Science, Technology, Engineering & Math: STEM Solution Group Report

November 2013

Historically, the Jesuit effort to "find God in all things" has had the result that Jesuits have made significant contributions in broad areas of science and technology such as astronomy, algebra, natural history and geography. That tradition is alive at Regis University, where about a quarter of the academic work available to students is STEM-related, although several strategic opportunities exist to further strengthen this situation.

The National Academy of Public Administration 2013 Report on Higher Education demonstrates several important trends related to STEM education. First, there is a shortage of STEM applicants for jobs, despite the projections that the STEM fields will grow faster than other areas of employment. Second, there is pressure for academic institutions to better prepare students for employment, by focusing on both technical and employment–related skills such as critical thinking. With this background, the STEM Solution Group has been formed, with the charge as follows.

> *Identify emerging career trends in science, technology, engineering, and math areas, including teacher education in these fields, and recommend curricular and other program offerings for future university investments*.

For the purposes of our work, we define STEM to include not only courses and degrees related to Science, Technology, Engineering and Mathematics but also those in the health related professions and teacher education with a STEM focus.

STEM Programs at Regis:

Regis College (RC) currently has programs in 8 related STEM fields: Biology, Chemistry, Biochemistry, Environmental Studies, Mathematics, Physics, Neuroscience, Psychology, and Computational Sciences (includes computer science). 22 faculty members provide inquiry driven instruction to an annual enrollment of 300 to 400 total students in STEM related courses (326 students in 2013; 386 in 2012), which represents ~18% of RC enrollments. The Masters in Biomedical Sciences has seen increasing enrollment with 20-30 students trained annually (22 students in the Fall of 2013; 29 in the Fall of 2012), which represents ~1.5 % of RC enrollments. Undergraduate and Graduate teacher education in STEM fields includes 6 students each.

The *College for Professional Studies* (*CPS*) degrees that are coded as STEM-related include the undergraduate programs of computer science and networking and information science with 728 students in AY2012-13. The Master's programs include those in software engineering and information assurance with 770 students in AY2012-13. This represents approximately 20% of the CPS enrollments. In the School of Education in CPS, there were 77 students in AY2012-13 pursuing degrees for science and math teaching, including 38 with an instructional technology focus. This represents less than 5% of CPS enrollments.

Rueckert-Hartman College for Health Professions (RHCHP) has 2 degrees which are coded for STEM: the Master of Science in Health Informatics and Information Management (23 enrolled in AY 2012-13) and the Certificate in Health Care Informatics (4 enrolled). Other programs that are STEM-related include the Health and Exercise Science Major in the School of Physical Therapy. The professional programs are not

coded as STEM, yet are considered strong programs with science at their core. These programs have faculty and space resources which support science at Regis University (6 science faculty in the schools of pharmacy and physical therapy). See Appendix A for information on enrollments.

Methods:

We identified and analyzed national and emerging career trends in STEM including Health Care, and identified STEM fields of study that had growth rates of > 19%. (Appendix B) Teacher education was included based on Department of Education predictions, though the rate of growth is less than 19%. Further, we interviewed admissions counselors in Regis College for highly requested areas of studies. Then these emerging careers trends were evaluated against the strengths and resources at Regis University.

Principal Findings:

1. **Capacity**
   Given current levels of faculty and space resources, there is limited ability to realize growth in numbers of students enrolled in STEM related classes. Lower division STEM courses in RC are full and laboratory scheduling is difficult. Expansion opportunities exist for most upper division STEM courses in Regis College. Attrition is common between lower and upper division STEM courses as many students go on to other science and health programs at Regis, such as pharmacy and nursing.

2. **Computer Science**
   Nationally, computer science is a strong growth field in the STEM disciplines and current Regis opportunities provide a strong foundation in this area. The computer science emerging careers include the math–heavy fields of computer animation, simulation and robotics, and the data-heavy health information technology. We encouraged the Computer Information Science (CIS) Solution team to review these opportunities.

3. **Teacher Education**
   Federal and state experts cite STEM secondary teachers as an area of need due to the dearth of secondary STEM teachers and impending retirement of a generation of teachers in these positions. Given the relatively low number of students enrolled in Regis CPS and Regis College secondary STEM-related teacher education programs, this appears to be a potential growth area for initial licensure and added endorsements. Most secondary students come to Regis CPS already holding an undergraduate degree or substantial credits in the discipline, and pursue required education courses. Nearly all Regis College students major in one of the science or math disciplines in addition to taking education courses. Because the content knowledge, pedagogical content, and skills in these teaching fields must be solid, further discussion is warranted to investigate collaborative opportunities across the university, between STEM faculty members and education programs.

4. **Health Related Fields**
   The high- growth career trends in health care include health information management, biomedical engineering, dietician/nutrition, pharmaceutical sciences, mental health counseling and nurse practitioners. Currently, RHCHP is in the process of investigating the requirements for dietician/nutrition and pharmaceutical sciences and supports mental health counseling and nurse

practitioner expansion. The health information management programs have been referred to the CIS solution team for investigation, and biomedical engineering is being examined by the innovation team, although we also have identified resources needed.

5. Engineering

Several areas of engineering including environmental and biomedical engineering have strong career growth predictions and are top paying jobs requiring a bachelor's degree for entry into the field.

According to RC admissions, prospective students frequently ask about engineering. Through the dual degree program with Washington University in St. Louis (WUSTL) Regis students complete three years of education at Regis University and then transfer to WUSTL for the 2 remaining years in engineering. WUSTL guarantees students can complete the engineering degree in two years because student cohorts from other liberal arts college maximize enrollments for this special program. There have been 7 Regis University students who have done this program in the last 13 years.

Most Jesuit institutions without a school of engineering have dual degree engineering programs in place. The regional competition from nationally ranked Colorado engineering programs is significant. The development of an engineering program is a high-cost investment, requiring substantial infrastructure for modern engineering labs and the recruitment of significant new engineering faculty. Course requirements for Accreditation Board for Engineering and Technology (ABET) accreditation with our Jesuit liberal arts core would exceed current graduation credit requirements.

6. One University, and 3 Colleges

Repeatedly, we identified opportunities that cross colleges, but have significant hurdles that make it difficult for students to take relevant courses in other colleges. Different faculty models and administrative processes hinder the ability to work as "One University".

Principal Recommendations for Action:

Action 1: Expand the scope/capacity of STEM programs for modest growth

A. **Expand the Environmental Science (ENVS) programs** – The BA in Environmental Studies and the BS in Environmental Sciences started in 2009 and continue to have strong growth. Graduates continue to find meaningful professional opportunities despite a sluggish job market. Growth in the existing programs could be achieved with moderate investments in space and faculty. We support expansion to a graduate degree program which offers both MS degrees and certificates leading to a degree. A potential growth program within ENVS would be the addition of an emphasis in environmental chemistry with an Accreditation by the American Chemical Society.

B. **Expand lower division courses for STEM and Pre-health Students** – Increasing the number of lower division STEM related courses would allow opportunities for *all* students to participate in these areas of study. Specifically, the health programs at Regis include science and math pre-requisites and increasing the size of lower division courses would ensure a strong grounding in Jesuit education fundamentals in creating a stronger applicant pool for all the health programs. Expanding the size or number of sections in these types of courses would require modest investments in faculty and space.

C. **Grow Secondary science and math teacher education programs**--Given the low number of students enrolled in Regis STEM-related teacher education programs and national/state claims of

impending needs in these areas, this appears to be a compelling growth area for initial licensure and added endorsements. Most secondary licensure students come to Regis (CPS) already holding an undergraduate degree in the discipline, and pursue required education courses. The School of Education in the College of Professional Studies and Regis College Department of Education both currently offer a M.Ed. with secondary licensure and several secondary endorsements, including science, math, and technology. The CPS programs need to be updated and realigned with Colorado Department of Education and Council for the Accreditation of Educator Preparation (CAEP) standards. Further investigation of collaborative opportunities between STEM faculty members and the education programs in RC and CPS is advised.

Action 2: Start these programs:

A. **BS in Actuarial science** – Actuaries represent a growing field of employment and individuals must have a strong background in mathematics, statistics, and business. All these courses exist in RC and CPS, and students could be advised to take coursework that would prepare for the actuarial exam. However, creating a BS in Actuarial Science would require minimal investment and would provide an identifiable area of study that is math-related with significant career options. In addition, only one other Jesuit school has this program (Le Moyne) and of the Colorado schools, only CSU identifies this as a degree option.

B. **BS in Technical writing**–This growing field requires a degree in communication and knowledge of a specialized STEM field, such as engineering, computer science, or medicine. Web design experience also is helpful because of the growing use of online technical documentation. We propose a BS in Technical Writing, with tracks in medical, science and technology writing. This program would require additional course development, which would also expand options for non-degree students. This program has significant potential to increase enrollments in STEM-related courses.

C. Secondary technology education licensure– Secondary career and technical education (CTE) teachers often come from industry and lack formal pedagogical training. There are no educational programs for these individuals in Colorado, which creates a gap which can be addressed. These students would increase enrollment in the teacher licensure programs.

Action 3: Build capacity for engineering careers

A. **Expand existing capability to prepare students for engineering** – Some incremental steps could lead to a general engineering and engineering physics major in RC. Both programs can be ABET accredited with a minimum of ~80 credits in the major, although many programs have ~100 credits in the major. Two-thirds of the coursework already exists in physics and math. A two-semester introduction to engineering and senior design course would be required. Two to three additional labs to accommodate upper division engineering labs could be part of a future Science Building expansion. With the growth of the physics major and enrollments in the introductory courses, a new physics faculty member with an engineering background could be recruited in anticipation of teaching future engineering courses.

