Behavior Analytic Concepts and Change in a Large Metropolitan Research University: The Graduation Success Initiative

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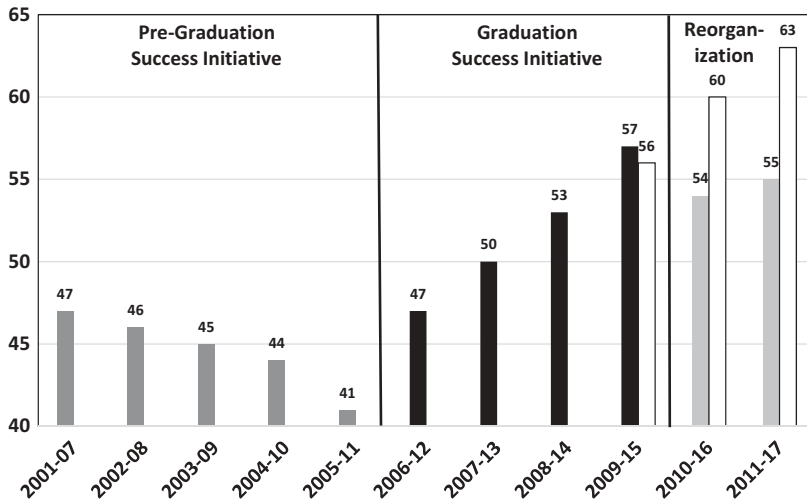
ABSTRACT

The Graduation Success Initiative is a complex, organization-wide application of behavior analytic concepts to improving undergraduate student retention and on-time graduation at a large metropolitan research university. The behavior analytic concepts discussed here include culture, supraorganismic phenomena, selecting environments, macrobehaviors, macrocontingencies, interlocking behavioral contingencies, metacontingencies, and rule-governed behavior. We introduce a change template that includes all pertinent agents in the university system and that focuses change efforts specifically on desired behaviors, targeted behaviors, strategic interventions, and reinforcing contingencies for each of the categories of agents. The Graduation Success Initiative produced a 16-point increase in on-time graduation in 4 years.

Undergraduate student success (as defined by variables such as retention and on-time graduation) has become a key indicator of college and university performance and is now typically an important part of performance-based funding and institutional rating systems. Supporting the academic and career success of undergraduates not only is the right thing to do but has also become critical to college and university base budgets, particularly for public institutions. The costs of students not completing their baccalaureate degree programs in 6 years, or not completing them at all, are high for individual students, their families, their colleges and universities, and regional and national economies. Selecting environments have made undergraduate student success a preeminent product of American colleges and universities.

In this article, we discuss from a behavior analytic perspective a national award–winning (http://undergrad.fiu.edu/gsi/gsi-news.html), university-wide set of systemic interventions called the *Graduation Success Initiative* (GSI; http://undergrad.fiu.edu/gsi/advisors.html). The GSI has transformed the administration of the undergraduate curriculum of a large metropolitan

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Figure 1. Six-year graduation rate (percentage who graduate on time) for cohorts of first-time-in-college students at FIU: (a) pre-GSI actual rates are dark gray, (b) GSI actual rates are black, (c) post-reorganization projected rates are light gray, and (d) target rates of FIU's *Beyond Possible* 2020 Strategic Plan (approved by the FIU Board of Trustees in March 2015) are white. FIU = Florida International University; GSI = Graduation Success Initiative.

research university and reoriented the university toward undergraduate student success. The GSI's systemic interventions are complex and extensive and produced at Florida International University (FIU) a 16-point increase in on-time graduation in 4 years, a significant turnaround from the institution's historical low to its historical high (see Figure 1).

Our purpose in discussing this case study is twofold: (a) to demonstrate the practical utility of behavior analytic concepts in guiding effective organizational change management, and (b) to describe specific ways to improve undergraduate student success in colleges and universities. Our intended audience includes practitioners, researchers, and theoreticians in the fields of behavior analysis, organizational change management, and higher education. We begin by setting the context and providing the key theoretical perspectives and definitions before diving into the details of the case study, FIU's GSI.

Contexts

The contexts that relate to our topic are myriad, and the perspective of the observer is critical. For example, if we look to improve student success at FIU from the point of view of the Florida State University System's Board of Governors (BOG), we see ourselves as policymakers who are establishing rules and contingencies to shape the behavior of university presidents with the idea that the presidential behavior shaping will trickle down through bureaucratic layers and affect students, economies, and constituents in positive ways.

However, if we are university presidents, the BOG is viewed as a part (albeit a significant part) of our selecting environment. To keep things manageable in our presentation, we adopt the single point of view of analysts and discuss three contexts at three different scales: organizational, state, and national.

Organizational context

FIU

The organization discussed here is large, and it exhibits high degrees of *environmental, component*, and *hierarchical* complexity (Glenn & Malott, 2004). FIU is a public metropolitan research university located in Miami, Florida, with both the *highest research activity* and *engaged* Carnegie designations. FIU's fall enrollment for 2015 was 54,093, of which 45,240 were undergraduates, and it is the fourth largest public university in the United States. Less than 10% of FIU's undergraduates live in campus housing. Moreover, 60% of FIU's newly admitted students are transfer students; 40% are first-time-in-college students (FTICs). Its primary feeder institutions are also large and complex: The Miami Dade County Public School District is the fourth largest in the nation, and Miami Dade College is the largest community college in the country. These three institutions constitute a huge informal urban public education system (Robertson, 1992). FIU is a Hispanic Serving Institution (HSI), and 88% of its students are underrepresented student populations (63% Hispanic). A total of 57% of FIU undergraduates receive a Pell grant, an indicator of student financial need and institutional commitment to access. FIU is first in the nation in awarding bachelor's and master's degrees to Hispanic students. FIU is rated 17th in the nation by *Washington Monthly*, which rates schools based on their contribution to the public good in three broad categories: social mobility (recruiting and graduating low-income students), research (producing significant scholarship and doctorates), and service (encouraging students to give something back to their country). FIU ranks above major national universities such as Princeton, Yale, Cornell, Columbia, Pennsylvania, Johns Hopkins, Ohio State, Texas, Duke, and many other familiar names. FIU produces $133 million a year in sponsored research and awards 159 research doctorates. The goals in FIU's new 5-year strategic plan include both undergraduate student success and research productivity. However, of the 20 strategic goals, 13 focus on undergraduate student success (see Table 1). Notwithstanding this major commitment to access and success, the faculty reward system strongly favors sponsored research and publication in refereed, high-impact journals consistent with other research universities.

Leadership change

In July 2014, the FIU president began a second 5-year term and selected a new provost. In April 2015, under the provost's leadership, the new

Table 1. The 20 Critical Performance Indicator Goals From FIU's *Beyond Possible* 2020 Strategic Plan (http://stratplan.fiu.edu).

2014	Performance indicator	2020
79%	FTIC 2-year retention with GPA above 2.0[a]	90%
53%	FTIC 6-year graduation rate[a]	70%
64%	AA transfer 4-year graduation rate	70%
68%	Percentage of bachelor's degrees without excess hours[a]	80%
77%	Graduates employed full time or in continuing education[a]	80%
46%	Bachelor's degrees in strategic areas[a]	50%
52%	Graduate degrees in strategic areas[a]	60%
$26,000	Average cost per bachelor's degree[a]	$20,000
$36,200	Median wage of bachelor's graduates[a]	$40,000
6,219	Bachelor's degrees awarded to minorities[a]	7,200
1,982	Number of first-generation graduates	2,300
4,737	Number of students participating in internships	6,000
159	Research doctoral degrees per year	200
83	Research staff/postdoctoral Fellows	129
2	Number of patents per year	20
2:8	Number of startups—AUTM:SBDC definitions	5:20
$176 million/ $53 million	Private gifts (total endowment)/private gifts (annual gifts)	$300 million/ $70 million
$197 million/ $20 million	Auxiliary revenue per year/auxiliary operating income	$240 million/ $25 million
$133 million/ $107 million	Research expenditures/S&E expenditures	$200 million/ $165 million
54,000/67:8:25	Total FIU students enrolled/mode of delivery (face to face: hybrid:online)	65,000/30:30:40

Note. FIU = Florida International University; FTIC = first-time-in-college students; GPA = grade point average; AA = associate's degree; BOG = Board of Governors; AUTM = Association of University Technology Managers; SBDC = Small Business Development Center; S&E = Science and Engineering.

