Students' Choices of College Majors That are Gender Traditional and Nontraditional

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Regression analyses of questionnaires completed by University students (99 men, 143 women) revealed that humanitarian concerns, femininity scores, masculinity scores, and utility values were significant predictors of college major. Education, English, and nursing majors had greater confidence, satisfaction, and expectations for future success than did engineering, mathematics, and physics majors.

Despite concerted efforts in the United States over the past 20 years to reduce a gender imbalance that favors men, women are still underrepresented in graduate programs and in employment that requires advanced training in engineering and the physical sciences. Choice of college major is an important factor in career development and vocational choice (Turner & Bowen, 1999). For example, a recent U.S. Department of Education report (Snyder & Hoffman, 2000, Table 258) showed that in 1996-1997, the percentages of bachelor's degrees earned by women in engineering and physics were 18% and 19%, respectively. Given these national enrollment patterns at the college level, the fact that women are underrepresented in advanced graduate training and in employment in these fields is not surprising. On the other hand, women have been and still are overrepresented in fields such as early childhood education and nursing. Again, choice of college major seems critical as fully 89% of majors in these fields are women (Snyder & Hoffman).

In the current study, a college major that has had a recent and continuing history of gender enrollment differentials of 80% or greater was considered to be a *traditional* major for the majority gender and a *nontraditional* major for the minority gender. For example, engineering is a nontraditional college major for a woman but a traditional major for a man. Nursing, on the other hand, is a traditional college major for a woman but a nontraditional major for a man. Note that characterizations of majors as traditional or nontraditional were based on actual enrollment patterns, not personal beliefs or stereotypes.

The main purpose of the current study was to clarify choices of traditional and nontraditional majors by female and male college students enrolled in coeducational institutions. Solnick (1995) found that female students were more likely to leave female-dominated majors when enrolled in women's colleges as compared to coeducational institutions. On the other hand, Solnick also found that students in women's colleges were not more likely than female students in coeducational institutions to choose male-dominated fields. Thus, Solnick's study does not help explain why women choose nontraditional majors and did not analyze men's choices of majors. Canes and Rosen (1995) found that from 1974 to 1988, the number of female faculty members in various majors bore no relation to the number of female students who chose those majors at Whittier College, the University of Michigan, and Princeton University. Thus, a simple role model effect did not seem to be operating as an explanation for women's choice of majors. Again, this study did not address nontraditional choices in male college students. Turner and Bowen (1999) showed that a measure of academic ability, namely the Scholastic Aptitude Test (SAT; now called Scholastic Assessment Test) could only account for some of the variance in the gendered nature of college major choices.

Rather than academic ability, per se, students'

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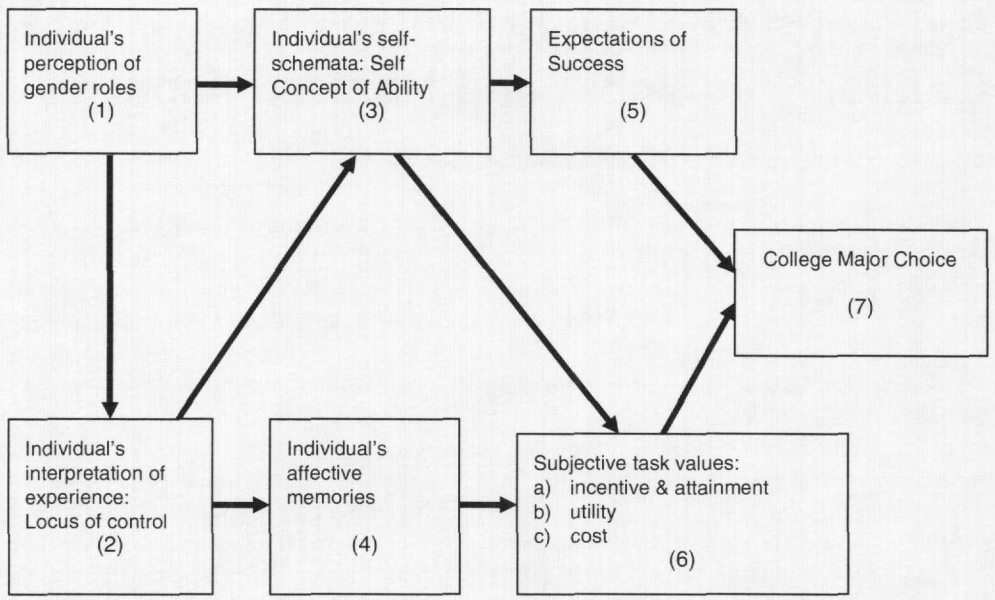

FIGURE 1. Expectancy-value model used to predict college students' choice of major.

