

Graduate Tuition Committee

Executive Summary

This document is to be part of an overall academic plan to address the financial shortcoming of the Cooper Union, presented by the engineering faculty to the acting dean for consideration by the President and the Board of Trustees.

Our mission was to propose a set of academic programs for the engineering school that not only fit but also enhance the Cooper brand. We described these programs to financial consultants (CDG consultants) hired by the administration of The Cooper Union who then created financial analyses of the projected revenues. We considered a variety of graduate programs, pre-college programs, and various certificate programs. The only programs that we did not consider were those directly related to the undergraduate curriculum, as this was the purview of a separate committee.

We propose that the engineering school-initiate four tuition-based programs – an expanded course-based masters program, an expanded summer program, and two certificate programs as outlined below. In choosing these programs we strove to balance multiple dimensions: feasibility, revenue-potential, fit to the Cooper brand, cohesiveness in theme, and fit to the evolution of engineering education globally and locally.

We believe these programs are feasible, fit our strengths, and have the potential to generate revenue for the engineering school. We worked with consultants hired by Cooper Union to complete the financial analyses of the programs, and while there were many variables that affect revenue potential, the most significant was the number of students that attend. As with any proposal, it is difficult to estimate demand and represents risk. To balance this risk, we propose that all four programs are initiated according to the timetable provided below. We believe this is important because the diversity of initiatives will allow us to scale up successful programs while scaling down underperforming programs. We believe that launching all four programs are feasible because they have a cohesive theme – the same classes are marketed to different audiences at different times. Consequently, the same administrative bodies and resources can be used across the different programs, reducing operational costs and providing redundancy to mitigate risk.

Graduate Tuition Committee Report

Four Programs at-a-glance

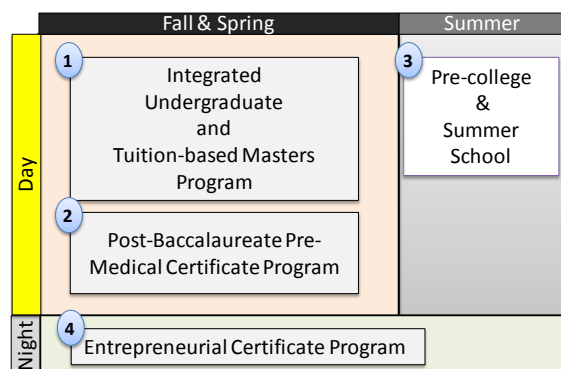


Figure 1: Organization of the 4 programs on the academic calendar.

1. Expanded Masters Degree Proposal

This proposal is based on a for-tuition Master's degree program, including our current program, and incrementally expanding the student base. For example, there are currently 24 tuition-free master's students (6 in each discipline), and we propose to double the student body to 48 in the first year of the plan. The attached financial analysis assumes a discounted tuition of ~\$25,000, representing a partial scholarship. Initially the program will be calibrated to attract a large segment of international students and full-time domestic students. In addition to developing all the administrative functions necessary to charge tuition, this plan will require developing effective channels abroad to funnel international students to The Cooper Union as well as developing institutional familiarity with the needs of international students. This plan does not initially focus on capturing the large population of part-time students, because of the extensive requirements of retooling our curriculum towards night classes and repeat classes that fit into the part-time student schedules.

2. Post-Baccalaureate Pre-Medical Program

This proposal is based on training individuals with college degrees in fields other than scientific disciplines (for example, music, economics, or philosophy) that nevertheless want to apply to medical school. This program would be similar to programs offered at Universities such as Columbia and NYU that have specific programs for these students. The attached financial analysis assumes tuition comparable, but still somewhat less, than what students pay in these other programs. The Cooper Union program would typically take two years and students are expected to take “core” pre-med courses – general chemistry 1 and 2 (with lab), organic chemistry 1 and 2 (with lab), biology 1 and 2 (with lab), physics 1 and 2 (with lab), and calculus 1 and 2 (or statistics). Students generally also participate in lab research and/or volunteer work at a local hospital.

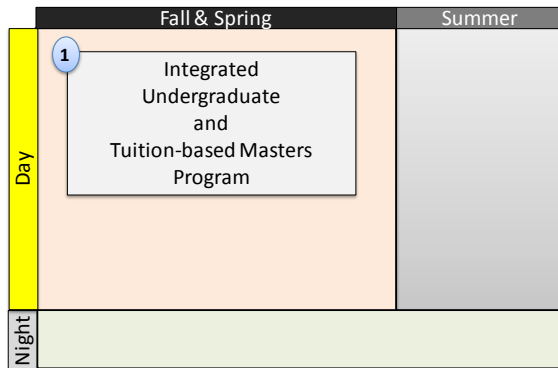
3. Summer Program

This proposal is based on a series of summer and Saturday classes aimed at current high-school students or college students taking summer classes. The attached financial analysis assumes a tuition for these programs that is typical for programs of this nature. There are three components to this plan: 1) A Saturday program that runs continuously during the academic year offering AP classes for college credit for gifted students. 2) A (larger) late summer program aimed towards the same segment and offering the same classes, and 3) an early summer program aimed towards recent high-school grads that either need to retake a class they have failed or want to get ahead in classes that are required for future semesters. This could also be the basis for a tutoring program where current Cooper students could earn money tutoring high school students.

4. Entrepreneurial Certificate Program:

This proposal is based on developing a night-program aimed toward professionals interested in technology management and entrepreneurship. The attached financial analysis assumes tuition for this program that is reasonable for such a program. The focus of the program is based on teaching technical skills that are necessary to prototype a product or service and launch a venture. It could begin as a certificate-granting program, but may develop to an accredited degree (a technical-skills based MBA) with proper collaborations and partnering as part of our long-term strategy. Courses would be taught at night and would focus on applied skills such as programming, prototyping, materials selection, manufacturing, etc.

Expanded Master's Degree Proposal



Summary Description

In this proposal the School of Engineering would begin attracting and recruiting students from outside The Cooper Union into a for-tuition Master's degree program.

Initially, students from outside The Cooper Union would attend graduate level elective courses already available and delivered as part of our on-going scheduled courses at The Cooper Union. As this proposal indicates, eventually changes to the entire Master's program (including the Integrated Master's Program) may be made.

Initially this proposal considers attracting outside students to our extant Master's Program, as well as possible changes to the program, and incorporating these students with our undergraduates in advanced elective courses. The nature of the cohort in the Master's Program and potential changes to both the degree and the curriculum are discussed. The associated costs and potential revenue are presented in the attached financial spreadsheets. A plan for phasing in changes to the program, coordinated with an increase in its size and the revenue stream, is proposed.

As we expand the graduate program in engineering at The Cooper Union, we MUST adhere to certain key features that identify The Cooper Union "brand" to attract tuition paying students.

- Close involvement with faculty, who serves as mentors to students.
- High caliber students taking academically rigorous courses, truly an "incubator".
- Successful alumni who are involved and invested in school.
- Combined, these features make The Cooper Union an "incubator" for leaders and innovators.

The Current Situation

The Cooper Union School of Engineering currently offers a Master of Engineering program in one of four disciplines: chemical, civil, electrical and mechanical engineering. These four disciplines correspond to the undergraduate programs (i.e., B.E. degree) that are accredited by ABET. It should be noted that ABET does not accredit both undergraduate and graduate programs at the same institution; therefore, the Master of Engineering program is not ABET accredited, nor are we proposing that we seek such accreditation for any graduate program in engineering offered at The Cooper Union.

A provision in The Cooper Union Course Catalog already exists to take in students from outside of the institution, provided they are:

- Students who have a Bachelor's degree from another institution; or
- Cooper Union alumni, that is, students who received the Bachelor's degree from the Cooper Union School of Engineering but left the school for some period of time, not having continued directly into the Master of Engineering Program.

It is rare, though not unprecedented, for such students to be admitted into the Master of Engineering program. The catalog currently states that any such students would be expected to pay tuition, though details are not specified.