[a]These nine performance indicators serve as part of the Florida BOG's 10 metrics that are used to determine performance-based funding allocations for FIU. The 10th BOG metric—university access rate (percentage of undergraduates with a Pell grant)—is not part of FIU's 2020 goals because access is such a central and well-developed part of the university's mission and operation that FIU consistently exceeds the BOG's highest benchmark (30%) by 20 percentage points (e.g., FIU reached 51% in the most recent funding cycle).

administration began significant reorganizations of the university. These rolling reorganizations are changing the organizational context of our discussion considerably, and it is impossible to know their effect as we write this article, although data-based projections are possible (see Figure 1).

State context

Florida state university system

Public postsecondary education in Florida is divided into two sectors: (a) community colleges (which now have some 4-year degrees and are called *colleges*) and (b) universities. The Florida College System includes 28 locally governed public colleges that are coordinated by the Florida Department of Education. Florida's 12 public universities are presided over by the Florida BOG, which plays a significant role in appointing individual university

presidents and trustees and establishes State University System policy with the support of a State University System chancellor and staff. Florida's 12 public universities comprise two flagship universities, three large metropolitan research universities (FIU is one of them), four regional universities, one Historically Black College or University, and two specialized universities (a state system honors college and a new polytechnic university).

Beginning two funding cycles ago for fiscal year 2014–2015, the BOG implemented a performance-based funding system that ranks Florida's public universities annually and allocates funding according to performance rank. The system (almost like a token economy system) is complex and evolving. However, in broad strokes, it involves 10 metrics, nine of which focus on undergraduate education (see Table 1). These metrics align with the performance indicators of the BOG's own 2025 Strategic Plan (http://www.flbog.edu).

Originally universities received 0–5 points for each of the 10 metrics, either for *Excellence* (meeting or exceeding set performance benchmarks) or for *Improvement* (meeting or exceeding the university's performance the previous year; see http://www.flbog.edu/about/budget/docs/performance_funding/PBF-Model-Benchmarks-2015–16.pdf). Now universities receive 0–10 points for each of the 10 metrics. Universities are allowed to choose the higher number between Excellence and Improvement, and in this fashion each university arrives at a total performance score initially somewhere between 0 and 50 and now between 0 and 100. For each funding cycle, a certain percentage of all universities' base budgets is taken and added to any new state money to create a reallocation pool based on performance ranking. If a university scores half or less of the total possible points, it loses the funds that were taken from its base budget and does not get that money back. The three lowest scoring universities, regardless of whether their scores are higher than half of the possible points, do not receive additional state funding and must submit and implement an improvement plan in order to get back the money taken for the reallocation pool. The ranking system is intentionally designed to function such that there will always be three institutions that do not get additional funding no matter how good their performance is nor how much it has improved. Roughly simultaneous with the advent of the BOG performance-based funding system came its moratorium on approving tuition increases. So this performance-based funding system with its 10 metrics, nine of which focus on undergraduate education, is the primary source of new funding for Florida's public universities.

Legislature and governor

The legislature and governor in Florida are solidly Republican and largely conservative in terms of political philosophy. Although they are certainly not a monolithic group, their shared belief appears to be that public higher

education should primarily focus on high-quality workforce development and economic development. Performance-based funding for Florida's public universities, with its emphasis on timely graduation and postgraduation employment, has the staunch support of both the legislature and governor, who control the final allocation of university funding.

National context

We should note that the emphasis on retention and timely graduation that is evident in Florida is widespread nationally among public and private funding programs for higher education. Funding opportunities are often closely tied to a data-based demonstration of improvement on these and related metrics. These environments are the ones in which FIU competes for additional funding that is critical not only to its development but more fundamentally to its survival.

Key theoretical perspectives and definitions

The work of behavior analysis has overwhelmingly been at the level of the organism. However, the behavior analytic perspective has obvious utility at larger scales, such as those of organizations and cultures, and this usefulness has supported the emergence and development of the field of organizational behavior management. Sigrid Glenn has been working individually and collaboratively for 30 years on developing a language and conceptual structure with which to analyze and discuss group units such as organizations and cultures and essentially extending the work of behavior analysis to a larger systems perspective so as to connect individuals and groups in dynamic relationship within a behavior analytic framework (Glenn, 1986, 1988, 1989, 1991, 2003, 2004, 2010; Glenn & Malagodi, 1991; Glenn & Malott, 2004; Malott & Glenn, 2006).

Some constructive published conversations with Glenn's point of view have emerged (e.g., Glenn, 2010; Houmanfar & Rodrigues, 2006; Houmanfar, Rodrigues, & Ward, 2010), and some useful commentary exists regarding the work yet to be done (e.g., Mattaini, 2004). However, Glenn's work in developing fundamental concepts still prevails and promises usefulness, and we utilize it here to define core concepts used in this analysis.

In addition to presenting selected concepts from Glenn's work (*culture, supraorganismic phenomena, macrobehavior, macrocontingencies, metacontingencies*, and *approaches to change*), we also address the key concepts of *rules* and *rule-governed behavior* (Houmanfar, Rodrigues, & Smith, 2009; Malott, 1992; Pelaez, 2013; Pelaez & Moreno, 1998). We have long worked within a complex dynamical systems perspective in our analysis of human experience (Robertson, 1983, 1984a), organizational development

(Robertson, 1984b), adult development (Robertson, 1988), urban postsecondary education (Robertson, 1991, 1992), college teaching (Robertson, 1996, 1999, 2000, 2001, 2002), behavior analysis of development (Novak & Pelaez, 2004), and rules and rule-governed behavior (Pelaez, 2013; Pelaez & Moreno, 1998), and complex dynamical systems is the overarching perspective that influences our discussion.

Culture and supraorganismic phenomena

This case study includes the intentional change of an organizational culture, and it is useful to begin our discussion with a definition of culture. Glenn (2004) defined *culture* as "patterns of learned behavior transmitted socially, as well as the products of that behavior (objects, technologies, organizations, etc.)" (p. 139). The concept of culture can be applied at various scales, including that of an organization.

When we are interested in organizational culture, we focus on patterns of behavior that are related to but not dependent on the learning history of the individual and that exist supraorganismically. Glenn (2004) explained it as follows:

> Culture begins with the transmission of behavioral content, learned by one organism during its lifetime, to the repertoires of other organisms. Thus, the locus of cultural phenomena is supraorganismic. Unlike learning, which is localized in repeated temporal relations between the actions of a single organism and other empirical events, the locus of cultural things is supraorganismic because it involves repetitions of the interrelated behavior of two or more organisms; one organism's behavior functions as the situation or consequences in the operant contingencies accounting for the behavior of the other. Such transmission requires no new biological trait or behavioral process, but it does initiate a new kind of lineage: a culturo-behavioral lineage. (p. 139)

Although cultural phenomena exist supraorganismically, we must remember that they are interrelated with and dependent on the learning of individuals. Intentional change in an organization such as a university must involve both the cultural and the individual (or behavioral) levels of analysis and intervention. Glenn (1988) expressed this interrelationship nicely:

> Because many individuals in a culture participate in the same cultural practices, it would be tempting to consider their behavior as functionally interchangeable. While that may be so at the cultural level, at the behavioral level it is not. Each individual's behavior must emerge as a function of specific historical, behavioral contingencies. Whatever a change in cultural practices involves at the cultural level of analysis, it also must involve changes in contingencies of reinforcement for the individuals participating in the practice. Sociocultural systems arise from the interrelationships among the contingencies of reinforcement of which individuals' operants are a function.... Obviously the social contingencies are replicated across individuals and generations or there would be no cultural continuity. (p. 167)

Cultural continuity in our university system, therefore, like in other organizational systems, has occurred for many decades. The continuity of our cultural practices becomes evident when one examines the persistent behavior patterns of faculty, students, and administrators, even in the face of major state-level funding changes. We continue here by addressing foundational concepts that we have used in our approach to strategic interventions.