Adapted from Figure 1 of Wigfield & Eccles (1992) by permission of Academic Press, Inc.

perceptions or beliefs about their own abilities and their feelings of self-efficacy have been shown to play a role in college major choice (Bergeron & Romano, 1994; Betz, Heesacker, & Shuttleworth, 1990; Hackett, 1985; Trusty & Ng, 2000). Eccles and her colleagues (Eccles, 1984, 1987, 1994; Eccles, Adler, & Meece, 1984; Wigfield & Eccles, 1992) have developed a theoretical model of achievement choice based on expectancy-value theory (see Figure 1) in an attempt to identify factors that influence individual achievement choice, persistence, and performance in a field of study. This model has been used to address questions relating to achievement behaviors, development of task values, and sex differences, especially for mathematics in the middle school and high school years. The current study expands upon previous efforts by including a wider range of majors and by focusing on college men as well as women as they make traditional, nontraditional, and gender-neutral choices of majors.

As can be seen in Figure 1, students' expectations for success in their major field of study (Component 5) and their personal sense of values (Component 6) are hypothesized to be proximal factors determining choice of major. Both expectations and values are each hypothesized to be influenced by students' academic self-concept (Component 3). Students' feelings about their previous academic experiences in high school (Component 4) should have an influence on their value systems. Finally, students' sense of gender identity (Component 1) and the degree to which they believe that their life experiences are under personal control (Component 2) are the most distal factors in the model. Use of an a priori model such as that depicted in Figure 1 to derive predictions is important in this study because students' choices had already been made and the design was therefore correlational and ex post facto in nature.

METHOD

Participants

The participants were 242 students enrolled in six different fields of study in a large, land grant, public university in the northeastern United

States. Table 1 shows the numbers of female and male students in each of these six fields. Physics and engineering were selected to represent male-dominated majors, with less than 20% female students, and were grouped together as *science* majors. Nursing, special education, and elementary education were selected as the female-dominated majors, with less than 20% male enrollment. These majors were grouped together to form a *helping profession* category. Mathematics and English were selected as neutral majors as nationally, mathematics has an enrollment ratio of 54% male to 46% female students, and English has an enrollment ratio of 34% male, and 66% female students. Enrollment numbers were obtained from the university institutional reports in 1993 and from the U.S. Department of Education (1991). A more recent U.S. Department of Education report (Snyder & Hoffman, 2000, Table 258) showed that for the 1996-1997 school year, the percentages of women earning bachelor's degrees in various fields were as follows: engineering, 18%; physics, 19%; mathematics, 47%; English, 66%; early childhood or elementary and special education, 89%; and nursing, 89%. Using a different methodology, Turner and Bowen (1999) had a similar classification of majors as dominated by either female or by male students. Finally, a report by McClain (2000) confirmed that both nursing and noncollege teaching are professions dominated by women. Thus, the enrollment patterns that formed the basis of our characterization of majors as gender-traditional or nontraditional have remained stable for most of the last decade.

Eighty-seven percent of the participants were enrolled at the university, 9% were from a neighboring engineering school, and 4% were from a neighboring liberal arts college. The latter institutions were used to obtain sufficient numbers of female students in engineering, and sufficient numbers of male students in education, and nursing.

Participants included 137 (57%) seniors, 89 (37%) juniors, 11 (5%) graduate or certificate-only students, 3 sophomores (1%), and 2 (1%) first-year students. The latter 16 students were all men enrolled in fields that are heavily subscribed to by female students. Students' self-identifications were as follows: 175 (72%) as Caucasian, 30 (12%) as Asian American, 17 (7%) as Hispanic, 12 (5%) as African American, and 8 (3%) as Other or no response. Ninety-four percent of the students reported that they were U.S. Citizens, and 86% said that English was their first language. Sixty-seven percent of the students reported that their high school GPA was B+ or above, and 29% reported C+ or above; 40% of the students reported that their current college GPA was B+ or above, and 54% reported C+ or above.