B. **Offer "Introduction to Engineering" course(s)**–At the Colorado School of Mines, all first year students take an introductory course that introduces students to open-ended problems, requiring

critical thinking, problem solving, teamwork, and computer programming and analysis to produce a solution. We should explore an articulation agreement allowing Regis students to take these School of Mines courses (EPICS I and II), as part of a pre-engineering track at Regis. This type of collaboration would be unique. Alternatively, we could develop a 3-credit "Introduction to Engineering" course that could be taught by a faculty member with an engineering background.

C. **Implement Pre-engineering marketing strategy –** Pre-engineering tracks through a physics or math major are natural pathways into the dual-degree engineering program at WUSTL. We need to highlight our strengths in physics and math in the liberal arts environment, preparing students to become liberally trained, socially conscious engineers.

D. **Pursue collaboration with other Universities** - Many institutions have dual degree engineering programs with more than one University. There may be other collaborative opportunities, such as with Colorado School of Mines where students in engineering could take liberal arts classes or Regis students could take engineering classes. These opportunities may also lead to additional dual-degree options.

Resources/Conditions needed for successful completion of these recommendations, including which might be appropriate for Campaign goals

Because STEM classes are a fundamental component of most programs, it is important to have lower division courses STEM classes available to all students. For example, the RC technical writing students might take a class in computer science or business offered in CPS. The primary barrier to filling classes is the variation in administrative requirements between the Colleges. Therefore*, the condition that is most essential for growth is to create an administrative structure that facilitates course work across the colleges at Regis University.*

The need for cross-college opportunities is great, and needs to be addressed strategically so that we maintain the strengths of our programs but allow for greater opportunities. We need higher levels of trust and collaboration across the University. We are hopeful that if we can remove the structural issues, the cultural differences between departments would likely diminish over time.

Similarly, opportunities for collaboration exist with other universities. By offering courses, existing or possible, to programs in other universities where such courses are not offered, we can utilize existing resources (faculty and courses) to their maximum potential. An example would be to offer to engineering students from the School of Mines courses in a health field that would broaden these students' education in areas they couldn't explore at Mines. Conversely, we also can enrich our existing or proposed STEM programs by accepting courses from other universities to satisfy elective or other requirements of our programs. *The second condition most essential for growth is agreements between Regis and other universities* to make cross-university enrollments more seamless.

Space is the most important resource necessary for expanding programs. At minimum, expanding the current Science building to include additional teaching/laboratory/research and office space is required to grow environmental science and expand sections in lower-division science courses. Included in expansion should be considerations of technology and research infrastructure associated with these focus areas. The addition of a "Makerspace", defined as a collaborative learning environment where people come together to use common tools (such as a 3D printer) to design and create, could facilitate innovation

within the STEM fields. These spaces are often housed within a library, and would require renovation of physical space. Both these projects are appropriate for a capital campaign.

Faculty resources are also required for growth in STEM related courses, particularly in chemistry, environmental science, physics, engineering and math. Faculty salaries in these areas vary, and some areas require higher salaries. The University will need to address the policies around salary differential among faculty, and could consider an endowed chair in one of these areas.

Some increases in STEM enrollments may be realized if overall enrollment rises. Therefore, recruitment and marketing efforts can be focused on the strength of our STEM courses as a part of our educational core. Additionally, efforts to increase internships and develop student portfolios will increase the employability of our graduates, leading to better overall enrollment.

Discussion of the value these recommendations will provide for the University and its students.

These recommendations allow Regis to create a *stronger identity* around our well-rounded Jesuit education. Regis University is primarily identified as a liberal arts school, despite strong programs in the STEM fields and health sciences. Employers are increasingly valuing STEM disciplines, as part of a liberal arts education, in hiring decisions. Imagine the possibility where Regis University has seamless agreements with other Universities, where a Catholic family that wants a Jesuit education for their children, but also wants strong science skills as well. Regis University would be demonstrating leadership in educational innovation, just as we have in the past.

The benefit for students is high. These recommendations provide additional STEM-related educational opportunities for all students; those that want to major in STEM disciplines and those that use STEM-related education to enhance their career readiness. The number of students who can get jobs upon graduation should increase, adding to our educational standing. Enhancing education also prepares students for life-long learning opportunities.

The benefit to society is high. Some of our most critical national challenges include technology, education, and health care. In the United States we have limited availability of qualified people in science, technology and engineering. By strengthening our STEM focus, Regis University will contributing to meeting this societal need. Educating teachers with STEM expertise will contribute to developing new solutions in technology and education. Similarly, health care is undergoing a significant change which will require innovations in health care delivery.

Recommended Timelines

Action 1: Expand

Expanding the size or number of sections in lower division STEM courses needs to be addressed soon in order to proceed with other opportunities; however, creative problem solving will be needed. The other expansion opportunities will take longer to implement and will require a commitment of funding for an expansion of the science building, and additional lab and faculty resources.

Action 2: Start
Creation of technical writing and actuarial science degrees can proceed quickly, if resources for additional faculty and program oversight are available.

Action 3: Capacity for Engineering
Design of the engineering preparation courses can begin quickly, if faculty workloads can be adjusted for program development, but further expansion and implementation will require additional resources.

For all actions, efforts should begin immediately to discuss ways to improve administrative processes across the University. Establishing relationships which are crucial to future collaborations with other universities should also begin immediately.

How these recommendations advance our Jesuit core values and identity

Earlier this year the humanities commission of the American Academy of Arts and Sciences produced a congressional report that asked, "Who will lead America into a bright future?"[1] Their answer was, "Citizens who are educated in the broadest possible sense". At Regis, *all* students are educated in the broadest possible sense. The integration of the humanities and the sciences as part of our liberal arts education prepares our students to be leaders into a bright future. St. Ignatius of Loyola's instruction to find God in all things compels a Jesuit liberal arts institution to provide a broad curriculum that includes both humanities and sciences.

The National Academy of Engineering also has issued its Grand Challenges of the 21st Century, based on a year-long international study. Ranging from "Provide Access to Clean Water" to "Advance Health Informatics," they all have one thing in common; to achieve any of them, STEM graduates are required.

Regis' mission includes a call to search for truth and make a positive impact in a changing society. This mission cannot be fulfilled without a strong foundation in STEM fields.

Solution Team Members:

1. Sue Scherer, Associate Dean, RHCHP (Chair)
2. Mark Basham, Associate Professor, Neuroscience, RC
3. Don Bridger, Director, Office of Academic Grants
4. Jay Campisi, Assistant Professor, Biology, RC
5. Rod Carter, Dean, School of Pharmacy, RHCHP
6. Stacy Chamberlin, Assistant Professor, Chemistry, RC
7. Todd Fantz – Associate Professor, Education, CPS
8. Matt Fete, Assistant Professor, Pharmaceutical Sciences, RHCHP
9. Martin Garnar, Professor and Reference Services Librarian
10. Quyen Hart, Assistant Professor, Physics, RC
11. Janna Oakes, Professor and Dean, School of Education, CPS
12. Admiral Richard Truly, Regis University Trustee; former NASA Administrator

[1] The Heart of the Matter. (2013). The commission on the humanities and social sciences. American Academy of Arts & Sciences. Cambridge, MA

STEM Solution Team Report Appendices

A. Enrollment Report spreadsheets
B. Career growth fields – evaluation matrix
C. ENVS supporting statements
D. Teacher Education support document
E. Actuarial science requirements
F. BS in Technical writing information
G. CTE teacher education statements
H. Engineering Program options
I. Additional recommendations and notes
J. References

Appendix A: Located in separate document

Appendix B: Located in separate document

Appendix C: Environmental Science Supporting Statements

The Environmental Studies (ENVS) Program at Regis College is an interdisciplinary program that offers two degrees (Bachelor of Arts in Environmental Studies, Bachelor of Science in Environmental Science) and a minor (Minor in Environmental Studies). Students take a variety of courses through different departments to gain both the breadth and depth necessary to solve complex environmental problems. The ENVS program promotes critical thinking, qualitative and quantitative reasoning, problem solving, and writing skills. Both local and global issues are emphasized in exploring environmental solutions for the common good of humanity and of the earth

Since 2009, the number of students graduating with a B.A. each year has typically been 2-3, and 3-5 students each year have earned B.S. degrees. During the 2012-2013 academic year the ENVS program experienced substantial growth as 14 new students declared ENVS majors (Figure 1). Since 2009, the number of ENVS majors has remained relatively stable around 12 students with a slight majority of students seeking a B.S. degree. The 2012-2013 year's influx of new majors represents a doubling of the size of the program, and indicates a continued and increasing demand for degrees in environmental studies and sciences. The proliferation of Environmental and Sustainability programs at institutions of higher learning in the U.S. has been notable (Frank et al., 2011). Regis was on the forefront of the Environmental trend in education when it started the Regis College Environmental Studies program in the early 1970s. We subsequently have fallen behind, especially as environmental and sustainability programs have proliferated in the 21st century.

