Flexible Pathways: Better Granularity and Greater Flexibility

Flexible pathways through a curriculum allow learners more ability to customize their learning experiences based on specific needs at any given time in their academic careers. The academic career, once defined as a four-year pipeline from high school to graduation or through a graduate degree, may become more intertwined with real-life experiences as students weave their pathways through periods of school, work, community service, and entrepreneurial or project work or combine various experiences at one time. Flexibility in time, place, and content of educational products and services will enable future learners to build programs to suit their specific needs and help them to meet the needs of a future society.

The Georgia Tech Commission on Creating the Next in Education (CNE) discovery report titled CNE Future Learner Needs Discovery Report (Georgia Tech 2016) highlights flexible pathways and discusses the currently available educational products that enable them, including certificates and minors; co-curricular programs such as study abroad, co-ops, entrepreneurial programs, community service, and participation in maker spaces; and hybrid degree programs such as 3+2 double degree and combined bachelor’s/master’s programs.

Existing programs should examine degree requirements to determine if there are topics of unnecessary depth and where these topics could be replaced by flexibility. For example, long prerequisite chains might be streamlined and replaced with self-paced tutorials and competency-based tests. Alternative courses or course sequences might be created for people who want or need “lite” versions of topics. Some required courses could be evaluated for possible conversion to electives. Several existing programs at Georgia Tech have gone through curricular revisions to increase flexibility, resulting in programs that better meet the needs of their students.

A great deal of flexibility can be gained by reducing the granularity of educational products in order to support customizable bundling of educational programs. With smaller and more varied units of education products, learners will have more choices in building degree programs. For example, the credit hour, or Carnegie Unit, is a measure of the amount of time that a typical student spends learning a course topic in a semester. In particular, one credit hour is deemed appropriate in cases where a student spends one hour per week with an instructor plus two hours extra work per week, or the equivalent.

Arguments against the Carnegie Unit, which was established in 1906, state that it is not a measure of learning (Fain 2012). Some students may teach themselves a topic in a fraction of the time that others may require to learn the topic under the guidance of an instructor. Should the unit of credit be a measure of learning not a measure of time? If so, how might it be validated and standardized so that its meaning is clear across schools and in industry?

These concerns over the appropriateness of the Carnegie Unit have existed for eighty years, as reflected by Walter Jessup, the president of the Carnegie Foundation, in a 1938 report, which stated that the credit system was “not good enough” for the education system that existed in 1937 and that “demonstrated achievement,” not time, should be the basis for promotion (Jessup 1938, vii).

A recent movement toward competency-based education seeks to address this gap between the credit hour as a measure of time and the more ideal measure of learning (Fain 2012). Competency-based education (CBE) allows for students to receive credit for their work when they successfully prove that they are sufficiently competent in a topic, even if they self-study. Advanced placement tests in languages, for example, allow students to bypass a prerequisite to take a course at a higher level. A limited number of academic credits toward a degree at Georgia Tech can be earned by passing an “Examination for Advanced Standing.” Credentialing student achievement based on competency or mastery of skills learned in experiential learning activities is an open issue that should be addressed by Georgia Tech. See the CNE Report Supplement Learning by Doing (Georgia Tech 2018) for specific recommendations.

Another option for reducing the granularity of educational units from current practice is to examine the motivation for parceling many courses as three credit hours (or lasting 15 weeks). There is no pedagogical reason for this practice, only the convenience of standardization. Courses being three or four credits means that students are limited in the variety of courses that they can take in their program of study. There are often deep prerequisite chains for courses, making classes inaccessible to those
outside of a major. Students who do take one-credit-hour (non-laboratory) classes that meet once per week often place lower priority on those courses than their three- to four-credit-hour classes.

**A Matrix of Minimester Classes**

One pilot idea that the Commission recommends for reducing course size and length is to create a framework of minimester courses that meet for three hours per week but last only five weeks. With each course being worth one credit, these courses can be concatenated to form a three-credit-hour sequence of (potentially) unrelated courses. Condensing the time period for the one-credit course to five weeks means that it can be taught at the same intensity and level as standard three-hour courses, but it does not last as long. The weekly time commitment of students in the course would be equivalent to other courses, unlike current one-credit-hour courses that often receive low priority of study time.

