Advising is the process by which learners find out how they are doing, what they are required to do next in their course of study, and what they should do to overcome difficulties in learning. Advising is also how they learn to articulate future goals and explore how their program of learning can be tailored to accomplish those goals. These processes are critical to student success, and while some highly motivated, knowledgeable, and fortunate students go through college with minimal formal contact with advising personnel or resources, advising is important for most learners, especially those who flounder in defining or pursuing educational goals and/or those who fail to meet academic expectations.

Advising can currently be subdivided into three types: prescriptive, intrusive, and developmental. Prescriptive advising is advising that is given to students about what courses to take and when. Intrusive advising is usually initiated by the advisor, not the student (hence the name), and is triggered when a student shows signs of failing to meet important academic targets. The goal of this style is to encourage the learner to reflect on what is going wrong and how to take steps to get back on track. Developmental advising is the advice-giving and mentoring that helps students articulate longer-term goals, both academic and after graduation.

Technology plays a role in all forms of advising, but it should be emphasized that technology is merely a means to an end. That end is the marshaling of available information to make wise choices. Ultimately, college students are adults who need to exercise agency over their futures. Their education is something that they design and grow from, not something that happens to them. Advising therefore occupies an intermediate position between two undesirable situations: letting students make potentially unwise and misinformed decisions, and making all the difficult decisions for them.

**Prescriptive Advising**

In strict cohort models of learning, such as the Great Books program at St. John's College where there are no majors and the curriculum is fixed each year for all students, prescriptive advising is barely necessary. At the other extreme, where learners create their own degrees from curricular elements (such as the independent major at many universities), advising becomes a collaborative design activity that results in a student's unique curriculum. Most curricula are intermediate in complexity, and Georgia Tech's degree programs are no exception. They are defined as complex webs, not sequences, and they are predefined, not constituted on the fly. Georgia Tech has many curricula, divided into predefined majors, concentrations, threads and pathways. But these divisions are many and varied, and they usually allow many options, electives, and alternative orderings of elements. Given that students can take several courses in different combinations, issues such as workload, logical sequencing, and the avoidance of conflicts become complicated optimization problems. There is clearly a role here for technology. Indeed, it is in prescriptive advising that technology interventions are the most feasible and necessary.

Prescriptive advising can be viewed as a form of navigation in which the terrain being navigated is the curriculum. Just as in geographical navigation, there is a starting point, which constantly updates as the learner "moves" through the curriculum, and a destination, which may also change as the learner's goals change. And, just as with physical navigation, there are constraints provided by the curriculum and the passage of time.

Students' starting points are not all the same or clear cut. An increasing number of students are arriving at college with credit. Some credits are obtained through dual-enrollment courses taken in high school. Other credits are obtained through equivalent pathways, such as Advanced Placement (AP) or International Baccalaureate (IB) courses. In more vocational settings (though not at Georgia Tech), prior work experience may exempt students from the need to take certain courses, particularly in the context of competency-based programs.

And, of course, students' destinations are varied. They may desire graduation quickly, on a standard timescale, or with the leisure to pursue extra options. They may be aiming to graduate with a double major, or a minor, or a certificate, or medical school eligibility. They may be driven to maintain a 4.0 GPA or be content with a C average. And, of course, the destinations may change as students learn more about themselves and what different majors, minors, and pathways have to offer.

In geographical navigation, we see a reduction in the need for human intervention as technology evolves; this is true also of prescriptive advising. Commercial flight crews no longer include a third flight officer; instrumentation and
procedures followed by the pilot and copilot now render the navigator redundant. Road trips no longer need a passenger to review a map; GPS navigation aids provide constant, real-time updates, recalculating optimal routes. In addition to making navigation easier and more efficient, technology removes the gap between planning and execution by permitting on-the-fly, incremental navigation. The same is true of prescriptive advising.

Navigating through a curriculum requires machine-readable and map-like curriculum representation. Curriculum maps are state-of-the-practice in curriculum design and assessment, and accreditation processes assume their existence. In contrast, a set of degree requirements that are expressed as a series of logical conjunctions and sequences are more difficult to understand. Faced with a curriculum expressed as a quasi-legal contract, students naturally play it safe and consult expert advice. Thus, professional academic advisors frequently spend much of their time sorting out sequencing problems in students’ schedules when they could be interceding more effectively in failing students’ plans or giving developmental advice.