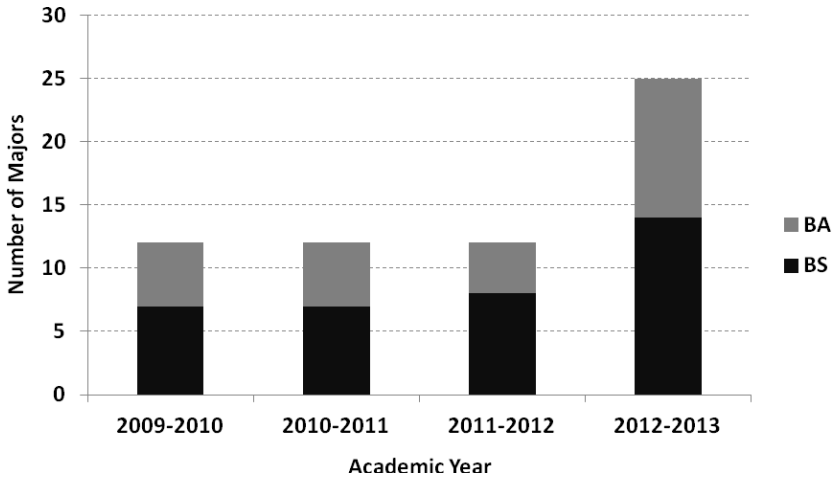

Figure 1. ENVS majors since 2009

The ENVS faculty report that graduates continue to find meaningful professional opportunities despite a persistently sluggish job market. Student success in the job market has been improved by internships and other professional opportunities, as well as a demand for environmental professionals in Colorado and further afield. These observations are consistent with the data received by the National Web Panel Survey of Executives and Hiring Influencers. Business professionals reported that STEM subject matter was considered attractive areas of study for job candidates. For example, 32% of respondents rated Environmental sciences as extremely attractive or attractive subject matter of candidates' degrees.

The ENVS program goals of promoting environmental stewardship and critical thinking about environmental issues are fully aligned with the Regis University mission, and faculty and students in the ENVS program look forward to future opportunities to serve the university and the wider community. For example, in the Fall of 2013 the Department of Biology in consultation with the ENVS Program proposed a graduate degree program that will grant both M.S. degrees and Graduate Certificates in the area of Environmental Biology. In addition, the proposed certificate may be used in combination with other, future offerings inside and outside of STEM departments to capitalize on the full range of program opportunities related to the environment and sustainability.

In order to promote the growth at both the undergraduate and graduate level in environmental and sustainability areas we believe significant support should be provided in this area. It is estimated that moderate growth (expanding current undergraduate offerings and establishing targeted graduate programs that do not exceed the existing infrastructure) can be achieved by a modest investment (see Appendix X). This investment would likely include increasing the number of faculty, increasing materials for additional lab offerings, increasing the computing capabilities on campus (hardware, software, bandwidth), and increasing support for field-based experiences. It should be noted that this investment would be in many departments (including, but not limited, to the Regis College Department of Biology) as the ENVS program is an interdisciplinary program. However, the growth of these programs ultimately will be limited by existing space and faculty numbers. Thus, in order for significant growth to occur (expanding current and creating multiple new undergraduate/graduate programs with higher enrollment) we believe a significant investment (see Appendix X) must be made that would include **expanding the current Science building** and/or creation of additional teaching/laboratory and office space on campus in addition to the previously listed investments (which would likely need to be expanded; e.g., modest growth might require 1-2 faculty members while significant growth might require 3-5).

One potential area for growth within ENVS would be to expand the chemistry focus of the program. Expansion of the current B.S. ENVS program to include an emphasis in Environmental Chemistry would require additional faculty and student recruitment to fill these upper division courses. This investment would require expanded efforts to recruit STEM and specifically ENVS students to insure the current student pool of STEM majors is not simply diluted into a new major track. Accreditation by the American Chemical Society for an Environmental Chemistry program could bolster the attractiveness of the expanded B.S. program. Although this ENVS Chemistry expansion requires moderate investment in both faculty and course offerings in upper division Chemistry courses, the ripple effect of increased student recruitment on lower division chemistry, biology, physics and mathematics courses could be

significant. Currently, these lower division courses are at maximum capacity and would require additional faculty, staff, classrooms, department funding, and, more importantly, teaching and research laboratory space. However, given the emphasis in recent years to expand STEM at Regis, these capital investments may be required with or without a B.S. ENVS Chemistry track.

Expansion to a Masters level ENVS program in Chemistry would require significant investment in faculty, instrumentation, research and teaching space and require a complete shift in funding schemes. Graduate students in Chemistry are paid for research contributions and teaching assistantships requiring significant external grant funding. Given the already strong regional and national programs at major R01 Universities and decreased federal grant funding per capita (per research laboratory), this masters level program would be a significant investment risk.

Frank, D., Robinson, K., & Olesen, J. (2011). The Global Expansion of Environmental Education in Universities. *Comparative Education Review*, *55*(4), 546-573.

Appendix D: Teacher Education Support Documents

Introduction

There has been a national call for more highly qualified STEM teachers at the secondary level. Although this area is not cited as a career growth area by the Bureau of Labor Statistics (BLS), it is compelling to note that secondary STEM teachers are nested within the general BLS category of secondary teachers. Researchers such as Ingersoll and Perda (2009) and the Colorado Governor's P-20 Council, however, do cite secondary STEM teachers as a growing need across the United States. Much of the need is driven by too few teachers being produced to keep up with both the retiring teachers and the teachers who do not remain in the profession (Ingersoll & Perda, 2009). Regis University has the opportunity to help with the teacher shortage by producing a greater quantity and quality of STEM teachers. Research has shown that teachers trained in high quality teacher education programs are less likely to leave the profession (Sterling, 2004).

Current Programs

Secondary licensing programs in science and mathematics already exist at Regis University, at both the undergraduate and graduate levels, in both Regis College and the College of Professional Studies. In Regis College, at the undergraduate level, students obtain a bachelor's degree in a science or mathematics discipline along with a teaching license. Regis College also offers an MA degree in education that leads to licensure. The students in the masters program either have a degree in the discipline they will teach or they have completed significant credit hours in that subject. The College of Professional Studies offers a similar degree, M.Ed. in Secondary Education, which also leads to licensure. All of the current programs have an opportunity for growth. With large regional competition, growth would need to come from advertising and possibly a stronger emphasis on becoming a science or mathematics teacher.

Secondary engineering is currently not a license recognized by the Colorado Department of Education. There are three methods currently used to bring engineering into secondary schools: through technology education programs, science education as called for in the new science standards and in STEM integration programs.

Appendix E Actuarial science requirements

Actuarial Science: Existing with Advising

Actuaries analyze the financial costs of risk and uncertainty. They use mathematics, statistics, and financial theory to assess the risk that an event will occur and to help businesses and clients develop policies that minimize the cost of that risk.

Quick Facts: Actuaries

2010 Median Pay	$87,650 per year $42.14 per hour
Entry-Level Education	Bachelor's degree
Work Experience in a Related Occupation	None
On-the-job Training	Long-term on-the-job training
Number of Jobs, 2010	21,700
Job Outlook, 2010-20	27% (Faster than average)
Employment Change, 2010-20	5,800

Education required:

Actuaries must have a strong background in mathematics, statistics, and business. Typically, an actuary has an undergraduate degree in mathematics, statistics, business, or actuarial science.
To become certified professionals, students must complete coursework in economics, applied statistics, and corporate finance. Coursework in calculus and business, such as accounting and management, are essential for students as well.

Students should also take classes outside of mathematics and business to prepare them for a career as an actuary. Coursework in computer science, especially programming languages and the ability to use and develop spreadsheets, databases, and statistical analysis tools, is valuable. Classes in writing and public speaking will improve students' ability to communicate in the business world.

Many students take internships, which are a valuable way to gain experience outside of the classroom while they are still in school. Many employers offer their interns permanent jobs after they graduate.

An increasing number of employers expect students to have passed at least one of the initial actuary exams needed for professional certification before graduation.

Sample program of study (Le Moyne)

Actuarial Science Concentration

Concentration Courses

MTH 313 Applied Statistics

Three additional MTH courses, either from the following list or approved by the department chair.

- MTH 303 Differential Equations
- MTH 312 Mathematical Statistics
- MTH 370 Intermediate Problem Solving
- MTH 421 Numerical Methods

ECO 113 Principles of Microeconomics

ECO 114 Principles of Macroeconomics

ACT 203 Financial Accounting

FIN 301 Managerial Finance

FIN 401 Investments

Free Electives (3)

The following courses are approved for VEE credits by SOA, CIA and CSA:

- MTH 313 Applied Statistics
- FIN 301 Managerial Finance
- FIN 401 Investments
- ECO 113 Principles of Microeconomics
- ECO 114 Principles of Macroeconomics

Quick Facts and Education Information from the Occupational Outlook Handbook

Appendix F: BS in Technical writing information

Technical writers, also called technical communicators, produce instruction manuals and other supporting documents to communicate complex and technical information more easily. They also develop, gather, and disseminate technical information among customers, designers, and manufacturers.

Quick Facts: Technical Writers

2010 Median Pay	$63,280 per year $30.42 per hour
Entry-Level Education	Bachelor's degree
Work Experience in a Related Occupation	1 to 5 years
On-the-job Training	Short-term on-the-job training
Number of Jobs, 2010	49,500
Job Outlook, 2010-20	17% (About as fast as average)
Employment Change, 2010-20	8,500

Education

Employers generally prefer candidates with a bachelor's degree in journalism, English, or communications. Many technical writing jobs require both a degree and knowledge in a specialized field, such as engineering, computer science, or medicine. Web design experience also is helpful because of the growing use of online technical documentation.

Work Experience

Some technical writers begin their careers not as writers, but as specialists or research assistants in a technical field. By developing technical communication skills, they eventually assume primary responsibilities for technical writing. In small firms, beginning technical writers may work on projects right away; in larger companies with more standard procedures, beginners may observe experienced technical writers and interact with specialists before being assigned projects.

Prospects for advancement generally include working on more complex projects, leading or training junior staff, and getting enough work to succeed as a freelancer.

