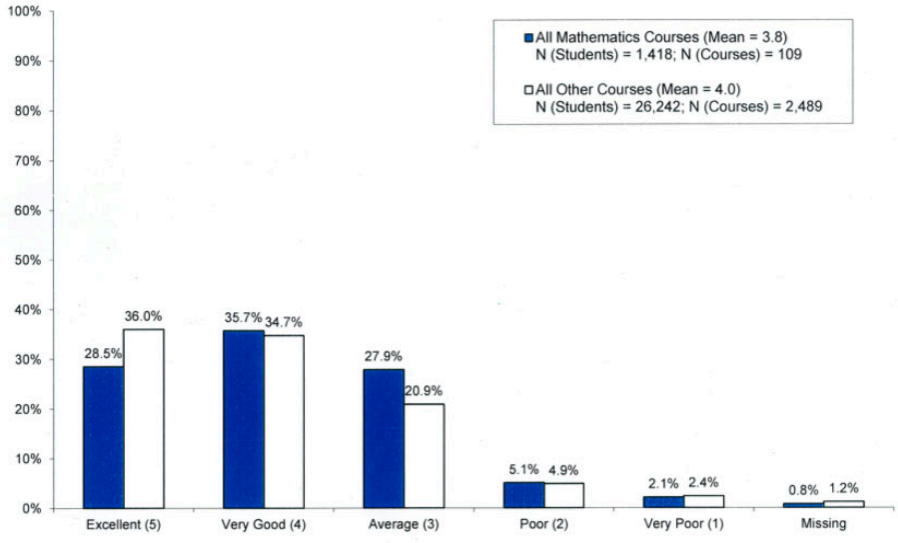
How would you rate this course overall?



Based on Fall Term 2009 through Summer Term 2012 courses (Includes Short and Summer Terms).

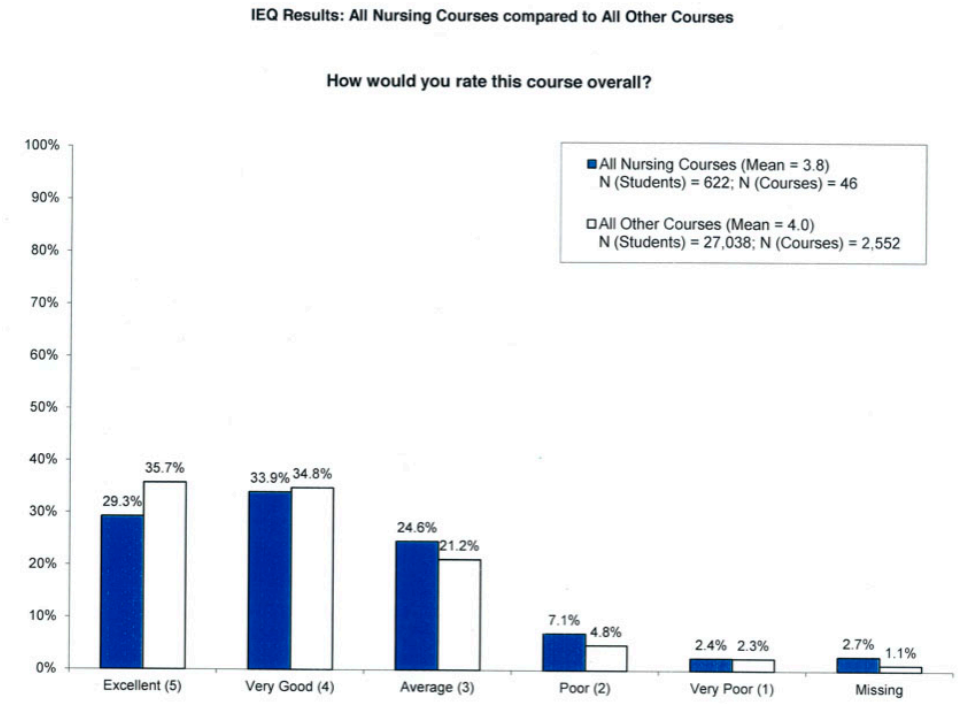
IEQ Results: All Mathematics Courses compared to All Other Courses

How would you rate this course overall?



Based on Fall Term 2009 through Summer Term 2012 courses (Includes Short and Summer Terms).

APPENDIX VII
(3 of 3)



Based on Fall Term 2009 through Summer Term 2012 courses (Includes Short and Summer Terms).

APPENDIX VIII

Classroom pedagogies by program that support effective learning as reported by Berea College alumni (2013)

	Biology	Chemistry	Mathematics	Nursing	Physics
Traditional Lecture	76.8%	55.4%	67.9%	17.9%	37.5%
Hands on laboratories	75.0%	67.9%	8.9%	19.6%	37.5%
Computer simulations	37.5%	39.3%	30.4%	10.7%	23.2%
Case studies or other relevant applications	53.6%	35.7%	21.4%	21.45	8.9%
Research Projects embedded within courses	73.2%	51.8%	10.7%	12.5%	8.9%
Discussion-based coursework	60.7%	39.3%	28.6%	19.6%	21.4%
Other	5.4%	5.4%	5.4%	3.6%	3.6%

Biology n=63*; Chemistry n= 20*; Physics n= 5*; Mathematics n= 20*; Nursing n= 21
* = includes double majors
NOTE: Totals will not add to 100% because respondents could check more than one response

Source: 2013 Division I Alumni Survey; OIRA

APPENDIX IX

Experiences in a Division I program/major in which you engaged while a student at Berea College

Experience	N	%
Research on campus within my major	83	67.5%
Research on campus outside my major	24	19.5%
Research off campus	55	44.7%
Internship	48	39.0%
International travel / study abroad	47	38.2%
Service Learning	33	26.8%
Directed Study	16	13.0%
Labor	87	70.7%
Symposia & Conferences	53	43.1%

***Note: totals will not add to 100% because respondents could check more than one response.**

Source: 2013 Division I Alumni Survey; OIRA

Appendix X

Post-Summer Research/Creative Project Survey Questions

1. Describe you summer project.
2. What was most interesting or exciting about your summer project?
3. What challenges or issues arose during your summer project?
4. What situation best describes with whom you worked during your summer project?
   - Worked closely with my faculty mentor
   - Worked with several other students and my faculty mentor
   - Worked mostly alone with occasional assistance
   - Worked on my own with little assistance
   - Other
5. What was your overall satisfaction with this arrangement?
   - Perfect for me
   - Worked OK
   - Would have liked a bit more attention/direction
   - Would have liked a bit less attention/direction
   - Felt I was largely ignored or a burden
   - Other
6. How much individual contact did you have with your faculty research mentor?
   - Worked side-by-side
   - Met/consulted daily
   - Met/consulted several times a week
   - Met once a week
   - Mentor was seldom available to meet or consult
7. Did you attend or participant in any on-campus seminars (e.g. weekly peer-sharing lunches, field trips,..)
8. If yes, which ones?
9. Which of the following statements best describes your current post-graduation plans?
   - Positive I want to attend graduate school
   - Fairly certain I want to attend graduate school
   - Uncertain I want to attend graduate school
   - Positive I want to attend professional school
   - Fairly certain I want to attend professional school
   - Uncertain I want to attend professional school
10. What impact did your summer experience have in helping you define your research interest?
    - Introduced me to a new field of research I might want to pursue
    - Introduced me to a new line of research in my major field that I might now want to pursue
    - Improved my understanding of the field and specialty I have already chosen
    - Encouraged me to investigate other areas of study or research
    - Generally broadened the scope of my research interests
11. Please rate you confidence in your skills and abilities in the following:
    - Keeping a research notebook or journal
    - Reading a primary research article
    - Giving a presentation in front of a group
    - Working as part of a research team
    - Doing research on your own
12. To what extent did your summer experience contribute to the following:
    - Enhanced my learning by providing opportunities to engage challenging, collaborative and directed projects in an apprentice-mentor relationship with faculty.
    - Fostered student-faculty interaction in creative work
    - Helped me understand the interplay between collaboration and independent thought and action in a complex, open-ended project.
    - Enhanced my communication skills.
    - Provided experience that would be helpful to me to pursue subsequent research & learning opportunities.
    - Allowed me to build self-confidence to pursue careers and further study beyond Berea.
    - Provided experience that will help me make informed career and graduate school decision
13. Any additional comments?

APPENDIX XI

"A Major in Science? Initial Beliefs and Final Outcomes for College Major and Dropout'"

Ralph Stinebrickner and Todd R. Stinebrickner
NBER Working Paper No. 19165 June 2013
JEL No. I21,I23,J0

ABSTRACT
Taking advantage of unique longitudinal data, we provide the first characterization of what college students believe at the time of entrance about their final major, relate these beliefs to actual major outcomes, and, provide an understanding of why students hold the initial beliefs about majors that they do. The data collection and analysis are based directly on a conceptual model in which a student's final major is best viewed as the end result of a learning process. We find that students enter school quite optimistic/interested about obtaining a science degree, but that relatively few students end up graduating with a science degree. The substantial over-optimism about completing a degree in science can be attributed largely to students beginning school with misperceptions about their ability to perform well academically in science.

