

Student Preference for Guidance and Complexity in College Major Requirements

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ABSTRACT

In order to graduate with a bachelor's degree, students must determine which classes they must take in order to satisfy the requirements of their major. These requirements are often complex and difficult to comprehend, leading to some policy interventions that aim to reduce complexity by either increasing the amount of student guidance in course choice or by reducing the amount of complexity-increasing choice. We perform two student preference experiments on students at two large four-year universities to determine how students might respond to increasing guidance or reduced choice in their course-taking options. We find that students do not respond strongly to increases in guidance, but strongly reject a reduction in options, even when given a rationale for the reduction. These results suggest that increased-guidance policies have some avenues to operate in without student pushback, but that strong reductions in choice are unlikely to be popular.

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Student Preference for Guidance and Complexity in College Major Requirements

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Abstract: In order to graduate with a bachelor's degree, students must determine which classes they must take in order to satisfy the requirements of their major. These requirements are often complex and difficult to comprehend, leading to some policy interventions that aim to reduce complexity by either increasing the amount of student guidance in course choice or by reducing the amount of complexity-increasing choice. We perform two student preference experiments on students at two large four-year universities to determine how students might respond to increasing guidance or reduced choice in their course-taking options. We find that students do not respond strongly to increases in guidance, but strongly reject a reduction in options, even when given a rationale for the reduction. These results suggest that increased-guidance policies have some avenues to operate in without student pushback, but that strong reductions in choice are unlikely to be popular.

Introduction

The graduation rate at colleges in the United States is low. Only 59.4% of full-time students who started at a four-year institution in 2009 graduated with a degree in 150% of the expected time.¹ The comparable figure at two-year institutions is even lower, only 30.9%.² A monumental amount of funding and effort goes towards educating students who do not end up with a degree. These aggregate figures also leave out significant variation in completion rates by demographic and socioeconomic factors. Many students are being left behind.

One explanation that has been suggested for low graduation rates is that a lack of structure and the predominance of complex requirements in curricular programs leaves students burdened by many, repeated choices they don't understand well and may make poorly. This is especially for students who have little experience with the system (Jenkins & Cho, 2013; Scott-Clayton, 2015). Scott-Clayton (2015) formulates this explanation in the context of community colleges, but at four-year colleges, too, graduation requirements and prerequisites are often deeply complex and require the student to make many choices. Given examples like the ones discussed below in Section 3, it is no surprise that students have difficulty determining which courses will lead to graduation.

In response to the complexity of these choices, some policy proposals recommend reducing available choice between courses for beginning students or heavily guiding it. These recommendations are perhaps best known as being part of the "guided pathways" approach, which many policy makers and state administrators are investing heavily in, hoping they will be successful in increasing graduation rates in several two- and four-year contexts (Jenkins & Cho 2013; Scrivener et al. 2015; Bailey, Jaggars, & Jenkins 2015). The guided pathways discussion extends on an issue that every department faces when designing their own major requirements – how should faculty ideas about what an ideal course list looks

¹ NCES Digest of Education Statistics 2016 Table 326.10.

² NCES Digest of Education Statistics 2016 Table 326.20.

like be balanced against student freedom in designing their own college curriculum? More stringent graduation requirements balance freedom against guidance, and simplicity against complexity, in many interacting ways.

This study examines one aspect of this discussion that is often pushed to the side – that of student preference. One reason why colleges tend to allow so much choice is that it allows students to study exactly what they would like, and allows students to tailor their education to their needs. An emphasis on choice and student freedom is a characterizing attribute of the American higher education system (Goldin & Katz, 2007). Forcing students to stick to a more rigid set of courses reduces that freedom, which one might expect would not be appreciated by students. If more guidance in course choice is indeed the way forward, it's important to know if such constraints might affect the majors that students choose and if administrators can expect pushback from students (or if students might even be likely to opt into majors or institutions with less rigid requirements).

We perform a series of hypothetical choice experiments on over 2,000 students at two large public four-year college campuses in Southern California. In the experiments, we present students with two randomly selected hypothetical course requirements for the same major (Biology, Economics, English, or Psychology). Course requirements vary between the two choices in up to three ways: in the number of courses from which students can pick; whether or not courses are grouped into distinct requirements; and the presence or absence of a crosscutting “department requirement” which does not meaningfully affect guidance but makes the task psychologically more complex. We also randomize whether or not a reason is given for the reduced number of available courses. Students self-report their preference between each pair of requirements on a seven-unit scale.

Across campuses and demographic groups, results are consistent. Students have a strong preference for more choices; long course lists are preferred to short course lists on average by 1.8 points

on a seven-unit scale. Giving a reason why the shorter course list is offered moderates this effect. Students are indifferent between major requirement lists that group courses and major requirement lists that do not. This is true even though grouping courses makes the task of selecting courses more rule-laden, and is strictly inferior to an un-grouped course list from a rational-choice perspective. Results on crosscutting department requirements are mixed; students dislike them when they are not linked to a particular skill (laboratory or writing) and are indifferent on average when the requirement is said to focus on a particular competence. The null effect of crosscutting requirements on average masks heterogeneity in preference – some students prefer the requirements and others dislike them.

Broadly, the results indicate that students want choice, do not mind guidance, and may actively dislike unnecessary complexity. Department and institution administrators should think carefully before they streamline course requirements within a major; a reduction in available course options may backfire in the form of student disfavor for the major. However, this can be taken as good news for guidance policies. If students do not mind guidance, and guidance can improve outcomes, then adding more guidance is a costless way to improve outcomes, at least for the average student.

Literature Review

Traditional decision theory has posited that choice is always good. Economic theory has long suggested that more choices allow decision makers to more effectively maximize their self-defined utility. Greater variety in available choices allows each individual to more precisely satisfy his/her own predefined preferences and increases the probability that all individuals in a society will be able to maximize their own unique utility functions (Mussa & Rosen 1978). Under these traditional economic models, decision makers will continue to evaluate options only so long as the perceived benefits outweigh the costs (Hauser & Wernerfelt 1990). Conventional economic theory states that choice does not reduce well-being for the person choosing.

For many decades, work from psychology similarly showed that the existence of choice always benefits decision makers. Choice increases individuals' intrinsic motivation, which can improve decision makers' probability of completing a task (Deci & Ryan, 1985; Zuckerman et al 1978). Choice also allows people to experience more control, which can increase satisfaction (e.g. Langer 1975; Rotter 1966). And choice can lead to greater well-being, as individuals tend to boost their subjective evaluations of chosen options (Shafir, Simonson & Tversky 1993; Bem 1967).

The intuitive simplicity of the idea that decision makers will be happier and better off with more choices allowed this premise to flourish for many decades. (And this is especially true in countries, such as the United States, where values such as autonomy and freedom are prized). However, beginning in the middle of the twentieth century, research highlighted the fact that such theories obscure or even ignore the cognitive demands of decision making in complex environments (e.g. Simon 1957). Difficult decisions, such as those with many options, those that are considered consequential, or those that involve the evaluation of lots of information, test the utility of traditional models of decision making (Botti & Iyengar 2006). Below we highlight three aspects of decisions that can upend conclusions from traditional models of choice.