The mean age for all student participants was 24.5 (SD = 5.7) years old. Male students enrolled in education and nursing were significantly older (mean age = 31.7) than all other groups of

TABLE 1.
Number of Female and Male Students in Each Major Field of Study

	Major Field of Study					
	Engineering	**Physics**	**Mathematics**	**English**	**Education**	**Nursing**
Females	17	6	17	22	61	20
Males	35	18	16	10	10	10
Total #	52	24	33	32	71	30
(% of Total)	(22%)	(10%)	(14%)	(13%)	(29%)	(12%)

students, whose mean ages ranged from 21.9 to 24.8 years old. The tendency for male students in education and nursing to be older was true for both institutions from which students volunteered. This trend was responsible for a significant institutional difference in mean age.

Procedures

Statistical tests (ANOVAs using Institution and College Major as between-subject factors) were conducted to determine if students' demographic characteristics and scores on psychological variables differed by institution. In all cases except one (student age), results did not vary by institution. For this reason, institution was dropped as a variable in further analyses.

The study was conducted in the 1994-95 academic year. Department chairs and deans gave permission to contact instructors of upper-level courses in each major field (so the 5 first- and second-year male students who participated were enrolled in advanced college courses). Instructors gave permission for the first author to visit classes and take a few minutes to explain the study and solicit voluntary participation. All students in attendance received a packet of materials that contained a letter of introduction, instructions, questionnaires, and a return envelope. Students were asked to return unused packets if they declined to participate. Participation was completely voluntary and anonymous. Approximately 900 packets were distributed and 306 returned as completed (34% response rate). Sixty-four packets could not be used because students were not in an appropriate major field.

Students' self-perceptions of gender roles (Component 1 of Figure 1) were assessed with the Bem Sex-Role Inventory (BSRI) (Bem, 1974, 1981) and the Personal Attributes Questionnaire (PAQ) (Spence, Helmreich, & Stapp, 1974). Previous studies have shown that sex role identity is a factor in student decision making (Chusmir, 1990; Galbraith, 1992; Lemkau, 1984; Lyson & Brown, 1982; Strange & Rea, 1983; Williams, 1989). Reliability estimates for BSRI scales range from .80 to .86 (Bem, 1974); reliability estimates for the PAQ scales range from .80 to .98 (Spence et al.). Component 2 of the model was measured by the Internal Control Index, which has a scale reliability around .85 (Duttweiler, 1984) and by the Internal-External Locus of Control Scale which has a test-retest reliability range from .49 to .83 (Rotter, 1966). Component 3 of the model was assessed by the Academic Self-Concept Scale, which has a reliability estimated at .92 (Reynolds, 1988). Component 4, students' affective memories for academic achievement, was assessed via questions devised for this study. For example, students rated their high school academic experiences on a 1 (*negative pole*) to 5 (*positive pole*) scale. Component 5, expectation for success in college academics, was also assessed via questions devised for this study. For example, students rated how well they expected to do in coursework this year as compared to other students in their major using a scale from 1 (*much worse than others*) to 5 (*much better than others*), with 3 indicating *average*. A factor analysis of responses yielded two factors: expected success on college grades, and expected success in career. These factor scores were used in subsequent analyses. Students' values (Component 6) were measured with the Rokeach Value Survey (Rokeach, 1973, 1983) and with a task value questionnaire devised for this study. On the latter instrument, students rated, on a 1 to 5 scale, the importance of various reasons for selecting their choice of college major (e.g., "I enjoy working with people," "This major leads to profitable careers.") A factor analysis of the task value questionnaire revealed four factors governing choice of major field: intrinsic interest in subject matter, humanitarian concerns, utility value, and outside influences. These factor scores were used in subsequent analyses.

The instruments when assembled into packets were presented in the following order: letter of introduction and instructions, demographic information sheet, BSRI, Rokeach Value Survey, student academic questionnaire, Academic Self-Concept Scale, task values questionnaire, Internal Control Index, PAQ, and Internal-External Locus of Control Scale. We were not able to record the time students actually took to complete these measures because the

measures were not completed in a laboratory setting. A student who completed the packet in one sitting would need 45 to 60 minutes.