The current Master of Engineering is largely delivered in the form of an Integrated Master's Program: undergraduate engineering students can take electives beyond those required for the Bachelor's degree prior to their graduating that can be used for the Master of Engineering degree. This is an important factor in encouraging and sustaining advanced studies and project work by undergraduate students, and it is vital that this Integrated Master's Program be continued. Currently, a significant number of students in graduate level courses offered by the school of engineering are undergraduates. Many students in our Master of Engineering program take advantage of this, and require significantly fewer than 30 credits to complete the Master degree after receiving their Bachelor's degree. The program of study for the Master of Engineering degree is currently as follows:

- 30 credits, of which 6 are Thesis (course number xx499), minimum 18 are graduate level, and at most 6 credits are advanced undergraduate level electives.
- At least one thesis advisor must be a full-time faculty member of the school of engineering.
- The thesis advisor also serves as graduate advisor, and in particular approves the set of courses used to complete the Master degree requirements.
- The departments and faculty advisors define the standards for theses.
- The faculty is compensated for master thesis advisement. This does not count towards the normal course load.

- Admissions decisions are made largely by the individual departments, based on applications submitted to the Office of Admissions.
- Elective courses are given both day and evening, Monday through Friday, and most (even those identified as being at the graduate level) are populated by undergraduate as well as graduate level students, because of the Integrated Master's Program.

All requirements for the Master degree can be completed within one year past the Bachelor's degree. However, students are given two years to complete the degree. Extensions beyond that require permission of the Dean of Engineering.

Proposed Tuition and Cohort

Initially, outside students can be admitted into the Master of Engineering program, without making changes to the degree or its requirements. As students are taken in, the sizes of existing electives will increase. As the program "ramps up", and more students are taken in, the number of elective courses that need to be offered will increase, adding to cost. Also, in this approach, the number of students undertaking theses will increase.

We categorize potential students in the Master program as follows:

- Undergraduate Cooper Union students who continue past four years to complete the Master Degree; they almost certainly participate in the Integrated Master program
- Outside students, as defined above

We propose that the admissions process and partial tuition scholarship offered to these two types of students should be separated. For example, outside students may be required to submit GRE results, and a higher partial tuition scholarship may be given to undergraduate Cooper Union students. For example, outside students may receive minimum 50% scholarship, and Cooper union students may receive a 75% scholarship, with additional merit-based scholarships available in select cases. Merit based partial scholarships will be an important feature to attract highly qualified students into the program.

We also identify three potential cohorts:

- International students
- Full-time (domestic) students
- Part-time (domestic) students

Part-time students generally have outside jobs, and it will be difficult to have such students if we retain our current mix of day/evening classes. At least initially, we recommend targeting international and full-time (domestic) students, since they can "fit in" with our existing Integrated Master's Program. This allows us to achieve economies of scale, *i.e.* elective class sizes would get larger but the number of additional courses that would need to be offered

would be minimal. For practical reasons, it is likely most outside students will be international, as the population of full-time (domestic) students in graduate programs in the United States is relatively small.

Currently, about twenty four students (six per discipline) are admitted into the Master's program. We propose that initially (i.e., starting with the first year of the new plan), this be doubled- about six students per discipline, mostly international, can be admitted. This may require a small increase in the number of electives, perhaps one or two per discipline.

Potential Changes and a Vision for the Master Program

Some potential changes and other issues that should be considered:

Change Degree Name "Master of Science"

A degree entitled "Master of Science" may be more attractive and marketable than one entitled "Master of Engineering." If this is borne out by market analysis, then the school may pursue registering an MS degree with New York State. Eventually, all students would receive an MS degree instead of an ME degree.

Expand List of Programs

Currently, the Master degree is offered in the four disciplines that match the undergraduate accredited programs. However, several other program names may be considered. For example, the Department of Electrical Engineering could offer a program in Computer Engineering as well as in Electrical Engineering. In that case, there are already a significant number of elective courses in the area, and is an example of a potentially cost-effective way of offering an additional program that can attract students. At least initially, the plan would be to have roughly the same number of graduate students associated with each of the Departments, but perhaps multiple named programs per Department. This may require registration with NY State, and potentially work by the Curriculum and Admissions Committees of the School of Engineering.

Program names that do not introduce significant marginal costs, *e.g.* a large set of dedicated electives, would be preferable.

Integration with Technology Management and Entrepreneurship

Marketing analysis may indicate a large potential population served by MS degree in technology management or entrepreneurship. As the Master program expands over several years in parallel with the Entrepreneurship certificate program, at some point we propose their resources could be pooled to support new programs, such as MS in Technology Management. The additional resources and expenditure for such a program, especially the initial costs, could be funded by the revenue streams generated by these two programs separately. We envision this as beyond the five year horizon, but may be a significant contributor to a steep increase in

revenue from the fifth to the tenth year.

Changing the Thesis Requirement

There are several reasons to revise the current thesis requirement:

- as the as the number of students increases, supervising theses increases the faculty workload and costs of the program;
- to the extent that at least some theses utilize laboratory facilities, there will be increased costs for use of those facilities; those facilities are also limited;
- marketing analysis may indicate a preference by prospective students to avoid a thesis.

Therefore, as the program ramps up, consideration should be given to removing the thesis requirement all together, making it optional (i.e., a choice of thesis or additional course work), or requiring it only for certain students (e.g., not for outside students). This study would require work by the Curriculum Committee of the School of Engineering.

Alumni Involvement

We propose to reach out to alumni and other “friends of Cooper” who can offer part-time positions or summer internships to students in the Master program.

Considering our mix of day and evening courses, many students have significant free time during the week, but cannot have a full-time position. On the other hand, many international and full-time students would benefit from having part-time positions.

Having a number of part-time positions available to be filled by our Master students would:

- Be an attractive feature to recruit students into the program
- Benefit the students, leading to success of alumni for the program (which in turn will increase the reputation of the program)
- Decrease the need for financial assistance to students, or the need to offer enhanced merit-based partial scholarships to attract students to the program
- Increase involvement, “buy-in” and enthusiasm from alumni and other “friends of Cooper.”

A significant feature of The Cooper Union is the success and societal leadership of its alumni. This will increase interaction among Master students and alumni, and can be a key attractive asset for us.

Faculty Involvement and Development

A key “brand” for Cooper Union is that students work closely with faculty. That is why we do not propose diluting this feature with, for example, online offerings. As a small school, we should continue the unique feature of providing close guidance and mentoring by faculty. Therefore, we propose that the courses offered for the Master’s program should be around a

50/50 mix of full-time and adjunct faculty.

The attached financial spreadsheets reflect the cost of instruction for full-time faculty and adjunct faculty, including the stipend for thesis advisement. They also factor in additional costs as the program expands, which may include the hiring of additional full-time faculty.

The availability of more advanced students to support faculty research, and the ability to offer advanced electives together with faculty development, will be an important features to attract and retain quality full-time faculty and also to attract good adjuncts.

Undergraduate Students

We believe we should remain primarily an undergraduate institution. The proposal does NOT reduce the size of the population of undergraduate students. We would retain the Integrated Master program, and the interaction of the undergraduate students with a larger and more diverse group of graduate students, and the availability of additional electives, would become attractive features of the undergraduate program.

It should be noted that a number of our required undergraduate courses are of an advanced nature, compared to the curricula in other engineering programs. Outside masters students may need to take some of these courses. Care will be taken not to represent these courses as “remedial” in nature, but rather they will be presented simply as prerequisites for some of our advanced electives.

By expanding the Master’s program in a way that it remains integrated with the undergraduate program, for example by keeping a mix of undergraduate and graduate students in the same courses, we will achieve more efficient utilization of space and faculty resources. As suggested before, the availability of part-time positions for our graduate students will allow us to rely mostly on international and full-time students, avoiding the larger marginal costs of accommodating part-time students.

We may also consider offering some electives evenings over the summer, to achieve more efficient utilization of space. Day courses over the summer may be less practical because it is more likely students would seek full-time employment or internships over the summer. In any case, offering summer courses will also reduce the pressure to have fewer undergraduate students.