Choice Overload. Research from psychology has highlighted that the effort needed to compare and evaluate many options, or “the cost of thinking,” can burden decision makers and lead to suboptimal outcomes (Shugan 1980; Greenleaf & Lehmann 1995). Too many options can lead to less satisfaction and lower confidence in a decision (Iyengar & Lepper 2000; Iyengar, Elwork & Schwartz 2006; Shafir, Simonson & Tversky 1993), a greater propensity to opt out of making a choice (Iyengar, Jiang & Huberman 2004; Iyengar & Kamenica 2006), or the inferior decision making strategies (Payne, Bettman & Johnson 1993; Kahn & Baron 1995).

Complexity of decisions. The amount of information associated with the consideration of each choice, as well as the decision maker's familiarity with this information, can also affect the choice

process. Whereas there are a limited number of simple dimensions on which one can judge the utility of a candy purchase (e.g. price, taste, nutritional content), selecting an apartment involves many more dimensions on which one can judge the quality of an option (e.g. location, size, price, neighborhood, walkability, parking availability, neighbors, land lord, public transportation, etc.). “As decision complexity rises, the very provision of choice, which is seemingly desirable and beneficial, can become paralyzing and debilitating, resulting in suboptimal decision making” (Botti & Iyengar, 2006, p. 24)

Decision Fatigue. The effect of each of these factors can be compounded when people are asked to make many decisions in a row. People quickly tire after making an initial decision, and their ability make utility maximizing decisions diminishes with each successive decision (e.g. Danziger, Levav & Avnaim-Pesso 2011; Vohs et al 2014; Muraven & Baumeister 2000; Levav, Heitmann, Herrman & Iyengar 2010). Decision makers are generally not aware of the potential for this fatigue and do not allocate resources evenly over sequential decisions (Gabaix et al 2006). This decision fatigue is especially problematic when people are asked to make a series of interrelated decisions, each of which affects subsequent decisions.

In recent years, policy makers have become aware of the potential disadvantages of complex choices and have worked to structure decisions in ways that support optimal choice. A number of policy remedies can address the various decision making concerns addressed above (Botti & Iyengar 2006). To counteract the potential negative effects of a choice with many options, policy makers can limit the number of options, only adding options when the potential benefits of choosing an option outweigh the potential costs of choice overload. There is evidence that limiting the number of options presented can help individuals to make cost efficient health insurance and Medicare choices (Johnson, Hassin, Baker, Bajger and Trueuer, 2013; Abaluck and Gruber, 2011).

In situations when limiting options is not politically feasible, policy makers can support decision making by highlighting particular dimensions of the options or by grouping similar choices together. These strategies can also be helpful in situations in which choices differ along a number of dimensions or situations in which information about options is not available or is complex. Sorting health insurance options by cost can lead to improved choices (Johnson, Hassin, Baker, Bajger and Trueuer, 2013), and different groupings on menus can affect food orders (Fox, Ratner & Lieb, 2005).

Wise default choice can also be used to help decision makers in such complex environments (Thaler & Sunstein 2008; Madrian & Shea 2001). The classic example of using default choices to guide behavior is in retirement systems, where default choices with higher contribution levels lead to actual higher levels of contributions (Benartzi & Thaler 2007)

Selecting appropriate courses in college, a necessary precursor to student success and persistence, is a decision environment that is ripe for choice engineering. Each semester, students are faced with many options of classes to take, these choices vary along a number of dimensions, information is not always available or easy to gather, each term requires multiple choices, and choices within a term and across terms are interdependent. A number of recent interventions have aimed to help students in making these choices, by limiting the number of choices initially available, by providing suggested curricula, or by defaulting students into classes (Jenkins & Cho, 2013). However, for each of these interventions to work, students must be complicit. If students are put off by suggestions, groupings, or defaults, well intentioned interventions might fail.

Description of Major Complexity

There is ample evidence that students do not always make optimal decisions in selecting courses (Bailey, Jagers & Jenkins 2015; Crosta 2014; Scott-Clayton 2015), which makes this is an environment with many opportunities for wise choice engineering by administrators, faculty, and policy makers.

However, like with any choice engineering endeavor, there are tradeoffs. There is a tension between allowing students freedom to choose their own path through the major and restricting the amount of choice by guiding students more directly. This tension is both practical and philosophical. Course requirements within majors need to prepare students for a range of career and educational next-steps. They need to provide students with a basic foundational knowledge, and they need to allow for students to indulge a wide set of interests, goals, and desires. Herein lies the tension. Simple, prescriptive major requirements allow faculty to guide the learning of students. However, prescribed majors may not serve diverse student needs and interests and may not build a necessary diversity of thought and training. Looser requirements with many options provide more choice and flexibility, but may allow students to graduate with fundamental gaps in knowledge and may create a fractured field. Also, depending on how it is done, restricting student choice can make the act of figuring out how to graduate more or less complex. Absolute freedom is simple, though perhaps still cognitively taxing (e.g. there are many paths to graduation if you can choose any 12 courses from a list of 250; but if each path successfully leads to graduation, you can never choose incorrectly). Absolute structure is also simple (e.g. the 12 classes necessary for graduation are the only courses available to take). It is the mixture of freedom and structure that creates difficult complexity.

The complexity in course requirements comes in many dimensions. Take, for example, the course requirements to earn a Bachelor's degree in biology from the Department of Ecology and Evolutionary Biology at the University of California, Los Angeles (shown in Figure 1). These requirements highlight the many types of complexity that college students face when deciding which courses they need to take each semester. We studied the course requirements lists for Biology, Economics, Psychology and English across the University of California and California State University systems and noticed some regularities.

Figure 1: Biology Major Requirements, Department of Ecology and Evolutionary Biology, UCLA



BIOLOGY MAJOR (CATALOG MAJORS SPRING 2015 AND LATER)

Life Science Core Curriculum:

Life Sciences 1, 2, 3, 23L, and 4	
Chemistry 14A, 14B, 14BL, 14C, and 14D OR Chemistry & Biochemistry 20A, 20B, 20L, 30AL, 30A, and 30B <i>(NOTE: Students considering medical or pharmacy school who take the 20/30 series should also take 30C; some pharmacy schools may require 30CL. Some professional schools may still require Chemistry 14CL/30BL.)</i>	
Mathematics 3A, 3B, 3C OR Mathematics 31A, 31B, 32A <i>(Some pharmacy schools may require the 31/32 series.)</i> OR Life Sciences 30A, 30B	
Physics 6A, 6B, 6C OR 1ABC, 4AL, 4BL	
Statistics 13	

Upper Division Requirements: (courses may be applied to ONE category only; courses must be a minimum of FOUR units to count as a stand-alone course)