Macrobehaviors

Put simply, a *cultural practice* is a particular behavioral pattern that many people exhibit. In an organization such as a university, an example would be the majority of students in cohort after cohort for decades taking more than 6 years to finish a baccalaureate degree program or not finishing at all. Glenn (2004) referred to cultural practices as *macrobehavior*:

> Much of the behavioral content of individual human repertoires is similar to the content of many other humans. The term *cultural practices* refers to similar patterns of behavioral content, usually resulting from similarities in environments.... The need for a term subsuming a supraorganismic class of behaviors is recognized, [and] we will use the term *macrobehavior* here. (p. 140)

We use the term *macrobehavior* to refer to behavioral patterns that are shared by large proportions of the individuals who occupy the various roles in FIU's organizational systems (e.g., faculty, students, and administrators).

Macrocontingencies

The cumulative effect of macrobehaviors Glenn (2004) called *macrocontingencies*, which she defined as follows:

> ... the relation between a cultural practice and the aggregate sum of consequences of the macrobehavior constituting the practice. ... The recurring behavior of each person has its own effects, and the relation between the behavior and that effect can alter the probability of the recurrence of that individual's behavior.... In addition to those individuated consequences, the combined behavior of all the people (the macrobehavior) has a cumulative effect. This effect cannot function as a behavioral consequence because it is not contingent on the behavior of any individual.... It is contingent on the macrobehavior of the cultural practice. An important feature of macrocontingencies is that their cumulative effects are additive. (pp. 142–143)

So using our example of prolonged undergraduate study at FIU, the macrobehaviors of dropping out or not graduating on time produce the macrocontingency of significant numbers of young adults in South Florida experiencing the double jeopardy of high student loan debt and underemployment.

The extent to which untimely progress to degree had become a cultural practice or macrobehavior at FIU is illustrated by the reaction to a joke the student body president made when speaking at a commencement 5 years ago before the GSI began. A student website had been started that invited completing the stem "You know that you are an FIU student if . . ." (à la comedian Jeff Foxworthy's joke stem "You know that you are a redneck if . . ."). The student body president had selected several entries from the website for her speech, but the one that got the entire arena to laugh the loudest was "You know that you are an FIU student if you are starting your eighth year and still haven't graduated."

Metacontingencies

When making intentional changes in an organization to improve its function, we need to identify the key recurring behavioral patterns at the cultural level that need to be changed. Glenn (2004) called these recurring behavioral elements *metacontingencies*, and they need to be distinguished from mere cumulative consequences such as *macrocontingencies*.

> A clear distinction between the concepts of metacontingencies and macrocontingencies is needed.... The concept of metacontingencies addresses evolution by selection when the lineages that evolve are not the recurring acts of individuals . . ., but rather are recurring interlocking behavioral contingencies (IBCs) that function as an integrated unit and result in an outcome that affects the probability of future recurrences of the IBCs.... The recurring IBCs comprise operant contingencies in which the behavior of two or more people functions as environmental events for the behavior of the others. The outcomes produced by recurrences of the IBCs are not the cumulative effect of the participants behaving individually, but rather the effect of their interrelated behavior.... Metacontingencies, then, are the contingencies of cultural selection. They give rise to the organized collections of behavioral contingencies that constitute increasingly complex cultural-level entities.... Cultural complexity is the outcome of cultural selection that results in nested hierarchies of IBCs. (pp. 144–145)

So if department chairs and their faculty interact in such a way that they are not aware of the courses that their students need in order to progress, frequently the courses are not offered. Those consequences of those interrelated behaviors on the part of the department chair and faculty become part of the environment in which the student attempts to progress in a timely fashion. The interrelated behavioral patterns and contingencies (interlocking behavioral contingencies) recur and so become a metacontingency. Because they recur broadly in the university in many departments, they become a metacontingency at a higher organizational scale. If college deans are not focusing on undergraduate student success metrics, then the departmental metacontingency of not offering courses that allow students to progress in a

timely fashion is reinforced, and we have a metacontingency at the college level. If the provost behaves similarly, then we have a university-level meta-contingency. These interrelated metacontingencies illustrate the phenom-enon of the nested hierarchies of recurring interlocking behavioral contingencies that undergo cultural selection. Because of the significance of the BOG's performance-based funding system in FIU's selecting environ-ment, these metacontingencies do not serve the organization's continued development and the survival of all of its parts. Even with poor performance in the funding model, the university would surely persist, but with the ensuing budget cuts not all of its parts would survive.

Approaches to intentional change

The approach to university transformation reported in this article utilizes both changing *macrobehaviors* through changing reinforcement systems at the level of individual learning and changing *metacontingencies* particularly through the manipulation of rules (Glenn & Malott, 2004; Houmanfar et al., 2009; Malott, 1999, 2001, 2003; Malott & Glenn, 2006; Malott & Salas Martinez, 2006; Malott, 1992; Pelaez, 2013). Regarding changing *macrobeha-viors*, again Glenn (2004) put it well:

> Because the macrobehavior of cultural practices is a function of operant contin-gencies that operate independently, but concurrently and similarly, on the behavior of many people, behavior analysts have rightly called for analysis of the contin-gencies that maintain the behavior that constitutes the practice. ... When inter-ventions are designed to alter the cumulative effect of a cultural practice, they must necessarily identify the operant contingencies that account for the behavior of individuals who participate in the practice. The more individuals whose behavior changes, the greater is the impact on the cumulative effect. This method of cultural intervention entails modifying the operant contingencies that are likely to maintain the behavior of large numbers of people. (p. 148)

Regarding the "engineering" of *metacontingencies*, Glenn (2004) had this to say:

> Because much of the operant behavior of modern humans is embedded in orga-nizations that have recurring IBCs [interlocking behavior contingencies], survival of those organizations is, at the very least, important to those humans. The fact that the organizations exist at all, however, suggests that the IBCs were selected by their external environment and, therefore, are an important part of the larger culture, whether or not alternative organizational structures are considered more desirable. Engineering, then, can also occur with respect to the IBCs in metacon-tingencies. (p. 148)

Changing the interlocking behavioral contingencies of metacontingencies can come from two types of interventions: (a) in the environment utilizing selection processes, and (b) directly in the metacontingencies themselves. First, the selecting environment can be changed so that it favors different

metacontingencies. In Florida, that is exactly what the BOG has done through its new performance-based funding system that favors undergraduate student success. One can also apply this environmental manipulation at intraorganizational scales, where the selecting environments within the university favor metacontingencies that promote undergraduate student success, such as when student success metrics are included in the evaluation of the president, provost, deans, and chairs.