RESULTS

Predicting Major Field Choices

Multiple regressions were run to assess the contribution of each variable included in the expectancy-value model to the choice of major field. Major field was therefore the dependent variable in these analyses and was dummy coded as follows: helping professions, 1; English, 2; mathematics, 3; and science, 4. Note that "higher scores" for major represent science majors. (Results did not vary appreciably when English and mathematics were coded together or when each of the six majors was coded separately.) The independent variables in the regression analyses were: expected success in college grades, expected success in career, intrinsic interest in subject matter, humanitarian concerns, utility value of major, outside influences, academic self-concept, affective memory about school, BSRI femininity score, BSRI masculinity scores, PAQ expressive scale score, PAQ instrumental scale score, PAQ Male-Female Positive scale score, internal control index, and the internal-external locus of control score. The Rokeach Value Survey was excluded because the results are rank-ordered scores and are not appropriate for use in regression analyses.

The results of the multiple regression analysis revealed an overall $R^2 = .45$; $F(15, 201) = 10.93$, $p < .001$. The beta weights and p values for the five significant predictors revealed by this analysis are reported in Table 2. Two value scores and three sex-role identity scores were significant predictors of students' choices for major fields. Students who endorsed humanitarian concerns and who had higher femininity scores were more likely to be in the helping professions than in the sciences. Students who did not endorse humanitarian concerns and who had lower femininity scores were more likely to be in the sciences than in the helping professions. Students who endorsed utility values, had higher masculinity scores, and higher male-female sex role scores were more likely to be in the sciences than in the helping professions. Students who did not endorse utility values, and had lower masculinity, and male-female sex role scores were more likely to be in the helping professions than in the sciences. Regressions were conducted for female students and male students separately. An $R^2 = .45$ was obtained for female students, $F(15, 109) = 6.09$, $p < .001$. Significant beta weights were obtained for humanitarian concerns (beta = –.55; $p < .001$), and for the BSRI femininity scale (beta = –.26, $p < .05$). The

TABLE 2.
Significant Predictors of Major Field Choices According to a Multiple Regression Analysis

Independent Variable	Beta Weight	Significant *T*
Utility Value of Major	+.13	$p < .05$
BSRI Masculinity Scale	+.17	$p < .05$
BSRI Femininity Scale	–.19	$p < .01$
PAQ Male-Female Positive Scale	+.26	$p < .01$
Humanitarian Concerns	–.50	$p < .001$

Note. Positive values indicate a choice in the direction of science fields; negative values indicate a choice in the direction of helping profession fields.
BSRI = Bem Sex-Role Inventory.
PAQ = Personal Attributes Questionnaire.

TABLE 3.

Rank-Order Differences Among Four Major Fields on Sex Role Identifications, Academic Experiences, Expectancies, Satisfaction, Self-Concept, and Values

	Major Field of Study			
	English	Education & Nursing	Engineering & Physics	Mathematics
BSRI Feminine	3 [b]	1 [a]	4 [b]	2 [b]
PAQ Expressive	3 [b]	1 [a]	4 [b]	2 [a,b]
PAQ Male-Female	1 [a]	2 [a]	4 [b]	3 [b]
Academic Self-Concept	1 [a]	2 [a,b]	3 [b,c]	4 [c]
Affective memories	1 [a]	2 [a,b]	3 [b,c]	4 [c]
Satisfaction with major	1 [a]	2 [a]	3 [a,b]	4 [b]
Expected grades	1 [a]	2 [a]	3 [b]	4 [b]
Intrinsic interest in subj.	1 [a]	2 [b]	3 [c]	4 [c]
Humanitarian concerns	2 [a]	1 [a]	4 [b]	3 [b]

Note. Rank of 1 = *highest scoring major*, rank of 4 = *lowest scoring major*. An ANOVA revealed a significant main effect due to major field for each variable listed. Row superscript values that differ indicate significant mean differences ($p < .05$) between majors according to post hoc tests.

regression for male students yielded an $R^2 = .33$, $F(15, 76) = 2.53$, $p < .01$. Significant beta weights were obtained for humanitarian concerns (beta = –.33, $p < .05$), utility value of major (beta = .22, $p < .05$), and PAQ male-female positive scale (beta = .32, $p < .05$).