<p>CATEGORY ONE: Biochemistry. Chemistry 153A</p> <p>CATEGORY TWO: Foundation Courses. Choose TWO COURSES (totaling at least 8 units) from the following list: Ecology & Evolutionary Biology 100, 109, 116, 120 or 185, 121 <i>(Students who have taken EEB 120 cannot also take EEB 185.)</i></p> <p>CATEGORY THREE: Laboratory Courses. Choose TWO COURSES (totaling at least 8 units) from the following list: Ecology & Evolutionary Biology 100L*, 101, 103, 105, 107, 109+109L (count as ONE course), 110, 111, 112, 113A, 114A, 115, 117, 128, 134A, 136, 152+162L (count as ONE course) OR 162+162L (count as ONE course), 170**, C174, C177, 181 <i>(combinations of lecture and lab, e.g., EE BIOL 109+109L, count as ONE course in this Category).</i></p> <p><i>Four (4) units from a Field Biology Quarter (FBQ) or Marine Biology Quarter (MBQ) may be applied, and the following courses or listed combinations can count as ONE (1) of the required two (2) courses: Physiological Science 166**;</i></p> <p>Microbiology, Immunology & Molecular Genetics 101+ Microbiology, Immunology & Molecular Genetics 100L (must take BOTH courses to count as ONE course in this Category.)</p> <p>At least ONE course in this Category must be an EE BIOL laboratory course.</p> <p><i>*As of Fall 2011, EE BIOL 100L is four (4) units and may count as a stand-alone lab course, but EE BIOL 100 must be taken either concurrently (co-requisite) or prior (pre-requisite) to EE BIOL 100L. EE BIOL 100 as a stand-alone course may count towards either Category 2 or Category 4 or Category 5, but NOT in all three categories.</i></p> <p><i>**Students cannot take both EE BIOL 170 and Physiological Science 166.</i></p>	
<p>CATEGORY FOUR: UPPER DIVISION EE BIOL ELECTIVES. Choose TWO COURSES (totaling at least 8 units) from the following list: Ecology & Evolutionary Biology 100, 101, 103, 105, 107, 109, 110, 111, 112, 113A, 114A, 115, 116, 117, C119A, C119B, 120 or 185*, 121, 122, 125, C126, M127 <i>(same as Environment/Geography M127)</i>, 128, 129, 130, M131 <i>(same as Geography M117)</i>, 133, 135, 136, 137, M139 <i>(same as A&O Sci M105)</i>, 142, M145 <i>(same as EPSS M118)</i>, 146, 151A, 152, 153, 154, 155, 160, 162, 168, 170, M171 <i>(same as Anthropology M125A)</i>, CM173 <i>(same as EPSS CM173)</i>, C174, 175, 176 <i>(counts as half a course)</i>, C177, C179, 180A <i>(counts as half a course)</i>, 180B, 181, 186, 187, 198A and 198B <i>(must take both courses)</i>, or 199 <i>(maximum of 4 units of 199 can count on the major)</i>.</p> <p>Molecular, Cell, & Developmental Biology 138, 165A.</p> <p><i>Eight (8) units from a Field Biology Quarter (FBQ) or Marine Biology Quarter (MBQ) may be applied.</i></p> <p><i>*Students cannot take both EEB 120 and EEB 185.</i></p> <p>ANY Ecology & Evolutionary Biology courses not applied under Category 2 or 3 may be applied in this category.</p>	
<p>CATEGORY FIVE: UPPER DIVISION SCIENCE ELECTIVES. Choose THREE COURSES (totaling at least 12 units) from the following list: Anthropology 120 and/or ONE of 124A, 124P, 128A Atmospheric & Oceanic Sciences ONE of 102, 103, 104, M105 (same as EE Biol M139), 130 Biomathematics 110 and/or Biostatistics 100B (Biostatistics 100A is an enforced requisite for Biostatistics 100B.) Chemistry (any upper division course EXCEPT 189-199; Chem 153L recommended) Earth, Planetary, and Space Sciences 116 Ecology & Evolutionary Biology (any upper division course EXCEPT 189-196) <i>NOTE: Four (4) units from a Field Biology Quarter (FBQ) or Marine Biology Quarter (MBQ) may be applied to Category 5.</i> Geography 112 and/or ONE of 108 or 111 Human Genetics C144 or Life Sciences 100HA or 100HB or 100HC (only one from this group is allowed) Mathematics (any upper division course EXCEPT 105A, 105B, 106, 189-199) Microbiology, Immunology, & Molecular Genetics (any upper division course EXCEPT 189-199) Molecular, Cell, & Developmental Biology (any upper division course EXCEPT 188-199D) Neuroscience M101A, M101B, M101C, 102, M130, M148 Physics (any upper division course EXCEPT 188SA-199) Physiological Science (any upper division course EXCEPT 188SA-199) Psychology 115</p> <p>Any course listed, but not applied under Category 2, 3 or 4, may be applied to Category 5.</p>	

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- **Number of options:** The number of courses that count toward a major requirement is often staggeringly large. In this example, over 150 unique classes are listed as counting towards the biology major. In addition, some upper division electives can be fulfilled by “any upper division course” in a range of departments. The number of unique paths to graduation for any given major can reach well into the millions. As the number of options increases, the complexity of the choice increases through sheer expansion in the number of possibilities. This is especially true if this freedom of choice is combined with other restrictions so that the question of whether or not a given course list leads to graduation must be considered for each path.
- **Groupings:** Most major requirements separate courses into large groups. In this example, upper division requirements are grouped into: Biochemistry, Foundation Courses, Laboratory Courses, Upper Division Biology Electives, and Upper Division Science Electives. Grouping a given number of available courses into larger buckets increases guidance in choice and restricts choice. Grouping can be thought of as either increasing or decreasing complexity. From a computational standpoint, selecting a set of courses that satisfies a requirement list with groups is more difficult, but from a psychological standpoint, groups may make the task easier *because* it restricts the range of available choices, and breaks the decision down into multiple smaller decisions.
- **Cross-Cutting Requirements:** Many majors have departmental requirements that cut across groupings. For example, English majors often have writing requirements that can be fulfilled by courses in a number of groupings, and Biology majors often have laboratory requirements that can be fulfilled by courses across groupings. The degree to which these requirements affect guidance varies depending on how restrictive they are. But cross-cutting requirements do make

the task of satisfying requirements more psychologically complex, since students must consider how courses fulfill requirements across multiple dimensions.

- **Temporal Dimensions:** Most majors have courses that have pre-requisites. Some courses can only be taken after a required precursor is taken. These timing issues can increase the complexity of deciding which set of courses to taken in a given semester or of planning the ideal multi-semester sequence of courses.
- **Complicated Groups:** It is not uncommon for group requirements to be markedly more complicated than simple repetitions of “take X courses from this group.” For example, group requirements can be nested. A requirement might instruct the student to take three courses out of a group of five courses, but also specify that one of those three must be from a subgroup of two, or that two of those courses can only count towards the requirement if both are taken. Some courses might belong in more than one group, and depending on the major, may or may not be able to count for both group requirements at the same time.