A four-year degree plan, of the kind supplied to entering undergraduate students at Georgia Tech, merely illustrates one canonical path through the curriculum and becomes almost worthless as soon as the student diverges from the plan. This divergence may happen for many reasons, such as the student already having met some requirements, an unavoidable class conflict, illness or personal circumstances requiring a reduced course load, missing a semester, or course cancellation, for example.

Curriculum map technology is used in commercial products, which have the benefit that they provide a student or an advisor with scenarios for degree completion (though not necessarily all the other destinations considered above). It is essential to keep the map up to date so that the internal curriculum representation does not diverge from the published degree requirements.

An additional advantage to curriculum maps over degree plans is that administrators can interrogate the curriculum to look for opportunities to streamline. And, both network analysis and performance analysis are feasible. In network analysis, simple engineering flow models and graph theory can be applied to a curriculum to look for locations where efficiencies may be sought. For example, courses that have many prerequisites or that are required for many subsequent courses are obvious points where things can go wrong for a student. Failing such a course or failing to schedule it in time can have a disproportionate impact on success.

Performance analysis is laid over the network analysis and takes account of aggregate student performance to predict outcomes. Courses with high DFWI rates (percentages of grades that are reported as D, F, Withdrawn, or Incomplete) are obvious candidates for redesign or reconsideration. When combined with network analysis (the courses of interest often being those that are required by the most downstream courses), performance analysis may reveal patterns that suggest different ways to modularize the curriculum. Technology that performs these analyses has been developed by University of New Mexico; University of California, Davis; and others.

A simplified curriculum allows learners to provide one another with more reliable advice. They do this now, but sometimes the advice is based on scuttle and rumors, is misguided, or reflects a culture toward the attainment of narrowly defined, easily quantified goals (i.e., an overemphasis on grades, “getting out,” and starting salaries) that we do not want to go unchallenged by professional advisors who have a broader perspective.

Experiments in Georgia Tech’s School of Electrical and Computer Engineering in which student peers give advice to each other via the Q&A platform Piazza have been quite successful, but only because they are overseen by professional advisors who can intervene to correct misinformation. We expect prescriptive advising to be more self-driven, effective, and reliable in programs where the curriculum has been simplified for navigation.

The Georgia Tech Commission on Creating the Next in Education (CNE) recommends that prescriptive advising be handled in a more systematic way than is currently done. When curriculum is redesigned, administrators should make evidence-based decisions guided by the curriculum as a map of dependencies overlaid by historical performance data. Two technologies are needed here: “curriculum GPS navigation” aids for use by students on their own or with advisor help, and network and performance curricular analytics software for curriculum planners. There is also the opportunity to ramp up lightly moderated peer advising networks.

Looking further ahead, the Commission envisions that artificial intelligence (AI) agents could help navigate learners through the hundreds of curricular and cocurricular opportunities available at Georgia Tech so that they can select those that fit their interests. Moreover, the AI agent could go beyond advising and be actively involved in whole-person education in these types of activities.
Intrusive Advising

In contrast to the structural nature of prescriptive advising, intrusive advising is customized and given based on an individual performance profile. Because it is usually triggered by negative events (e.g., failure of a course, early warning signs of disengagement), it is a much more emotionally charged personal process and requires hands-on intervention by a trained professional. Whereas prescriptive advising could in principle be largely automated, the role of technology in intrusive advising is much more symbiotic. Specifically, its role is to gather data and trigger early alerts on which the professional can act.

Effective intrusive advising depends on, more than anything else, accurate and complete data about ongoing student performance. While it may be possible to provide coarse-grained intrusive advising after poor final grades in a course, it is more effective when fine-grained data are available that permit earlier interventions.

In some university programs, fine-grained data about ongoing assignments and class attendance are fed from a learning management system (LMS) into the advising alert system. In other programs, the LMS data at the course level are held by the instructor of record and only final grades, or midterm grades in the case of lower-division courses, are reported as a function of an administrative requirement, with little integration between LMS and advising platforms. We see this spectrum between coarse-grained and fine-grained information play out across Georgia Tech’s courses and programs.

The finest level of learner data is usually available—out of necessity—for online courses. Data on performance in massive open online courses (MOOCs) and in Georgia Tech’s online Master of Science in Computer Science (OMSCS) are available down to the key-click level or dwell times in self-paced learning examples. Research is needed to determine the optimal level of granularity of such data, but the availability of data that is too fine-grained at least gives us the benefit of discarding what we don’t need.