Ralph Stinebrickner Berea College 608 Chestnut Street Berea, KY 40403 and University of Western Ontario ralph_stinebrickner@berea.edu

Todd R. Stinebrickner Department of Economics University of Western Ontario London, Ontario, N6A 5C2 CANADA and NBER trstineb@uwo.ca

http://papers.nber.org/tmp/17674-w19165.pdf

APPENDIX XII

Examples of Active Learning Strategies used in Division I Programs

Process-oriented guided-inquiry learning (POGIL)
[e.g. BIO110 Hoffman, CHM222 Garrett]

Problem-based learning
[e.g. PHY 217/218 Hodge, PHY315/316 Veillette)

In-class writing
[e.g. BIO222, 330 Anderson)

Case study
[e.g. BIO324 Rosen, NUR 354, 450]

Journal Club (primary literature presentations)
[e.g. BIO330,441 Anderson; BIO325, 331 Hoffman; BIO324 Rosen; NUR352, 353)

Teaching to Learn presentations
[e.g. BIO222 Anderson; BIO325, 331 Hoffman; NUR 448 Turner]

Process demonstrations / role playing
[e.g. BIO110 Hoffman, Anderson]

Small group collaboration
[e.g.BIO102 Blank; BIO113 Rosen; BIO494 Scudder-Davis; CHM221 Garrett, MAT115 Ellis; MAT125 Gratton, NUR 350, 354)

Mock grant/research proposal writing
[e.g. BIO113 Rosen; BIO 222, 441 Anderson; BIO323 Rowley]

Research/Project posters
[e.g. BIO113 Rosen; BIO222 Anderson; CHM222 Garrett; NUR353]

Video production
[e.g. NUR350]

Community projects
[e.g. BIO 325 Hoffman; NUR 448 Turner; CHM313 M. Saderholm; NUR 353, 448, 450)

APPENDIX XIII

URCPP Projects in Division I (2003 – 2013)

Program	URCPP participants	Number of faculty	Number of projects	Number of students
Biology	Adams, Christopher Anderson, Dawn Blank, Ken Blank, Sarah Hoffman, Megan Rosen, Ron Rowley, Marc Scudder-Davis, Roy Thompson, Ralph	9	18	55
Chemistry	Baltisberger, Jay Cunningham, Mark Garrett, Mary Robert Kovacevic, Anes Saderholm, Matthew Smithson, Paul	6	17	41
Math	Blackburn-Lynch, James Gratton, Larry Hawkins, Dollena	3	8	22
Nursing	Villaran, Teresa	1	1	3
Physics	Hodge, Tracy Lahamer, Amer Majumdar, Kingshuk Veillette, Martin	4	14	26
Totals:		23	58	147

Notes:

- Sixteen of the 23 faculty members listed above have carried out two or more URCPP projects during the ten-year span. The average number of projects per faculty member is 2.7.
- During this same period, faculty members in Divisions II – VI carried out a total of 83 URCPP projects involving 176 students. Note: three projects were run by pairs or trios of faculty from Math and Computer Science, but are counted in Div I for this calculation.

APPENDIX XIV

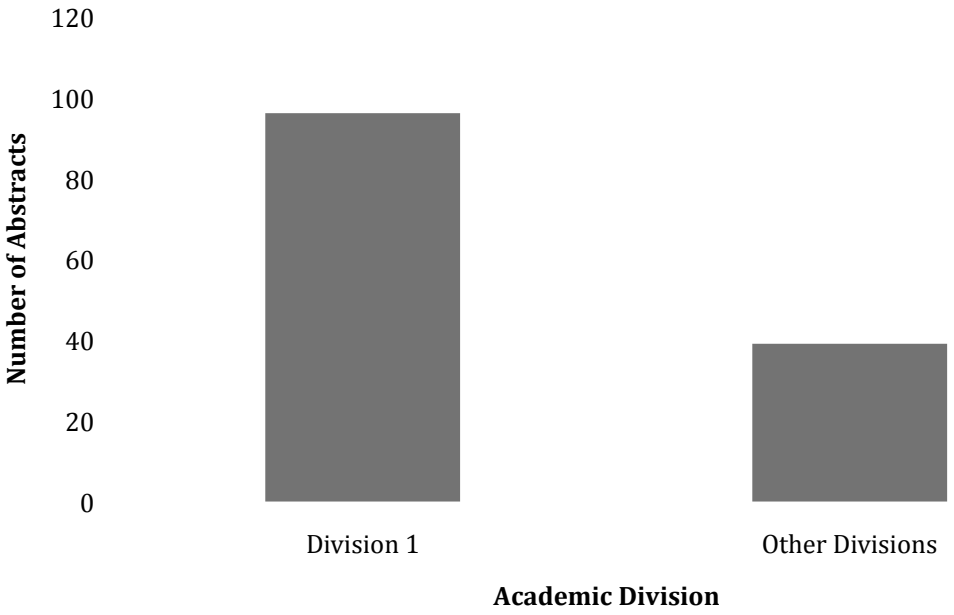
Off-campus Summer Undergraduate Research Internships for Berea College students (2010 – 2012)

Institution	# of students	Program
Cincinnati Children's Hospital Medical Center Internship	1	BIO
Clemson University Internship	1	CHM
Clinic for the Rehabilitation of Wildlife	2	BIO
Fermi Labs and Illinois Accelerator Internship	1	PHY
Harvard School of Dental Medicine Internship	1	CHM
Hughes Science Pipeline, Barnard College	1	BIO
Iowa State University Internship	2	CHM
Johns Hopkins Institute	1	BIO
Lee Teng Internship	1	PHY
Marshall University Internship	1	PHY
Mayo Clinic Internship	6	BIO & CHM
Meharry Medical College Internship	1	BIO
Miami University Internship	1	CHM
National Institutes of Health	3	BIO & CHM
Penn State College of Medicine Internship	1	CHM
Research Corporation (Cottrell College Science Award)	4	CHM & PHY
State University of New York Internship	2	CHM
U of L	15	BIO & CHM & PHY
UK (including KBRIN)	17	BIO & PHY
UNC	1	CHM
University of Tennessee Internship	1	PHY
University of Tennessee Space Institute Internship	1	TEC/TAD
University of Toledo Internship (NSF)	1	PHY
Vanderbilt	11	BIO & CHM
Vanderbilt Mouse Metabolic Phenotyping Center Internship	1	BIO
	80	

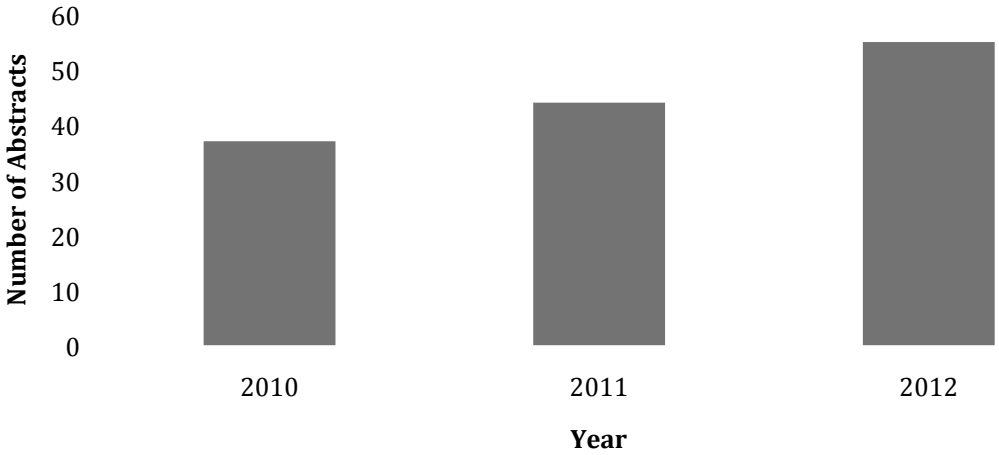
APPENDIX XV

(1of 2)

Number of research abstracts submitted by undergraduates in Division I and all others between 2010 and 2012



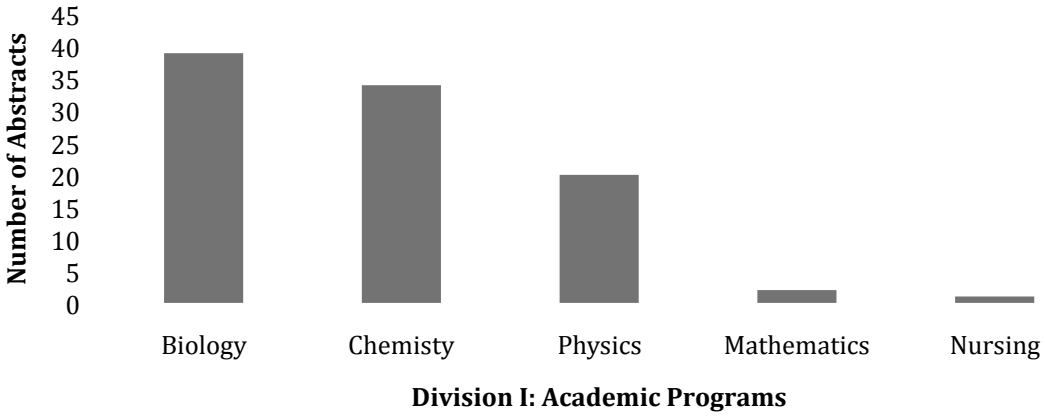
Number of research abstracts submitted by students to the "Journal of Undergraduate Research Abstracts" at Berea College between 2010 and 2012