Profiles of Different Major Fields

Separate Sex of Subject (2) × Major Field of Study ANOVAs were conducted on each of the variables used to predict choice of major. In only 1 of 15 cases was the sex of subject × major interaction significant (for the PAQ-Expressive scale). In only three cases was a significant main effect for sex of subject obtained and each of these involved sex role identifications (females were higher on the BSRI femininity and PAQ male-female scales; males were higher on the BSRI masculinity scale). In contrast to the generally nonsignificant effects due to student sex, a significant main effect for major field was obtained in 9 of 15 cases. These differences are summarized in Table 3.

The profiles of English majors and students in the helping professions were very similar to one another as were the profiles of students in the sciences and in mathematics. The helping profession students were set apart by their identification with feminine and expressive sex roles and their endorsement of humanitarian concerns. Along with the English majors, helping profession students expressed more positive academic memories, higher academic self-concepts, expected to receive higher grades, were more satisfied with their majors and expressed a greater intrinsic interest in their majors than did students in the sciences and mathematics.

Grades received in major courses were likely responsible for the above patterns pertaining to academic self-concept and satisfaction with major. One-way ANOVAs using the four major fields as the independent variable and students' self-reported grades as the dependent variable revealed several significant differences among majors. The majors did *not* differ on self-reported high school GPAs. Significant effects were

obtained for expected grades in current major courses, $F(3, 237) = 6.15$, $p < .001$; current college GPA, $F(3, 237) = 7.41$, $p < .001$; current major GPA, $F(3, 237) = 5.08$, $p < .002$; and expected GPA at graduation, $F(3, 237) = 7.85$, $p < .001$. Post hoc LSD tests revealed that science majors reported lower grades than English and helping profession students in all cases; mathematics students reported lower grades than English students in all cases; and mathematics students reported lower grades than helping profession students for expected grades in current major courses and in expected GPA at graduation. We found no significant differences between science and mathematics majors nor were there significant differences between English and helping profession majors in grades. Students' total academic self-concept scores and their overall satisfaction with major scores were each significantly correlated with each of the above grade scores (except high school GPA). For example, academic self-concept and major GPA were correlated $r(239) = .525$, $p < .001$; satisfaction with major and expected GPA at graduation were correlated, $r(239) = .344$, $p < .001$. Interestingly, students' self-reported intrinsic interest in their major area was not significantly correlated with their self-reported grades. Academic self-concept and satisfaction with major were significantly correlated, $r(239) = .433$, $p < .001$.

DISCUSSION

Why do certain majors continue to show marked gender imbalances in terms of enrollments? This pattern has persisted with respect to engineering and the physical sciences in spite of concerted efforts over the last two decades at the national, state, and institutional levels to increase the participation of women. (Similar efforts to increase the participation of men in nursing and in early childhood education have not occurred with the same vigor.) Recent studies have shown that students' choices of majors cannot be fully explained by institutional factors such as single-sex versus coeducational or numbers of female faculty in various departments (Canes & Rosen, 1995; Solnick, 1995) or by academic ability as measured by the SAT (Turner & Bowen, 1999). Institutional variables and intellectual ability no doubt play a role in selection of a major, but they are not the whole story. Previous work using expectancy-value theory (Eccles, 1984, 1987, 1994; Eccles et al., 1984; Wigfield & Eccles, 1992) has shown that reframing the question about gender imbalances in academic achievement in terms of students' choices is useful. The question becomes, Why do women tend to choose certain majors and men choose certain other majors? The current study has added to this work by expanding this basic question to include not only traditional and nontraditional choices in men as well as women, but also by including major fields that do not show large gender imbalances in enrollments (English and mathematics). The current results show that the model depicted in Figure 1 can account for a wide variety of choices made by female and male college students.

As it turned out, students' value systems but not their expectancies for success were a significant predictor of major choices. For both men and women alike, endorsement of humanitarian concerns was associated with selection of a helping profession major and failure to endorse humanitarian concerns was associated with selection of a science major. In addition, students in a helping profession ranked first, and students in a science major ranked last, on the humanitarian concern scale. Stressing the importance of the utility value of a major was also found to be associated with selection of a science major, especially in male students. The design of our study does not allow us to specify a causal direction for these significant relationships between values and choice of college majors. It is likely that students select courses of study based on their value systems and that once the courses are selected, experiences in those courses tend to reinforce those value systems. For example, students who want to help others might be drawn to early childhood or special education, or to nursing, and subsequent experiences in those majors such as stressing the importance of meeting student and patient needs, serve to underscore the importance of helping others. Students who find their humanitarian value

systems to be contradicted by their experiences in courses are likely candidates to discontinue study in that field, especially if a mismatch becomes evident (cf. Lips, 1992; Ware & Lee, 1988).