Sample program of study (Carnegie Mellon)

Prerequisites

Mathematics Prerequisite (1 course)

Complete one of the following:

21-111	Calculus I
21-112	Calculus II
21-120	Differential and Integral Calculus
21-127	Concepts of Mathematics

Statistics Prerequisite (1 course)

35-201	Statistical Reasoning and Practice

Computer Science Prerequisite (2 courses)

Complete two of the following courses:

15-101	Exploring Programming with Alice
15-102	Exploring Programming with Graphics
15-110	Introduction to Programming*

TWC Core Requirements (5 courses)

76-26x	Survey of Forms (Nonfiction, Fiction, Poetry, or Screenwriting)
76-271	Introduction to Professional and Technical Writing
76-390	Style
76-391	Document Design*
76-487	Web Design** (and 76-488 Web Design Lab)

Complete 3 advisor-approved courses structured as follows. At least one of the three must be chosen from the "Recommended" options below. The remaining 2 courses can be from the "Recommended" or "Additional Options" lists.

Recommended Options

76-359	Planning and Testing Documents
76-397	Instructional Text Design*
76-491	Rhetorical Analysis
76-419	Communication Revolutions and Technologies
76-474	Software Documentation

76-481	Writing for Multimedia*

Additional Options

76-301	Internship
76-318	Communicating in the Global Marketplace
76-385	Introduction to Discourse Analysis
76-386	Language and Culture
76-387	Sociolinguistics
76-389	Rhetorical Grammar
76-395	Science Writing
76-397	Instructional Text Design
76-419	Communication Revolutions and Technologies
76-428	Visual/Verbal Communication
76-476	Rhetoric of Science
76-492	Rhetoric of Public Policy
39-605 & 39-606	Engineering Design Projects

Technical Communication Electives (3 courses)

Complete 3 advisor-approved electives in management, technology, and social issues, chosen from the following options. Additional options may be advertised on a semester-by-semester basis. Note that at least some of these courses may have prerequisites. Please check course listings for details and plan accordingly. Courses in this category may double count for both the TWC/TC degree and a major or minor in another department.

05-410	Human-Computer Interaction Methods
05-413	Human Factors
05-499	Special Topcs in HCI
15-105	Principles of Computation
15-xxx	Computer Science courses (beyond the 2 required)
19-448	Science, Technology, and Ethics
36-309	Experimental Design for Behavioral and Social Sciences
36-350	Data Mining

51-261	Communication Design Fundamentals
51-262	Communication Design Fundamentals
51-263	Industrial Design Fundamentals
70-311	Organizational Behavior
70-332	Business, Society, and Ethics
70-342	Managing Across Cultures
80-220	Philosophy of Science
80-221	Philosophy of Social Science
80-241	Ethical Judgments in Professional Life
80-242	Conflict and Dispute Resolution
80-243	Business Ethics
80-244	Environmental Ethics
80-291	Issues in Multimedia Authoring
80-341	Computers, Society, and Ethics
85-211	Cognitive Psychology
85-213	Human Information Processing and Artificial Intelligence
85-241	Social Psychology
85-370	Perception
85-392	Human Expertise
85-395	Applications of Cognitive Science
85-417	Cognitive Modeling and Intelligent Tutoring Systems
88-223	Decision Analysis and Decision Support Systems
88-260	Organizations
88-341	Organizational Communication

Theory/Specialization Courses-Scientific and Medical Communication Track (3 courses):
Complete 3 advisor-approved courses structured as follows. At least one of the three must be chosen from the 3 "Recommended" options below. The remaining 2 courses can be from the "Recommended" or "Additional Options" lists.

Recommended Options:

76-395	Science Writing

76-476	Rhetoric of Science
76-494	Healthcare Communications

Additional Options:

76-301	Internship
76-318	Communicating in the Global Marketplace
76-359	Planning and Testing Documents
76-372	Introduction to Journalism
76-385	Introduction to Discourse Analysis
76-386	Language and Culture
76-387	Sociolinguistics
76-389	Rhetorical Grammar
76-397	Instructional Text Design
76-419	Communication Revolutions and Technologies
76-428	Visual/Verbal Communication
76-481	Writing for Multimedia
76-491	Rhetorical Analysis
76-309	Experimental Design for Behavioral and Social Sciences
39-605	Engineering Design Projects
79-330	Medicine and Society
79-331	Body Politics: Women and Health in America
79-333	Biology and Society: Evolution Animal Experimentation and Eugenics
79-335	Drug Use and Drug Policy
80-220	Philosophy of Science
80-244	Environmental Ethics
80-245	Medical Ethics
88-223	Decision Analysis and Decision Support Systems

Natural Sciences and Engineering-SMC Track (3 courses)

Complete 3 advisor-approved courses that contribute to the student's chosen focus. The courses may be all in one area such as biology, or spread across areas. The basic courses in biology, chemistry, and physics are listed below. Additional options include advanced courses in any of these areas as well as basic and advanced classes in statistics, or engineering. Consult your English Department advisor on the appropriateness of specific courses for your interests. Courses in this category may double count for both the TWC/TC degree and a major or minor in another department.

03-121	Modern Biology
03-231	Biochemistry I
09-105	Introduction to Modern Chemistry I
09-106	Modern Chemistry II
09-221	Laboratory I: Introduction to Chemical Analysis
33-111	Physics I for Science Students
33-112	Physics II for Science Students
42-101	Introduction to Biomedical Engineering
42-202	Physiology
42-444	Medical Devices

Quick Facts and Education Information from the Occupational Outlook Handbook

Appendix G - CTE teacher education statements

Given that the STEM acronym contains more than science and mathematics, the task force also examined the potential of developing licensing programs in secondary technology and engineering education. Technology education, which grew out of industrial arts in the 1980s, is becoming a catalyst for providing context for problem-based learning using STEM integration (Sanders, 2009). Currently, only Colorado State University is offering a license in Technology Education in the state. To finish the CSU program and gain licensure, students need to complete an engineering degree plan. Secondary schools are sending their career and technical education (CTE) teachers to Hays State in Kansas or to University of Wyoming for their endorsements in this area. The secondary committee believes this would be a great opportunity to further our partnerships with community colleges for vocational high school teachers. We are unsure on the on the market demand for a licensing degree in technology education. More marketing research needs to be accomplished to determine need and viability for such a program.

Appendix H - Information used to Evaluate Engineering Program Options

Prepared by Quyen N. Hart (Assistant Professor of Physics, Regis College) November 2013

This appendix summarizes the preliminary research used to evaluate the viability of starting any engineering program at Regis University. The headings mirrored the evaluation matrix used by many of the Solution groups in their discussions.

Introduction

Several areas of engineering (environmental, biomedical, petroleum, and mining) have strong career growth predictions and are top paying jobs requiring a bachelor's degree for entry into the field. According to Regis College admissions, prospective students frequently ask about engineering. Through the dual degree program with Washington University in St. Louis (WUSTL) Regis students complete three years of education at Regis University and then transfer to WUSTL for the 2 remaining years in engineering. WUSTL guarantees students can complete the engineering degree in two years because student cohorts from other liberal arts college maximize enrollments for this special program. There have been 7 Regis University students who have done this program in the last 13 years. Most Jesuit institutions without a school of engineering have dual degree engineering programs in place. The regional competition from nationally ranked Colorado engineering programs is significant. The development of an engineering program is a high-cost investment, requiring substantial infrastructure for modern engineering labs and the recruitment of significant new engineering faculty. Course requirements for ABET accreditation with our Jesuit liberal arts core would exceed current graduation credit requirements and become a 5-6 year program.

Based on this research, **the STEM solution does not recommend pursuing a School of Engineering**. The capital investment required to start a school of engineering from the ground up is substantial. With the Science building on the Lowell campus at capacity, a new engineering building would be needed. Engineering is a hands-on discipline, which requires substantial laboratory space to conduct experiments, fabricate tools and materials, construct systems and needs state-of-the-art equipment to keep up with current technology trends. The majority of engineering courses would need to be developed by all new engineering faculties. Most engineering schools require ~100 credits in engineering (for ABET accreditation) and ~30 credits in non-engineering courses. If Regis University were to adopt this model, we would substantially reduce our liberal arts core requirements below current values (by half for Regis College core requirements). CU-Boulder has ~ten engineering programs nationally ranked at 30 or higher, while Mines has several programs ranked at 50 or higher. How would Regis rise above the nationally ranked engineering programs in the region if we lost our Jesuit identity in the engineering program? The stiff competition and tuition differences would be difficult obstacles to tackle.

Physical Resources on Lowell Campus in the SCIENCE building

- All science laboratory space is being utilized on T/TH during the am/pm prime lab times. Many evening sections have been added to accommodate additional sections. Regis College science classes are at capacity and college growth is restricted by space issues (not only in the sciences, but across the campus too, e.g., dorm space, parking, etc.)

- **Physics:**

SCI 130 - intro physics/astro lab/lectures; upper division physics (modern physics, electronics, optics); Our calculus-based physics course is held in Loyola to have two large sections (36 students) over there.

SCI 133 – small lab space unsuitable for lectures; modern physics lab, physics research, small machine shop

SCI 137 – computer lab for CS courses, astro lab and use by many different departments

- **Psychology/Neuroscience**

  SCI 114 - main teaching lab space, used for almost all of our lab classes (NS 261, NS 486, NS 488, PY 424, PY 443, NS 401, and probably a couple of others that I've forgotten)

  SCI 113 - small histology lab used for lab prep, student research, faculty research

  Several small human testing rooms used for student and faculty research

  One animal testing room used for student and faculty research

- **Biology:**

  SCI 210: Human Bio lab; Anat & Phys labs (undergraduate and graduate)
  SCI 209: Molecular Bio lab: upper division labs
  SCI 206: General Bio lab: lower division (Organismic and Molecular) labs
  SCI 204: Organismic Bio lab: upper division lecture/labs (undergraduate and graduate); Geology
  SCI 205: Small EEB research space
  SCI 207/208: Small MCDB research space

- **Chemistry:**

  SCI 303 – Principles Lab T/Th, T pm

  SCI 306 – Org. Chem Lab T/Th, T pm

  SCI 312 – Spring Nursing Chem Lab, Fall Biochem lab

  SCI 310 – Upper Division Chem labs (biochem, environmental, upper physics), and maybe Principles lab for overflow; Faculty research

  SCI 311/312 – Research space for faculty (4+) and undergraduates (20+); they have to use the other classroom lab space due to inadequate research lab space.