APPENDIX XIV

(2 of 2)

Number of abstracts submitted by undergraduates in the Biology (40.63%), Chemistry (35.42%), Mathematics (2.08%), Nursing (1.04%), and Physics (20.83%) Programs between 2010 and 2012 at Berea College



APPENDIX XVI

(1 of 2)

Berea Undergraduate Research Symposium Program (2012)

12th Berea College Undergraduate Research Symposium

Poster Presentations (continued)		
Science Lobby	Stacey Roberts & Brittany Stowers	African American Families and their Heritage in Garrard County Kentucky--Phases I and II
	Aaron Meadows	Taiji Improves Kinetic Link Coordination
	Marissa Brown, Mackenzie Endres, Rohan Isaac, & Tommy Boykin	Laser Ablation of Boron Fullerenes
	James Perrugia & Fidel Tewolde	Ground State Energies and Isomer Configurations of Nanoclusters
	Christopher B. Yaluma	The Identification of Few Layer Graphene and the Growth of Nanoribbons on Silicon Nitride Substrates
	Joshua Callahan, Yuta Katsumi, Chido Matara, & Shelby Williams	Neurophysiological Indices of Cognitive Style
	Brian Easterday, Tierah Ellard, Matthew Jenkins, & Jordan Monger	Design of a flexible research vehicle for future studies at Berea College
	Sam Hawes	The History, the Music and the Construction of the Kentucky Dulcimer
	Kristina Carter, Sara Dean, Valerie Frost, & Alena Gordienko	From Anecdote to Assessment: the Robust Beauty of Using Multiple Regression and Path Analysis to Explore Retention, Graduation, and Academic Performance at a Small Liberal Arts College
	Horton Li	LKB1 effect on MicroRNA expression in lung adenocarcinoma
	Dipendra Sharma Chapagain & James T. Molchanoff	Influence of Boundary Conditions on Metastable Lifetimes For The Ising Model on Hyperbolic Plane

12th Berea College Undergraduate Research Symposium

Poster Presentations		
Room	**Student Presenter(s)**	**Title**
Science Lobby	Ericka Berg, Bailey King, Michon Martin, Juliana Dolan, & Franceska Mehmeti	Proterometra macrostoma (Trematoda: Azygiidae): Location of the Redia and Emergence Path from the Snail Intermediate Host, Elimia semicarinata (Gastropoda: Pleuorceridae)
	Juliana Dolan, Franceska Mehmeti, Ericka Berg, Bailey King, & MIchon Martin	Proterometra macrostoma (Trematoda: Azygiidae): Effect of Serotonin and Melatonin on Redial Movement and Emergence of the Cercaria from the Redia and the Snail, Elimia semicarinata (Gastropoda: Pleuorceridae)
	Karen Reynolds	Understanding SERF function: Creation and behavioral analysis of dSERF deletion mutants
	Katherine Webb	Detection and mapping of invasive plant species and hiking trails at Indian Fort Mountain in Berea, KY
	Dallas Cook, Russell Hammond, & Horton Li	Synthesis of Fluorescence-Quenching Derivatives of Lysine and Glutamic Acid
	Trena Payton & Amanuel Tesfamichael	Synthesis of Enantioenriched β-Ketoesters via a Quinine-Catalyzed Ketene-Claisen Condensation
	Chelsey Lloyd & Michelle Bloom	Synthesis of Enantioenriched β-Ketoesters via an Azaferrocene-Catalyzed Ketene-Claisen Condensation
	Diego Moya, Elijah Whitaker, Melanie Burt, & Julianna Dolan	Characterization of Internally-Quenched Fluorescent Peptide Substrates for the Peptidase Neurolysin
	Chyna Johnson	Design and Synthesis of STAT3 Inhibitor
	Marceline G. Aengwanama	Runx1 Interacts With DeltaNp63alpha to Regulate Target Genes

APPENDIX XVI

(1 of 2)

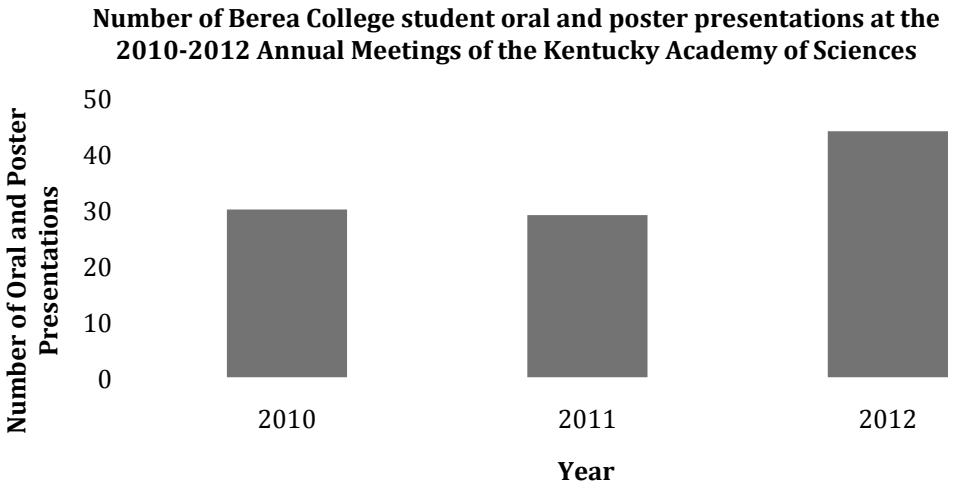
12th Berea College Undergraduate Research Symposium

Oral Presentations

Room	Time	Presenter	Title
Science 106	3:00-3:15	Premila Samuel	The mechanism of action of Prevotella histocola in the immunomodulation of experimental autoimmune encephalomyelitis (EAE).
	3:15-3:30	Imelda Hot	Blood Plasma Coagulation Induced by Poly(ethylene glycol) Materials
	3:30-3:45	Chido Hambira	Combinatorial synthesis of a thiourea library for the aminolysis of N-acyl homoserine lactones
	3:45-4:00	Kelly Mouapi	Epitope Mapping of Vimentin in Arthritis-susceptible HLA-DRB1* 0401 and resistant *0402 mice

Room	Time	Presenter	Title
Science 101	3:00-3:15	Tommy O. Boykin	Synthesis of Copper-Based Superconductors
	3:15-3:30	Rohan Isaac, Tommy Boykin, Marissa Brown, & Mackenzie Endres	Synthesis and characterization of Half-Metallic Heusler Alloys.
	3:30-3:45	Lydia Joiner	Berea College Gardening Project
	3:45-4:00	Raven Weaver	Perceptions of Aging: the power of knowledge and action
	4:00-4:15	Rachel Krebs	The effects of gender and writing assignments on implicit attitudes of gender roles

APPENDIX XVII



APPENDIX XVIII

DIVISION I – FACULTY PUBLICATIONS WITH BEREA COLLEGE STUDENT CO-AUTHORS (2003—2013)

Biology – Rosen

Rosen, R., E. Berg, J. Dolan, B. King, M. Martin, and F. Mehmeti. 2013. *Proterometra macrostoma* (Trematoda: Azygiidae): Location of the redia and emergence path from the snail, *Elimia semicarinata* (Gastropoda: Pleuroceridae). Journal of Parasitology. 99 (4): TBD

Rosen, R., C. Albers, A. Chambers, A. Faust, E. Fleming, A. Holmberg, A. Meador, K. N. Mouapi, K. Sandefur, and L. Ware. 2011. Effect of osmolality and selected ions on retraction of the distome body into the cercarial tail chamber of *Proterometra macrostoma* (Trematoda: Azygiidae). Journal of Parasitology. 97(1): 36—39.

Rosen, R., D. Bastakoty, T. Dolma, A. Fidler, M. Gunaratna, R. Twiggs, B. Viragh, J. Fleming, B. Jovanovic, A. Sarshad, E. Throop, F. Zaki, and A. Ammons. 2009. *Proterometra macrostoma* (Faust) (Trematoda: Azygiidae): Further studies on strains at North Elkhorn Creek, Scott County, Kentucky. Journal of the Kentucky Academy of Science. 69(2): 43—49.

Rosen, R., D. Bastakoty, T. Dolma, A. Fidler, M. Gunaratna, R. Twiggs, B. Viragh. 2009. Experimental infections of bluegill, *Lepomis macrochirus* Rafinesque, wth cercaria of the digenean, *Proterometra macrostoma* (Faust): (I) Infectivity of the embryonic cercaria and (II) Initiation of egg development. Journal of the Kentucky Academy of Science. 69(2): 106—107.

Rosen, R., J. Fleming, B. Jovanovic, A. Sarshad, E. Throop, F. Zaki, and A. Ammons. 2005. Location of the redia of *Proterometra macrostoma* (Trematoda: Azygiidae) in the snail, *Elimia semicarinata* (Gastropoda: Pluerocercidae), and daily emergence of its cercaria.. Journal of the Kentucky Academy of Science. 66(2): 89-93.

Rosen, R., A. Ammons, A Boswell, A. Roberts, A. Schell, M. Watkins, J. Fleming, B. Jovanovic, A. Sarshad, E. Throop, and F. Zaki. 2005. Effect of light wavelength and osmolality on the swimming of the cercaria of *Proterometra macrostoma*. Journal of the Kentucky Academy of Science. 66(2): 94—100.