As the program evolves, decisions to adjust the relative sizes of the undergraduate and graduate population could be made. But the analysis assumes approximately 120 undergraduates and 80 graduates admitted per year.

Tuition to be Charged by Credit

In developing the financial analysis some assumptions had to be made about how tuition would be charged. The spreadsheets assume tuition would be charged by credit, not a flat fee for the program. This was based on how we anticipate the program is to be delivered to the students. Some students may take a longer time to complete the requirements of the degree, but may take fewer courses per semester. Some may want to take additional electives, beyond those required for the degree.

In addition, as stated above, some students may need to take several advanced undergraduate courses for the degree. Currently, Cooper Union students may take up to 6 credits of undergraduate electives for the Master degree. Some outside students may need more undergraduate credits to support the minimum number of graduate courses they need, thus necessitating more than 30 credits to complete the degree. By charging by the credit, these students will be treated fairly for these additional courses.

The cost per credit could be computed as considering a full-year tuition divided by 30 credits (assuming a standard load of 15 credits per semester for two semesters).

Recruitment, Admissions and Student Services

A key cohort to populate the master program is international students. Initially, certain regions where Cooper already has some “inroads,” such as South Korea or central Africa, should be considered. Admission standards (*e.g.* whether GRE is required) need to be made, and resources are required to recruit and support international students. The Cooper Union currently has some experience with a limited number of undergraduate international students.

We recommend that resources be specifically allocated to support the expanded graduate program. This includes career services, sponsored social activities, networking and interactions with alumni.

Possible Financial Impact

Conway, Del Genio Gries & Co., LLC has been providing consultative services to The Cooper Union and has also been developing initial financial analyses of various proposals including this one. This is a quick summary of the important costs and potential revenue by steady state (year 2020)

Start up Costs: \$150,000

Marketing Costs: \$120,000 annually

Executive Administrator: \$100,00 annually

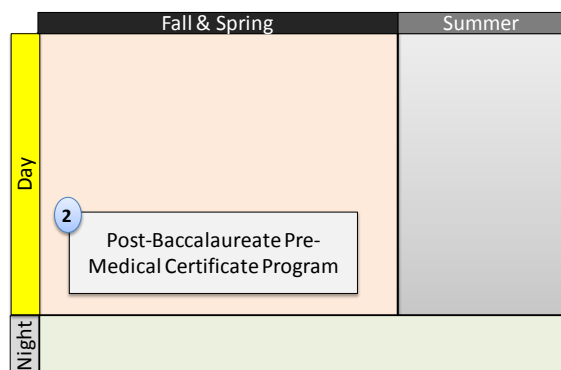
Program Director(s): \$38,000 annually

Administrative Assistant: \$60,750 annually

Student ramp up: 24 students initially, ramping to 80 by year 2020.

Revenue: up to \$1,966,933 by the year 2020

Post Baccalaureate Course-Based Premedical Program



Summary Description

This proposal advocates that the School of Engineering starts attracting and recruiting students from outside The Cooper Union, for a for-tuition, course-based premedical (non-degree granting) program. In this program the requirements for application to medical school would be satisfied through coursework alone, consequently no experimental research or thesis would be required.

Students recruited into this program would attend undergraduate level courses specifically designed for these students; current undergraduates at The Cooper Union could be allowed to take these courses (for a tuition fee, perhaps at a discounted rate, but these credits would not count towards their graduation requirements). This is because these courses would be fundamentally different from our current offerings (referred to as “science and math courses” for simplicity). In contrast to the majority of our science and math courses, these courses would: 1) run with a large number of students (approximately 100); 2) consist almost entirely of post baccalaureate students with weak science and math skills; 3) bear a uniform credit scheme of 4 credits for a lecture-based course and 2 credits for a laboratory-based (practical) course; 4) be graded by using “plus” and “minus” grades, in addition to letter grades (that is, students may receive an A+, A-, B+, B- etc in addition to A, B, C, D, and F); 5) be allowed to be repeated by a student (the student could be charged the appropriate tuition for the course each time he/she takes it).

Students would attend 10-14 credits of coursework in each of the fall and spring semesters for two years. Depending on availability/feasibility, students may also have the option of taking courses over the summer.

Initial financial analysis provided by CDG suggests that, based on a targeted number of 100 students per year, the potential annual net income from this proposal could reach \$3.3 M after 10 years and have accumulated approximately \$16.3 M of net income over that period. Analyzing different growth profiles indicates that even at slow program growth over a 10 year period the project is financially attractive.

This proposal is synergistic with the current educational programs and objectives at Cooper Union and would be an excellent “first step” in capitalizing on our “brand” – providing high quality engineering education.

Concept

According to the American Association of Medical Colleges (AAMC) website, in 2011 43,919 students applied to medical schools across the country. Medical schools in New York state alone received 82,449 applications, which corresponds to approximately 5889 students (each student submits an average of 14 applications to medical school). An increasing number of these students apply as “post-baccs” – that is, they did not apply while they were undergraduates in a traditional pre-med program. Rather, they majored in a field other than a scientific discipline (for example, music, economics, or philosophy) and have decided to apply to medical school after completion of the necessary requirements.

The resources needed would be significant – most notably the creation or rental of a biology lab space. There would also need to be an increase in administrative support and additional faculty, including extra support staff to attract/recruit students, as well as administer the program in the School of Engineering. It is envisioned that these courses will be taught primarily (if not exclusively) by adjuncts to ensure that enough courses are available and to keep the costs as low as possible.

Because this program would build on work already being done by faculty and staff new agreements between The Cooper Union and its faculty unions may be unnecessary.

Implementation

The courses for this program, on the most part, are already offered and taught at The Cooper Union – but in a very different form. Having originated in the Department of Chemistry this description of program implementation is a suggested approach for premedical students.

The following requirements are suggested for admissions:

- A current transcript from a four-year college or university and evidence of academic achievement appropriate for the degree program applied to.
- If considered necessary satisfactory results from a Cooper Union placement test for the post-baccalaureate premedical program.
- A personal statement indicating why the student wants to enroll in this program.

Credit Requirements:

A minimum of 48 credits beyond the baccalaureate degree must be completed at The Cooper Union (in addition to possible undergraduate deficiencies). The 48 credits offered for the degree must satisfy the following distribution:

Program of Study:

A complete program of study is designed by the student with the assistance and approval of the academic adviser(s) and approved by the Office of the Dean of Engineering.

The program for post-baccalaureate premedical students would initially offer the following course list:

- Introductory to College Chemistry ("Pre-Chem")*
- Pre-Calculus*
- General Chemistry I and II
- General Chemistry Laboratory
- Organic Chemistry I and II
- Organic Chemistry Laboratory
- College Biology I and II
- Biology Laboratory
- College Physics I and II
- Physics Laboratory
- Calculus I
- Probability and Statistics

A post-baccalaureate premedical student attending the course-base program would be required to take all of the courses listed above (except for courses with an *, which may be omitted if the student scores highly on a placement exam). Thus a typical breakdown would be as follows:

Semester 1:

- General Chemistry I
- Calculus I
- College Physics I
- Physics Laboratory

Semester 2:

- General Chemistry II
- Probability and Statistics
- College Physics II
- General Chemistry Laboratory

Semester 3:

- Organic Chemistry I
- College Biology I
- Biology Laboratory
- Volunteer/research

Semester 4:

- Organic Chemistry II
- College Biology II
- Organic Chemistry Laboratory
- Volunteer/research

Project:

Each student would be required to volunteer at a hospital for at least one year, for partial fulfillment of the post-baccalaureate premedical requirements. This project must be discussed with and approved by an adviser prior to being started. If the student does not complete this project, he/she will not be eligible for a committee letter of support as part of his/her application to medical school.

Financial Impact

Conway, Del Genio Gries & Co., LLC has been providing consultative services to The Cooper Union and has also been developing initial financial analyses of various proposals including this one. This is a quick summary of the important costs and potential revenue by steady state (year 2020).