- No more room for additional faculty offices in Science. We had to turn closets into offices!
- The science building underwent renovations in 2007.
- Here are examples of necessary lab space for typical labs course in mechanical, environmental, or biomedical engineering.

Mechanical: http://www1.villanova.edu/villanova/engineering/departments/mechanical/facilities.html

Engine, steam turbine, (wind turbine?), dynamics testing lab

Computer labs to aid computer engineering design:
http://www1.villanova.edu/villanova/engineering/departments/civil/facilities/computer.html

Environmental Engineering Lab space and equipment:

http://www1.villanova.edu/villanova/engineering/departments/civil/facilities/environmental.html

http://www1.villanova.edu/villanova/engineering/departments/chemical/facilities/envlab.html

Analytical Chemistry lab with gas chromatograph with mass spectrophometer detector (GC/MS) with ion and electron ionization capabilities, gas chromatograph with flame ionization, thermal conductivity, and electron capture detectors, variable wavelength scanning UV/Vis spectrophotometer,

Fluid Mechanics Lab:

http://www1.villanova.edu/villanova/engineering/departments/civil/facilities/fluid_mechanics.html

Lab to conduct experiments on open channel flow, centrifugal pumps and groundwater flow.

Water Resources Lab:

http://www1.villanova.edu/villanova/engineering/departments/civil/facilities/water_resources.html

Total and Dissolved Solids Testing, Spectrophotometer, High Performance Liquid Chromatography, Atomic Absorption Spectrometer, hydrologic instrumentation

Biomedical Engineering Labs:

http://www.bucknell.edu/academics/college-of-engineering/academic-departments/biomedical-engineering/facilities.html

- Equipment provides for instruction into areas of cardiovascular fluid mechanics, pulmonary function, hemodialysis, drug delivery, electrocardiography, electromyography, human gait and balance, and soft-tissue biomechanics. Exercises include both bench-top experiments and computer based simulations.
- Biomedical engineering teaching laboratory with multiple workstations for electrocardiography, electromyography, electroencephelography, soft tissue biomechanics, pulmonary function, muscle force, hemodialysis.
- Project development laboratory for fabrication of student projects.
- Scanning electron microscope, Rapid prototyping facility, State of the art chemistry and biology laboratories.

Human Resources

- Average salary of engineering faculty are as follows**:** Full Professor $114,365, Associate Professor $87,663, Assistant Professor $75,822, Instructor $57,678
  (Reference: http://chronicle.com/article/Average-Faculty-Salaries-by/126586/)

- Average Faculty Salaries across CO institutions: Full Professor $118±15K, Associate Professor $83±10, Assistant Professor $72±10K
  (Reference: http://chronicle.com/article/2013-aaup-survey-table/138291)

- Assuming that at least 3 new faculty would need to be hired to start ONE engineering specialty (e.g., PhD in mechanical engineering or biomedical engineering), what would be the cost? The cost for THREE new

assistant engineering faculty with fringe benefits = $275K (going up to $318K for all associate professors and $449K all at full professor)

- Recruitment of new faculty would require that they develop a new program with minimal lab resources and small start-up funds. Engineering faculty would be unable to contribute to core classes in the sciences or integrative core class in the College.

Level of Competition

- This is a summary of the 2013 US News and World Report national rankings of Colorado engineering programs and comparison of tuition cost to Regis College.

National Rankings

Reference: http://colleges.usnews.rankingsandreviews.com

	CU-Boulder	Mines	CSU	UCD
Engineering School	34	57		
Chemical Engineering	18	47	60	
Environmental	22	27	34	
Materials		36	59	
Computer Science	31	110		
Undergraduate Engineering	32			139
Civil Engineering	19		35	108
Aerospace	14			
Electrical	36		67	
Mechanical	30		77	
biological/agricultural			23	

TUITION Costs (in $1000)	CU-Boulder	Mines	CSU	UCD	Regis
In-state	13.3	14.4	9	6	31
Out of state	34.7	30.3	35	15	31

Market Need

- The STEM solution identified engineering careers as an area of high growth, as based on the predictions from the Bureau of Labor Statistics.
- Discussion surrounding competition with **national-ranked** regional engineering program have surfaced and the group asked which type of engineering fits well with the Jesuit mission. Environmental engineering, biomedical engineering, and general engineering were areas of discussion. We note that general

engineering degrees (such as one at Johns Hopkins University) may not prepare students to be working professional engineers.

Financial Aid Burden – Probably similar to those encountered in the Regis College, where the discount rate is just under 50%.

Recruitment Difficulty

- Recruitment of students with high probability of success may be difficult when students are comparing tuition costs of highly ranked Colorado programs compared to an expensive school with a fledging engineering program.
- Based on research data on typical ACT/SAT scores in math, math assessment tools used in chemistry and physics, and anecdotal evidence from various STEM faculty in Regis College, the percentage of students academically prepared to start AND succeed in an engineering program is small and probably similar to numbers and success rates of students majoring in biochemistry.
- What can a Regis engineering program offer students that the other Colorado ranked institutions cannot and is that extra "thing" worth the cost differential? If students are comparing the discount rate at Regis (~50%) versus area schools, then the cost differential is small.

Mission Fit

- All areas of engineering can fit into the Jesuit mission where engineers contribute to the improvement of society by inventing, constructing, designing tools. However, the rigorous nature of an engineering program, with 100+ credit hours in the major alone, would require a reduction in the liberal arts core, which is at the heart of a Jesuit education. How can we train engineers to go out and make the community a better place without the integrative core classes that ask them to think about those questions that cross cut different disciplines?

Organizational ROI

- Initial financial investment for faculty, supporting staff, construction of additional lab space (Science Building expansion or a new building entirely), and necessary lab equipment and computer infrastructure for such lab space would be substantial.
- Most engineering programs at our sister Jesuit institutions exist in a College of Engineering. Jesuit schools without a School of Engineering have dual degree engineering programs in place. The only exception is Loyola University Maryland, that has a department of engineering in the College of Arts and Sciences and the department has four engineering concentration areas.
- Without reliable market research regarding the regional interest in a school of engineering at a liberal-arts university, the financial risk in starting a school of engineering could be substantial.

Student ROI

- Incoming students would need to start any engineering program in their first semester of school. Currently Regis College students do not declare a major until the spring of the second year. Pre-engineering students need to have a SOLID preparation in science and math to begin the foundational courses required of upper-division engineering courses. Given the typical science and math preparation of incoming Regis College freshman, a small percentage of physical science students would be posed for academic success in this discipline.
- Even with a 50% discount rate, the tuition costs are similar to the full-tuition at highly ranked regional engineering programs. Without this discount rate, students would be comparing an expensive engineering

degree to the regional schools and wonder if the extra cost is due to the liberal arts concentration. However, a liberal arts emphasis in engineering would require either (a) an increase in the graduation credits for engineering degree to account for the major and the core or (b) a decrease in the liberal arts core which diminishes the Jesuit-focus of such a degree.

- Although working as a professional engineer doesn't always require graduation from an ABET accredited program, having ABET accreditation would be a goal for such a program. Most ABET accredited engineering programs have 100+ credit hours in engineering course work with another 30+ credits in non-engineering coursework.
- The growth in this sector of employment is high and students would mostly likely find a well-paying position with this degree.

Fit with Structure

- In the current university structure, an engineering program would naturally fit within Regis College where the majority of physical science and math courses are housed.
- A typical engineering curriculum requires starting this major in your first year in order to graduate in four years.
- Based on an initial survey of typical engineering courses in mechanical and biomedical engineering, only one-third to one-half of the required course work (typical foundational courses in basic science and math and computer science, and some upper division physics and chemistry courses) exists in Regis College. No upper division engineering courses exist (as far as I am aware.)
- At this writing there is neither available lab space nor requisite lab equipment to begin engineering courses in the Science Building. The existing science and computer lab spaces are most likely unsuitable for most upper-division engineering courses and labs.

Adaptability

- The required course work for this major is highly structured, with students needing to be enrolled in 18+ SH per semester to graduate in 4 years.
- Since engineering programs need as much lab work as other science disciplines, different modes of delivery at the undergraduate level does not seem possible. There are no traditional science courses (physics, chemistry, biology) in CPS.