It is the findings from this empirical investigation that we took into account when deciding on the dimensions to vary in our experiment, which is described in the next section.

Experimental Methods

In this paper, we present experimental findings describing student preferences across three dimensions of curricular complexity: number of options available, course groupings, and crosscutting departmental requirements. These results come from two field experiments in which we presented students with two different lists of major requirements for one of four majors: Biology, Economics, English, or Psychology. We elicit their stated preference rating between the two options.

In Study A, each set of major requirements included a list of required core lower-division courses and a list of upper-level elective courses from which to choose. The upper-level courses vary on two attributes: (1) whether or not there are different groupings of courses from which students must choose (Groups vs. No Groups), and (2) whether or not there is an overlapping “department requirement,” indicating a subset of courses marked by stars that the student must take at least two of (Stars vs. No Stars). Table 1 lists the four possible major requirement lists that students might see for Biology. The structure for other majors (psychology, economics and English) was identical, except that the course names were different.

Table 1: Major Requirement Lists for Biology in Study A

No Groups, No Stars	Groups, No Stars	Stars, No Groups	Groups and Stars
<u>Take all of the following core courses:</u>	<u>Take all of the following core courses:</u>	<u>Take all of the following core courses:</u>	<u>Take all of the following core courses:</u>
Chemistry I Organic Chemistry Calculus I Physics I Introduction to Life Sciences	Chemistry I Organic Chemistry Calculus I Physics I Introduction to Life Sciences	Chemistry I Organic Chemistry Calculus I Physics I Introduction to Life Sciences	Chemistry I Organic Chemistry Calculus I Physics I Introduction to Life Sciences
<u>Choose six of the following upper-level courses:</u>	<u>Upper A: Advanced Basics (Take two classes)</u>	<u>Choose six of the following upper-level courses:</u>	<u>Upper A: Advanced Basics (Take two classes)</u>
Principles of Evolution Microbiology Entomology Population and Community Ecology Plant Cell Physiology Conservation Biology Contemporary Topics in Biology Statistics in the Natural Sciences Field Botany Ornithology Mammalogy Plant Taxonomy Animal Physiology Marine Ecology	Principles of Evolution Microbiology Entomology Population and Community Ecology Plant Cell Physiology <u>Upper B: Methods (Take two classes)</u> Conservation Biology Contemporary Topics in Biology Statistics in the Natural Sciences Field Botany <u>Upper C: Special Topics (Take two classes)</u> Ornithology Mammalogy Plant Taxonomy Animal Physiology Marine Ecology	Principles of Evolution* Microbiology* Entomology Population and Community Ecology Plant Cell Physiology Conservation Biology* Contemporary Topics in Biology Statistics in the Natural Sciences* Field Botany Ornithology Mammalogy Plant Taxonomy* Animal Physiology* Marine Ecology* Courses marked with a * fulfill the department requirement. You must take two courses that fulfill a department requirement.	Principles of Evolution* Microbiology* Entomology Population and Community Ecology Plant Cell Physiology <u>Upper B: Methods (Take two classes)</u> Conservation Biology* Contemporary Topics in Biology Statistics in the Natural Sciences* Field Botany <u>Upper C: Special Topics (Take two classes)</u> Ornithology Mammalogy Plant Taxonomy* Animal Physiology* Marine Ecology* Courses marked with a * fulfill the department requirement. You must take two courses that fulfill a department requirement. Two courses from the same group cannot both count towards the department requirement.

In all cases, there are fourteen upper-level courses from which to choose, and students must choose six of them. The *Groups* attribute significantly limits the number of possible combinations of upper-level courses that lead to graduation. The *Stars* attribute is very easy to satisfy and does not limit the number of routes to graduation by much, but does add complexity in determining whether any given combination of courses successfully leads to graduation.

In Study B, each list of major requirements included only the upper division requirements for a major. All major requirement lists were grouped, and each major had three groups of upper level requirements: advanced basics, methods, and special topics. The major requirement lists vary on two attributes: (1) the number of courses available to satisfy the group requirements (either 14 or 26—Short vs. Long) and (2) whether or not there was an overlapping “lab requirement” or “writing requirement,” indicating a subset of courses marked by stars that the student must take at least two of (Stars vs. No Stars). This department requirement differed from the requirement in Study A in that it was described using field specific language (“writing” or “lab” requirement), rather than being called a generic “department requirement.” In addition, half of students were randomly assigned to be given a explanation for how the short and long lists of courses were chosen (the long list was said to represent “all of the classes that have been popular with students over the past five years” and the short list was said to represent “the core concepts of the discipline, as identified by the department’s faculty”). Unlike in Study A, in order to maximize power and to avoid the explanation being confusing, every choice given to respondents was always between one long list and one short list. Courses were dropped at random to make the short list, to avoid bias that may arise if a particularly appealing course was always on the long list but not the short list. and the department requirement was assigned to random classes. Table 2 lists four possible major requirement lists that students might see for Biology. The structure for other majors is identical, except that the course names are different.

Table 2: Major Requirement Lists for Biology in Study B

Short, No Stars	Long, No Stars	Short, Stars	Long, Stars
<u>Upper A: Advanced Basics (Take two classes)</u>	<u>Upper A: Advanced Basics (Take two classes)</u>	<u>Upper A: Advanced Basics (Take two classes)</u>	<u>Upper A: Advanced Basics (Take two classes)</u>
Population and Community Ecology Entomology Biodiversity and Extinction Microbiology Biology of Invertebrates	Population and Community Ecology Entomology Biodiversity and Extinction Microbiology Biology of Invertebrates Molecular Evolution Marine Botany Principles of Evolution Plant Cell Physiology	Population and Community Ecology* Entomology* Biodiversity and Extinction* Microbiology Biology of Invertebrates	Population and Community Ecology* Entomology* Biodiversity and Extinction* Microbiology Biology of Invertebrates Molecular Evolution Marine Botany Principles of Evolution Plant Cell Physiology
<u>Upper B: Methods (Take two classes)</u>	<u>Upper B: Methods (Take two classes)</u>	<u>Upper B: Methods (Take two classes)</u>	<u>Upper B: Methods (Take two classes)</u>
Field Botany Statistics in the Natural Sciences Contemporary Topics in Biology Principles of Systematic Biology	Field Botany Statistics in the Natural Sciences Contemporary Topics in Biology Principles of Systematic Biology Theoretical and Computational Biology Mathematical and Computational Modeling Community Ecology Population Genetics	Field Botany* Statistics in the Natural Sciences* Contemporary Topics in Biology* Principles of Systematic Biology	Field Botany* Statistics in the Natural Sciences* Contemporary Topics in Biology* Principles of Systematic Biology Theoretical and Computational Biology Mathematical and Computational Modeling Community Ecology Population Genetics
<u>Upper C: Special Topics (Take two classes)</u>	<u>Upper C: Special Topics (Take two classes)</u>	<u>Upper C: Special Topics (Take two classes)</u>	<u>Upper C: Special Topics (Take two classes)</u>
Herpetology Plant Adaptations Tropical Animal Communication Mammalogy Cancer Cell Biology	Herpetology Plant Adaptations Tropical Animal Communication Mammalogy Cancer Cell Biology Ornithology Animal Physiology Plant Taxonomy Marine Ecology	Herpetology* Plant Adaptations* Tropical Animal Communication* Mammalogy Cancer Cell Biology Courses marked with a * fulfill the lab requirement. You must take two courses that fulfill a lab requirement. Two courses from the same group cannot both count towards the lab requirement.	Herpetology* Plant Adaptations* Tropical Animal Communication* Mammalogy Cancer Cell Biology Ornithology Animal Physiology Plant Taxonomy Marine Ecology Courses marked with a * fulfill the lab requirement. You must take two courses that fulfill a lab requirement. Two courses from the same group cannot both count towards the lab requirement.