Start up Costs: \$200,000

Marketing Costs: \$90,000 annually

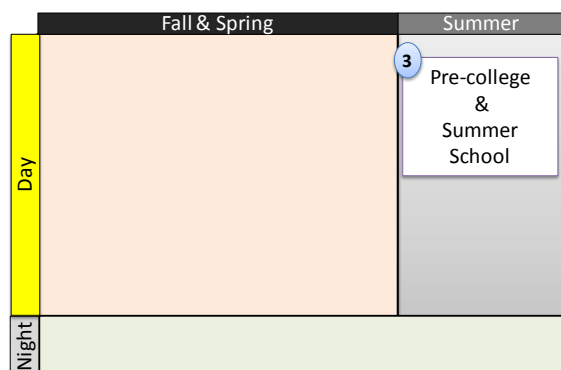
Program Director(s): \$25,000 annually

Academic Advisor(s): \$67,500 annually

Student ramp up: 30 students initially, ramping to 117 by year 2020.

Potential Revenue: up to \$3,100,969 by the year 2020

Summer Program



Summary

This proposal is based on a series of for-tuition summer and Saturday classes aimed at current high-school students or recent high-school grads. There are three components to this plan: 1) a Saturday program that runs continuously during the academic year offering AP classes for college credit for gifted students. 2) A (larger) late summer program aimed towards the same segment and offering the same classes, and 3) an early summer program aimed towards recent high-school grads that either need to retake a class they have failed or want to get ahead in classes that are required for future semesters. An additional possibility would be establishing a profit-sharing tutoring program where current Cooper students can earn money tutoring high school students.

Concept

Due to differences in the academic calendars between high school and college students (Figure 1), there are at least two distinct student bodies that could be targeted by our summer program. The end of the academic year for college-level students is generally in mid-May, whereas the academic year does not end for High school students until the end of June.

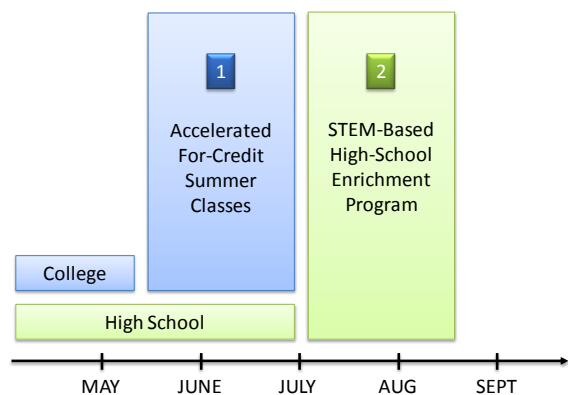


Figure 1: Scheduling Summer Program for best fit to student schedules

Our proposal is to target the two constituencies by creating two consecutive 5 week accelerated programs that are each honed to appeal to the different needs of each group. The first group would be structured like an accelerated summer school – by offering core STEM courses for-credit at an accelerated rate. This would appeal to transfer-students, students that have failed a course, or students that are looking to get ahead for whatever reason. The second section would be aimed towards high-school students that have just ended their school year. We would offer core STEM courses as well as other college-level courses, such as design courses, project courses, or leadership/entrepreneurial courses. One particularly appealing direction that we are considering is an introduction to engineering course that surveys each of the engineering disciplines in turn, rotating each week to a new discipline over a 5 week period.

Value to students

There are many reasons why a high school student may want to attend the pre-college program. The program targets students who...

- Want to pursue a degree in engineering
- Want to develop or research a topic in engineering
- Gain a first-hand experience to understand what engineering is all about
- Gain an opportunity working with Cooper Union faculty/current students

Implementation

Curriculum:

Accelerated Summer Program

The Accelerated Summer Classes is aimed at current college students and would run for 5 weeks, Monday-Friday. The exact makeup of the courses would be adjusted to the market for college level classes, but would be selected from our existing curriculum. For example, a STEM focus would include calculus I, calculus II, general chemistry I, general chemistry II, physics I, physics II, organic chemistry I, organic chemistry II, general chemistry Lab, organic chemistry Lab, and physics lab.

STEM-Based High School Program

The STEM based High school program is aimed at current high-school students and would run for 5 weeks Monday-Thursday. Class times will be from 10AM to 12PM and 2PM to 5PM for a total of 5 hours of class per day, of which three hours are for lab/research work. Although the program is 5 weeks long, 4 days may be needed to have orientation, ice-breaking events, professor/RA/TA introductions, and rituals at the end of the program. Thus, there will effectively be four weeks of instruction.

The program can be adapted to our existing project-based summer program with the addition of tuition. Another approach is to institute an “Introduction to Engineering Disciplines” program in which students rotate through the major engineering disciplines weekly, completing projects and touching on the major challenges and directions in each discipline (Figure 2).



Figure 2: A possible structure for the High-school Program in which students rotate through week-long projects in each of our 4 major engineering disciplines.

Both approaches have similar financial structure; therefore we make little distinction between the programs in this proposal.

Web-based portfolio for each student.

One value we can offer to incoming students is personalized development of a web-based portfolio. Each student would be assigned a page to populate with their bio, recent projects, and interests. This portfolio will allow the students to have a reference when applying to other institutions or the Cooper Union and may become a valuable asset to them that keeps them linked to our institution. The portfolio would structure some of our teaching methodology – project-based assignments would be documented on the portfolio. Students would be assigned titles Project-leader, Design lead, etc. that would impart a sense of value and achievement.

Social Events:

Social events are extremely valuable to incoming students and unstructured free time in New York City can be a significant source of anxiety for parents. We propose that Cooper Students acting as RAs hold nightly events Monday-Friday and weekly meetings. The cost of these events would not be included in tuition or resident fees, but our RA's would be compensated for their time and expenses.

Interaction with Cooper Students:

In addition to social events, incoming high school students would have the chance to interact with Cooper engineering students directly in their project work.

TAs will be present to aid the professors during the lecture and lab time. When the professor is not available to aid the high school students, TAs will be available. Although teaching is done by

the professors, there will be a lot of collaboration between the high school students and the TAs. Thus, TAs should be bright Cooper Union undergraduate students who are comfortable with the concepts/labwork that is being taught.

Do we accept everyone who applies?

One of the challenges in setting up the summer program will be targeting the correct student segment. We are not a faculty particularly suited for remedial education. Students who failed college courses would have little hope of passing more difficult, accelerated course taught here. Thus, we would want to target our courses and our student population towards students that want the challenge.

Do we give grades?

College students who are taking courses for credit would be subjected to standard cooper “A B C D F” grades. High school students would not receive credit, but would be rewarded with web-based portfolio and certificates of accomplishment.

Financial Impact

Conway, Del Genio Gries & Co., LLC has been providing consultative services to The Cooper Union and has also been developing initial financial analyses of various proposals including this one. This is a quick summary of the important costs and potential revenue by steady state (year 2020)

Start up Costs: \$0 (because based on existing program)

Marketing Costs: \$40,000 annually

Program Director(s): \$33,000 annually

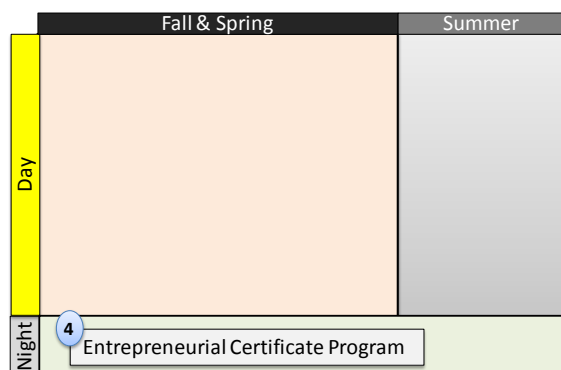
Administrative assistants (2 people): \$108,000 total annually

Student ramp up: 226 students initially (across both programs), ramping to 446 by year 2020.