Partnership Potential

- Regis College has a current 3+2 Dual Degree Engineering program with Washington University in St. Louis, as do many other similar small liberal arts college
    - Washington University has a cohort of 40 students each year where all students have similar small, liberal-arts backgrounds. That gives the program a small school feel with a tight group going through a similar experience. So in addition to scheduling, there is built in community and support. That can be a big deal for someone from a place like Regis College and going to Large State University.
    - In the last 13 years, 7 Regis College students have attended Wash U through the Dual Degree program. We've not had any in the last couple years. All have successfully completed the program and had jobs in hand before finishing. I am working with one student right now on applying for Fall 2014.
    - Every year we have at least a handful of students that start out intending to pursue Dual Degree Engineering, and I would guess that there are another handful for whom the option being available factors in their decision to come to Regis. Over the last 13 years, a handful of students have

pursued graduate programs in engineering or second bachelors programs instead of going to Wash U. The other students tend to find other options along the way. Location has been a factor in the decision for a couple students, but their ability to find other options to pursue seems to be a bigger factor.
    - Wash U has this identical agreement with about 100 small liberal arts schools. It is definitely their program and we participate in it. (Wash U is not Jesuit.)
    - Jim Seibert, Math Faculty in the College, has informally explored "dual degree" options with Marquette and with Mines. Neither could compare with what Wash U offers. Because Wash U has this agreement with about 100 schools, they have a cohort of about 40 students every year. This allows them to schedule a two-year sequence of courses that guarantees a student can get the courses they need in two years. No other place I've talked to could guarantee that the courses our students would need would be scheduled in such a way that a student would finish in two years.
- Of a sample of 25 liberal arts college, with similar enrollment numbers as Regis College and students with similar ACT/SAT scores, all, but 4 colleges, had partnerships with more than one engineering programs at different institutions. Washington University, Columbia, and Case Western University were common partnership schools. Colorado College has dual degree engineering pathways with Columbia University, University of Southern California, and Rensselaer Polytechnic Institute (RPI).
- Does Regis University need to explore other Dual degree programs that might be more appealing than Washington University (USC for CA students?)

Aligned with Strengths

- Regis University has no track record regarding engineering-like classes in any of the three colleges. A new engineering program with a potentially different organizational structure (faculty pay scales, building resources, liberal arts core, etc.) would be a much larger discussion than what can be fully conducted in this STEM Solution group. Our health care education in RHCHP is strong, but pursuing a biomedical engineering program would struggle with then same issues presented in this appendix.
-

Additional Comments about Biomedical Engineering

UC-Denver just started their first class of biomedical engineers (Fall 2013). Students spend the first two years in the Engineering campus and the last two years at the Anschutz Medical campus in specially designed teaching and lab space dedicated to this program.

Students in CU-Boulder Engineering programs can choose to emphasis in biomedical engineering in each of the typical foundational engineering disciplines. Students in mechanical engineering can choose to emphasize in biomedical or environment engineering.

CSU just opened an entire school of biomedical engineering (BME) and was the first to award degrees in this area in CO (2011). They also have a 5-year dual degree engineering program where student work towards BME and another engineering degree. There are only two programs of its kind in the nation. (https://www.engr.colostate.edu/bep/)

Biomedical engineers need a strong foundation is an existing, established area of engineering, e.g., chemical or mechanical engineering. For example, drug development requires a strong chemical engineering background, medical imaging requires a strong electrical engineering background, and implants, computer modeling, biomechanics, and biomaterials requires a strong mechanical engineering background. (Reference: http://www.engr.colostate.edu/sbme/pdfs/Denver5280Event-Jan2011-ForWeb.pdf) ***It appears to me that***

biomedical engineering programs sprouted from strong mechanical or electrical engineering programs at the home institution (and not the other way around). Biomedical engineering would provide interesting interdisciplinary collaborations across different colleges (PT, biology, physics, and computer science).

Additional Comments about General Engineering:

At Mines, the general engineering BS degree is multi-disciplinary and requires students to choose a specialty in the typical foundational disciplines (mechanical, civil, electrical, environmental). They have an engineering core list of classes (39 credits), only NINE credits of humanities and social sciences(!), and then additional upper division course work in the specialty.

Bachelors of Science are also awarded in Mechanical Engineering and the basic engineering core classes are similar to the general engineering. In the last two years the courses are advanced mechanical engineering courses, providing more in-depth, practical design projects specific to this discipline. Environmental engineering is a part of their Civil engineering program.

Bachelors of Arts in General Engineering, similar to a program at Johns Hopkins University, is not a major that prepares engineers to apply their knowledge (and it's not ABET accredited either). This interdisciplinary major merges the area of liberal arts, science, math, and technology targeted to students who do not want to become professional engineers.

(Reference: http://engineering.jhu.edu/academics/general-engineering/)

Listing of existing and new engineering courses that would be needed for a biomedical engineering program.

Based on the comparison of engineering courses at a small sample of institutions, any new engineering program (Environmental, Mechanical, or Biomedical engineering) would require the creation of nearly 150-200% of the existing number of existing foundational courses at Regis University.

Reference: http://www.engr.colostate.edu/sbme/pdfs/BME-MECH%20Checksheet-Rev4-5-2013.pdf

Five year program Biomedical Engineering and Mechanical engr. at CSU

Existing	New
Physics sequence	Intro to BME
Chemistry Sequence	Intro to ME
Calculus sequence (3 sem)	ME Problem solving course
Diff. Eqn	Intro to Manufacturing Process
Thermo (with engineering focus)	Engineering design sequence
Cellular Biology	Engr. Mechanics sequence
Human Physiology	Intro to EE
Organic Chemistry	Engr. Experiments

Biomechanics	Mechanics of Solids
	Intro to Engr. Materials
	Biomaterials
	Mech. Of fluid flow
	Mechatronics
	Engineering design project
	Heat and Mass transfer
	Machine design
	Design Practicum

At UC-Denver Bioengineering degree (128 credits with 24 credits in core)

Existing	**New (biomechanics track)**	**New (medical device track)**
Calculus sequence (3 sem)	Bio-engr design & Prototyping	Biomedical signaling
Linear algebra	Computational methods in BME	Biomedical electronics
Differential equations	Cell Biology for BME	Intro to biomedical imaging
General Biology sequence	Biomaterials sequence	biophotonics
General chemistry sequence	Bioengineering design sequence	lasers in Medicine
organic chemistry	Biomedical devices	Matlab
General physics sequence	Biomedical instrumentation	Biomedical imaging II
Physiology	Senior design process	Physiological signal analysis
Statistics	Advance Biomechanics	
Biomechanics sequence	Biotransport & Heat transfer	
	Finite element analysis	
	Polymer biomaterials	
	mass transport in bio systems	
	Neural interface with biomechanics	
	Matlab	
	biofluid dynamics	

At CU-Boulder Bioengineering degree in ME program (128 credits with 24 credits in core)

Existing	New
Calculus sequence (3 sem)	Intro to Engineering
Linear algebra	Intro to Engineering Computing
Differential equations	Computer aided design
Year long physics	Thermodynamics sequence
Experimental physics	Heat Transfer
Circuits & Electronics	Material science
Fluid Mechanics	1st year engineering project
	Chemistry of energy/materials
	ME Technical
	ME Design project sequence
	Computational methods
	Measurements lab sequences
	Manufacturing process & system
	Dynamics
	Statics
	Statics & structures
	Component design
	Mechanics of solids

At Washington University, St. Louis BME (Regis College Dual Degree Engineering) (100 core units + 21 more credits)

http://bme.wustl.edu/undergraduateprograms/Pages/undergraduate-core-curriculum.aspx

http://bme.wustl.edu/ContentFiles/UG-Forms/2013_UndergraduateHandbook.pdf

Existing (at Regis)	New
Chemistry sequence	Physiological control systems
Physics sequence	Engineering Math
Biology sequence	Electrical networks
Calculus sequence (3 sem)	Engineering EM principles
Differential equations	Intro to BME

CS programing	Quantitative Physiology sequence
Biomechanics	Bioengineering Thermo
Prob/Statistics for Engineers	Transport
	BME design
	Engr. Virtual studio I,II,III,IV
	Technical writing
	5-6 Electives from 40+ choices!

At Washington University, St. Louis Mechanical Engr. (Regis College Dual Degree Engineering)

Existing (at Regis)	**New**
Physics sequence	Computer-aided design (CAD)
Calculus sequence (3 sem)	Intro to ME
Differential equations	Engr. + Sci Computing
Chemistry	Mechanics I,II, III
Circuits	Engineering Math sequence
Prob/Statitics for Engineers	Material Science
Thermodynamics	Technical writing
Fluid Mechanics	Machine elements
	Mechanics Lab
	Heat Transfer
	Dynamics & Vibrations
	Senior Design
	Simulations and Control
	Design of thermal systems
	7 upper division Electives

Basic Engineering Program at Mines (ME emphasis)

Existing	**New**
Chemistry sequence	Fortran programming
Physics sequence	Design sequence

Calculus sequence (3 sem)	Multi-disp. Engineering lab
Biology	Fluid Mechanics
Circuits & Electronics	Statics
Intro to Programming	Programming concepts
Prob/Statitics for Engineers	Engineered Materials
Thermodynamics	Mechanics of materials
Fluid Mechanics	Mechanical Field Session
Human systems (Social Science)	Dynamics
Differential equations	Info System Science
	Feedback Contol Systems
	Computer-aided engineering
	Senior Design Project
	Heat Transfer
	Machine Design
	Electives from 30+ options!

Basic Engineering Program at Mines (Environmental emphasis)

Existing	**New**
Chemistry sequence	Design sequence
Physics sequence	Statics
Calculus sequence (3 sem)	Fortran programming
Biology	Multi-disp. Engineering lab
Circuits & Electronics	Mechanics of materials
Fluid Mechanics	Advanced Engr. Math
Prob/Statitics for Engineers	Dynamics
Thermodynamics	Envr. Science & Engr. Sequence
Ecology (elective)	Engineering Field session
Human systems (Social Science)	Senior Design
Differential equations	Computer-aided engineering

	10 Envr. Engr Electives

Mechanical Engineering Program at Mines (138 hours)

Existing	New
Physics sequence	Design sequence
Calculus sequence (3 sem)	Statics
Biology	Engineered Materials
Human systems (Social Science)	Mechanics of materials
Linear algebra	Multi-disp. Engineering lab
Differential equations	Intro to scientific computing
Circuits & Electronics	Dynamics
Prob/Statitics for Engineers	Feedback Control Systems
Thermodynamics	Computer-aided engineering
Fluid dynamics	Senior Design
Chemistry sequence	Heat Transfer
	Machine design
	6 Electives from 30 choices!