In each study, for each preference-rating question a student sees, the major (Biology, Economics, English, or Psychology) is randomly selected. The major they see is unrelated to the student's expected major and to the class in which the experiment is being administered. Two different major requirement lists (in Study A, out of No Groups, No Stars; Groups, No Stars; Stars, No Groups;

Groups and Stars; in Study B one Short and one Long option out of Short, No Stars; Short, Stars; Long, No Stars; Long, Stars) are randomly chosen. One is assigned to be Requirement List A and placed on the left, and the other is Requirement List B on the right. Then, the student is directed to choose their preference between the two: Definitely Choose A, Very Likely Choose A, Probably Choose A, Neutral, Probably Choose B, Very Likely Choose B, or Definitely Choose B. These responses are coded 1-7, with “Definitely Choose B” as 7. This approach is identical to a preference-rating conjoint experiment with Length/Groups and Stars as the two attributes being varied (Orme, 2006).

In Study A, each student was given two of these preference-rating questions, and in Study B each student was given three questions. The questions may be for different majors or for the same major. Following these questions, we elicit demographic and background information from the student: gender, age, declared and planned major, class standing, current GPA, and self-perception of quantitative ability. In the next section, we describe the data collection methods, the data itself, and our methods of analysis.

Data and Analysis

For Study A, we administered the survey in-person in 34 different course sections between April and June 2017. For Study B, we administered the survey in 16 different course sections between September 2017 and January 2018. Both were administered at large public colleges in Southern California. Introductory courses were favored in course selection, but otherwise classrooms were selected by convenience. The survey was administered in two Earth Science classrooms, one Sociology classroom, 32 Economics classrooms,³ 13 Psychology classrooms, and 3 Education classrooms.⁴ In each classroom setting, a survey administrator would explain the purpose of the survey and read the instructions. Students would then be directed to an online survey module usable on phone, tablet, or

³ Three of these sections were taught by one of the authors.

⁴ Two of these sections were taught by one of the authors.

laptop. Paper surveys were available for students who were unable to use the online version or did not want to.

Underclassmen were favored by the focus on introductory courses, but class standing was fairly evenly distributed. In Study A, 26.5% of respondents were freshmen, 30.0% were sophomores, 22.1% juniors, 20.8% seniors, and .6% were graduate students. Study B happened to enroll more upperclass students. Only 11.6% were freshmen, 36.8% sophomore, 31.4% junior, 20.1% senior, and .2% graduate students. Gender was weighted towards women in a way fairly representative of introductory courses, with 61.0% of the sample reporting female and 37.9% reporting male, with the rest reporting other or preferring not to say. In both studies age was distributed as one might expect given the college sample, and the mean and median age in both studies was 20.

We also asked students to self-report two aspects of their academic ability. First we asked them to self-report their best guess of their current GPA in college. In Study A, GPA averaged to 3.11, and in Study B it was 3.13. While we expect that self-reported GPA is overstated, previous work finds that it is strongly correlated with actual GPA (Kuncel et al., 2005). We also asked students to rate their own quantitative abilities relative to the average student. Consistent with other studies using self-report of ability, students rarely report themselves as being below average – In Study A, only 1.9% marked themselves as far below average, and 7.9% somewhat below average. The bulk of students rated themselves as average (37.5%) or somewhat above average (44.3%). 8.4% report themselves as far above average. The distribution is similar in Study B (.8% far below, 5.7% somewhat below, 35.9% average, 49.9% somewhat above average, 7.7% far above average).

These demographic and background characteristics allow us to add nuance to our analysis of how student preferences respond to the different major requirement listings.

Given 1,181 students with two ratings each (from Study A), and 883 students with three ratings each (from Study B) we have 5,011 preference ratings from 1 (Definitely Choose A) to 7 (Definitely

Choose B). For each study, we model preference ratings as a basic function of the model requirement type they are choosing between:

$$Rating_j = \alpha + \beta \sum_{i=2}^4 RequirementList_j^i + \varepsilon_j \quad (1)$$

for each preference-rating task j and major requirement type i . Before running the model, we first copy the data. In the original copy, $RequirementList_j^i$ is a dummy referring to the major requirement type in Requirement List B. In the copy, $RequirementList_j^i$ refers to Requirement List A, and $Rating_j$ is inverted so a higher number indicates a higher preference. This allows the effect of each requirement type to be pooled together regardless of which side of the page it was on.⁵ We then adjust the degrees of freedom to be the actual sample size so that standard errors are not underestimated.

In effect, each model constructed using Equation 1 is a simple OLS model with three dummy regressors. In Study A, there is one for “Groups, No Stars,” one for “Stars, No Groups,” and one for “Groups and Stars,” with “No Groups, No Stars” as the reference group. In Study B, the dummies are “Long, No Stars,” “Long, Stars,” and “Short, Stars,” with “Short, No Stars” as the reference category. A positive β coefficient indicates a more-preferred major requirement list.

$Rating_j$ is treated as a continuous variable and the model is estimated using OLS. However, results are substantively identical if $Rating_j$ is instead treated as ordinal and the model is estimated using ordered logit. OLS is preferred here, to match standard conjoint choice analysis with preference ratings (Orme, 2006), and for ease of interpretation.

We estimate Equation 1 for the whole sample, and by student subsample, for both Study A and Study B in the next section.