Tuition: \$2500. (Does not include revenue from renting dorm)

Potential Revenue: up to \$937,332 by the year 2020

Vision2Reality Certificate Program in Entrepreneurship



Summary

“Vision2Reality” Certificate Program in Entrepreneurship:

The Certificate Program in Entrepreneurship would be an after-hours program aimed at professionals interested in learning entrepreneurship by immersion, prior to going out on their own. The focus of the program would be to develop the technical skills necessary to prototype a product or service required for a successful business launch. We would also develop business-planning skills necessary to launch a new venture from a product or service innovation. Upon successful completion, the candidate student will receive a certificate, but may develop to an accredited degree (a technical-skills based MBA) with proper collaborations and partnering as part of our long-term strategy. Like any successful business, this program will depend upon partnering with industry. Courses would be taught at night by well-known adjunct professors and interested full-time Cooper professors (at overload rates) and would focus on applied skills such as programming, prototyping, materials selection, manufacturing, etc.

Concept

This 12-month program would consist of 8 classes offered sequentially in 6 week segments.

One of the main attractions would be our selection process that would be designed to attract a diverse group of incoming talent. We would aim to curate the incoming cohort so that it contains a mix of professionals with proven skills in key disciplines that we chose in advance. For example, the incoming cohort would contain creative professionals, financial professionals, technical professionals, and marketing professionals. In general we would aim for established professionals looking to make a career change rather than new graduates just entering the market.

Classes would be conducted after hours and/or on the weekends, where students would attend for 6-8 hours per week. The first half of the program would be focused on teaching participants skills from each segment – thus business professionals might learn technical or creative skills while creative professionals focus on business skills. The goal would be to become intimately

familiar with the language and processes in each of the disciplines and to network with each other in a targeted, participatory way (Figure 3). The second half of the program would be focused on teaming up with fellow students and developing entrepreneurial proposals for the end of the year competition. Additionally, one of our educational priorities would be to include a systematic patent review as part of our design process. We believe that without an initial careful study and analysis of the prior art (so as to find a patentable niche) most (non-software) inventions will have little or no IP value. We also believe that exploring and analyzing prior art is good education and will help distinguish our institution.



Figure 3: Possible organization of the Entrepreneurial Certificate Program

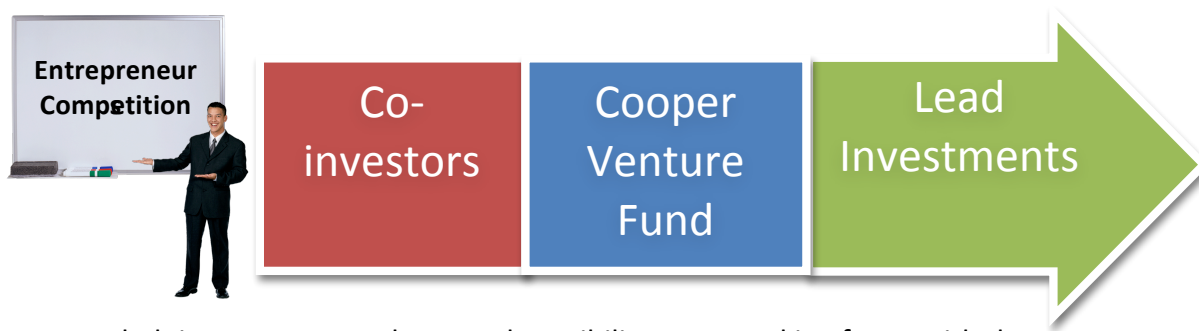
End of the Year Entrepreneurs' Competition

A common element in many entrepreneurial programs is an end of the year competition where participants pitch their ideas in front of a panel of experts. The winners receive financial backing from the institution to launch their business plan and negotiate terms for ownership in the company. The funding for these investments come from a variety of sources including the tuition pool, venture capitalists, grants, and other sources of capital. The losers of the competition do not generally receive any compensation (Figure 4).



Figure 4: Standard Entrepreneurs Competition

We propose an alternative model in which winners of the competition are viewed as leaders of Cooper's venture fund while the losers are viewed as co-investors. Thus, part of the tuition paid to Cooper would buy shares in the Cooper Venture Fund – a fund that invests in Cooper Startups (Figure 5). The value to our students is clear - with the same personal capital a participant would make an educational investment as well as a financial investment. Our entire cohort of students (both winners of the competition and losers) would have a vested interest in the success of the startups that are launched (the lead investments). Cooper graduates may be more likely to stay active within the Cooper network; lending their expertise to Cooper funded



startups, helping to promote them, and possibility even working for or with them.

Figure 5: Cooper's Co-investment Strategy

We believe our strategy represents real value to our students – paying for education is costly and we could offer a method to mitigate that expense. Likewise, a major component of the value derived from a prestigious institution for a student is the network of talent that s/he builds. Our strategy explicitly builds a focused network. From a potential student's perspective, paying tuition to Cooper's Vision2Reality program would buy a first class education, allow access to a diverse network of skilled professionals, and buy a ground floor investment in a series of well-funded and highly-vetted startups (Figure 6).

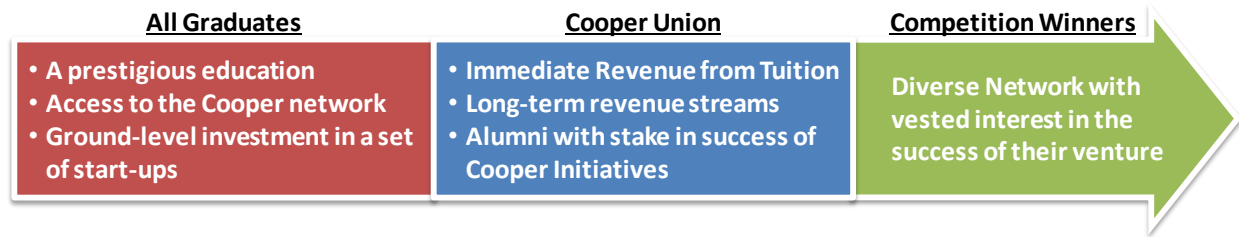


Figure 6: Value to each constituency

For Cooper Union, the Vision2Reality program takes advantage of the opportunities being created by the major technological push by the city to enter entrepreneurial space akin to Silicon Valley. It gives us visibility, prestige, immediate revenue from tuition, and the possibility of a long term income from our investments – diversifying our revenue sources.

The Cooper Union Venture Fund

One of the attractions of our program would be the co-investment opportunity for students – their tuition would buy both a quality education and shares of the Cooper Union Venture Fund. The fund would be comprised of investments in Cooper Alumni Startups. 10% of the tuition from the program would be redirected as prize capital for the entrepreneurial competition. This would increase the scope of revenue streams available to Cooper Union – successful startups would generate revenue and increase the visibility and prestige of our institution. If we do our jobs well and produce successful entrepreneurs, access to the Cooper Venture Fund itself may prove to be a significant draw for students.

Implementation

Several faculty and topic areas have already been identified for the core portion of the learning experience. The number of elective opportunities will initially be based upon student interest and availability of experienced instructors. The 8-class track for the program would be comprised of 6 required classes and 2 elective classes. The exact determination for which classes will be in the required track is not complete, but the full list of classes that we can offer with resources that we have already identified are as follows:

Entrepreneurship (general)
 Day Zero - The Day Before Hanging a Shingle
 Entrepreneurial Finance (specific)
 Entrepreneurial Marketing (general)
 Product Design
 Service Design
 Business Analyst - information architecture
 Software Design - graphic arts

Software Design - user experience
 Software Design - user interface
 Software Systems Design - mobile - Android
 Software Systems Design - mobile - Windows
 Hardware Systems Design - electronics
 Hardware Systems Design - data center
 Hardware Systems Design - HVAC
 Mechanical Systems Design - "machine shop" / Prototyping
 Marketing - Sizing the Market
 Entrepreneurial Sales - process and planning for direct sales
 Entrepreneurial Sales - process and planning for channels
 Scaling the Sales Force - e-commerce
 Scaling the Sales Force - SEO
 Entrepreneurial Business - contracts negotiations
 Entrepreneurial Business - business/customer development
 Entrepreneurial Business - business/partner development
 Entrepreneurial Accounting
 Patents, Trademarks, & Copyrights for the Entrepreneur
 Entrepreneurial Corporate & Tax Law
 Project Management - prep for PMP certificate
 Product Management - prep for Pragmatic Marketing certificate
 Business Model Design - innovating revenue generation
 Software Development - modern architectures & languages
 Software Development - Big Data / distributed computing
 Entrepreneurial HR: How to craft incentive plans including options
 Intrapreneurship: How to be an entrepreneur inside an existing company
 How to "teach" entrepreneurship
 How to "teach" intrapreneurship

Classes could take place on or off campus since none require special laboratories or certifications. Students would be required to have their own laptops to acquire and source content for classroom requirements. Many programs have started to appear in this space over the past few years, but the Cooper Union program will be heavily focused on the mentor/mentee relationship, where the individual interaction time will be as important as the classroom time. The extension of the Cooper Union brand and teaching philosophy into the entrepreneurship space provides us an opportunity to further leverage our faculty, staff and alumni experiences into meaningful content for others to add to their knowledge set.

Establishing partnerships with different business sectors and entities will enhance the opportunities we can provide our students upon completion of certificate requirements.

Credit Requirements:

This would be a certificate granting program, so no degree would be given. The 8-class track for the program would be comprised of 6 required classes and 2 elective classes.

Financial Impact

Conway, Del Genio Gries & Co., LLC has been providing consultative services to The Cooper Union and has also been developing initial financial analyses of various proposals including this one. This is a quick summary of the important costs and potential revenue by steady state (year 2020)

Start up Costs: \$125,000

Marketing Costs: \$60,000 annually

Program staff: \$75,000 annually

Student ramp up: 20 students initially, ramping to 80 by year 2020.

Potential Revenue: up to \$1,618,576/yr by the year 2022

Appendices

Frequently Asked Questions:

When do the programs begin?

Assuming that the trustees vote in February of 2013, and that there is some lead time to develop the programs, hire the correct people, and develop the marketing, the earliest we could offer any new program would be the Fall of 2014. There is also a lead time for charging undergraduate tuition, so if the trustees decide to try to meet revenue goals through expanded graduate programs first (and hold undergraduate tuition as a safeguard), then they would have a limited period of time to collect performance data on the success of these programs before they would have to decide whether to instigate undergraduate tuition.

What percentage of our revenue would come from each program?

The numbers are continuously being adjusted as we delve deeper into each program. For example, the entrepreneurial certificate program has yet to be optimized for cost and profitability, but an estimate of the ratios can be found in the figure below:

<u>Net Revenue (Rent Affected)</u>	<u>FY14</u>	<u>FY15</u>	<u>FY16</u>	<u>FY17</u>	<u>FY18</u>	<u>FY19</u>
ENG MS	(427,899)	806,352	834,352	1,231,333	1,847,421	1,906,294
Summer	289,000	385,390	517,503	626,017	751,233	894,375
Post Bacc Med	(342,468)	425,133	1,145,789	1,635,362	2,135,341	2,553,748
Entrepreneurship	(351,460)	94,002	98,382	462,307	505,655	986,959
Total	(832,827)	1,710,877	2,596,026	3,955,019	5,239,651	6,341,376

It is clear that by the year 2019 about 50% is from the pre-med program, and about 30% is from the Master's program. The entrepreneurship program and the Summer program come to about 15% each, but with the caveat that we are reserving 10% of the revenue generated by the program to reinvest in a Cooper Union Venture Fund.

What is the single biggest driver in terms of profitability of any of the programs?

The biggest driver of revenue is the number of students that buy our programs. For example, it is more profitable to accept 4 more pre-med students, even if we have to open a new section for them because at \$25,000/year the rental costs and adjunct costs are completely covered and then some...

How much bigger is the school going to get?

Currently we offer ~300 sections/year and we have 32-33 FT faculty which means ~120 sections are taught by adjuncts. By 2018 we will have an additional 97 sections

taught predominantly by adjuncts... about 40 of those sections are from the premed program.

We would also be accepting more students. This is the single biggest driver. The excel document allows us to play around with the student ramp up rate and the steady state number. An example in our proposal is below. You can see that many of the students are from the high-school program. This is because the model for such programs is low tuition, but high volumes. These numbers are spread across the entire year and for the high school program across both sections.

	FY14	FY15	FY16	FY17	FY18	FY19	FY20
Enrollment							
ENG MS	-	48	48	60	80	80	80
Summer	226	271	316	361	406	451	456
Post Bacc Med	-	30	58	76	93	105	117
Entrepreneurship	-	20	20	40	40	60	60
Total	226	369	442	537	619	696	713

Do we have a bottom-line estimate on how many additional classrooms are needed for the GTC programs?

This is a somewhat complex calculation based on how efficiently we use our space and what other programs are concurrent – and this depends on the time of day and month. We calculated a worst case scenario where all of the programs (except the master’s program and the summer program) were completely rented space. We calculated space requirements from the chart below and applied market rates. The cost estimates are in the Figure below. The takeaway is that rent is not a major determining factor of the profitability of the program. The most significant factor is the number of students.

Classroom Capacity

	Mon	Tues	Wed	Thurs	Fri	Sat	Hours / Week		
							Weekdays	Eve and Wknds	Total
9-10:30	1.5	1.5	1.5	1.5	1.5	1.5	7.5	1.5	9.0
11-12:30	1.5	1.5	1.5	1.5	1.5	1.5	7.5	1.5	9.0
1-2:30	1.5	1.5	1.5	1.5	1.5	1.5	7.5	1.5	9.0
3-4:30	1.5	1.5	1.5	1.5	1.5	1.5	7.5	1.5	9.0
6-9pm	3.0	3.0	3.0	3.0	3.0	3.0		18.0	18.0
Hours							30.0	24.0	54.0
Sections (3 Hrs = 1 Section)							10.0	8.0	18.0

Notes:

The 18 sections can be broken into either a) 10 FT sections + 8 PT sections or b) 18 FT sections.

If a program has a max section size of 30, then 30 students x 40 sq ft per student = need for a 1,200 sq ft classroom

If a program has a max section size of 15, then 15 students x 40 sq ft per student = need for a 600 sq ft classroom

<u>Implied Rent</u>	<u>FY15</u>	<u>FY16</u>	<u>FY17</u>	<u>FY18</u>	<u>FY19</u>	<u>FY20</u>	<u>% of Classes Rented</u>
ENG MS - Fall/Spr Day	-	-	-	-	-	-	0%
ENG MS - Fall/Spr Eve	-	-	-	-	-	-	0%
Summer	-	-	-	-	-	-	0%
Post Bacc Med - Fall/Spr Day	38,500	60,500	82,500	99,000	104,500	110,000	100%
Entrepreneurship - Fall/Spr Eve	15,889	15,889	25,667	31,778	31,778	31,778	100%
Entrepreneurship - Fall/Spr Wknd	7,944	7,944	12,833	15,889	15,889	15,889	100%
Entrepreneurship - Summer	11,917	11,917	19,250	23,833	23,833	23,833	100%
Total	74,250	96,250	140,250	170,500	176,000	181,500	
Total (Rounded to Nearest Classroom)	132,000	132,000	198,000	198,000	198,000	198,000	

What is the ratio of Full time faculty to Adjunct Faculty?

This depends largely on the program. The Master's program is roughly 50/50 while the pre-med program is almost entirely adjunct driven. There is an input toggle for each program within the excel sheet to adjust this ratio and see the effect on revenue. The ratio that we propose is shown in the figure below (note the FT Faculty are new faculty hires while the ADJ Faculty is simply a measure of new class sections that must be taught by adjuncts).

<u>New FT Faculty</u>	<u>FY15</u>	<u>FY16</u>	<u>FY17</u>	<u>FY18</u>	<u>FY19</u>	<u>FY20</u>
ENG MS	1	1	2	2	2	2
Summer (FT on overload)	-	-	-	-	-	-
Post Bacc Med	-	-	-	-	-	-
Entrepreneurship (FT on overload)	-	-	-	-	-	-
Total	1	1	2	2	2	2
<u>ADI Faculty</u>						
ENG MS	6	6	-	-	-	-
Summer (excludes TA's)	13	13	16	18	19	19
Post Bacc Med	14	22	30	36	38	40
Entrepreneurship	8	8	14	17	17	17
Total	41	49	60	71	74	76

How are programs staffed in terms of ratios of full-to-part-time faculty, at other schools?

I understand the financial need to start off with many adjuncts and almost no new full timers for these programs, do we have historical data on what it took to get programs off the ground in terms of full-time faculty?

We believe this is an important variable to be concerned about, the quality of our program will be directly affected by the quality of our adjuncts and the way we organize them. Currently we do not have historical data as to other programs and their Full-time to adjunct ratios. As mentioned previously, we do have a toggle on the excel sheet that can adjust the ratio and see the effect on revenue.

What is the governing structure of these programs?

Each program is slightly different. The master's program has an executive administrator that is shared between the 3 schools. This person would be akin to a provost or a dean, in charge of developing the overall program. There would also be program directors, made mostly of Full time faculty with course releases, and administrative assistants dedicated to the

program. Details of the costs and governing structure for each program can be found in this summary.

	ENG MS	Summer	Post Bacc Med	Entrepreneurship	Total
Executive Administrator	\$ 135,000	\$ -	\$ -	\$ -	\$ 135,000
Program Dir (incl Ben, Course Release)	\$ 38,000	\$ 33,000	\$ 25,000	\$ 38,000	\$ 134,000
Admin Assistant	\$ 60,750	\$ 108,000	\$ -	\$ 60,750	\$ 229,500

Guiding Questions for developing individual programs:

1. **Who are our most important customers for the program and what are we offering them?**
 - a. **Breaking them down into groups outside the scope of undergraduate:**
 - i. Pre-university
 1. Supplying programs to individuals wishing to apply to engineering school; like Kaplan but not test-focused, more like knowledge expansion coupled with gaining lab experience
 2. HS enrichment programs; like Kumon
 - ii. Post-baccalaureate
 - iii. Professional
 1. certificates in key engineering areas with vertical focus, e.g., financial services, media
 - a. PE exam prep
 - b. Software development tracks
 - i. Mobile software
 - ii. Social Computing
 - iii. Big Data/Distributed computing
 - iv. Signal/Big Data Analysis
 - v. Search/SEO
 - vi. UI/UX (coupled to Art School for Graphic Arts)
 - c. Hardware development tracks
2. **Why will the program be perceived as valuable?**
3. **How does the new program fit into the existing Cooper programs?**
 - a. Do we already have established classes and expertise in the program?
 - b. Does the public assume that we are already good at it?
 - c. Does the program strengthen and fit well with the Cooper brand of intimate, difficult, and merit-based?
4. **How well does the program fit into the changing landscape of education?**
 - a. Is the need already being filled by our competitors?
 - i. What are the competing programs and how are they structured?

- b. How will outsourcing or free online-learning affect the program?
- 5. **How will our potential students expect us to treat them?**
 - a. Will they feel they are part of the core Cooper community?
 - b. Will they expect small classes and personal help?
 - c. Will they expect job placement and networking events?
 - d. Will they expect personal email addresses? Monthly newsletters? Campus gyms?
 - e. Will they expect flexibility in class times and teachers?
 - f. Will they expect customization in terms of their individual needs and desires?
- 6. **What resources will we need to carry out the program?**
 - a. What key intellectual property do we need to produce to run the program?
 - i. Course syllabus
 - ii. Course schedules
 - iii. Classroom assignments.
 - iv. Advertising materials
 - v. Lists of enrolled students
 - vi. Qualified professors assigned to these classes
 - vii. Managers
 - viii. Business strategy and timelines.
 - ix. A body of rules and a managing faculty body to apply these rules.
 - x. What else? Are there sample curriculums, websites, and organizations already available online that we can jump-start from?
 - b. How many classrooms will we need?
 - i. How much of that is new space?
 - ii. What would be the maximum class size?
 - iii. Do we need labs, computers, software licences, or other resources for the program?
 - c. How many professors will we need?
 - i. How many new professors?
 - ii. Do we need safety officers, lab techs or other specialized staff?
 - d. What other human resources do we need?
 - i. Advertisers, managers, advisors, specialists?
 - e. What existing resources do we have that could be applied well?
 - i. Networks, Grants, equipment, Media outlets, course materials, etc..
- 7. **What are the important items to consider in terms of a financial analysis (net present value, discounted cash flow return, gross revenue, overhead and indirect costs)?**
 - a. What can we charge per credit or class and what do we need to charge to make a profit?
 - b. How much do competitors charge?

- c. What are the most important costs inherent in our business model?
 - i. Which key resources are most expensive?
 - ii. Which key activities are most expensive?
 - d. Does the perception of value come primarily from low cost to our competitors or high return on value?
 - e. What are the fixed costs (salaries, rents, utilities)
 - f. What are the variable costs
 - g. Does this program benefit from economies of scale and/or economies of scope?
 - h. For what value are our students really willing to pay?
 - i. For what do they currently pay?
 - j. How are they currently paying?
 - i. Their parents? Through summer savings? Trust Funds? At the beginning of each semester?
 - k. How would they prefer to pay?
 - i. At the successful completion of a course? Per credit hour? later, when they have a job?
- 8. How do we raise awareness about our programs?**
- a. How do we advertise and raise awareness now?
 - b. How do other comparable organizations raise awareness?
 - c. Do we need any new efforts or channels?
 - d. What is the most cost-efficient way to raise awareness of our programs?
- 9. How do we help our students see the value in our program?**
- a. What is it that we are offering that is unique and innovative?
 - i. Does our program need to be perceived as new and exciting to succeed?
 - b. How should we position ourselves in the existing market?
- 10. Through what mechanism do our students purchase our programs?**
- a. Do they apply online?
 - b. Are there interviews and entrance exams?
 - c. Do they pay per course?
 - d. Do companies pay for them?
- 11. How well does our program integrate to our students existing routines?**
- a. Convenience: Will the timing of these classes fit well with what our students need?
 - i. Can the program be compressed into a summer program or a weekend program?
 - b. Accessibility: Are they convenient geographically?
 - i. Is all our teaching done in a classroom, or can part of it be done online or on site (at the high school, at the company headquarters, etc)?

12. How do they know they have completed the program?

- a. How many classes would be required for the student to get a certificate or degree in the program?
- b. Do they need to complete a project and write a thesis?
- c. Will there be some sort of public presentation and graduation?

13. In what ways do we provide support after they complete the program?

14. How can we best insure that we will “get the job done”?

- a. What key activities do we need to really get right?
- b. What bottlenecks do we need to push through?
- c. How can we prioritize the generation of key resources?
- d. How soon can program launch?
 - i. Can the program launch in stages?

15. Who can we identify as our key partners and what do we need them to do for us?

- a. Corporate sponsors?
- b. Medical Schools?
- c. High-Schools?
- d. Government programs?

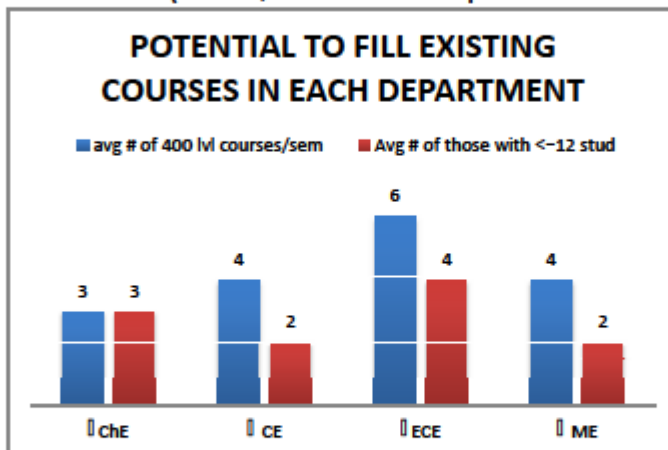
16. What do we need to do for our key partners to make them happy and want to work with us?

Questions to ask ourselves:

- 1. In what ways can we reduce the risk to us in taking on this program?
- 2. In what ways can we reduce the risk to new students in enrolling in our programs?
- 3. In what ways can we reduce the costs to us in starting this program?
 - a. Are there space-sharing ideas? Potential partners? Grant revenue? Corporate Sponsorship?
- 4. How can we integrate this program with other new programs?
 - a. Do we need to establish a dedicated person or team to coordinate the messaging and operation of these new projects?

Graduate Elective Assessment for Unused potential

GRADUATE COURSE ANALYSIS (400-level, does not include independent studies or Thesis)



Chemical Engineering (ChE)

	F12	S12	F11	S11	F10	S10	F09	S09	F08	S08	F07
Total # students	28	28	34	26	37	50	23	10	5	7	4
avg # of 400 lvl courses/sem	3	4	5	4	4	5	3	2	1	2	1
Avg # of those with <=12 stud	3	4	5	3	3	4	3	2	1	2	1
Total # courses 13-18 stud	0	0	0	1	0	1	0	0	0	0	0
Total # courses >18 stud	0	0	0	0	1	0	0	0	0	0	0
Total # courses ft	3	4	5	4	4	5	3	2	1	2	1
Total # courses pt	0	0	0	0	0	0	0	0	0	0	0

Civil Engineering (CE)

	F12	S12	F11	S11	F10	S10	F09	S09	F08	S08	F07
Total # students	46	41	47	62	86	88	41	87	30	65	45
Total # courses	4	4	4	5	6	6	3	5	3	5	4
Total # courses <=12 stud	3	3	3	3	3	1	1	1	2	2	2
Total # courses 13-18 stud	1	1	1	1	0	4	2	2	1	2	2
Total # courses >18 stud	0	0	0	1	3	1	0	2	0	1	0
Total # courses ft	4	2	3	2	5	3	3	2	1	2	4
Total # courses pt	0	2	1	3	1	3	1	3	2	3	0

Electrical & Computer Engineering (ECE)

	F12	S12	F11	S11	F10	S10	F09	S09	F08	S08	F07
Total # students	65	61	45	69	78	88	73	54	70	63	54
Total # courses	5	6	6	6	7	7	7	4	6	7	5
Total # courses <=12 stud	3	4	6	4	5	3	6	2	3	5	2
Total # courses 13-18 stud	1	2	0	1	1	3	1	2	2	2	3
Total # courses >18 stud	1	0	0	1	1	1	0	0	1	0	0
Total # courses ft	3	3	4	4	4	4	4	1	2	4	2
Total # courses pt	2	2	2	2	3	3	3	3	4	3	3

Mechanical Engineering (ME)

	F12	S12	F11	S11	F10	S10	F09	S09	F08	S08	F07
Total # students	43	24	59	49	52	43	61	22	39	38	35

Assessment of Underused potential in current Curriculum

Analysis of Maguire Report:

Master of Engineering Programs

Institution	Length	Delivery	Size	Price	Comments	Cost per Contact hour	Assumptions
<u>Columbia University</u> [1]	5-year limit (masters & professional degrees); 7-year limit (doctoral degree)	Online	<u>699</u> [2]	\$1,578 per point (credit tuition); \$634 per point (audit tuition); plus, additional fees	Masters (MS; MBA/MS), post-masters (PD), & doctoral (DES) degrees	105	15 hours per semester/credit
<u>Stevens Institute of Technology</u> [3]	Full- and part-time options (≥ 30 credits total)	On-campus & online; plus, Washington, DC site		14,400 per year (9-12 credits); or \$1,280 per credit	17 Master of Engineering fields	85	15 hours per semester/credit
<u>University of Southern California</u> [4]	1.5-2-years on-campus (full-time); or, online (part-time)	On-campus & online	<u>2,706 (full-time); 1,513 (part-time)</u> [5]	\$1,569 per unit (on-campus); \$1,569 per unit (online)	Approx. 30 masters programs offered online	105	15 hours per semester/credit
<u>Cornell University</u> [6]	1-year program	On-campus		\$21,592.50 per semester	15 Master of Engineering fields	96	Assume 5 classes per semester
<i>Duke University</i>							
I. Master of Engineering[7]	18-24 month program	On-campus		\$18,420 per semester		82	Assume 5 classes per semester
II. Master of Engineering Management Program	1-year MEM program (on-campus)[8]; 2-year d-MEMP program (online)[9]	On-campus; & online (d-MEMP requires 3 on-campus residencies)	<u>26 students (d-MEMP)</u> [10]	\$21,240 per semester (MEM); \$5,310 per course (d-MEMP)		118	Assume 5 classes per semester

Modified Maguire Analysis of Master's of Engineering Programs

Summer Programs

Institution	Length	Delivery	Size	Price	Comments	Cost per Contact hour	Assumptions
<i>Stanford University</i>							
<u>I. School of Engineering</u> [1]	4-week program	Residential	50 students (maximum) 15 students (average); class sizes range 10-40 students	N/A	Free to newly admitted Stanford freshman	72	4 days per week with 6 contact hours per day
<u>II. EPGY Summer Institutes</u> [2]	3- & 4-week sessions	Residential		\$5,150 (3-week); \$6,550 (4-week)		68	4 days per week with 6 contact hours per day
<u>Stevens Institute of Technology</u> [3]							
<u>Stevens Institute of Technology</u> [3]	2-week program	Residential		2200	3 sessions	61	3 sessions per week with 6 contact hours per session
<u>Johns Hopkins University</u> [4]							
<u>Johns Hopkins University</u> [4]	4- & 5-week sessions (depending on location)	Residential; commuter	10:1 student/teacher ratio (class size ranges 18-24 students)	\$55 (application fee); \$2,100 (tuition); \$2,600 (optional residential fee at Johns Hopkins site); \$100 (international student fee)	Commuter sites in California, Maryland, Pennsylvania, & Washington, DC	19	4.5 weeks, 4 days per week with 6 contact hours per day
<i>Cornell University</i>							
<u>I. College of Engineering</u> [5]	1-week programs	Residential		1450	Diversity programs	60	4 days per week with 6 contact hours per day
<u>II. School of Continuing Education and Summer Sessions</u> [6]	6-week program	Residential		9995		69	4 days per week with 6 contact hours per day

Modified Maguire Analysis of Summer Programs

Post-Baccalaureate Programs

Institution	Length	Delivery	Size	Price	Comments	Cost per Contact hour	Assumptions
Boston University [1]	Individualized course of study (based on student's background)	On-campus	49 students	\$20,424 per semester (full-time tuition); \$1,276 per credit (part-time tuition)	Designed for students with non-engineering background	91	15 hours per semester/credit
Stevens Institute of Technology [2]	4-course/12-credit program	On-campus & online		14,400 per year (9-12 credits); or \$1,280 per credit	Also offers custom programs for corporate employee enrichment	85	15 weeks per semester
Tufts University [3]	4-course programs	On-campus		\$3,430 per course/credit	Certificates offered in 12 areas	229	15 hours per semester/credit
State University of New York at Stony Brook [4]	Individualized course of study (based on student's background)	On-campus & online		<u>Tuition rate based on course level & resident/non-resident status</u> [5]			
Columbia University [6]	Individualized course of study (based on student's background)	On-campus	Between 480[7] and 606[8] students	\$1,392 per credit; plus, additional fees	Offers traditional (3-years), part-time (5-years), and accelerated (< 3-years) program sequences	93	15 hours per semester/credit

Modified Maguire Analysis of Post-Baccalaureate Certificate Programs