Environmental Engineering Program at Mines (138 hours)

Existing	New
Physics sequence	Earth & Environment
Calculus sequence (3 sem)	Design sequence
Chemistry sequence	Statics
Chemical Thermodynamics	Mechanics of materials
Differential equations	Multi-disp. Engineering lab
Circuits & Electronics	Envr. Science & Engr. sequence
Fluid Dynamics	Fortran programming
Prob/Statistics for Engineers	Dynamics
	Env. Engr. Lab sequence
	Senior Design

	Envr. Eng. Field Session
	Hydrologic & Water Engr.
	Environmental Law
	7 electives from 12 electives

At Regis College, New Physics program (approved 2012)

Existing	**New (we already taught 90% of these classes as independent study)**
Physics sequence	E&M
Calculus sequence (3 sem)	Mechanics
Linear algebra	Thermo
Differential equations	Modern Lab
Quantum Spectroscopy	Senior Capstone
	Analytical mechanics
	Intro to Astrophysics
	Intro to Fluid Mechanics

Appendix I: Additional recommendations and notes

Teacher education degrees at Regis are not coded as STEM within the current standardized coding schema; therefore, enrollments in these areas must be manually coded and tracked by Regis University personnel if the University desires to do so.

It is recommended that reports from the Strategic Planning Task Forces, including appendices, be housed in the library digital repository for future strategic planning and institutional reference.

Other options for expansion that came up and were briefly explored by the task force, but are not STEM – related, include:

MA in Applied Research Methods and Statistics (research in social science and education)

a. Supporting Data: Average growth per Occupational Outlook Handbook; minimal local competition.
b. Mission Focus: Degree aimed at training professionals to conduct research in education and the social sciences.
c. Add'l Information: Offers the university an opportunity to centralize graduate research courses, thereby providing larger class sizes and a diversity of perspectives within the graduate research learning environment. Also provides the University an opportunity to increase data literacy within its staff through ETB. As an applied program, graduate action research projects could benefit the University and larger community.
d. Resources: Current instructional resources are in affiliate ranks, with a limited number of qualified persons. Would require at least one ranked faculty member to start, with close monitoring as the program grows.

PhD or EdLD in School Psychology- includes clinical requirements – APA accrediting body.

a. Supporting Data: 22% growth (faster than average) per Occupational Outlook Handbook
b. Mission Focus: Commensurate with our mission and meeting a need within our community.
c. Add'l Information: School of Education (CPS) willing to collaborate with Dr. Reynolds and Dr. Arman in the Counseling Division (both have school psychology backgrounds). Dr. Reynolds has been consulted and is open to exploring possibilities for this program. Could be a "hybrid residency" model in which residential educational experiences are interspersed with clinical experience and online study.
d. Resources: Would require at least one, preferably two, ranked faculty with doctorates in School Psychology to oversee clinicals, clinical placement, affiliates, curriculum, etc.

Appendix J: References

1. NAPA Group. Trends and Best Practices in Private Higher Education: Prepared for Regis University. January 2013.
2. Projected growth rate, number of new jobs, and starting salary:U.S. Department of Labor, Bureau of Labor Statistics. (2012). *Occupational Outlook Handbook.* Retrieved from http://www.bls.gov/ooh/

3. Unemployment rate (not calculated by the BLS; information is estimated by private firms):*StudentScholarships.org.* (2013). Retrieved from http://www.studentscholarships.org/
4. Jesuit competitor schools:Association of Jesuit Colleges and Universities. (n.d.). *Jesuit College Search*. Retrieved from http://www.ajcunet.edu/institutions?Page=DTN-20130128030719
5. Colorado competitor schools: *The College Blue Book*, 40th ed. (2013). Detroit: Macmillan Reference USA. Retrieved from http://go.galegroup.com/ps/i.do?id=GALE|3LIQ&v=2.1&u=regis&it=aboutBook&p=GVRL&sw=w&id=GALE|3LIQ
6. MakerSpaces: http://theunquietlibrarian.wordpress.com/2012/06/28/makerspaces-participatory-learning-and-libraries/
7. Ingersoll, R. M., & Perda, D. (2009). The Mathematics and Science Teacher Shortage: Fact or myth. Retrieved September 27, 2013, from https://www.csun.edu/science/courses/710/bibliography/math%20science%20shortage%20paper%20march%202009%20final.pdf
8. Sanders, M. (2009). STEM, STEM Education, STEMmania. The Technology Teacher, 68(4), 20-26.
9. Sterling, D. R. (2004). The teacher shortage: National trends for science and mathematics teachers. The Journal of Mathematics and Science: Collaborative Explorations, 7, 85-96.

Appendix A STEM Enrollment Data					
STEM Percentage of Total Participation				Revised:	9/24/2013
	AY 2008-2009	**AY 2009-2010**	**AY 2010-2011**	**AY 2011-2012**	**AY 2012-2013**
College for Professional Studies Program Participation	9,547	9,417	9,038	8,577	7,535
College for Professional Studies - STEM	1,469	1,504	1,501	1,592	1,601
STEM Percentage of CPS	**15.39%**	**15.97%**	**16.61%**	**18.56%**	**21.25%**
Regis College Program Participation	1,575	1,556	1,629	1,764	1,845
Regis College	279	306	357	404	371
STEM Percentage of RC	**17.71%**	**19.67%**	**21.92%**	**22.90%**	**20.11%**
Rueckert-Hartman College for Health Professions Program Participation	2,486	2,650	3,015	3,177	3,213
RHCHP Department of Health Services Administration	1	2	16	19	23
STEM Percentage of RHCHP	**0.04%**	**0.08%**	**0.53%**	**0.60%**	**0.72%**
	13,573	13,570	13,577	13,400	12,525
	1,749	1,812	1,874	2,015	1,995
STEM Percentage Regis University Total	**12.89%**	**13.35%**	**13.80%**	**15.04%**	**15.93%**

CPS School of Management mis-coded CIPs removed					
RHCHP all programs added					
Consistent across Colleges for Degree Seeking only					
Academic Program Participation				Revised:	9/24/2013
- by DHE CIP code					
- Degree seeking programs only					
- Teacher Education included manually by Major Code					
- Red delineates inactive programs					
College / School / Department / Program	Academic Year				
	AY 2008-2009	AY 2009-2010	AY 2010-2011	AY 2011-2012	AY 2012-2013
College for Professional Studies	**1,469**	**1,504**	**1,501**	**1,592**	**1,601**
CPS School of Computer and Information Science	**1,334**	**1,362**	**1,378**	**1,475**	**1,504**
CPS School of Computer and Information Sciences - UG	**703**	**690**	**658**	**679**	**728**
BS in Business Technolgy Management					1
BS in Computer Information Systems	198	180	166	159	139
BS in Computer Information Systems to MS	47	45	32	23	19
BS in Computer Networking	114	133	134	126	121
BS in Computer Networking to MS	20	26	23	19	12
BS in Computer Science	272	275	275	328	422
BS in Computer Science to MS	43	45	44	42	32
BS in Computer Science.Mathematics	3	1			
BS Individualized			1	1	1
BS.CIS:Enterprise and Web Application Engineering	14	7	3	1	1
BS.CIS:Information Systems Security	28	22	12	9	7
BS.CIS:Object-Oriented Programming	9	3	4	3	
BS.CIS:Software Engineering	19	13	8	2	5
BS.CN:Advanced Networking	33	19	13	5	3
BS.CN:E-Security	17	13	8	6	3
Master of Science Computer Information Technology	**637**	**707**	**735**	**779**	**770**
MS in Computer Information Systems	1	1			
MS in Database Technologies	108	133	146	152	130
MS in Information Assurance	67	103	146	157	154
MS in Information Assurance:Cyber Security	3	7	9	16	32

MS in Information Assurance:Info Assurance Policy Mgmt	1	1	1	1	2
MS in Information Technology Management	94	130	139	148	131
MS in Software Engineering	135	173	180	209	229
MS in Systems Engineering	60	108	109	121	116
MSCIS:Database Technologies	1				
MSCIS:Database Technologies-Networking Technologies		1			
MSCIS:Management of Technology	3	1			
MSCIS:Management of Technology-Networking Technologies		1			
MSCIS:Multimedia Technologies	1				
MSCIS:Networking Technologies	1	1			
MSCIS:Object-Oriented Technologies	1	1			
MSCIS:Self Selected	1			1	
MSCIT:Database Technologies	61	27	15	9	4
MSCIT:Database Technologies-E-Commerce Engineering		1			
MSCIT:Database Technologies-Executive Information Tech	6	5	1	1	
MSCIT:Database Technologies-Management of Technology	1	1			
MSCIT:Database Technologies-Networking Technologies		1			
MSCIT:Database Technologies-Object-Oriented Technologies	5	1			
MSCIT:Database Technologies-Software Engineering	24	12	3		2
MSCIT:Database Technologies-Systems Engineering	13	8	3	2	
MSCIT:E-Commerce Engineering	2	3			
MSCIT:E-Commerce Engineering-Management of Technology	3			1	
MSCIT:E-Commerce Engineering-Networking Technologies	2	1			
MSCIT:E-Commerce Engineering-Object-Oriented Tech		1			
MSCIT:Executive Info Technologies-Software Engineering	9	6	5	4	
MSCIT:Executive Info Technologies-Systems Engineering	11	5	6	2	
MSCIT:Executive Information Technology	27	15	7	4	
MSCIT:Management of Technology	12	4	1	2	
MSCIT:Management of Technology:Object-Oriented Tech	3	1	1		
MSCIT:Management of Technololgy-Networking	3				