The minimester framework can be overlaid on a standard semester schedule, with sufficient minimester offerings forming a matrix of courses available to learners, as shown in Figure 1. There is precedent, and current Institute policies allow for the minimester framework. All current summer courses are taught in a condensed manner compared to fall and spring courses, while short summer courses are condensed to half of that time. There are also semester courses that can be taught in a condensed manner outside of a normal semester. Thus, this idea can be enacted immediately.

By increasing flexibility of course offerings, the minimester framework provides the opportunity for a broader selection of courses to be taught that give either depth or breadth to a program of study. For example, the Commission recommends that a set of one-credit-hour introductory interdisciplinary courses be offered that would serve a general population by introducing the terminology, technology, trends, issues, and applications of the topic. If the course scope is very general and not deep, the prerequisites can be very slight or nonexistent.

Such a set of courses would support whole-person education, especially if they are taught in multidisciplinary discussion or project formats. At the other end of the spectrum, this minimester format allows faculty to teach niche or advanced topics suitable for fourth- or fifth-year undergraduates, graduate students, or even alumni who would like to come back to take a specialty course.

Academic units could use the minimester platform to break up curricula into smaller stackable units, in which one course is partitioned into three segments to make curricula more customizable. Perhaps only one of those segments is needed as a prerequisite for a future course, thereby streamlining prerequisite chains. The first course in the segment might be a more general introduction to a topic, whereas the other segments might provide depth and could be converted into electives. Transfer students whose courses do not exactly match those of Georgia Tech could take a minimester segment of a course to catch up on content they lack familiarity with. Similarly, graduate students come to Georgia Tech with a variety of undergraduate courses and course topics and could use minimester courses to fill in gaps in preparing for specific graduate-level courses.

If successful, a framework consisting of a large selection of minimester courses would give students more flexibility and more accessibility to various topics, especially those outside of their major, thus bridging disciplinary silos. An infrastructure for a matrix of one-credit-hour courses could also serve as

- a low-risk platform for experiments in education, such as pedagogy and partnerships in education with industry or students helping to develop and teach the courses;
- a set of low-time-commitment training courses for graduate students who want to go into academic careers; and
- a set of courses to be used for partial course buy-out by research faculty.

---

**Figure 1: Sample scheduling for minimester classes.**
To be most effective for enhancing whole-person education and expanding disciplinary boundaries, a partnership between students, faculty, alumni, and corporate partners could both determine the best set of topics and develop the course materials. These particular courses would have broad appeal. Examples of this approach might be Introduction to Embedded Systems, which would be aimed at any student who wanted to work on hobbies and projects with microcontrollers. Another example is cybersecurity, which is an important topic to many fields but has existing courses that require several prerequisites in order for students to enroll in them. Alumni and corporate partners could identify other topics that graduates may need in industry.

**Stand-Alone Certificates**

At the program level, there are credentialed college programs offering associate, bachelor’s, master’s, or Ph.D. degrees. Smaller units of credentialing would give future learners more flexibility to target the topics they wish to pursue while still enforcing some structure on the set of courses needed for those credentials. This flexibility would be especially desirable for any student who has obtained a bachelor’s degree and wishes to reengage with a university in order to renew or retarget their set of skills.

Many schools offer minors and certificates, at both the undergraduate and the graduate level, for students who are already enrolled and seeking another standard degree. If these certificates are offered as stand-alone credentials without the need for students to be enrolled in another degree program, then the number of students who have access to Georgia Tech education could increase. Georgia Tech would validate the certificates and recognize them on official transcripts.

Flexible graduate credentials may replace the traditional master’s degree over time, so this move will help the university adapt to new market conditions. There is currently strong interest among companies and professionals alike for working professionals to have access to credentialed educational programs that are shorter in length than a traditional master’s degree and are more targeted in scope so that they can be agile in knowledge and skill sets. This initiative for redefining the post-graduate space would support a strong workforce and a strong state economy. In addition, it would allow faculty the opportunity to see their research used in industry, discover new research questions based on its usage, and have easier access to industry sponsors for research proposals and activities.

Graduate certificates are recognized by the University System of Georgia (USG) and offered by many universities across the country. In fact, according to the Council of Graduate Schools (CGS) and the Graduate Records Exam (GRE) Survey of Graduate Enrollment and Degrees (Okahana and Zhou 2017), graduate certificates are on the rise nationally, with an average annual growth of approximately 22 percent awarded in the STEM fields of engineering, computer science, mathematics, and physical and earth sciences over a five-year time frame from 2011 to 2016.

These types of graduate certificate programs are composed of a set of graduate-level courses that form a coherent theme. For the purposes of that CGS/GRE survey, the size of the program was defined as being 15–18 credit hours (Okahana and Zhou 2017), while USG allows for a graduate certification program to be > 9 hours. EdX offers a set of MicroMasters® certificates from universities across the world, including Georgia Tech’s Analytics: Essential Tools and Methods course. The university-credentialed certificate programs of study can be offered independently so that students can customize their own graduate-level experiences—perhaps one certificate in management and one in technology, or three such certificates within a given discipline that can be “stacked” or combined to form a standard master’s degree in that discipline. For potential students, these programs need to be designed for flexible delivery and be offered at affordable price points.

**Off-Ramps and On-Ramps**

As learners progress through programs or alumni progress through their careers, easy off- and on-ramps are needed for further flexibility. For undergraduate students, this may look like breaks away from campus while working or pursuing service activities. Having more classes offered online will allow these students the flexibility to pursue part of their education at a different time and place than on-campus students. Online education at the graduate level is already common. The popularity of the online Master of Science in Computer Science (OMSCS) and the online Master of Science in Analytics (OMS Analytics) programs indicate that there is a market for online degrees. Online students generally progress through degree programs more slowly, and many take breaks as they try to fit the rigor of the education around their careers and personal lives.

An easy on-ramp for Georgia Tech alumni would be to allow them to come back at any time to take a course, either at the undergraduate level or at the graduate level, regardless of their undergraduate GPA. This perk would be advertised to prospective high school students and would
build a culture of lifelong engagement. The culture could be changed from wanting to “get out” to being happy to be “forever in.” The process for admitting students as non-degree-seeking status would be streamlined for alumni, removing the decision-making part of the process and leaving only the administrative aspects of making sure that the students have the appropriate account access. Having online courses and minimester courses would give these alumni even more flexibility to fit education into their work schedule.

Traditional admissions for master’s degree programs are based heavily on undergraduate GPA. However, learners mature at different rates, and some take very roundabout paths to find their true academic passions. Someone who has been out of school and working for ten years should not be judged solely on mediocre performance as an eighteen-year-old. An alternative on-ramp for graduate degrees should be considered that is based on performance in the extra courses that students took as non-degree-seeking learners. These courses would be more timely and relevant to the topics studied in graduate school than those taken as an undergraduate. This situation is most natural for students who earn graduate certificates and perform well in the process. Those certificates can become alternative credentials for admissions to master’s or Ph.D. programs.

Georgia Tech currently offers many programs aimed at working professionals who are beyond a bachelor’s degree. These programs combine a variety of for-credit and noncredit programs, workshops, webinars, and class meetings in various levels of granularity in order to provide learners with a great deal of flexibility to build their academic careers around their lives.

However, in the future, a more robust product offering must exist that will likely include products with price structures ranging from free to degree. Leveraging an array of learning products enables the individual to pick and choose products that best fit the learner’s needs, available time, and price points. Across any one knowledge space, Georgia Tech must relate today’s products of webinars, massive open online courses (MOOCs), workshops, conferences, short courses, noncredit certificates, credit certificates, and minors along with degrees that couple with new knowledge inputs from Georgia Tech’s research. Further, it is envisioned that new kinds of products will also likely need to be invented that meet the needs of tomorrow’s learners.
References