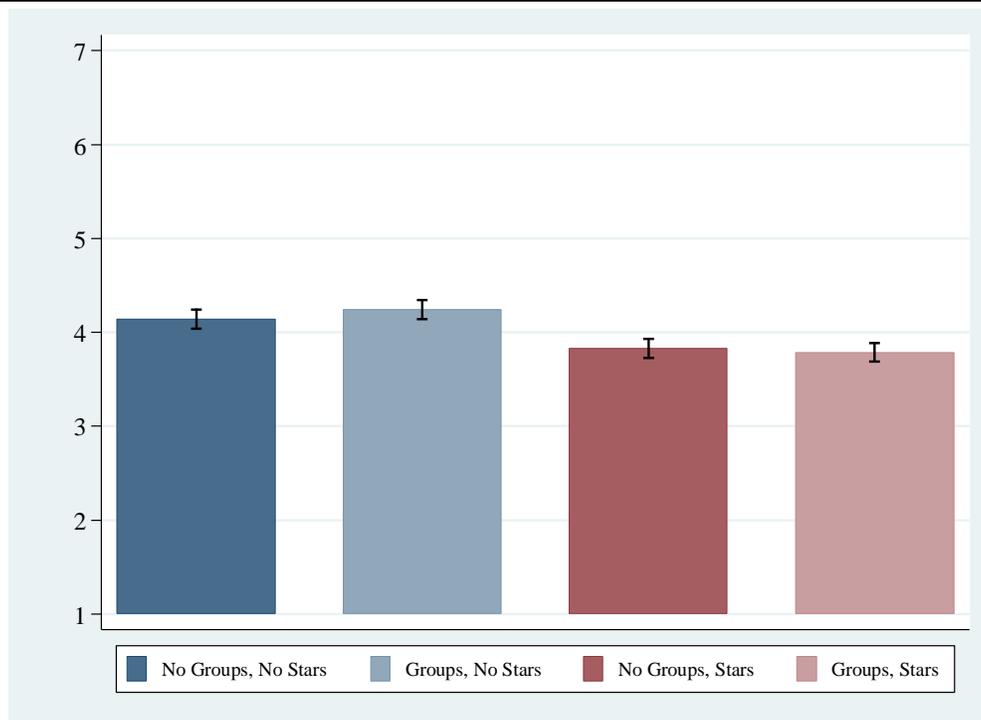
⁵ This approach also ensures that we do not need to account for person-specific correlation in the error term. Since major requirement lists are randomly assigned, within-person correlation in the error term across their two preference rating tasks can only be an abstract bias towards option A or option B, regardless of the content of those options. Including each task once as written, and once with the options reversed, cancels out this bias.

Results

a. Study A – GROUPING AND STARS

Figure 2 shows the average preference rating for Study A by major requirement type, aggregated across all majors and without taking into account the opposing major requirement type being considered. By construction, the average preference rating is 4. From this graph we can see three basic findings.

Figure 2: Average Preference Ratings in Study A



The first is that the two major requirement types with No Stars are significantly preferred to the two with Stars. The two types without Stars both have average ratings significantly above 4, and the two with Stars both have average ratings significantly below 4.

The second finding is that within the No Stars and Stars groups, there is no significant difference between No Groups and Groups. Further, the sign of this insignificant difference is inconsistent – Groups, No Stars has a slightly higher average than No Groups, No Stars, but Groups and Stars is slightly less preferred compared to Stars, No Groups.

Finally, even for the No Stars and Stars distinction, this difference is not enormous in size, even though this difference is statistically significant: -.310 of a point when paired with No Groups, and -.455 of a point when paired with Groups. The difference in average ratings is less than one unit, which would be the difference between “Neutral” and “Probably Choose A/B.”

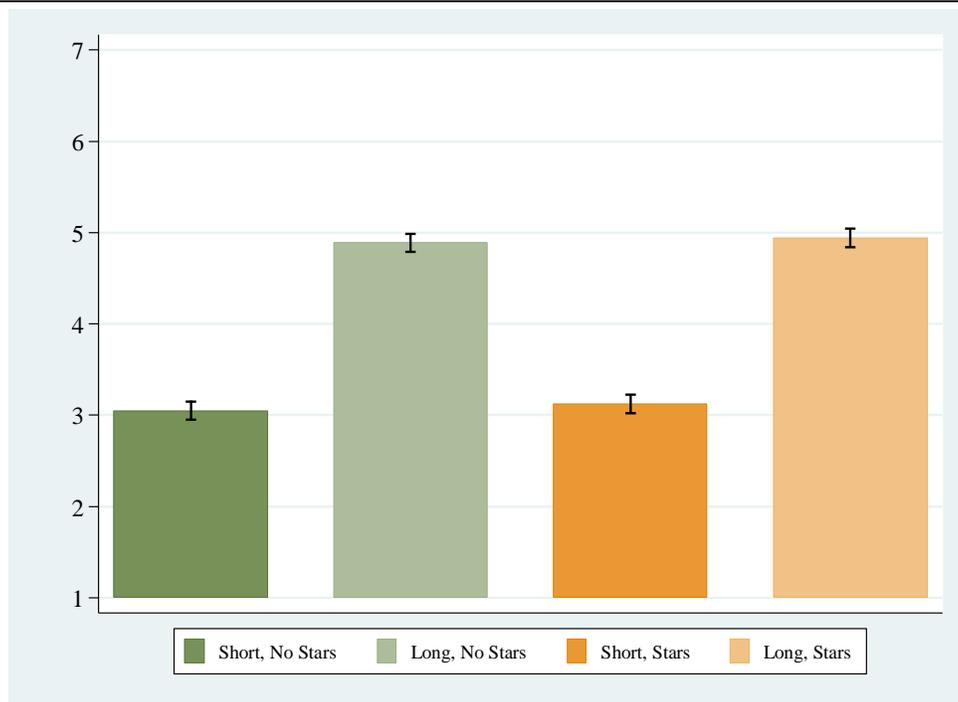
Notably, the difference between types is overstated somewhat by the fact that a requirement type cannot be paired against itself. If one major requirement list is more popular, its advantage is amplified by the fact that it never has to face off against its popular self. However, adding a control for the other requirement does not change significance or meaningfully change point estimates. Additionally, the major requirement list explains only a small portion of the variation. The R^2 value from a regression of ratings on requirement types is only .012, indicating considerable heterogeneity in preferences, which we address in Results section d.

From these results we can conclude that there is an average preference for No Stars over Stars, to the extent of about a third of a preference rating point on average, but that students do not on average care whether the courses are Grouped or not. This is consistent with students not minding additional guidance, but not strongly preferring it either. They do not like needless complexity, but the preference against it is smaller than might be expected.

b. Study B – NUMBER OF COURSES AND STARS

Results from Study B allow us to examine three additional questions: (1) do students have a preference against additional guidance when it comes in the form of actually removing course options, (2) does explaining the purpose of a limited course list affect preferences, and (3) is the finding on cross-cutting departmental requirements from Study A replicated when we included discipline specific requirements (“writing” or “lab”) rather than a general “departmental” requirement? Figure 3 shows students’ average preferences for short and long course requirement lists, with and without crosscutting departmental requirements. In this figure we see the strongest result of the paper: students have a strong preference for the longer course lists. Both with and without stars, students have a preference of roughly 1.8 units on a 7-unit scale for having more courses from which to choose within each group of classes.

Figure 3: Average Preference Ratings in Study B



We also see that students do not have a significant preference for or against overlapping departmental requirements (stars). This is in contrast to Study A, where we found a negative effect of departmental requirements. We cannot rule out that this might be due to a difference in samples across studies, though we note that the departmental requirement was presented differently in the two studies. In Study A the requirement was called a “departmental requirement” while in Study B it was called a “writing” or “lab” requirement depending on the department. This finding weakly suggests that if students know the reason for an added layer of complexity, they are less likely to actively dislike it.