College advisors can use this information to help students select courses and majors. Brief interviews with students about their values can be of assistance in course selection. On the other hand, perhaps the status quo can be changed. College instructors need to be mindful that a failure to consider a broad spectrum of student values in their courses might be shrinking the potential pool of students who select additional courses in that field. Science instructors, in particular, tend to view their role as teachers in terms of presenting facts and principles much more than a focus on student development (Angelo & Cross, 1993). College professors cannot change the fact that beginning engineers tend to earn higher salaries than beginning teachers in the current job market. However, engineering faculty can point out the benefits to society that accrue from the work of engineers just as education faculty can point out some of the economic-utilitarian benefits associated with a K-12 teaching career (job security, steady income growth, 10-month contracts, etc.). College personnel need to emphasize the full range of values that are associated with all fields of study as a means to increase diversity in the major pool. However, at a given institution, if a major is associated with certain value systems (such as humanitarian concerns) but not others (such as utilitarian concerns), college personnel can use this information in advising students who are uncertain about which path to pursue.

Of course, students select courses and majors based on their prior academic performance and their expectancies for future academic performance in that field, not just on the basis of their value systems. The fact that we did not find expectancy for success to be a predictor of college major choice is not a serious threat to the expectancy-value model because we only asked students how they expected to do in their current and future fields compared to others in those same fields. Recall that our sample consisted of declared majors (mostly third and fourth year students). If we had asked students how they expected to perform in a wide range of courses, we might have found expectancy to predict choice as well. A test of this part of the model would require administration of an expectancy-for-success measure in a wide variety of majors at the start of the first year of study with a longitudinal follow-up.

As for the more distal factors described by the model in Figure 1, only gender role orientation was found to be predictive of college major choice. For women, a higher score on the BSRI femininity scale was associated with choice of a helping profession major. For men, a higher score on the BSRI masculinity scale and the PAQ male-female positive scale was associated with a choice of a science major. These associations suggest that gender role identifications are influential in students' choices of fields of study. Scores on the gender role identification measures were the only ones in the study to vary significantly by sex of student. Given these sex differences and the fact that a feminine orientation was associated with choice of a helping profession major, whereas a masculine orientation was associated with choice of a science major, it would seem that traditional sex-role stereotypes are still operative in student decision making. This conclusion is not as surprising for male students' avoidance of nontraditional majors as it is for female students' avoidance of nontraditional majors given the efforts that have been made to attract women into engineering and the physical sciences. In sum, students' choices of college majors can be explained by their sex-role orientation and by their value systems.

The results of this study also showed that the majors sampled had distinct profiles on the variables assessed and that these profiles did *not* vary by sex of student. English and helping profession majors generally scored higher than mathematics and science majors on academic self-concept, academic affective memories, satisfaction with major, expected grades in major, and intrinsic interest in subject matter. We were interested to note that these measures of academic self-evaluation and performance were higher in the majors that have a predominance of female to male students. The fact that these

results did not vary with the sex of student means, for example, that women majoring in English and the helping profession majors were more similar to men in these same fields than they were similar to women in mathematics or the science majors. The majors had distinct profiles such that mathematics and science majors had lower academic self-concept scores, were less satisfied with their major, and had less intrinsic interest in their major than English and helping professions majors.

Many of these differences among majors seemed to reflect the fact that students in the sciences and in mathematics reported receiving and expected to receive lower grades than students majoring in English and in the helping professions. College course grades have been found to vary in this fashion in several empirical studies (see Young, 1993, for a review). In the current study, the impact of grades was found to be substantial across majors. Students' self-reported GPAs in their majors correlated with academic self-concept scores. Students' self-reported expected GPAs at graduation correlated with their current satisfaction with their majors. College advisors may want to have recent institutional GPA information by major field in order to help students choose majors or to help them evaluate their performance relative to other students in a major as requirements are completed. In any event, students' feelings and beliefs about their grades apparently had an impact on the distinct major profiles observed in this study.

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