It is useful to think of metacontingencies in terms of three interrelated phenomena: (a) interlocking behavioral contingencies, (b) an aggregate product, and (c) a receiving system (Glenn & Malott, 2004, p. 100). For FIU metacontingencies that pertain to undergraduate student success, a receiving system would be the Florida BOG, and the desired aggregate product (as defined by the performance-based funding metrics) would be minority students who persist and graduate on time in majors of strategic workforce emphasis without excess hours and who are employed at a high salary or are pursuing further education within 1 year of graduation. The receiving system functions as a selecting environment for the interlocking behavioral contingencies that produce or do not produce the desired aggregate product:

> Analogous to operant reinforcement in individual behavior, the external environments of organizations deliver selecting consequences. Customers "buy" (or don't buy) the organization's products, shareholders buy or sell their stocks, granting agencies award grants or don't, government regulators award passes or levy penalties, and so forth. Most of these consequences are contingently related, however imperfectly, to the products off the interlocking behavioral contingencies. (p. 100)

The second type of intervention is also used by the GSI and involves intentionally changing the interlocking behavioral contingencies of metacontingencies so as to better adapt the university to its selecting environment (e.g., BOG performance-based funding) delivering the desired aggregate product (e.g., employed graduates). This approach is more proactive and gets quicker results. Glenn (2004) described this second approach as follows:

> This tactic entails altering the components of the IBCs [interlocking behavior contingencies] so that they are better adapted to the current selecting environment. Planned variations of the recurring IBCs can be designed to produce outcomes more suitable to the demands of the external environment. Engineering change to enhance the survival of organizations (recurring arrangements of IBCs) requires analyses of current metacontingencies and also analyses of the specific behavioral contingencies that affect the outcome of IBCs. It should be obvious that all of the IBCs and the operant contingencies in complex organizations cannot be analyzed. There must be some way to distinguish between those that can be ignored and those that must be addressed. (p. 148)

As we will see, one of the contributions of the GSI is that it illustrates the use of big data analysis to identify the critical metacontingencies that must be addressed.

The higher education literature includes a number of major works that address the issue of best practices regarding what institutions can do to promote student success (e.g., Astin, 1977, 1985, 1993; Chickering & Reisser, 1993; Kuh, Kinzie, Schuh, & Whitt, 2010; Pascarella & Terenzini, 2005; Tinto, 1994, 2012). However, the clear direction among institutions that have become leaders in these efforts to improve student success is to focus on developing sophisticated algorithms either by their own internal research groups or by vendors, or by both, that analyze extremely large internal data sets with many, many variables to produce actionable results for their decision makers regarding their students. For example, when vendors come into institutions now, they first create a digital footprint, which means that they catalog *every* available data point that is routinely collected digitally, ranging from predictable data points such as performance data entered into course learning management systems to more exotic data points such as swipes in the food court on students' payment cards. The point here is that these ongoing analyses of extremely large data sets are very useful in identifying metacontingencies that are critical to making strategic interventions that lead to the desired change and that they come from an institution's analysis of itself, not from the general literature.

Rules and rule-governed behavior

Manipulating *rules* and thereby shaping *rule-governed behavior* (Houmanfar et al., 2009; R. W. Malott, 1992; Pelaez, 2013; Pelaez & Moreno, 1998) are useful tools for intentionally changing *macrobehaviors* and *metacontingencies*. Skinner drew a distinction between *contingency-shaped behavior*, which is maintained by direct consequences and prompted by discriminative stimuli, and *rule-governed behavior*, which is controlled by verbal behavior and only indirectly controlled by consequences (Skinner, 1953, 1957, 1966, 1969). Skinner (1969) construed *rules* as verbal stimuli that specify behavior and its consequences, either directly or indirectly.

Pelaez's (2013) recent analysis of rules and rule-governed behavior pertains importantly to the GSI interventions. Her analysis of rule following includes the interrelation between the form and function of the rule. For example, each contingency set verbally described in a rule or instruction given to a student involves a mutually dependent relationship between the verbal rules (stimuli) and the individual's selected responses. Pelaez's taxonomy of rules includes at least five dimensions (or continua) that affect their function and effectiveness: (a) *explicit versus implicit*: "Rules can be distinguished based upon the completeness or specificity of the contingencies expressed" (p. 262), (b) *accurate versus inaccurate*: "An *accurate* rule specifies contingencies that, when followed, match certain event-consequence relationships in the environment—they are congruent (that is, they have

correspondence with the environmental contingencies experienced by the subject)" (p. 263), (c) *lower versus higher rule complexity*: "The contingencies specified in a rule include at least one relation between the behavior, its antecedent stimuli, and its consequences … *[R]ule complexity* refers to the number of dimensions of the antecedent stimuli and their relations" (p. 263), (d) *rules provided by others versus self-provided rules*: "In cases of *rules provided by others*, the speaker (rather than the listener) specifies, implicitly or explicitly, the criterion for the listener's behavior. In the case of *self-provided (self-given) rules*, the speaker and the listener are the same individual" (p. 264), and (e) *immediate versus delayed contingencies*: "A rule could specify or imply *immediate* or a *delayed consequence* for following or not following such rule" (pp. 265–266).

In transforming FIU's administration of the undergraduate curriculum to reorient the university toward student success, new rules (or in university parlance, "policy") were developed in order to change individual behavior and organizational metacontingencies to promote student retention, on-time graduation, and vocational launch. The rules were provided by others (e.g., for students by the university, for advisors by their supervisors, and for academic administrators by their supervisors) with the aspiration that they would generate self-provided rules that would be congruent with student success and the goals of the organizational interventions. The strategic new rules were as explicit, accurate, and as simple as possible with as immediate consequences as possible.

The Graduation Success Initiative

The purpose of the GSI is to improve undergraduate student success as defined by specific metrics. When the GSI began in 2011, the emphasis was on improving the 6-year graduation rate of cohorts of FTICs (see Figure 1). With the advent of the Florida State University System's performance-based funding in 2014, the metrics defining undergraduate student success expanded to include nine of the 10 Florida BOG's metrics that focus on undergraduate education. Furthermore, with the university's approval of its new *Beyond Possible* 2020 Strategic Plan in 2015, the list of metrics that define undergraduate student success has expanded to 14: the 13 of 20 strategic plan metrics that relate to undergraduate education plus the BOG's access metric that expresses the percentage of undergraduates receiving Pell grants (see Table 1). These metrics define the *products* that an important element in the university's *selecting environment* (the Florida State University System's BOG) overtly wants from the university.

Immediate results and system building

The GSI has two interrelated goal domains that require simultaneous, not sequential, attention:

- *Immediate results*: Developing data-based practices for rapid improvement in retention and on-time graduation.
- *Sustained, long-term results*: Building a comprehensive, university-wide system that sustains significantly higher levels of retention, on-time graduation, and integration of academics and career development and thereby changes the university culture to one in which on-time graduation and career readiness are the expected norm.

Immediate results

FIU needs to make immediate improvements in its student success metrics (*products*) because of the urgency in the university's *selecting environment* related to the BOG's performance-based funding as well as to selection criteria of other public and private funding sources with similar emphases on timely graduation and workforce development. Critical to making this rapid progress (*product improvement*) is work of the Division of Undergraduate Education's Office of Retention and Graduation Success (ORGS). With the advent of the GSI in 2011, ORGS was created and grown to include four doctorally prepared and one master's-prepared behavioral scientists whose major purpose is to conduct research on FIU's students related to their academic success and to make data-based practice recommendations to appropriate FIU faculty and staff. At universities, offices of institutional research are typically consumed by generating reports that are simple tabulations rather than sophisticated statistical analyses and predictive modeling. The presence of FIU's research group in ORGS is a rare occurrence broadly in American higher education but certainly not uncommon among the colleges and universities that are making significant progress in improving student success. Often this work is outsourced to vendors who call it *predictive analytics* or *data science*. However, the work is simply applied behavioral science all the same, and FIU is fortunate to have this function in house. This granular analysis of FIU's students, not analysis taken from the published research literature that may or may not apply to FIU's students, has proven invaluable in moving the needle quickly on key student success metrics.