Table 3 expands on the comparison in Figure 3 by accounting for the presence of an explanation for why the long and short course lists are present (the long list was said to represent “all of the classes that have been popular with students over the past five years” and the short list was said to represent “the core concepts of the discipline, as identified by the department’s faculty”). Column 1 simply repeats the analysis shown in Figure 3 in regression form, and Column 2 interacts an indicator for the long courselist with a variable indicating that the student saw an explanation.

Table 3: Regression Results from Study B

	(1) Rating	(2) Rating
Short, No Stars (Reference)		
Long, No Stars	1.840*** (0.100)	1.984*** (0.124)
Short, Stars	0.074 (0.101)	0.070 (0.101)
Long, Stars	1.893*** (0.101)	2.039*** (0.125)
Explanation		0.141 (0.101)
Explanation * Long		-0.284** (0.143)
Constant	3.049*** (0.071)	2.978*** (0.087)
Participants	886	886
Tasks Completed	2,657	2,657
R-squared	0.199	0.201

Table 3 shows that the explanation has some noticeable effect in defraying the preference for long class lists. The gap between Long and Short shrinks by between .284 points in the presence of an explanation, and this change is significant. We also note that much more of the variance in ratings is explained in Study B than in Study A, with R^2 values nearer to .20. A comparison of long vs. short classes animated much more of the ratings than a comparison of grouped vs. non-grouped classes.

From these results we can conclude that there is a preference for more course options within major requirements. This result is somewhat defrayed when students are told that the shorter course lists represent the courses that the department's faculty consider to be the core concepts of the discipline. We do not see that students mind having additional departmental requirements, at least in Study B where they are presented alongside an explanation for why the requirement is there. Since the explanation for the department requirement is not randomized (it was varied across studies), however, it is not clear whether the lack of an effect here is because of the additional explanation, or is just a failure to replicate a false result from Study A.

c. Subgroup Analyses

The results in the previous section used a sample aggregated over all respondents and all types of questions. This leaves the possibility that there are meaningfully different preferences between subgroups of the respondents.

Tables 4 and 5 shows that it is not the case that the aggregate results are present only for specific subgroups. Separating students by gender, class standing, or self-reported GPA or quantitative ability shows that the results are rather consistent across all of these groups. There are differences between them in the exact size of the coefficients, and given the smaller sample size in these subgroup analyses, effects are less often significant. However, the consistency of these results across subgroups lends weight to the original aggregate interpretation. The general story still holds.

All eight of these analyses generally back up the aggregate analysis. No general department requirement (No Stars in Study A) is preferred to a general department requirement (Stars), and there is little meaningful effect of Groups. Across subgroups, we also see a preference for longer course lists over shorter course lists, and no real effect of department requirements (Study B).

Table 4: Study A Results by Demographic Subgroup

	Self-Reported GPA		Gender		Class Standing		Self-Report Quant. Ability	
	≤ 3	> 3	Male	Female	Fr/So	Ju/Se	≤ Average	> Average
No Groups, No Stars (Ref)								
Groups, No Stars	0.303*	-0.028	0.194	0.074	0.240	0.034	0.088	0.128
	(0.164)	(0.131)	(0.176)	(0.127)	(0.189)	(0.122)	(0.145)	(0.144)
Stars, No Groups	-0.258	-0.390***	-0.148	-0.381***	-0.081	-0.375***	-0.344**	-0.265*
	(0.163)	(0.133)	(0.177)	(0.127)	(0.191)	(0.122)	(0.144)	(0.146)
Groups and Stars	-0.271*	-0.421***	-0.196	-0.438***	-0.045	-0.472***	-0.231	-0.475***
	(0.162)	(0.131)	(0.174)	(0.127)	(0.187)	(0.121)	(0.144)	(0.143)
Constant	4.060***	4.209***	4.039***	4.186***	3.971***	4.204***	4.125***	4.151***
	(0.115)	(0.093)	(0.124)	(0.090)	(0.133)	(0.086)	(0.103)	(0.101)
Tasks Completed	959	1372	888	1429	624	1715	1112	1237
Participants	480	686	444	715	312	858	556	619
R-Squared	0.017	0.013	0.007	0.017	0.006	0.016	0.010	0.017

Table 5: Study B Results by Demographic Subgroup

	Self-Reported GPA		Gender		Class Standing		Self-Report Quant. Ability	
	≤ 3	> 3	Male	Female	Fr/So	Ju/Se	≤ Average	> Average
Short, No Stars (Ref)								
Long, No Stars	1.907***	1.845***	1.778***	1.872***	1.590***	1.850***	1.709***	1.937***
	(0.160)	(0.134)	(0.158)	(0.132)	(0.277)	(0.108)	(0.151)	(0.134)
Short, Stars	0.196	0.010	0.010	0.109	0.270	0.053	0.152	0.017
	(0.162)	(0.134)	(0.159)	(0.133)	(0.286)	(0.108)	(0.153)	(0.134)
Long, Stars	2.021***	1.836***	1.723***	2.000***	1.655***	1.909***	1.770***	1.978***
	(0.161)	(0.135)	(0.160)	(0.132)	(0.283)	(0.108)	(0.154)	(0.134)
Constant	2.971***	3.077***	3.122***	3.005***	3.127***	3.047***	3.093***	3.017***
	(0.112)	(0.095)	(0.113)	(0.093)	(0.194)	(0.076)	(0.108)	(0.095)
Tasks Completed	998	1533	1088	1518	306	2336	1122	1526
Participants	333	511	363	506	102	779	374	509
R-Squared	0.212	0.196	0.182	0.211	0.155	0.201	0.175	0.216

d. Heterogeneity in Ratings

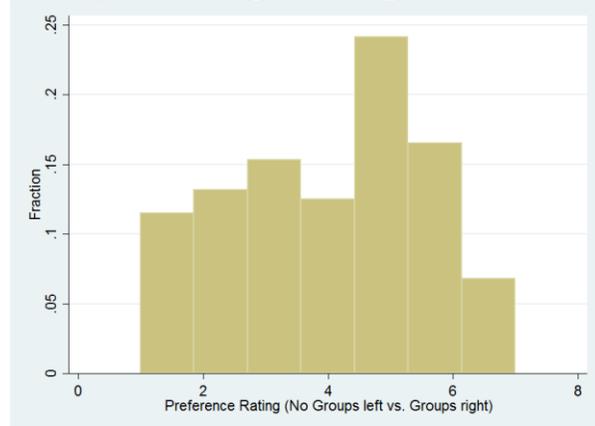
The results in the previous two sections look only at average differences in preference ratings between the different major requirement lists. However, this masks heterogeneity in the responses. Just because students on average prefer long lists to short lists does not mean that some proportion does not have the opposite preference. The average difference may also be affected by differences in the strength of preference.