Rosen, R., E. Anderson-Hoagland, C. Barton, B. Berry, J. Hardy, and T. Wangmo 2005. Natural and experimental infections of centrarchid fish by the digenetic trematode, *Proterometra macrostoma*: Detection of new infections and host histopathology. Journal of the Kentucky Academy of Science. 66(2): 101—106.

Biology – Thompson

Thompson, R.L., D.B. Poindexter, K. Rivers Thompson. 2013. *Thlaspi alliaceum* L. (Roadside Pennycress) new records to Georgia, Missouri, and North Carolina. Phytoneuron 2013-67. To be Published Sep 2013. ISSN 2167 933X.

Thompson, R.L. and J.R. Abbott. 2013. History, dispersal, and distribution of *Buddleja davidii* Franch. (Scrophulariaceae) in Kentucky. J. Bot. Res. Inst. Texas 7(1):495-505.

Thompson, R.L., D.B. Poindexter, and J.R. Abbott. 2012. Vascular flora and plant communities of Dead Horse Knob (Rucker's Knob), Madison County, Kentucky. J. Bot. Res. Inst. Texas 6(2):631-651.

Thompson, R.L. and D.B. Poindexter. 2011. Species richness after *Lonicera maackii* removal from an old cemetery macroplot on Dead Horse Knob, Madison County, Kentucky. Phytoneuron 2011-50. Published 10 Oct 2011. ISSN 2153 733X.

Abbott, J.R. and R.L. Thompson. 2011. New combinations in *Phoradendron leucarpum* (Viscaceae).J. Bot. Res. Inst. Texas 4:139-141.

Poindexter, D.B. and R.L. Thompson. 2011. Noteworthy collections: Kentucky. *Lotus tenuis* Waldst. & Kit. ex Willd. and *Puccinellia distans* (Jacq.) Parl. Castanea 76:190-192.

Poindexter, D.B. and R.L. Thompson. 2010. The reemergence of *Puccinellia rupestris* (Poaceae) in North America. Rhodora 112:435-440

Thompson, R.L. and C.A. Evans. 2010. Eastern mistletoe (*Phoradendron leucarpum*, Viscaceae) infestation of host trees in Jessamine County, Kentucky. J. Kentucky Acad. Sci. 71:19-25.

Thompson, R.L. and S.R. Green. 2010. Vascular flora of an abandoned limestone quarry in Garrard County, Kentucky. Castanea 75:245-258.

Poindexter, D.B. and R.L. Thompson. 2009. Vascular flora and plant habitats of Wallace Woods, a Hemlock-Northern Hardwoods Palustrine Forest, Crawford County, Pennsylvania. Rhodora 111: 231-260.

Taylor, D.D. and R.L. Thompson. 2009. First report of oak mistletoe [*Phoradendron leucarpum* (Raf.) Reveal & M.C. Johnston] on the invasive liana, Oriental bittersweet (*Celastrus orbiculatus* Thunb.). J. Kentucky Acad. Sci. 70:97.

Poindexter, D.B. and R.L. Thompson. 2008. Six noteworthy vascular plants for Kentucky: Two state records and four range extensions. J. Kentucky Acad. Sci. 69:66-68.

Thompson, R.L., K. Rivers Thompson, E.A. Fleming, R.D. Cooks, J.R. Price, M.N. Naseman, and A.J. Oles. 2008. Eastern mistletoe (*Phoradendron leucarpum*, Viscaceae) in the city of Berea: A high incidence of infestation and eight new host species for Kentucky. J. Kentucky Acad. Sci. 69:3-10.

Thompson, R.L. and D.B. Poindexter. 2006. Vascular flora of the Elk and Bison Prairie, Land Between The Lakes National Recreation Area, Trigg County, Kentucky. Castanea 71:105-123.

Thompson, R.L., J.R. Abbott, and A.E. Shupe. 2005. Vascular flora from five plant habitats of an abandoned limestone quarry in Clark County, Kentucky. J. Kentucky Acad. Sci. 66:24-34. Thompson, R.L. and D.B. Poindexter. 2005. Host specificity of American Mistletoe (*Phoradendron leucarpum*, Viscaceae) in Garrard County, Kentucky. J. Kentucky Acad. Sci. 66:40-43.

Thompson, R.L. and J.R. Skeese III. 2005. Vascular flora of Golden and Silver Falls State Natural Area in the Oregon Coast Range, Coos County, Oregon. Madroño 52:215-221.

Abbott, J.R., R.L. Thompson, and R.A. Gelis. 2004. Noteworthy vascular plants from Kentucky:a state record, range extensions, and various species of interest. J. Kentucky Acad. Sci. 65: 94-103.
Thompson, R.L. and C.A. Fleming. 2004a. Vascular flora and plant communities of the John B. Stephenson Memorial Forest State Nature Preserve (Anglin Falls Ravine), Rockcastle County, Kentucky. Castanea 69:125-138.

Thompson, R.L. and C.A. Fleming. 2004b. Vascular flora of five reservoirs in the Berea College Forest, Madison and Jackson counties, Kentucky. J. Kentucky Acad. Sci. 65:116-131.

Thompson, R.L. and F.D. Noe, Jr. 2003. American mistletoe (*Phoradendron leucarpum*, Viscaceae) Rockcastle County, Kentucky. J. Kentucky Acad. Sci. 64:29-35.

Biology – Rowley
Rowley, M, Massana, K, Wier, A. 2011. Localization of photoreceptors in the cercariae of *Proterometra macrostoma* (Trematoda: Azygiidae). *Journal of Parasitology* 97(5): 805-808.

Chemistry – Kovacevic
Kovacevic, A., Meadows, K. R., Counts, M., Arthur, D. J. 2011. Solvent influence in the formation of normal and abnormal carbene complexes in reactions of imidazolium salts with [Ir(H)2(PPh3)2(OCMe2)2]BF4" *Inorgan. Chim. Ac.* 373: 259-261.

Chemistry – Saderholm
Saderholm, M. and Reynolds, A. 2011. Jmol-Enhanced biochemistry research projects. Journal of Chemical Education. 88(8): 1074-1078.

Physics – Lahamer
Bailey, M., M. Yusuf, and A. S. Lahamer. 2010. Mössbauer study of iron rich cereal and iron supplement. Journal of the Kentucky Academy of Science. Submitted and accepted. 2010.

Mono P, and A. S. Lahamer. 2008. Mössbauer study of the half metallic ferromagnet Fe1-xCoxSi. Journal of the Kentucky Academy of Science. 69(2): 170-177.

Lahamer, A. S., S. B. MaClure, S. M. Mahurin, and R. N. Compton. 2004. Search for parity-violating energy difference between a *d*- and *l*-iron complex. Journal of the Kentucky Academy of Science. 65(1): 5-11.

Appendix XIX

Alumni Survey: How important is it that Division I emphasize preparing students for the following careers?

Career	Very Important.....Not Important At All					
	(5)	(4)	(3)	(2)	(1)	Mean
Medical/ Nursing/ Health (N=119)	69.7%	22.7%	7.6%	0.0%	0.0%	4.62
Basic Research (N=119)	64.7%	27.7%	6.7%	0.8%	0.0%	4.56
Teaching: K-12 Level (N=117)	25.6%	33.3%	28.2%	9.4%	3.4%	3.68
Industry (N=119)	34.5%	37.0%	20.2%	8.4%	0.0%	3.97
Teaching: College/ University Level (N=119)	37.8%	35.3%	17.6%	8.4%	0.8%	4.01
Non-Profit (N=119)	20.2%	31.1%	30.3%	14.3%	4.2%	3.49
Business (N=118)	16.1%	32.2%	33.9%	15.3%	2.5%	3.44
Other (N=10)	30.0%	30.0%	10.0%	10.0%	20.0%	3.40

APPENDIX XX
(1 OF 2)

Independent Health Sciences major
(Iowa Inter-departmental Studies model)

Jamie Nunnery (Graduated May 2013)	Jessica O'Neill
Women's & Children's Health emphasis	Family Health emphasis

UNIVERSITY OF IOWA	Jamie	Jessica
Foundations (5 core courses)		
General Chemistry (1)	CHM113: Nursing Chem	CHM113:Nursing Chem
Biology (1)	BIO100: Intro Bio	BIO441:Cell Bio
Math/Statistics (1)	MAT104: Statistics	MAT104: Statistics
Social Science (1)	PSY100: Intro Psych	PSY100: Intro Psych
Science Elective (1)	BIO101/102: A&P	BIO101/102: A&P
MULTI-DISCIPLINARY EMPHASIS (Multi-disciplinary Science electives)		
Iowa = 15 hrs min		
Science Component	CFS221: Nutrition BIO207: Pathophys (NUR) BIO222: Microbiology BIO330: Genetics BIO324: Parasitology	CFS221: Nutrition BIO207: Pathophys (NUR) BIO222: Microbiology BIO330: Genetics
Emphasis Component	HLT215: Signif Issues Hlth WGS236: Womens's Hlth	HLT 210: Health In Appalachia WGS236: Women's Hlth PEH221: Hlth/Movment for the Young Child
Capstone	BIO 490: Maternal & Infant Hlth in Appalachia	PSJ490: Meeting Millennium Develpmnt Goals (Family Hlth)
9 courses total (Iowa)	11 courses + capstone	11 courses + capstone

APPENDIX XX
(2 OF 2)

Neuroscience independent major
(Stacy) Lee Ware
(Graduated May 2012)

Major Courses

1. BIO 323 Human Physiology
2. BIO 325 Neurobiology
3. BIO 441 Cellular and Molecular Biology
4. CHM 345 Biochemistry
5. PSY 205 Statistics for Psychology
6. PSY 208 Cognitive Psychology with Lab
7. PSY 212 Behavioral Neuroscience
8. PSY 306 Research Methods

Capstone Course

1. PSY 424 Senior Research (Capstone)

Collateral Courses

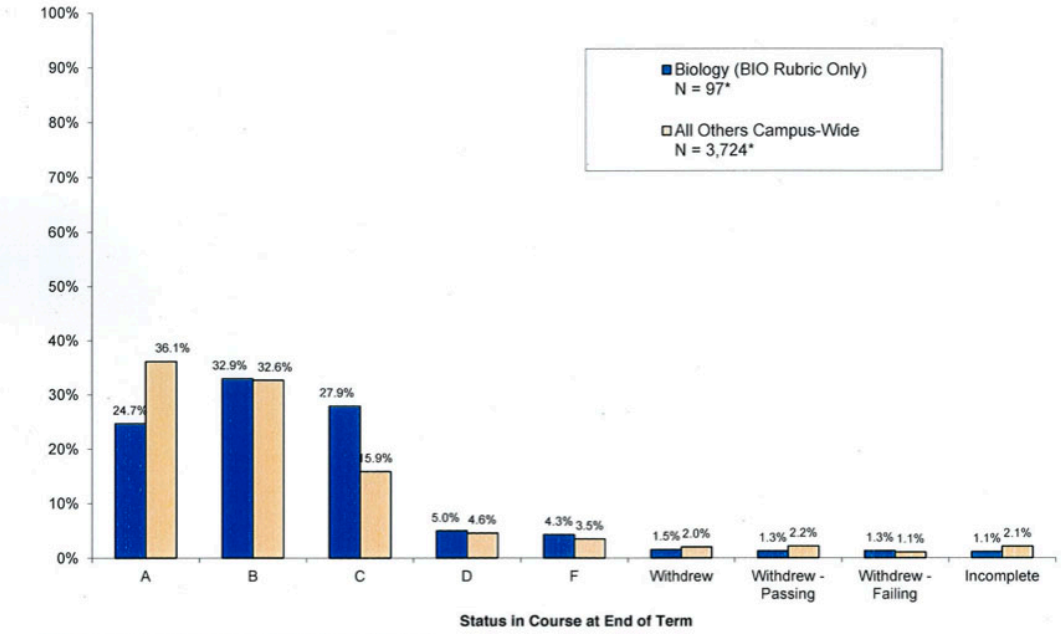
1. CHM 221 Organic Chemistry I
2. CHM 222 Organic Chemistry II
3. BIO 330 Genetics

APPENDIX XXI

(1 of 3)

Biology

Grade Distribution for Academic Years 2009-10, 2010-11, and 2011-12 Compiled

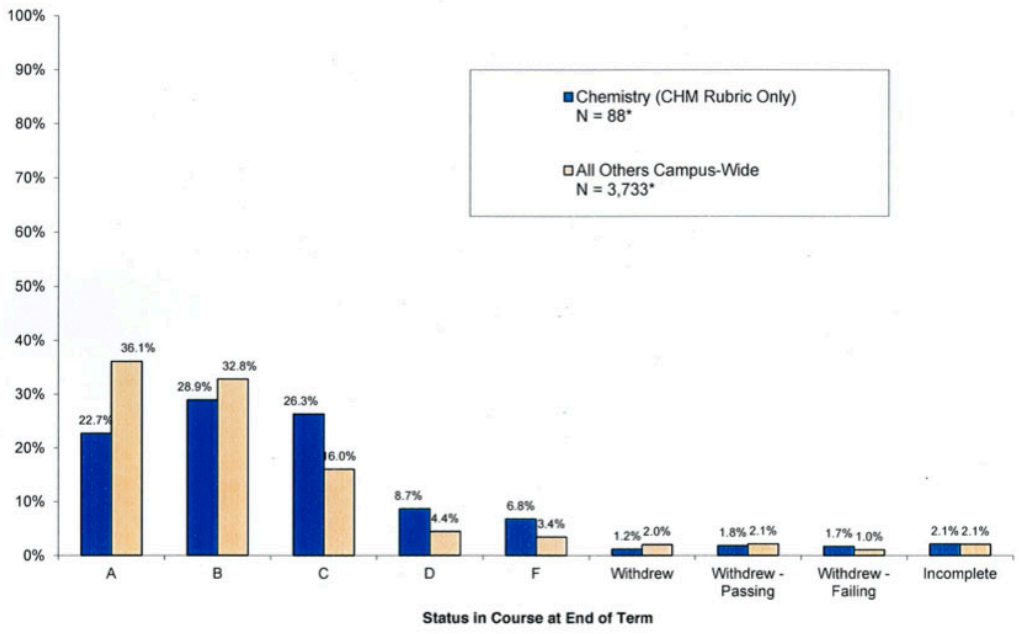


*Includes all *for-credit* courses (including internships, etc).

NOTE: Graph is based on static reports at the end of each term; therefore, grades of "I" are still included even if the grade has since been changed. Grades from cross-listed courses are included in the graphs only under the course rubric for which the student was enrolled.

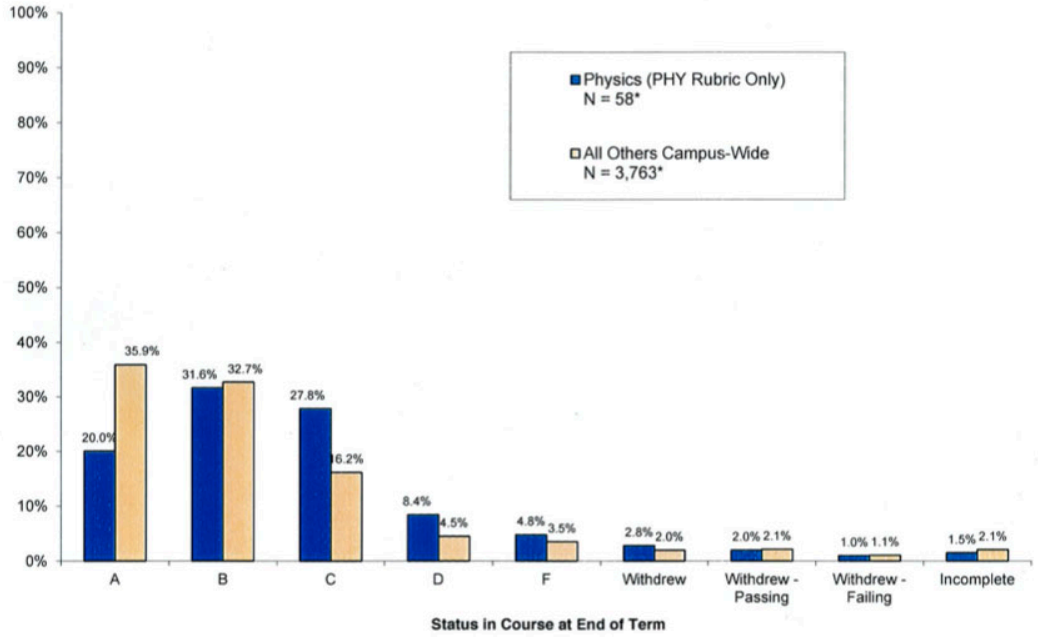
Chemistry

Grade Distribution for Academic Years 2009-10, 2010-11, and 2011-12 Compiled

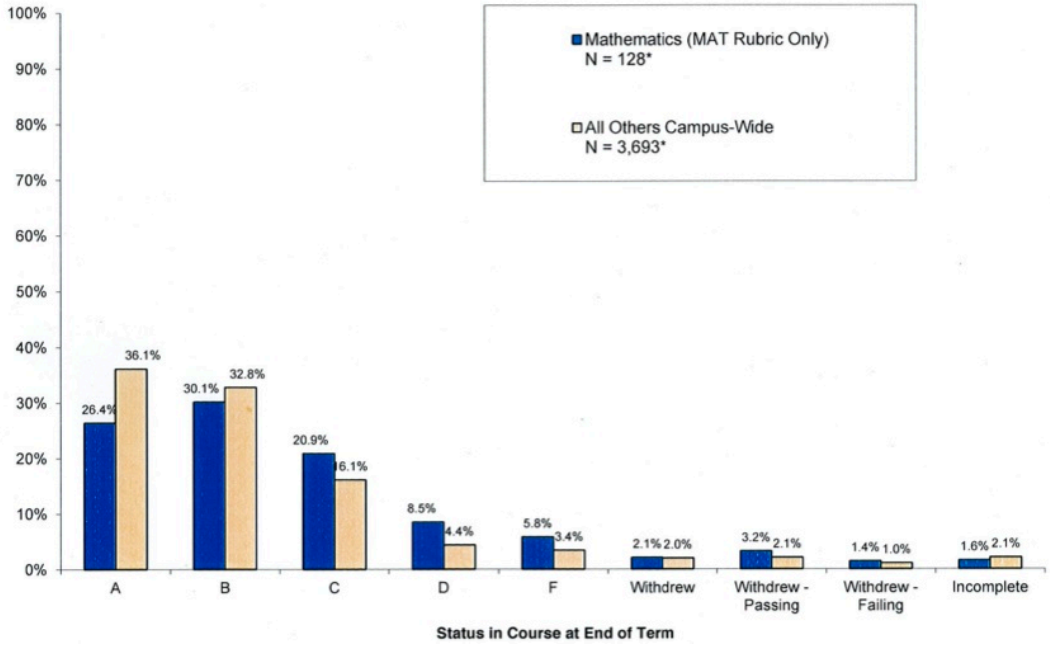


APPENDIX XXI
(2 of 3)

Physics
Grade Distribution for Academic Years 2009-10, 2010-11, and 2011-12 Compiled

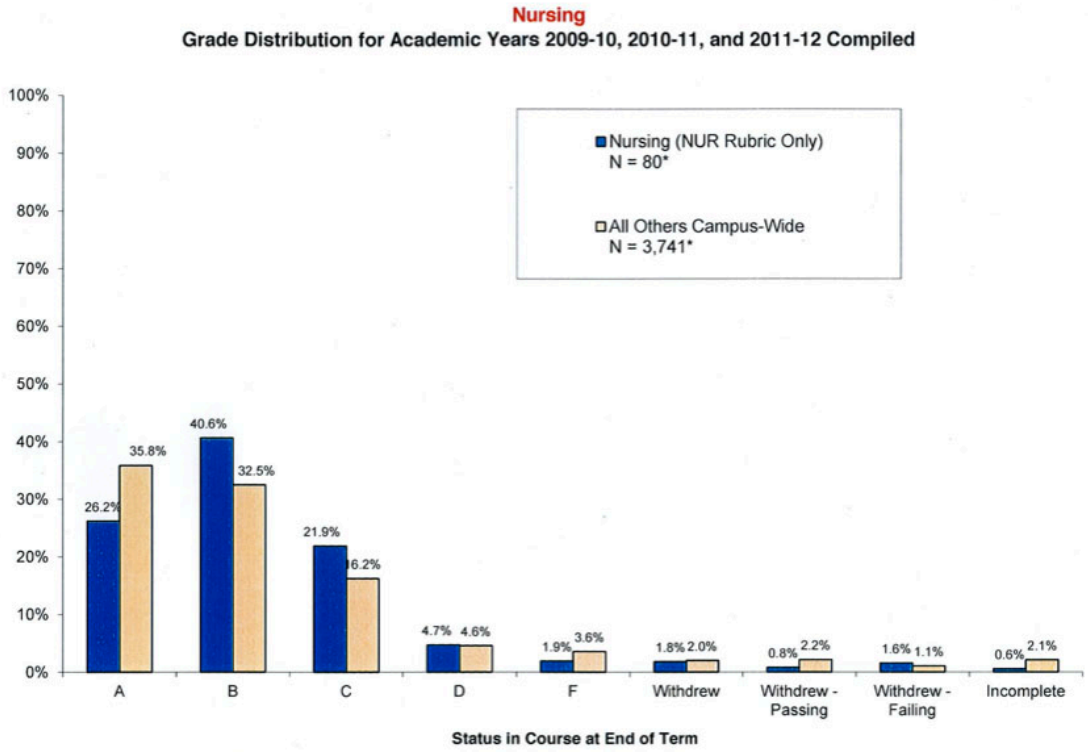


Mathematics
Grade Distribution for Academic Years 2009-10, 2010-11, and 2011-12 Compiled



APPENDIX XXI

(3 of 3)



APPENDIX XXII

Division I Course Loads

(Fall 2011/2012#)

BIOLOGY

Course	Enrollment	Capacity
100	10	26
101A*	23	24
101B*	16	24
110A*	29	30
110B*	32	30
110C*	30	30
113*	27	24
114*	16	24
220*	11	24
222*	19	24
386CA*	10	12
386RR*	29	24
441*	13	24

CHEMISTRY

Course	Enrollment	Capacity
101A	28	30
101B	22	30
101C	31	30
101D	31	30
131A*	28	32
131B*	15	16
221A*	13	16
221B*	22	25
221C*	16	25
222*	23	25
311*	24	25
345	29	30
362*	6	15
370*	11	15
470*	15	16

PHYSICS

Course	Enrollment	Capacity
111A*	16	18
111B*	13	18
217A*	14	16
217B*	15	16
217C*	7	16
316*	18	20
335*	7	10
365	10	12
386S	9	12
481	6	10

MATHEMATICS

Course	Enrollment	Capacity
010	12	15
011A	11	15
011B	11	15
011C	15	15
011D	9	15
011E	13	15
011F	15	15
012A	15	15
012B	10	15
012C	15	15
104A	23	24
104B	19	24
105A	25	25
105B	23	25
115A	25	25
115B	21	25
115C	25	25
115D	25	25
125	25	25
135A	26	25
135B	25	25
201	19	20
225	29	25
308	13	25
315	16	25
426 capstone	5	12
435	9	25

NURSING

Course	Enrollment	Capacity
BIO207*	31	40
341A*	7	10
341B*	10	10
350A*	3	10
350B*	10	10
351A*	9	10
351B*	2	10
447A*	10	10
447B*	3	10
448A*	7	10
448B*	6	10

 # = as data available 2011, 2012; some courses alternating years

*** = course includes a lab, is entirely lab-based or includes a clinical session**

APPENDIX XXIII

Division I Faculty Advising Loads (Fall 2012)

Program	Faculty member	Primary advisees	Secondary	Minor
BIO	Anderson, Dawn	33	1	0
	Douglas, Neil	15	0	0
	Hoffman, Megan	18	1	0
	Rosen , Ron	20	0	0
	Rowley, Marc	21	0	0
	Scudder-Davis, Roy	26	1	0
	Total	133		
CHM	Baltisberger, Jay (sabbatical)	0	1	0
	Garrett, Mary Robert	9	3	0
	Kovacevic, Anes	11	1	0
	Saderholm, Matt	12	0	0
	Smithson, Paul (CHM&SENS)	10	1	3
	Total	42		
PHY	Hodge, Tracy	14	1	1
	Veillette, Martin	8	0	2
	Total	22		
MAT	Barnard, Kristen	3	0	0
	Blackburn-Lynch, James	3	1	0
	Gratton, Larry	19*	0	0
	Lee, J.P.	5	2	0
	Rector, Judy	5	2	0
	Total	35*		
NUR	Carr, Judith	10	0	0
	Kirby, Carol	24	0	0
	Tolliver, Janis	9	0	0
	Vickous, Susan	13	0	0
	Villaran, Teresa	15	0	0
	Total	71		

* = includes GSTR110 advisees

Note: If faculty member is not listed, he/she has no advisees Fall 2012
Source: Division I Data Report, Fall 2012. OIRA

APPENDIX XXIV

A link to what we know about planning learning spaces and what we need to know

Vision, Goals, and Strategy

LSC Vision:
That all 21st century undergraduates, no matter their background or career aspiration, have ready access to physical learning environments that enable them to become engaged learners:

- Constructing their own learning, actively involved with cooperative, problem-driven teams
- Communicating and collaborating with peers and colleagues, formally and informally, face-to-face and virtually
- Connecting their campus-based learning experiences to real-world opportunities and challenges
- Celebrating as members of a robust 21st century community of learners.

The physical environment that serves such a vision is one that provides undergraduates opportunity to acquire the skills, capacities, depth of knowledge, and self-awareness that prepare them for their future responsibilities as engaged members of the 21st century workplace, engaged citizens of a free society.
The cultural environment that serves such a vision is one in which there is a communal understanding of and commitment to goals for student learning across the campus, as well as a recognition that building community is both means and end of the process of planning spaces for learning.

LSC Goals:
The primary goal is:

- To inform the work of campus planning teams with responsibility for shaping, maintaining and renewing undergraduate learning environments—whether the focus be remodeling a single classroom; recycling an out-dated library; renovating for interdisciplinary STEM learning and research; redesigning the landscape/greening the campus; imagining, designing, constructing, and maintaining a major new facility; developing/implementing a multi-year agenda for shaping formal and informal learning spaces campus-wide.

Toward that end, further LSC goals are to engage a broad community of stakeholders in:

- Promoting evidence-based design as a foundation for shaping and reshaping physical learning environments in colleges and universities across the country
- Supporting the design and development of physical learning environments that explicitly reflect awareness of research on how people learn
- Capturing emerging best practices for imagining, designing, constructing, renovating, and maintaining spaces for undergraduate learners
- Distilling and disseminating relevant resources as broadly as possible, connecting theory to practice.

LSC Strategy:
Our central strategy is to create and catalyze a feedback loop through which the broad community of stakeholders can: ask and respond to questions about all aspects of planning learning spaces, collaborate in exploring lessons learned from the community of experienced practitioners; advancing what is known about how the quality and nature of learning spaces affects the quality and nature of learning in the undergraduate setting.

http://www.pkallsc.org/

Appendix XXV
(2 of 2)

STEM Learning Spaces
From Planning to Designing

Facilitator
Jeanne L. Narum, Principal, Learning Spaces Collaboratory
jlnarum@ico-dc.com

Hosts
Matt Saderholm, Associate Professor & Chemistry Program Coordinator
Larry Gratton, Associate Professor of Mathematics

Berea College
Berea, Kentucky
May 23 - 24, 2012

LEARNING SPACES
COLLABORATORY

*Full workshop document attached as separate pdf file.

Appendix XXV
(2 of 2)

SUMMARY AGENDA

◆

Wednesday, May 23	
3:00 p.m.	**SETTING THE STAGE** *What will be accomplished at the end of the workshop*
3:30 p.m.	**PLENARY SESSION** *Overview of 21st century STEM learning environments*
4:00 p.m.	**SMALL GROUP "THINK/SHARE" DISCUSSION** *Getting inside the heart and head of the Berea community*
4:30 p.m.	**REVIEW; CRITIQUE; GENERAL DISCUSSION OF POSTERS**
5:00 p.m.	**PLENARY SESSION** *Spaces illustrating visions of 21st century learning and learners*
5:30 p.m.	**TIME FOR REFLECTION** *Capturing ideas to carry forward into Thursday*
6:15 p.m.	**DINNER**
7:00 p.m.	**PANEL DISCUSSION** *Student perceptions of STEM learning at Berea, present and future*
7:45 p.m.	**GENERAL DISCUSSION AND AN INTRODUCTION TO THE CASE STUDY**
Thursday, May 24	
8:00 a.m.	**BREAKFAST**
8:30 a.m.	**DISCUSSION OF CASE STUDY**
9:40 a.m.	**INFORMAL TIME FOR POSTER REVIEW**
9:45 a.m.	**PLENARY SESSION** *Overview of the process of planning for assessing: Barriers and opportunities*
10:15 a.m.	**BREAK**
10:30 a.m.	**REPORT OUT ON THE PRE-WORKSHOP AUDIT**
11:00 a.m.	**TIME FOR PERSONAL REFLECTION** *My most audacious idea to advance our planning is:*
11:30 a.m.	**OPEN FORUM ON AUDACIOUS IDEAS** *Pushing the envelope in shaping our planning*
12:15 p.m.	**LUNCH**
12:45 p.m.	**PLANNING FOR PLANNING**
2:45 p.m.	**FINAL REMARKS**
3:00 p.m.	**WORKSHOP CONCLUDES**

APPENDIX XXVI

June 6, 2012

Memo to: Matt Saderholm; Larry Gratton; Chad Berry
From: Jeanne Narum
Re: **Follow-up thoughts from the May 23/24 Berea/LSC workshop.**

Greetings. I assume your team is well-underway to advance ideas and implement plans that emerged during our time together. It was an inspirational time for me, as I hope it was for you. I am certain you all also share my sense of both the challenge and the opportunity. Here are thoughts that re-emphasize points made during our discussions and/or that reflect best practices and lessons learned from other 'planning learning spaces' initiative.

- Beginning with the end in mind, noting that there are several ends in mind that should drive your planning. These include:
    - How the new STEM spaces will be making a difference to the Berea learning community ten years out, and how you will know. This means attention to a diverse set of markers, from less impact on energy use/budget, to more interdisciplinary initiatives and to better recruitment and retention of students, alumni better prepared for service and leadership in fields requiring some knowledge of science and are able to apply that knowledge in their work beyond Berea.
    - What will be possible on move-in day, on the first day of the first semester of the life of building. This means attention to sustaining existing best programmatic and pedagogical practices; it also means that new programmatic and pedagogical practices are now adequately housed, etc.
    - What will be presented to the architects, when selected, as pre-planning that they can base the work of programming. Here also is the need to set the time by which this will happen.
    - What will be accomplished by the end of 2012.
    - What will be accomplished by the end of the summer.
- Backward engineer your planning process in a way that keeps each of these 'ends' in mind. This process will involve: getting the right people to the table in appropriate and timely ways; establishing rules of the road for how the process will proceed (issues brought to the table; priorities determined; tasks assigned; communicating, etc.); identifying a beginning set of questions to address, and revisiting the questions as your planning proceeds, to ensure you arrive expeditiously at each end; identifying possible barriers and being aware of possible serendipitous opportunities that will arise.
    - *People:* consider this: a) a small executive committee (5 – 7members), each with an assigned taskforce. This design is intended to give all involved specific rather than general, ill-defined, task to accomplish. Note also the need for short-term group assignments (auditing alumni/employers, whatever the task might be). This complex network of participating planners requires careful orchestration (thus the need for a

small executive committee) and transparency in operations. Find an odd-ball among your community/alumni body to bounce ideas off. I was very impressed by the group assembled at the workshop and their very obvious commitment to take on specific tasks in a timely manner (I hope those efforts are progressing.)

- *Rules of the road:* I commented on this aspect of planning earlier: the need to ensure all voices are heard, but that there is a process of determining which issue needs to be addressed and if an issue is to be addressed, what is the priority and timing for addressing it. There are obviously other rules of the road for a planning team, including that no idea is too dumb to mention; no one can ever mention, "well, we tried that 10 years ago." This is why having agreed on question/issues to address is important, because that can side-track discussion into personal swamps.

- *Questions to ask:* My reflection on the workshop is that you've identified most of the key questions and the processes by which they need to be addressed. Larry's summary of his audit and the comments by the students were very helpful. My only suggestion here is to make the questions public and provide opportunity for your colleagues to review the answers to those questions as they are being shaped. A new set of questions that is emerging in my ongoing LSC work includes, "how will this space be understood?" I am also increasing my emphasis (mentioned during the workshop) on intentionally-designed clusters of spaces that collectively serve the variety of learning goals for a single student or collaborating groups of students. Thus another new question: how many different learning activities can this space serve, formal or informal, scheduled or 24/7?

- *Barriers and serendipitous opportunities:* Barriers are things to work around, and you can do that. In the case of serendipitous opportunities, I think chance favors the prepared. Thus the public identity of the planning committee should be that this is a visioning group, that a 'wow' factor is part of the end in mind, that no idea is too dumb to mention. If you remember, I think that the best planning occurs when the team of planners understands that they are a team of learners—and that the same kind of collaborative contextual creative problem-solving that you might expect from students is to be expected of the planning team. Thus, think about individual reflective papers on the process of planning, of the Kolb learning cycle to reflect on what is happening and to keep improving the process of planning, of the need for celebrating the fact that building community is happening because of your efforts.

Probably more to come.

APPENDIX XXVII

Technology Upgrades to Hall Science Room 306

- Two 55" Mondopads positioned at different ends of the room
- A SMART Board with dedicated computer
- Collaboration tables for each Mondopad allowing multiple students to send their laptop displays to the Mondopad display
- A set of 12 iPads that can be displayed on the Mondopads using Apple's mirroring technology
- A new central wireless projector that can display the output from a computer or either Mondopad was centrally placed with a drop-down screen.
- A new sound system with wireless microphones
- Sound damping panels to modulate ambient noise
- 6 rolling whiteboards (3'x4') and one large whiteboard (4'x8')

APPENDIX XXVIII

Uses of Science 306 Technology to date

- The projector accepts wireless input using the WIPS protocol allowing laptops to wirelessly access the projector, leading to a more dynamic classroom experience
- The Mondopads can be used as PCs allowing in-class use of chemical structure software (e.g. ChemDraw, Chem3D..
- The Mondopads have a built in touch screen, allowing dynamic interaction with displays.
- The Mondopads have a whiteboard application, allowing them to be used for mini-lectures.
- The Mondopads can receive input from up to 8 i – devices (iPads, iPhones, macbooks, etc.). In several classes, iPads from the set of 12 were distributed to groups of students and students used the iPads to share results from group work with the whole class.
- The projection system allows for displays to be shared. Therefore, the main display can be sent to each Mondopad for a lecture or the Mondopad display can be pulled up to the main display if a particular student group's work needs to be seen & discussed by the whole class.

APPENDIX XXIX

Evening Science Library Usage 2012-2013

(numbers represent students)

Week	Sun	Mon	Tues	Wed	Thurs
08/19/12	No Data This Week				
08/26/12		0	3	6	7
09/02/12	?	0	3	1	2
09/09/12	3	2	7	10	8
09/16/12	4	4	13	?	14
09/23/12	2	31	6	5	10
09/30/12	0	4	8	6	4
10/07/12	1	0	15	6	8*
10/14/12	5	14	17	5	13
10/21/12	4	16	4	3	7
10/28/12		23	11	28	12
11/04/12	3	16			
Day. Tot.	**22**	**110**	**81**	**63**	**76**

01/06/13					9
01/13/13	4	11	8	10	13
01/20/13	3	16	7	17	17
01/27/13	6	5	22	15	19
01/03/00	22	22	36	25	19
02/10/13	2	18	14	7	26
02/27/13	1	19	17	1	4
02/24/13	3	28	18	13	4
03/03/13	2	9	Labor Day	7	17
03/10/13	**Spring**	**Break**			
03/17/13	(Break)	23	18	5	10
03/24/13	3	35	35	12	**Good Friday**
03/31/13	3	28	9	25	16
04/07/13	6	30	16	?	22
04/14/13	9	5	15	19	22
04/21/13	2	32	23	5	15
04/28/13	7	14	21	12	
Day Tot.	**73**	**295**	**259**	**173**	**213**

*** = New furniture arrives**

APPENDIX XXX

Alumni Survey: Rate the physical condition of each of the following while at Berea College: labs (N=112), classrooms (N=114), study areas (N = 114) and equipment (N=113).

Facilities	Excellent	Very Good	Good	Fair	Poor	Mean
	5	4	3	2	1	
Labs	10.7%	29.5%	37.5%	19.6%	2.7%	3.26
Classrooms	10.5%	34.2%	36.0%	19.3%	0.0%	3.36
Study Areas	14.0%	25.4%	36.8%	17.5%	6.1%	3.24
Equipment	14.2%	33.6%	34.5%	14.2%	3.5%	3.41

APPENDIX XXXI

Alumni Survey: What was the nature of your community outreach/service learning? Choose all that apply (NOTE: Total will not add to 100% because respondents checked more than one response)

Outreach	N	%
Scientific Demonstrations In School Systems	16	13.0%
Health Fairs	17	13.8%
Tutoring Local Students	25	20.3%
Judging Science Fairs At Local Schools	1	0.8%
Service Learning	23	18.7%
Other, please specify	19	15.4%

APPENDIX XXXII

STEMN Outreach Retreat Report
Prepared by Donna Morgan | Brushy Fork Institute
June 20, 2013

Background

Members of the Division I programs at Berea College (Natural and Physical Sciences, Technology and Applied Design, Computer Sciences, Math and Nursing) held a retreat on June 10, 2013 in the Trustees Room of the Seabury Center. The purpose of the retreat was to engage educators and administrators from the schools in Madison County in thinking about outreach and partnership opportunities between Berea College and the local schools in relation to STEM education. The group modified the STEM terminology to emphasize the Nursing program at Berea as an important component of STEM education.

The planning group of Berea College faculty for the meeting included Ron Rosen, Matt Saderholm, Tracy Hodge, Megan Hoffman, Larry Gratton, Paul Smithson, Jon Saderholm, Mark Mahoney, Jan Pearce, Teresa Villaran, and Sandy Bolster. The Division I faculty members engaged Brushy Fork Institute to lead planning for the retreat, and Donna Morgan and Rodney Wolfenbarger took on this work.

During planning, the group defined the goals of the retreat as follows:

- To educate Madison County educators and administrators about existing opportunities for collaboration/outreach with the Division 1 programs;
- To initiate or strengthen collaborative relationships with educators and administrators in Madison County and beyond;
- To engage educators, administrators and students in "outside the box" thinking about needs and opportunities related to science education in the community;
- To craft potential ideas for outreach programming that will have a measurable impact on science education in Madison County and beyond;
- To design next steps in exploring potential ideas that rise to the top;
- To strengthen connections within Berea College (CELTS, Externally Sponsored Programs, CDL)

Results of the Retreat

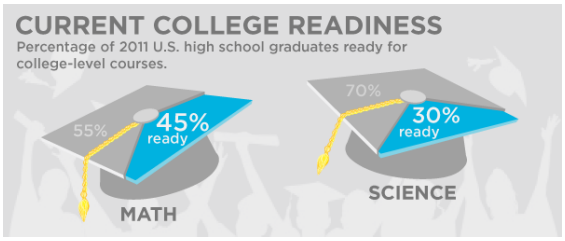
The outreach planning retreat was designed to gather input from the community educators about STEM education in the local school systems during the morning sessions, and then to spend the afternoon sessions with community educators and Berea College faculty and staff interacting to brainstorm ideas for outreach. The morning session began with an analysis of what community educators felt was working well with STEM education in their schools and where they felt the gaps existed. Following this session, the community educators were divided into tours to see the facilities on campus including the Science Building, the Nursing Building and the Technology and Applied Design Building.

The participants returned from the tours to have lunch and hear from a panel of Berea College STEM students about their experiences before and after coming to Berea and what would have been helpful to prepare them for a college career path in STEM education. Following the panel, faculty and staff brainstormed project ideas for outreach programming. They undertook a process to prioritize their ideas and then spent some time in small groups thinking about what might be needed to implement the ideas that rose to the top. The remainder of this report shares the information generated as part of this day-long process

**A copy of the full STEMN Outreach Retreat Summary is attached in a separate pdf.*

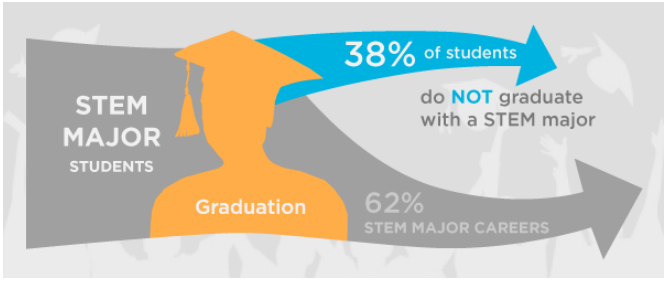
Appendix XXXIII

STEM Education Statistics (www.nms.org)



Decline in Education in America's Elementary and Secondary Schools

- **45 percent** of 2011 U.S. high school graduates are ready for college-level math.
- **30 percent** of 2011 U.S. high school students are ready for college-level science.
- Only **12 percent** of black students and **17 percent** of Hispanic students took Algebra I before high school in 2009. But, **48 percent** of Asian students took Algebra I before high school in 2009.
- In 2009, **34 percent** of American fourth grade students, **30 percent** of eighth grade students, and **21 percent** of twelfth grade students performed at or above the proficient level in science.
- **9 percent** of Hispanic and **10 percent** of black U.S. students took advanced Algebra or calculus in 2008, compared to **22 percent** of white students and **43 percent** of Asian students.
- **27.6 percent** of AP test takers in the class of 2011 earned a qualifying score on a STEM exam.
- **27 percent** of 2011 test takers took an AP science exam and **26 percent** took an AP math exam.
- **25 years ago**, the U.S. **led the world in high school and college graduation rates**. Today, the U.S. has **dropped to 20th and 16th**.



Decline in Higher Education in America

- Students who progress through at least Algebra II in high school are **twice as likely** as those who do not to complete a four-year degree.
- **38 percent** of students who start with a STEM major do not graduate with one.
- In 2009, men age 25 and older held **87 percent** of bachelor's degrees in engineering fields.

- In 2009, of the 56 million people age 25 and over with a bachelor's degree, nearly **20 million** of them held a degree in a science and engineering field.
- **STEM majors make more than non STEM majors**. Petroleum engineering majors make about $120,000 a year, compared with $29,000 annually for counseling psychology majors.

Teachers

- In 2007, **about a third** of public middle school science teachers either did not major in the subject in college and/or are not certified to teach it.
- **36 percent** of public middle school math teachers in 2007 either did not major in the subject in college and/or are not certified to teach it.

International Comparisons

- U.S. students recently finished **25th in math** and **17th in science** in the world compared to 31 other countries.
- The prestigious World Economic Forum ranks the U.S. as No. 48 in quality of math and science education.
- In 2008, **4 percent** of U.S. bachelor's degrees were awarded in engineering. Compared to **31 percent** in China.
- In 2008, **31 percent** of U.S. bachelor's degrees were awarded in science and engineering fields. Compared to **61 percent** in Japan and **51 percent** in China.

Workforce

- As of February 2012, **more than half** of the 30 fastest growing occupations require some level of post-secondary education.
- "**All of the increase in employment** over the past two decades has been among workers who have taken at least some college classes or who have associate or bachelor's degrees – and mostly among workers with bachelor's degrees."
- In 2008, **59 percent** of all jobs in the U.S. economy required post-secondary education. (Up from **28 percent** in 1973.)
- By 2018, it is projected that **63 percent** of all jobs in the U.S. economy will require post-secondary education.
- By 2018, **92 percent** of traditional STEM jobs will be for those with at least some post-secondary education and training.
- **23 percent** of STEM workers are women, however women make up **48 percent** of workers in all occupations.
- In 2009, **12 percent** of STEM workers were non-Hispanic black and Hispanic. But,non-Hispanic black and Hispanic individuals accounted for **25 percent** of overall employment.
- Jobs in computer systems design and related services, a field dependent on high-level math and problem-solving skills, are projected to grow 45 percent between 2008 and 2018.
- The U.S. may be short as many as three million high-skills workers by 2018.

Research and Development

- In 2009, U.S. scientists fielded nearly 29 percent of research papers in the most influential journals compared to 40 percent in 1981. STEM Crisis is causing a reduction in research which leads to growth.
- By 2009, for the first time, over half of U.S. patents were awarded to non-U.S. companies because STEM shortcomings are forcing a hold on innovation.

Appendix XXXIV

The International Center for Supplemental Instruction

Overview of Supplemental Instruction

Definition:

Supplemental Instruction (SI) is an academic assistance program that utilizes peer-assisted study sessions. SI sessions are regularly-scheduled, informal review sessions in which students compare notes, discuss readings, develop organizational tools, and predict test items. Students learn how to integrate course content and study skills while working together. The sessions are facilitated by "SI leaders", students who have previously done well in the course and who attend all class lectures, take notes, and act as model students.

Purpose:

1. To increase retention within targeted historically difficult courses
2. To improve student grades in targeted historically difficult courses
3. To increase the graduation rates of students

Participants:

SI is a "free service" offered to all students in a targeted course. SI is a non-remedial approach to learning as the program targets high-risk courses rather than high-risk students. All students are encouraged to attend SI sessions, as it is a voluntary program. Students with varying levels of academic preparedness and diverse ethnicities participate. There is no remedial stigma attached to SI since the program targets high-risk courses rather than high-risk students.

UMKC

http://www.umkc.edu/asm/si/overview.shtml#