For example, prior to each fall, the ORGS research team conducts a simple analysis and identifies all undergraduate students who are well positioned to graduate by the end of that academic year (have a grade point average (GPA) of 2.0 or higher and have at least 100 semester credits). Every undergraduate student at the university has an academic

advisor, and these advisors are expected to work their caseloads *proactively* (reaching out to students), not *reactively* (waiting for the students to appear on their doorstep). The ORGS researchers give each advisor the list of his or her well-positioned students so that the advisors can contact these students in order to have a graduation planning session. The supervisors of the advisors and the deans in each college are notified of this process. In addition, the ORGS researchers analyze the remaining courses needed among these well-positioned students and get that information to the pertinent chairs and deans. In an August 2013 survey that sampled from more than 8,700 undergraduate students who were well positioned to graduate, the greatest perceived barrier was overwhelmingly course availability (simply having the required courses offered and with sufficient seats)—63% compared to 31% for financial issues. The Division of Undergraduate Education created GSI Course Availability Grants for departments that lacked resources to fund additional sections and Degree Completion Grants for students who needed just a bit more money (up to $1,200) in order to finish on time. These interventions exemplify changing conditions in order to change *macrobehavior* rapidly within this cadre of undergraduates who were well positioned to graduate.

System building for ongoing improvement

The GSI's evolving set of university-wide interventions to create new rules and new systems and subsystems of *interlocking behavioral contingencies* and *metacontingencies* that generate the desired student success *products* is complex. However, the GSI's fundamental conceptual framework is simple and focuses on the student: (a) help students to discern an appropriate goal (major and career) early, preferably at admission; (b) provide a clear path to that goal; (c) give immediate feedback whether on or off the path; and (d) remove barriers and add supports on the path. The GSI framework is replicable at any institution regardless of size, type, or resource availability. This framework generates specific problems to be solved, such as the following:

- How do you get students to discern an appropriate major (one that fits their preparation, ability, preferences, vocational interests, and goals) when they apply for admission or soon thereafter?
- How do you create a clear semester-by-semester map for all majors of what courses to take in order to get from admission to graduation in 4 years, or at least in 6 years?
- How do you track the progress of more than 45,000 undergraduates, give them immediate feedback on whether they are on track, and guide them in what to do if they are off track?

- How do you identify the common barriers keeping students from progressing as well as the most frequent and consequential supports that are needed by students to persist and advance along their paths?

Building a system that solves problems such as these requires significant change in many *metacontingencies* that involve many agents in the university system and subsystems. An accurate figure that shows the many systemic agents that have been involved with the GSI transformation has been developed and utilized. However, the figure is too complex to be presented here. Table 2 simplifies this list of agents considerably and presents the change template that has been used in the GSI.

In its 4-year history, the GSI has had essentially two phases: (a) Phase I, focusing on *advising* and Points 1–3 in the conceptual framework (identifying an appropriate behavioral goal, providing a clear path to that goal, and giving contingent feedback whether on or off the path); and (b) Phase II, focusing on *teaching* and Point 4 in the conceptual framework (adding supports and removing barriers on the path).

Participation in this work has been extensive throughout the university and has involved integrating efforts both *vertically* (e.g., among faculty and staff with direct service responsibilities for undergraduates and all levels of administrators up to the trustees) and *horizontally* (e.g., academic advising, teaching faculty, predictive analytics, technology, enrollment services, academic departments and colleges). This vertically and horizontally integrated conceptual framework that includes every systemic agent involved with undergraduate student success has produced a simple organizing template that guides the overall institutional change process (see Table 2). It provides a framework for identifying and targeting critical *macrobehaviors* and *metacontingencies.*

The change discipline captured in the template begins by identifying the behaviors that are desired on an agent's part in order to promote student success as defined by the designated metrics that have been discussed previously ("Desired Behavior" in Table 2). Then, the current behavior of the agent is analyzed against the desired behavior ("Targeted Behavior"

Table 2. Simplified University-Wide Change Template.

ELEMENTS	DESIRED BEHAVIOR	TARGETED BEHAVIOR	STRATEGIC INTERVENTIONS	REINFORCING CONTINGENCIES
STUDENTS				
ADVISORS				
ENROLLMENT SERVICES				
FACULTY				
ACADEMIC DEANS				
PROVOST				
PRESIDENT				
TRUSTEES				

in Table 2). These agents may be categories of actors (such as students, advisors, admissions counselors, faculty, chairs, and deans) rather than individuals (such as the president or provost). In the case of categories of actors, the objective is to identify current behavior that is typical of the category (frequently exhibited by individual members of the category) and is problematic with regard to promoting student success as defined by the metrics (i.e., interferes with generating the *product* desired by the *selecting environments*). Next, a "Strategic Intervention" (see Table 2) is developed and implemented that works to change the behavior of the agents from the targeted problematic behavior to the desired behavior. Finally, contingencies are secured in the system that reinforce the desired behavior ("Reinforcing Contingencies" in Table 2). In system building, the focus is on changing metacontingencies, and one useful tool is the strategic manipulation of *rules*. In illustrating the use of this change template, we concentrate on the transformation of the university admission and advising systems (or the GSI's Phase I) because these interventions are the oldest and most mature and therefore are those for which we have the most data.

Transforming the admission system

Desired and targeted behavior

Let us start with students. The GSI conceptual framework begins by clearly stating that the *desired behavior* of students is that they identify their appropriate major at admission to the university or as soon as possible thereafter. An appropriate major is defined as one that fits the student's abilities, preparation, goals, interests, and vocational choices. The FIU data strongly indicate the value of finding an appropriate academic home early. For example, in 2009, prior to the GSI, of the students who were admitted to a major, 77% graduated on time. However, more than 5,900 students (21% of active undergraduates) had earned more than 72 credits (of 120) but were not admitted to a major. A policy (*rule*) existed that students were supposed to be admitted to their major at 60 credits, but the rule was not enforced, largely because the rule observance was devoid of contingencies for anyone at that time—students, faculty, or staff. Notwithstanding the 77% on-time graduation rate of students in majors, overall graduation rates for the university were percentages in the dismal mid-40s and falling. The consequence of academic homelessness appeared to be vulnerability to dropping out: In 2009, among students who dropped out, 75% had never formally declared a major. If students did persist even without a major, usually they were doomed to prolonged study beyond the limits of their financial aid. This situation provides a good example of the ineffectiveness of rules for which

the contingencies are not immediate. So with the GSI the *targeted behavior* for students was delayed selection of their appropriate major.

Strategic interventions

An explicit *rule* has been instituted that every student must declare a major at admission. The challenge is to try to make sure that the major is appropriate and not frivolous or fanciful. A *strategic intervention* involved standing the academic progression paradigm on its head. Prior to the GSI, the sequence had been for students to become admitted, then begin receiving academic advising, and later begin career development. With the GSI, academic advising and career development have been integrated and have become a part of the admission process right from the beginning. When students apply for admission to FIU, as part of the admission process they take a 10-min online vocational interest assessment. The assessment instrument is a respected and validated career development tool first introduced in 1938 by Dr. Frederick Kuder (http://www.kuder.com). The Kuder tool has been branded MyMajorMatch for FIU in line with the naming of its suite of GSI tools: MyFIU, MyMajor, MyMajorMatch, My_eAdvisor, and Panther Degree Audit (http://undergrad.fiu.edu/gsi/advisors.html, http://undergrad.fiu.edu/gsi/advisors-tutorials-training.html). MyMajorMatch provides the applicant with an assessment of his or her vocational interests expressed in terms of the job taxonomy system used by the national Occupational Information Network (O*NET; http://www.onetcenter.org/) under the sponsorship of the U.S. Department of Labor's Employment and Training Administration. The MyMajorMatch taxonomy has 16 job *clusters* that are then divided into 77 job *pathways*. All of FIU's undergraduate majors are mapped onto the 16 clusters and the 77 pathways. From June 2011 through June 2012, applicants received notice of their top five clusters of interest based on their inventory results. After June 2012, applicants were informed of their top five pathways, a much finer grained analysis than clusters.