Figures 4a-4d show the distribution of preference rankings comparing preferences for each attribute when compared against its alternative; i.e. the distribution of preferences when a Grouped list is compared against a non-Grouped list. 4 is a rating of Neutral. 1, 2, and 3 are “Definitely Choose,” “Very Likely Choose,” and “Probably Choose” the major requirement list with the attribute listed on the left, and 7, 6, and 5 are the same for the major requirement listed on the right. Choice tasks in which an attribute is compared against itself are not included (for example, No Groups, No Stars vs. No Groups, Stars does not show up in the No Groups vs. Groups graph). The graphs aggregate responses across all such questions regardless of what other attributes are present, but comparisons look generally the same if other attributes are accounted for.

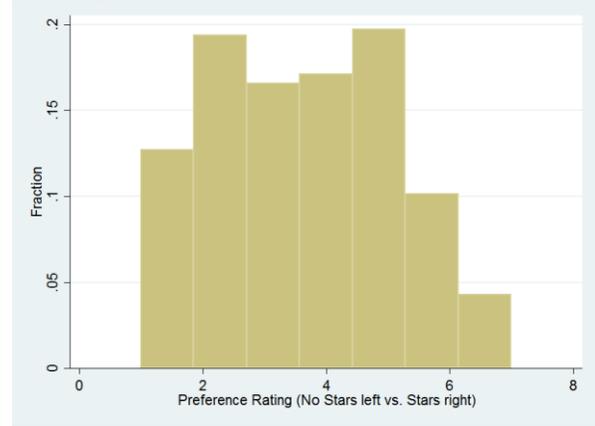
The first feature of these distributions we can note is that there are students choosing each of the seven ratings for every attribute. So there is definitely considerable heterogeneity in preference. Also, while the average differences in preference ratings across types are fairly small (generally within the range of a quarter of a point in Study A), this is not the result of students generally being neutral between the two options. Neutral is a relatively uncommon response compared to both of the Probably Choose options. The small average effect in Study A is the result of differing preferences cancelling each other out on average.

Figure 4: Preference Distributions

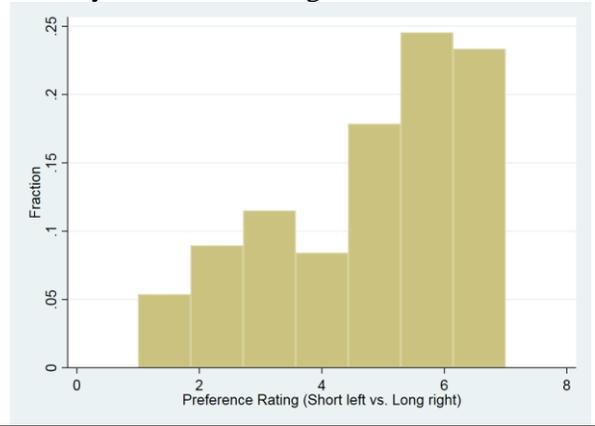
a. Study A: No Groups vs. Groups



b. Study A: No Stars vs. Stars



c. Study B: Short vs. Long



d. Study B: No Stars vs. Stars



Ratings are from 1 to 7, with 1 indicating strongest preference for the major requirement attribute listed first (for example, “No Stars” in Figure 3a), and 7 indicating strongest preference for the major requirement attribute listed second (“Stars” in 3a). Graphs include preference ratings from all questions comparing these attributes, regardless of the other attributes present. Results are similar if graphs are broken out by other attributes present.

One of the main results from Study A is that there is not a large difference between Groups and No Groups. Figure 3a is consistent with a small average difference between Groups and No Groups, but the distribution is not symmetrical. The small average difference is to some extent a difference in strength of preference. There are more people who prefer Groups to those who dislike them; ignoring neutral responses, 54.2% of respondents preferred Groups to No Groups. However, those people who like them have weaker preferences, whereas the people who dislike Groups have their preferences evenly distributed across the three strengths, making the average difference zero. Neutral is not a

particularly common choice, so this is not true neutrality, but rather a balance of a slightly larger number of moderate preferences with a slightly smaller number of stronger preferences.

The other result of the aggregate analysis in Study A is that No Stars is preferred to Stars. In Figure 3b shows that this result holds up well. While there are a large number of respondents reporting a slight preference for Stars, these are overwhelmed by the large number of people who dislike Stars overall, many of whom have strong preferences. Very few people have a strong preference in favor of Stars. There is a strong lean in the sample towards No Stars, although heterogeneity is still definitely present, with about 30% of the sample reporting a preference for the Stars variant.

There are two main results from the aggregate analysis of Study B. The first is that Long is preferred to Short. This is heavily supported in Figure 3c. Every preference rating in favor of Long has significantly more respondents than any preference rating in favor of Short, or Neutral. While there is a non-ignorable minority who prefer the Short lists, the distribution tilts heavily towards Long.

The second result of Study B is that there is no significant preference for or against Stars. The graph largely backs this up. responses are balanced for and against. Like in Study A, the average neutrality actually represents a mix of for- and against- preferences, with neutral as a less common choice.

Conclusion

Low and stagnant graduation rates at colleges across the country have lead policy makers and administrators to examine the ways in which institutional structure and policies might affect student persistence. Descriptive work of course requirements within majors and empirical and theoretical work examining decision making more broadly indicate that simplifying major requirements might be one policy lever to increase graduation rates within majors. Administrators and policy makers have advocated for changes such as reducing the number of options available, grouping similar courses, and

providing default curricular maps. However, these changes will not have a meaningful effect if students are turned off by such attempts at simplification. If students prefer choice and freedom to structure and simplicity, well intentioned policies might have unintended consequences.

We perform a choice experiment on over 2,000 students at two large public four-year college campuses in Southern California to examine these questions. We find that students are indifferent between major requirement lists that group courses and major requirement lists that do not. Students have a strong preference for more options. Long course lists are preferred to short course lists by 1.8 points on a seven-unit scale, and giving a reason why the shorter course list is offered moderates this effect only by about .3 points. Results on crosscutting department requirements are mixed.

The results of this study do not have anything to say about whether reduction in choice and guidance has actual positive effects on student performance. Rather, we look at whether implementing these policy changes is likely to lead to pushback from students. We find that the actual form that the guidance takes matters quite a bit. Students are not fans of obviously reduced choice in the form of fewer classes, though their dislike is attenuated when the rationale is given to them. However, additional guidance in the form of the relatively easy-to-understand grouping is fine. Further, complexity should be kept in mind. While we did not find overwhelming evidence that students disliked the increase in complexity that comes along with crosscutting department requirements, administrators should be wary of adding needless complexity to the already complex task of selecting courses.

The current winds of policy reform seem to be heading in the direction of more guidance. But this cannot be done blindly. Students may accept less restrictive forms of guidance as opposed to approaches that obviously limit what they can do. The possibility that students may abandon programs or universities because they do not like restriction of choice is real. Student preferences should form the bounds of the reform options that administrators have.

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