Technologies					
MSCIT:Networking Technologies	7	5	1		
MSCIT:Object-Oriented Technologies	7	1	1	1	
MSCIT:Self-Selected	4	4	1	1	
MSCIT:Software Engineering	33	21	14	8	2
MSCIT:Software Engineering-Systems Engineering	5	3	4	1	1
MSCIT:Systems Engineering	49	29	10	8	3
Master of Science Software and Information Systems Galway	**48**	**60**	**73**	**85**	**77**
CPS School of Education and Counseling	**94**	**108**	**101**	**101**	**87**
CPS School of Education and Counseling - UG			**2**	**1**	
BS Individualized			**2**	**1**	
TL Mathematics			2	1	
Master of Education	**94**	**108**	**99**	**100**	**87**
Master of Education	**36**	**28**	**23**	**8**	**4**
Scnd Mathematics	9	5	3		
Secondary Science	16	11	6		
TL Mathematics	6	5	8	4	2
TL Science	5	7	6	4	2
MED:Instructional Technology	**43**	**60**	**51**	**55**	**38**
MED:Space Studies	**15**	**16**	**8**	**9**	**11**
Master of Education.Secondary		**4**	**15**	**24**	**30**
Secondary Science		2	3	1	4
TL Mathematics		2	2	4	2
TL Science			10	20	26
Master of Education.Secondary-Nevada			**2**	**1**	**1**
TL Science			2	1	1
Master of Education.Urban Education Secondary				**3**	**3**
Secondary Science				1	1
TL Mathematics				1	1
TL Science				1	1

CPS School of Humanities and Social Science	**1**			**1**	**1**
CPS School of Humanities and Social Sciences - UG	**1**			**1**	**1**
BS in Criminology - Computer Networking				1	1
BS Individualized - Occupational Safety & Health	1				
CPS School of Management	**39**	**34**	**22**	**14**	**8**
CPS School of Management - UG	**2**	**2**	**2**		
BS in Accounting - Computer Information Systems	1				
BS in Business Administration - Computer Information Systems		1	1		
BS in Business Administration - Computer Science	1	1	1		
Master of Science Management	**37**	**32**	**20**	**14**	**8**
MS in Organization Leadership:Info Tech Ldrshp & Mgmt	10	11	10	7	5
MS in Orgnztn Ldrshp:Hmn Rsrc Mgmt,Ldr-Info Tech Ldr,Mg	6	7	6	3	1
MS in Orgnztn Ldrshp:Info Tech Ldr,Mgmt-Prjct Ldr, Mgmt	7	6	2	2	
MS in Orgnztn Ldrshp:Info Tech Ldrshp,Mgmt-Ldrshp, Mgmt	5	5	1	3	2
MSM:Computer Info Technolgy-Project Ldrshp & Mgmt	7	1	1		
MSM:Computer Information Technology	6	3		1	
MSM:Computer Information Technology-Organizational Ldrs	4	2			
MSM:Human Resource Management-Computer Information Tech	1	1	1		
Regis College	**279**	**306**	**357**	**404**	**371**
Regis College Graduate Biomedical Science			**22**	**42**	**47**
MS in Biomedical Sciences			22	42	47
Regis College Undergraduate	**279**	**306**	**337**	**363**	**326**
BA in Biology	23	30	34	24	18
BAS Thematic	1	1	1	1	
BAS Variable Majors	16	16	18	21	15
BS Honors in Biochemistry	7	2	3	6	7
BS Honors in Biology	7	7	6	5	2
BS Honors in Chemistry	8	8	8	3	3
BS Honors in Neuroscience	4	5	6	4	5

BS in Accounting	1			1	2
BS in Biochemistry	28	31	26	26	23
BS in Biology	106	120	130	129	103
BS in Business Administration	5	4	4	2	
BS in Chemistry	19	26	28	21	17
BS in Computational Physics		1	1	1	1
BS in Computer Science	26	23	27	35	29
BS in Economics			1	1	1
BS in Environmental Science				1	1
BS in Mathematics	32	27	31	32	31
BS in Neuroscience	47	60	68	86	85
BS in Physics				1	1
Rueckert-Hartman College for Health Professions	**2,486**	**2,650**	**3,015**	**3,177**	**3,213**
RHCHP Department of Health Services Administration	**152**	**163**	**199**	**208**	**197**
Health Care Administration	55	59	65	66	62
Health Information Management	54	61	68	79	66
Master of Science Health Services Administration	47	47	68	66	75
RHCHP Division of Counseling and Family Therapy	**12**	**57**	**141**	**242**	**345**
Master of Arts Counseling Psychology	12	57	141	242	345
RHCHP School of Nursing	**1,949**	**2,022**	**2,189**	**2,144**	**2,069**
Accelerated Nursing	289	295	299	287	286
CHOICE Nursing	72	74	89	73	95
Doctor of Nursing Practice			34	58	63
Master of Science in Nursing	918	998	1,018	923	855
Traditional Nursing Undergraduate	154	156	201	223	172
Registered Nurse to Bachelor of Science in Nursing	750	802	820	791	792
RHCHP School of Pharmacy	**7**	**62**	**141**	**208**	**287**
Doctor of Pharmacy	7	62	141	208	287
RHCHP School of Physical Therapy	**366**	**348**	**348**	**380**	**318**
Doctor of Physical Therapy	366	348	345	372	308
Health and Exercise Science			3	8	10
Grand Total Student Participation	**4,234**	**4,460**	**4,873**	**5,173**	**5,185**
- Includes Teacher Education & RHCHP (not STEM)					

Opportunity Evaluation

	Opportunity	Fiscal Resource Requirements	Physical Resource	Human Resource Requirements	Level of Competition	Market Need	Constituency	Financial aid burden	Recruitment Difficulty	Mission Fit	Organizational ROI	Student ROI	Fit with Structure	Sustainability	Scalability	Adaptability	Partnership Potential	Aligned with strengths	Total Score	Comments
SCI	Environmental Science in Chemistry- modest growth opportunity (expansion of a BS)	3	4	4	3	4	3	3	4	5	4	5	5	5	3	5	5	5	70	Expansion of current course offerings hiring an Environmental Chemist (1-2 Expansion would have to be balanced of Chemsitry and ENVS students. Env environmental chemistry courses wo significant expansion of ENVS and Ch
SCI	Environmental Science in Chemistry- significant growth opportunity (Masters Level with externship)	1	3	4	3	4	3	NA	3	5	4	3	2.5	5	2	4	5	3	54.5	Our greatest competition will be exis CSU, and CU Boulder, with other prog would also compete with Chemistry I Analytical Students for a masters prog significant foot in the door at Colorad government labs. However, there are NCAR, NIST, NREL, and the USGS to graduate level program in Chemistry for their research time. Tuition is a structure would require a complete s model requiring significant external competition for grant dollars with
SCI	Environmental Science in Chemistry- significant growth opportunity (Masters Level with in-house research)	1	1	4	1	3	3	NA	1	5	1	3	1	5	1	4	5	2	41	Please see comments above.
TECH	Technical writing	4	4	3	5	3	2	2	4	4	3	3	5	5	4	5	1	5	62	Carnegie Mellon BS in Tech Writing
MATH	Actuary	5	5	5	3	4	2	1	5	3	3	4	5	5	4	3	1	5	63	
MATH	Applied Research Methods & Statistics	3	5	2.5	3.5	3.5	4	5	3	5	4	3.5	3.5	5	5	5	3	3	66.5	DU has MA & PhD, UNC has MS & Ph
MATH	Operations Research & Biomedical Stats	3	4	1	1	3	3	3	3	4	3	3	2	3	3	2	1	2	44	possibilities and have been deemed
ED	Secondary education (technology)	4	4	5	4	4	5	5	4	4	4	4	5	5	4	5	5	4	75	
ED	Secondary education (science)	4	5	3	2	4	4	5	3	5	3.5	4	4	4	5	5	5	5	70.5	
ED	Secondary education (math)	4	5	3	2	4	3	5	3	5	3.5	4	4	4	4	4	5	4	66.5	
ED	Secondary education (integrated STEM)	4	5	4	3	3	4	5	4	5	4	3.5	4	4	5	5	5	5	72.5	
ED	School psychologist	3	5	2.5	3	4	4	5	4	5	3.5	3.5	5	5	4	3	5	5	69.5	J. Reynolds & J. Arman in Counseling APA or NASP accreditation require
	Classification:	1: Requires high t	1: Requires new l	1: difficult to recr	1: High volume, hig	1: Saturated m	1: Low numbe	1: High burde	1: High cost, new marketing model	1: Not a fit with mission	1: Signif. Operating loss	1: Low employer demand, high cost	1: Unaccept able	1: Year to Year	1: Not scalable/no expanson possibility	1: Rigidly structured with no flexibility	1: None	1: Not aligned		
		2: Requires invest	2: Requires reno	2: difficult to recr	2: High volume, av	2: Saturated m	2: Low numbers, moderate risk				2: Short-mid term loss	2: Low employer demand	2: Poor	2: 2-5 yrs			2: One potential partner; no track record			
		3: Investment of	3: Requires partn	3: additional, but	3: Few competitor	3: Open marke	3: Moderate n	3: Mod burde	3: Moderate cost & investment in marketing	3: Potential fit, but....	3: Revenue neutral	3: Moderate employer demand	3: Moderat e	3: 6 - 10 yrs	3: Some scalability with additional moderate investment	3: Some adaptability depending on market needs	3: Multiple partnership s with no track record	3: Some synergy		
		4: Modest budget	4: Requires mino	4: existing, but ne	4: Few competitor	4: Open marke	4: Moderate numbers, lower risk				4: High	4: High employer demand	4: Strong	4: 10-15 yrs			4: One proven partner			
												5: High			5: Easily scalable with	5: Adaptable for all modes of	5: Multiple			