Essentially, MyMajorMatch is an online learning system that teaches applicants what their top vocational interests are, what their FIU major would be if they wanted to pursue a particular vocation, and what the names of the majors mean defined in terms of what they would actually take. College applicants, particularly first-generation students, frequently do not understand what the names of various majors mean except in the most general terms. A tool was created called *MyMajor*, an easily searchable website describing all of FIU's majors in terms of the following information: (a) a nontechnical, student-friendly program description; (b) admission requirements; (c) career opportunities (for Florida, any specific state, or the United States as a whole); (d) contact information; and (e) semester-by-semester Major Maps (for FTICs and transfer students). These semester-by-semester maps define the major in curricular detail, specifying exactly

which courses the student should be taking each semester in order to graduate in 4 years for FTICs and in 2 years for transfer students. The site has a "compare" button that allows students to make side-by-side comparisons of up to three majors. MyMajorMatch links seamlessly to MyMajor. Students take the inventory and receive their top five vocational interests with a handy tab of recommended majors for each one that takes them directly to that major in MyMajor with their defining Major Maps.

The creation of the Major Maps was a collaboration between the faculty responsible for each of FIU's 70 majors and the researchers in the Office of Retention and Graduation Success (ORGS). Using multivariate statistical techniques, the researchers were able to identify not only *critical indicator courses* (courses in which performance correlated significantly with retention and on-time graduation) but also the level of performance that was necessary in those courses. For example, ORGS research found that if journalism majors did not achieve at least a B- in their freshman composition class, then they had only an 18% chance of graduating on time. These research results were given to faculty to apply in creating their Major Maps for students. Not only are the Major Maps crucial for defining the meanings of the names of majors for applicants, but as we see later they constitute a core intervention for Points 2 and 3 of the GSI conceptual framework—providing a clear path to the goal of on-time graduation in an appropriate major and giving immediate feedback whether on or off the path—both of which are the basis for the tracking tool, My_eAdvisor. The Major Maps function as sets of explicit rules regarding what courses to take, when to take them, and what performance threshold pertains.

We should note that the system attempts to *accelerate* the discernment process for selecting an appropriate major, not to *foreclose* it. The data clearly indicate that for FIU students the romantic vision of a 2 + 2 model (2 years of general exploration followed by 2 years of specialization) does not lead to on-time graduation. As we have seen, the FIU data simply do not support the belief that after 2 years of taking disconnected courses in a cafeteria-style general education program students have a Damascus Road experience and know clearly what major and profession they wish to pursue and then do so promptly and successfully. The GSI system—high tech and high touch—attempts in a focused, intentional way to help students to learn quickly what it is they would like to do to earn a living and what they should study to do so.

Reinforcing contingencies

Contingencies have been designed to reinforce the students' behavior of discerning and selecting an appropriate major at admission. Applicants have to declare a major as part of the admission process; it is an explicit *rule*. So one reinforcement is simply being allowed to complete the admission process. "Undecided" and "undeclared" are not options. If an applicant is truly clueless or resistant for some reason to declaring a major, he or she can

select one of six exploratory tracks: (a) administration and management, (b) biological and environmental sciences, (c) global and social sciences, (d) humanities and the arts, (e) health sciences, and (f) physical science and engineering. Each exploratory track has a curriculum designed to help the student to discern his or her major quickly. An explicit policy (*rule*) has been created that all exploratory students must have a major before they earn 45 credits. It is interesting that only 2% of entering students declare an exploratory major. Only students' academic advisors can change their majors, and frivolous major changes have been eliminated. Stealth majors, in which a student declares one major (e.g., liberal studies, with few specific requirements) but really pursues another major (e.g., business administration, with a calculus requirement that presents a barrier to many aspiring stealth majors), have been all but eliminated because the tracking tool, My_eAdvisor, lets advisors know immediately whether students are off track for their declared majors. If students want to change their majors, they must have a serious interaction with their academic advisor.

Remember that one of the desired behaviors is *discerning* an appropriate major, not just *declaring* one. Taking MyMajorMatch and going through the learning system that it entails is an important part of this discernment process. Applicants receive a To-Do List on their MyFIU portal as part of the admission process. In addition to listing such things as sending transcripts and payment for admission fees, it also includes taking MyMajorMatch. The clear and intended impression is that completing MyMajorMatch is a required part of the admission process. So being able to remove it from the To-Do List is reinforcing. In fact, neglecting to take the inventory does not stop the admission process, but the applicant does not know that. In addition, after admission, the student's advisor notes immediately that the student has not taken MyMajorMatch and strongly and persistently encourages the student to complete that task. So another reinforcement for the student's discernment behavior is the positive or negative feedback of the advisor regarding completing MyMajorMatch.

Lastly, the empowerment that comes to the student from the MyMajorMatch learning system (i.e., knowing one's professional interests and specifically how those interests can be pursued in this new academic environment) provides another reinforcement, perhaps the most powerful one. If the assessment really works—actually provides useful information that promotes students' success—then its reputation of utility becomes a reinforcement for its completion by succeeding cohorts.

During the 4 years of its use (October 2011–November 2015), 65,640 MyMajorMatch assessments have been completed (Figure 2 displays the top interest clusters). The tool is definitely being used.

Initial research (Trusty, 2014) supports the efficacy of MyMajorMatch as a tool for helping students to identify an appropriate major. A cohort of 12,697
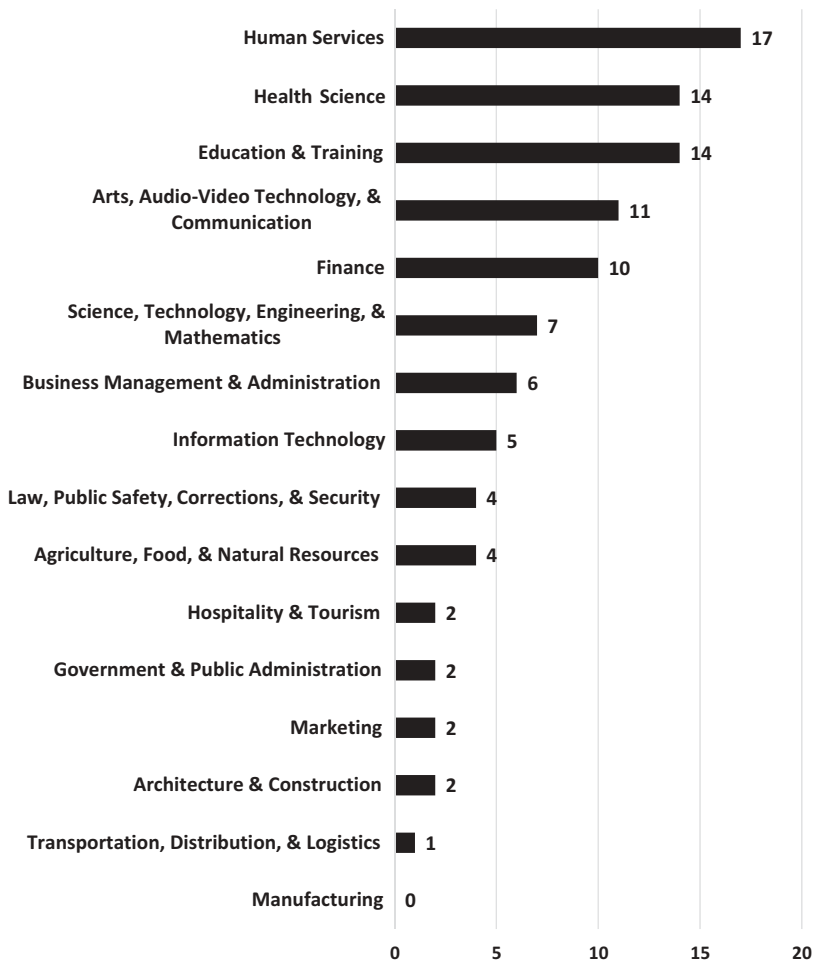
Figure 2. Cumulative percentages (October 2011–November 2015) of top interest clusters for Florida International University applicants and students taking the MyMajorMatch assessment.

students who entered FIU prior to August 6, 2012, and had access to MyMajorMatch constituted the study's sample. Their academic performance was examined for the next three semesters that made up the academic year 2012–2013. These students all had the opportunity to take MyMajorMatch and to accumulate three semesters of coursework. Of the 12,697 students in the sample, 6,506 (51%) students completed MyMajorMatch. Remember that its completion is not actually required to complete the admission process; it only appears that it is required. The study's dependent variable was GPA. There were two independent variables: (a) congruence between the major selected by the student and the majors indicated by MyMajorMatch, and (b) whether the student took MyMajorMatch.

The findings (Trusty, 2014) showed significantly higher GPAs for students who selected a major that was in their top five interest clusters than for those

who did not: analysis of variance for the first semester, $F(5, 6500) = 2.335$, $p = .040$; cumulative through second semester, $F(5, 6{,}129) = 2.530$, $p = .001$; cumulative through third semester, $F(5, 4636) = 4.511$, $p < .0005$. The effect was strongest for students who selected a major congruent with their top three interest clusters. This difference in GPAs grew with each succeeding semester, thus indicating a compounding positive effect of selecting an appropriate major as indicated by MyMajorMatch.

For entering freshman (Trusty, 2014), the difference in cumulative three-semester GPAs for students who took MyMajorMatch (61%) and those who did not take MyMajorMatch (38%) was also statistically significant: analysis of variance cumulative through third semester, $F(1, 4373) = 41.661$, $p < .0005$. This finding was true whether or not the students who took MyMajorMatch selected majors congruent with their interest clusters. It is interesting that women were overrepresented among those students who took MyMajorMatch (women = 57%, men = 44%), and men were over-represented among the students who chose not to take MyMajorMatch (women = 43%, men = 56%).

Completing MyMajorMatch does appear to have value for discerning an appropriate academic major early in the student's academic career. This utility reinforces its promotion and use in future cohorts.

Transforming the advising system

The *interlocked behavioral systems* of students and advisors illustrates nicely the way in which the GSI is actually a massive and complicated transformation of *metacontingencies* extending through reporting systems all the way from students to the Board of Trustees.

Desired and targeted behavior

Selecting an appropriate major puts the student on the path to on-time graduation in that appropriate major *if* the student follows that path as prescribed in the semester-by-semester Major Map, which then becomes the *desired behavior*: staying on track. The *targeted behaviors* (such as not consulting the Major Maps at all and choosing courses ignorantly, creating schedules of convenience, or listening a little too closely to the advice of uninformed friends or family) are those behaviors that lead the student not to follow his or her Major Map.

Strategic interventions

Two examples of the GSI's strategic interventions to produce the desired behavior are *high touch* (creating 69 new advisor lines in 5 years and introducing a radically different advising paradigm) and *high tech* (the My_eAdvisor tracking tool).

High touch. Early in the GSI, undergraduate advising was removed from the faculty's set of responsibilities and moved to a professional advisor model. Faculty were encouraged to continue to mentor undergraduates, but the core academic advising was put in the hands of master's-prepared professionals. A career path of six levels was created for advisors with the intent of attracting and retaining professionals who were making academic advising a career, not merely something that one did while finishing a terminal degree, waiting to find a real job, supplementing the family income, and so forth. The GSI moved the university to a caseload advising model. Annual investments over 5 years added 69 advising lines to approach the 400 to 1 ratio of students to advisors that is a best practice established by the National Academic Advising Association. Every student is assigned to a professional advisor at admission.

The new academic advising paradigm is a caseload model that requires advisors to work their caseloads proactively and that involves two new integrations into the explicit, interlocking rules for, and responsibilities of, the academic advisors: (a) integrating lower and upper division advising, and (b) integrating career development with academic advising. Because students select their majors at admission and enter their colleges immediately, the need no longer existed for a university cadre of lower division advisors who advised the general education program and helped students to discover a major in their first 2 years. The course recommendations for the first 2 years are now embedded in the Major Maps, and the advisors now have the responsibility of redirecting students to an appropriate major somewhere in the university if the students need a new dream. In addition, they must advise the upper division major. Moreover, academic advisors are now expected to be knowledgeable of MyMajorMatch and the Occupational Information Network (O*NET) and to help students to connect their academic choices to their career development. Finally, academic advisors are expected to work their caseloads *proactively* (desired behavior) rather than waiting *reactively* for students to contact them (targeted behavior). The advisors are given a significant amount of information through both the behavioral scientists in ORGS and the GSI's advising tools (*strategic interventions*), and they are expected to act on that information to reach out both to students who are identified as succeeding and, especially, to those who are identified as at risk (ORGS behavioral scientists have now developed a statistical model that can predict first-to-second-year retention with 50% accuracy for entering students even before they take their first class). This information is readily available for advisors for their caseloads. Dashboards have been created to monitor the advisors' use of such tools as My_eAdvisor, and merit awards are based on their application of the new proactive advising paradigm (*reinforcing contingencies*).

High tech. Now for the high-tech example of a strategic intervention to achieve the desired behavior of students staying on track. My_eAdvisor is a powerful tracking system that was developed internally by an FIU team and that allows students and advisors to monitor academic progress vis-à-vis the Major Map. The Major Map shows semester-by-semester expectations of what courses need to be taken, what grades need to be earned, and what milestones need to be achieved in order to graduate on time. Both students and advisors have My_eAdvisor dashboards with important summaries and quick access to functionalities.

The student's My_eAdvisor dashboard includes: (a) the interactive Major Map, which displays curricular specifications, performance levels, and milestones necessary for the student to graduate on time; (b) advisor messages in addition to automated alerts at the end of each semester if the student strays from the Major Map; (c) universal advising notes, the accumulated notes from interactions with all advisors, which allow students and any FIU advisor to know what advice the student has received; (d) a scheduler, which allows the student access to interact with the advisor's availability and to make an appointment online; and (e) links to pertinent resources. The interactive Major Map is rich in detailed information for students about what they should be doing and whether they are doing it. The closer to the behavior that feedback occurs, the more likely it is that the feedback will be effective. In the case of My_eAdvisor, feedback is given immediately following each semester, and if students need to register for a course to correct a misstep, they can view the available sections and register for the course seamlessly from My_eAdvisor. This feature was challenging to build because of the link to real-time section availability, and no other tracking tool yet developed has it.

The advisors' My_eAdvisor dashboard includes: (a) all students assigned to that advisor, the roster of the advisor's caseload for whom the advisor is held accountable for monitoring the progress and proactively facilitating students' success in graduating on time in an appropriate major; (b) automated alerts at the end of each semester if their students stray from their Major Map; (c) early alerts during the semester from faculty who are teaching their students; (d) the advisor calendar, used to express advisors' availability and to make appointments online; (e) access to advisor notes for all students; (f) access to sending and receiving messages to and from students; and (g) advisors' profiles, including their basic contact information.

Reinforcing contingencies
Reinforcing contingencies for the students staying on track in terms of taking the correct courses, performing at least adequately in those courses, and meeting milestones include an automated system of praise (for staying on track) and alerts (for straying). At present, the system has many more automated alerts than praise, which is an area of needed improvement for

the system. Wired into the system are both *universal* alerts (e.g., maintaining a GPA of 2.0 or above and earning a certain number of credits at various durations) and *major-specific* alerts (e.g., taking the appropriate prerequisite and required courses for the major at the appropriate time). Alerts are generated at the end of each semester based on the students' performance and sent to both the students and their advisors. The advisors contact their students to resolve the alert. Weekly automated reports show whether individual advisors have acted on their alerts. These same automated reports show whether whole colleges or departments are acting on their alerts. Not acting on alerts has negative consequences, and these automated reports negatively reinforce the desired behavior at every level in the advising system. Acting on alerts avoids aversive outcomes. Ultimately, if students repeatedly ignore both their alerts and advisors, the advisor or the system will place a hold on the students' ability to register for courses. This is a primary terminal contingency in a chain of events and alerts. Then the students must contact their advisor in order to lift the hold (eliminating or escaping it), thereby guaranteeing a conversation with their advisor about possible issues.

Each week, My_eAdvisor usage data for all of its tools (not just alerts) are displayed in automated reports for the university as a whole, by college, and by individual advisors within colleges. Thus, students' and advisors' behavior are being regularly monitored. Advising administrators have access to the performance of individual advisors whom they supervise. Unit deans have access to the performance of their advising administrators and advisors. The provost has access to the performance of the entire system and all of its personnel directly and via the dean of undergraduate education.

Transforming gateway instructional systems

Recalling the GSI's conceptual framework—helping students to discern and choose an appropriate goal, providing a clear path to that goal, giving immediate feedback whether on or off the path, and removing barriers and adding supports along the path—we would like to close with a brief discussion of the GSI's next emphasis, which focuses on Point 4 (removing barriers and adding supports along the path).

The work of the behavioral scientists from ORGS shows that poorly performing gateway courses are a major barrier to student progression, particularly in the vulnerable first year. If students fail a course in their first or second semester, not only do they have to take the course over, but they also suffer consequences such as confirming their suspicion that they are not really suitable for college and increasing the possibility of dropping out. This vulnerability is particularly true for minority, first-generation students, such as many of FIU's students. For example, in FIU's 2012 FTIC cohort, 46% of students who failed Writing and Rhetoric I dropped out in

their first year. In the same cohort, students who failed one of three basic mathematics courses also dropped out in their first year at a high rate: (a) Intermediate Algebra, 38%; (b) College Algebra, 26%; and (c) Finite Math, 23%.

With the generous support of two grants from the Bill and Melinda Gates Foundation, administered by the Coalition of Urban Serving Universities and the Association of Public and Land-Grant Universities, the GSI has developed and is implementing a comprehensive, multiyear plan to improve the performance of 17 high-enrollment (>1,600), high-failure (>15%), high-impact (strong predictor of dropping out or delayed graduation) courses. In 2014–2015, the combined enrollment in these 17 courses was 44,773. This strategic intervention in a relatively small number of courses could have an extraordinarily large impact. The GSI's Phase I focused on a transforming the admission and advising systems, and now in Phase II the GSI focuses on transforming pedagogy in 17 critical gateway courses en route to transforming the teaching culture throughout the university (see Table 3).

FIU is one of 13 founding universities in the John N. Gardner Institute's Gateways to Completion Project (http://www.jngi.org/g2c/). That work was integrated into the GSI's Phase II emphasis on gateway courses. In 2013–2014, five low-performing courses (Finite Math, General Biology, General Chemistry, Introduction to Statistics I, and Writing and Rhetoric I) were selected for in-depth study by course-specific workgroups that included the department chair, course coordinator, teaching faculty, director of the ORGS, director of the Center for the Advancement of Teaching, and dean of undergraduate education. These five cross-unit teams produced 15 specific recommendations for improvement as measured by DFWI rates (the percentage of students with grades of D, F, Withdrawal, or Incomplete). These recommendations in many cases had direct application to the larger group of 17 gateway courses and became the basis for workgroups in all 17 courses. Many of the recommendations were integrated into the new FIU *Beyond Possible* 2020 Strategic Plan (approved by the FIU Board of Trustees on March 26, 2015).

The 15 recommendations represent a combination of *desired behavior* and *strategic interventions* related to improving the performance of gateway courses, removing obstacles and adding support to students' academic progression, and ultimately improving overall student success as measured by the aforementioned student success metrics. The 15 recommendations are as follows (in no particular order):

- Convert from adjuncts to full-time instructors in all gateway courses, which will involve strategic institutional investment over multiple years.

Table 3. Seventeen High-Enrollment, High-Failure, High-Impact Gateway Courses Targeted for Improvement in 2014–2015.

Course	Title	Enrollment			DFWI rate		
		2012–2013	2013–2014	2014–2015	2012–2013	2013–2014	2014–2015
MAC 1114	Trigonometry	1,476	1,682	2,022	52%	60%	52%
MAC 1140	Pre-Calculus Algebra	1,708	2,337	2,567	48%	58%	46%
MAC 2311	Calculus I	1,542	1,857	2,120	46%	52%	49%
MGF 1106	Finite Math	2,855	2,765	2,230	41%	49%	36%
ECO 2013	Principles of Macroeconomics	1,906	2,196	2,264	31%	41%	35%
CHM 1045	General Chemistry I	2,021	2,286	2,237	36%	39%	40%
ECO 2023	Principles of Microeconomics	2,205	2,048	2,661	21%	36%	21%
STA 3123	Introduction to Statistics II	1,768	2,079	2,447	22%	36%	31%
MAC 1105	College Algebra	2,007	2,035	1,896	38%	35%	36%
STA 2122	Introduction to Statistics I	2,265	2,216	2,023	31%	34%	33%
BSC 1010	General Biology I	1,987	2,250	2,647	29%	30%	29%
REL 2011	Religion: Analysis and Interpretation	1,915	1,951	1,666	19%	21%	19%
REL 3308	Studies in World Religion	2,360	1,848	1,543	17%	18%	16%
ENC 1102	Writing and Rhetoric II	4,507	4,581	5,081	13%	18%	14%
ENC1101	Writing and Rhetoric I	3,836	3,479	4,587	13%	17%	11%
PSY 2012	Introduction to Psychology	2,282	2,110	2,469	14%	15%	10%
SLS 1501	First Year Experience	4,213	3,837	4,313	8%	10%	8%

Note. DFWI = percentage of students with grades of D, F, Withdrawal, or Incomplete.

- Develop automated early alert systems for all gateway courses, which will include required use of a learning management system by faculty as well as clickers to facilitate automated attendance recording.
- Expand the number and use of learning assistants and create a central office that coordinates learning assistant recruiting, training, and strategic deployment.
- Improve gateway course teaching and learning physical environments (e.g., create discipline-specific gateway course learning resource centers and lounges, increase the number of active learning classrooms).
- Expand gateway course bridge programs both in the form of boot camps and in terms of collaboration with feeder secondary schools and community colleges.
- Develop strategic faculty development and awards programs that incentivize and support exemplary pedagogy in gateway courses.
- Develop dependable technological support and training for the use of instructional technology such as learning management systems and clickers, which are both necessary for automated early alert systems.
- Develop new business models that show the savings produced by improved retention and on-time graduation and thereby provide a data-based figure that is available for upfront investment.

- Develop dashboards that provide stakeholders with performance data related to gateway courses at the section level.
- Regularly disseminate predictive analytics to stakeholders.
- Set up robust and regular communication systems among faculty and administrators for feeding and receiving courses, programs, and institutions that provide a basis for curriculum alignment and assessment.
- Create a teaching initiatives coordinating council that regularly brings together all groups at the institution that are involved in major pedagogical reform.
- Incorporate "becoming a university student" learning objectives (e.g., study skills, reading strategies, writing skills, time management) into gateway courses.
- Guarantee course availability.
- Establish learning metrics that demonstrate that improvements in the performance of gateway courses (e.g., lower DFWI rates) are the result of increased student learning and not merely grade inflation.

The basis for *reinforcing contingencies* is clearly present in recommendations that involve creating data-based performance dashboards and awards programs. Because of the clear, statistical connection between overall student success metrics and gateway course performance, the university's performance on these metrics will serve as significant *reinforcing contingencies* for the *desired behaviors* at all levels to improve gateway course performance.

Conclusion

Our purpose in discussing this case study has been to demonstrate the practical utility of behavior analytic concepts such as interlocking behavioral contingencies, metacontingencies, and rule-governed behavior in guiding effective organizational change management and to describe specific ways to improve undergraduate student success in colleges and universities. The organization being transformed is complex *horizontally* with many different groups of agents and *vertically* with many hierarchical levels, and the interventions have been multitudinous. Even so, the theoretical perspectives and conceptual framework that inform these interventions are few and straightforward. We hope that our intended audiences—practitioners, researchers, and theoreticians in the fields of behavior analysis, organizational change management, and higher education—have found the discussion useful.

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