The coarse-grained data that are available in almost all residential courses are insufficient to automatically trigger many forms of effective intrusive advising. Instead, intrusive advising is usually triggered informally (e.g., through email contact to an advisor) and initiated through a professor who has reasons for concern. The degree to which faculty know their students; monitor student attendance; structure their syllabi with early, formative assessment in mind; and prioritize student welfare as a chief concern affects the likelihood that effective intrusive advising will be triggered informally. Faculty attitudes and organizational abilities aside, class size also affects intrusive interventions, which are harder to trigger in large classes where students’ identities and learning needs are more difficult to individuate.

Institutions with low retention figures (e.g., Georgia State University in the early 2000s) have benefited from student success initiatives that start with intrusive advising based on predictive analytics. It is important, however, to aim the technology use toward the problem that needs to be solved. At Georgia Tech, for example, the Institute could attack the major disparity between four-year and five-year graduation rates (47–85 percent) to see why students who could graduate in four years do not. It would be pointless to address first-year retention at Georgia Tech when that rate is already 98 percent.

More research is needed to ascertain whether commercial analytics solutions are suitable for interventions targeted at goals other than retention and what data need to be gathered. However, experience with retention-based analytics demonstrates that integration of nonacademic data (e.g., financial aid) with data about academic progress is critical, and there is every reason to believe that the need for this integration will extend to analytics aimed at attaining other goals.

Fine-grained analytics are not only feasible but probably also necessary for online students. Data for OMSCS shows that students take fewer courses simultaneously than residential students, as they tend to be in full-time employment, and they more frequently drop out for a single semester reprieve, as professional and personal issues are more likely to intrude. The experience of studying online while in full-time employment is precarious and fragile, and it is likely that for these students predictive analytics technology is likely to have the greatest benefit.

The Commission recommends that specific goals of intrusive advising be developed for Georgia Tech learners and implemented in a pilot program. Toward that goal, the learner data will need to be integrated into a common database to make the data subject to predictive analytics, which the system would use to generate early alerts. The Institute needs to create pilot efforts in online courses and programs where retention and progress through programs is more sporadic and precarious with the aim of expanding the pilot as needed.

All this emphasis on technology should not divert attention from the real challenge in intrusive advising, which is what happens after the student has been
identified. Frank person-to-person conversations that help students reflect and take action are challenging for both advisors and students. Many subtle cultural factors impede these conversations. At Georgia Tech, the “can do” spirit of our students, which helps so many of them to be self-starting agents, means that previously successful students retreat into denial or insist that next semester will be different. This mentality makes academic advising extremely challenging.

In addition, the professional statuses of academic advisors vary widely among academic units, and some advisors do not feel empowered to be the bearers of bad news or are overruled by well-intentioned faculty members who grant students petitions that only serve to dig them into deeper academic holes. Success in intrusive advising requires cultural and organizational transformation just as much as it requires technology innovation, and this requires greater integration and commonality of expectations and practices. Regarding these cultural and organizational interventions, the provost’s ongoing Task Force on Academic Advising is expected to complement the recommendations of the Commission.

**Developmental Advising**

Developmental advising helps learners understand and articulate what they are good at, and it helps them enjoy the educational experience and gives purpose to their lives. It leads to the selection of majors and other academic offerings and the choice of cocurricular and extracurricular activities that promote leadership development, and it helps learners prepare for or expand their careers, which include not only post-graduation employment but also graduate school opportunities, the formation of startup businesses, and other professional and self-employment opportunities.

Although many students arrive at college with ideas about what they will study and pursue as a career, many are confused by the choices before them. And many with supposed clear plans change them as they encounter other academic options. Thus, the selection of majors and counseling of students who are considering changing majors are important components of developmental advising. The need to facilitate such rethinking can vary widely among students and majors.

In vocational institutions (unlike Georgia Tech), majors are associated closely with careers, so the selection of a major is a critical career decision. In preprofessional programs like engineering or architecture, there is a strong correlation between students’ majors and their immediate post-graduation career or educational steps. At the opposite extreme is the liberal arts idea, in which the goal of higher education is to provide students with critical thinking and problem-solving skills through the pursuit of disciplinary majors without the expectation that the major necessarily dictates the student’s career path.

As parents and students become more concerned with return on investment (ROI), most institutions, which like Georgia Tech fall between the vocational and liberal arts extremes, are seeing a rise in the importance of developmental advising. In the absence of developmental advising programs and practices, students advise themselves or depend on peer-group and parental guidance for knowledge about the relationship between what they study and their broader goals, and such nonprofessional guidance can flow from misconceptions about what professional opportunities are available.

In contrast to prescriptive advising, which addresses how learners will meet well-defined (though not necessarily fixed) progress goals, developmental advising aims at personal development, including the formulation of these goals. It therefore blends forms of advising that are often the responsibility of faculty mentors, academic advisors, career advisors, and counselors. Some universities, recognizing that it is difficult, if not impossible, to separate career advising from other aspects of developmental advising, have made a radical step toward merging their career services and academic advising organizations. University of Nebraska, Lincoln, is one of the highest-profile examples of this trend.

At Georgia Tech, developmental advising falls into two almost discrete realms: academic advising and career advising, with some of the career advising provided centrally through the Center for Career Discovery and Development (C2D2) and specialized career advising provided within a number of schools and colleges. Organizational coordination is therefore essential. But more importantly, there needs to be greater coherence in the vision of what Georgia Tech tells students. Two Georgia Tech schools, Aeronautical Engineering and Materials Science and Engineering, make extensive use of tenure-track faculty as advisors, but the role of faculty as developmental advisors is muddied by students seeking prescriptive advice, something that faculty members are usually less well-equipped to provide.

The scope of career advising in college has been extended in recent years from a conventional model in which careers are chosen to one in which careers are designed or co-created. For example, Wake Forest
University elevated its career education efforts with the “Career Services Must Die” initiative. Stanford d.school offers one of Stanford’s most popular courses, “Designing Your Life,” in which developmental advising is turned into a self-defining exercise (Stanford University 2017). The exercise incorporates the design thinking processes pioneered by IDEO (IDEO n.d.). Many universities and companies have aligned around the goals of educating “T-shaped” professionals, which is the idea that a fulfilling education combines vertical progress through disciplinary and problem-focused subject matter with horizontal cross-cutting expertise in “soft” skills, interdisciplinary skills, and global and cross-cultural awareness.

Georgia Tech has developed a career education model under the auspices of C2D2 that teaches students “how work works” and advises students to follow “three P’s”: purpose, pivot potential, and professional practice. It is clear that faculty mentors and professional advisors have an important role to play in all of these developments and that the old model of delegating developmental advice to a career center located in the Division of Student Life fails to recognize the central academic role that developmental advising plays.

Indeed, automation can sometimes also enhance personalization. Consider, as an example, an undergraduate student interested in designing a curriculum for learning about the economics of climate change. The Institute may envision an automated system that can first provide access to all relevant courses, then provide snapshots of the various courses, and finally assist in interactively designing a preliminary curriculum that can be further refined through human counseling. Or consider, as another example, a remote student interested in determining whether an OMSCS course is relevant to her academic goals. An AI agent might help the student by walking her through the course. These are just two scenarios among potentially hundreds of use cases.

As Georgia Tech moves toward a new model for advising, the Institute will need to find new ways of supporting personalization at scale. Lifelong mentoring entails not only advising for traditional college students but also coaching for K-12 students and mentoring for our alumni. This raises the issue of how to scale advising in age-appropriate ways from a few thousand students to potentially hundreds of thousands of learners.

**Lifelong Advising**

The Commission recommends that advising move toward covering deeper questions of lifelong learning and whole-person development. Advising for whole-person development implies not only advising about course requirements and career placement but also for intrapersonal and interpersonal development.

In particular, Georgia Tech should investigate tighter integration between career education and major programs while avoiding the pitfall of portraying academic programs as narrowly focused on job opportunities. In addition, there should be greater involvement of tenure-track faculty in developmental advising (mentoring) with a clear delineation of responsibilities so that these do not involve most forms of prescriptive or intrusive advising.

In the longer term, an important element of the evolving architecture for supporting personal advising at scale could be the use of technology-assisted advising, such as AI, to partially automate the process. While some elements of advising are ineluctably personal and require in-person mentoring, other elements are more routine and can potentially be automated to achieve scalability without sacrificing personalization.
References:
