Student-Perceived Interferences to College and Mathematics Success

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Student persistence or departure from college is complex.

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ABSTRACT: *Nationally, developmental mathematics courses have some of the highest failure and withdrawal rates of postsecondary courses. A wide range of factors may be contributing to students' struggles in these courses. In order to help identify these factors, we asked students enrolled in developmental mathematics to identify factors interfering with their college success. Results suggested that students in these courses perceive a diverse set of academic and nonacademic interferences to their college success. Perceived nonacademic interferences related negatively with academic achievement and persistence. Our findings provide a holistic framework for conceptualizing additional academic and nonacademic support students might need.*

Developmental education (DE) mathematics courses can be a stepping-stone and an obstacle for students who enter college academically underprepared. When compared to other postsecondary courses, DE mathematics courses are among those with the highest failure (14.2%) and withdrawal (20.8%) rates (Adelman, 2004). Not passing DE mathematics courses can prevent students from advancing in their college coursework and may negatively influence their first impressions of college and their beliefs and attitudes about themselves as learners (Noel-Levitz, 2006). On the other hand, DE mathematics functions as a stepping-stone for students by helping them to develop prerequisite knowledge and skills for college-level mathematics coursework (e.g., Mireles, Acee, & Gerber, 2014). A major challenge for institutions, DE researchers, and practitioners is identifying variables that contribute to and detract from students' success in DE mathematics courses. Research has suggested that prior achievement, standardized test scores, learning strategy use, first-generation status, and socioeconomic status relate to students' success in DE courses (see Russell, 2008) and postsecondary education (Robbins et al., 2004), but rarely have researchers addressed students' perceptions of factors interfering with their success. Investigating student perceptions using open-ended questions could help capture a broad sampling of academic and nonacademic factors that may be interfering with students' success in DE mathematics. The present study aimed to capture such data to help researchers and practitioners more fully understand and address obstacles to student success.

In this study, we asked 362 students enrolled in DE mathematics courses to list circumstances that were making it more difficult to succeed in college. Goals included: (a) categorizing student-perceived interferences to success, (b) reporting the frequency of perceived interferences that fell within each category and subcategory, (c) analyzing relationships among demographics and the number of perceived interferences listed, and (d) analyzing relationships among perceived interferences and academic outcomes.

Review of Literature

College Student Access, Achievement, Persistence, and Retention

Student departure from college has been an important focus of research for decades. Much of this research has focused on the changing demographics of postsecondary students (Reason, 2009) and on student precollege, background variables such as high school GPA and college admission scores that help predict both access and persistence in college (Peltier, Laden, & Matranga, 1999; Reason, 2009). Research has suggested that once students matriculate into college, more proximal variables such as college GPA, academic skills, and integration into the institution help to explain student persistence (Ishitani & DesJardins, 2002; Mangold, Bean, Adams, Schwab, & Lynch, 2003). Titus (2006) found other factors, such as financial needs, negatively affect persistence and college completion.

Tinto's (1975) groundbreaking student retention model posited that students who integrate socially into campus communities are more likely to graduate. This theory created a base, which led to today's more holistic approach to examining student persistence and retention in college. Contemporary models have acknowledged that student persistence or departure from college is complex, generally based on multiple factors, and requires robust data to describe the phenomenon (see Seidman, 2012). Based on this view of persistence, retention research has focused on an institutional responsibility via formal and informal programming designed to support undergraduates

(Braxton, Hirschy, & McClendon, 2004; Keels, 2004; Lehr, 2004). Additionally, research on academic factors (e.g., academic difficulty and academic integration) and nonacademic factors (e.g., finances and isolation) helped to develop a more nuanced picture of student retention on campus (Tinto, 2007). However, Guiffrida (2006) argued that Tinto's theory of student departure has limited utility when applied to the retention of minority students, in that it does not take into consideration their support systems outside of college nor does it consider how those supports could influence persistence. Tinto's early work made assumptions about how and why students reach a decision to drop out but did not consult students as to whether these assumptions held true (Brunsden, Davies, Shevlin, & Bracken, 2000). Theories of college student retention have depended largely on research that has examined predictors of retention and less so on research that has examined reasons students give for departing (see Seidman, 2012). Furthermore, research on student-perceived reasons for leaving college has examined data reported after students had already departed from college (Bradburn & Carroll, 2002; Matross & Huesman, 2002). A primary focus of this study was to uncover factors students perceive as interfering with their success while enrolled in college.

Research on student perceptions of success has suggested that many nonacademic factors affect student persistence and success in college. Bradburn and Carroll (2002) found that 36% of college students cited a financial reason, 18% cited personal or family issues, but only 4% cited academic problems when asked why they departed from school. However, these attributions may correspond to intentionality. Matross and Huesman (2002) found that students who stopped out of college, but were planning to return, were more likely to cite finances or work related reasons, whereas students who dropped out of college, and were not planning to return, were more likely to cite academic reasons. Incorporating academic and nonacademic factors into research on college student success provides a much-needed holistic picture about student perceptions of success in college.

Developmental Mathematics

Research has suggested that students who place into DE courses, particularly mathematics, are at risk of performing poorly in college and dropping out (Adelman, 2004). Trusty and Niles (2003) found that students who placed in DE mathematics courses were less likely to earn a degree, even when compared to students who placed into DE reading courses. Among students attending the Achieving the Dream Initiative schools, only approximately 30% passed all of the DE mathematics courses in which they enrolled (Attewell, Lavin, Domina, & Levey, 2006; Bailey, 2009). Moreover, research has shown that large numbers of students who place into DE mathematics courses, especially the lowest-level courses offered at an institution, fail to enroll in such courses (Bailey, Jeong, & Cho, 2010; Jaggars & Stacey, 2014). Fike and Fike (2008) found that students who fail to complete their first DE mathematics course have an increased likelihood of not persisting to the next long semester. Research has also found that students who identify as African American and Hispanic place and enroll in DE mathematics courses at a disproportionately higher rate (Crisp & Delgado, 2014) and are less likely than their Caucasian counterparts to successfully complete their DE mathematics sequence (Bailey, Jeong, & Cho, 2010).

Researchers suggest several explanations both for the high percentage of student placement into developmental mathematics (Latterell & Frauenholtz, 2007) and for the tendency of these students to perform at lower levels. As noted by Bulger and Watson (2006), many students manifest their at-risk status through myriad factors, including low socioeconomic status, single-parent families (Chen, Kaufman, & Frase, 1997), low self-concept, prior school experiences (Roueche & Roueche, 1993), and what Hiroto and Seligman (1975) and Grimes (1997) have described as learned helplessness. In addition, DE mathematics courses often have larger enrollments than other DE courses (see Bailey, Jeong, & Cho, 2010; Boatman & Long, 2010; Parsad & Lewis, 2003), and nearly 80% of such courses are taught by part-time instructors (Gerlaugh, Thompson, Boylan, & Davis, 2007).

Large numbers of students who place into DE mathematics courses… fail to enroll in such courses.

We examined some of these background, internal, and environmental factors in the current study. We wanted to know what students in DE mathematics courses reported as factors interfering with their success in college. Along with calls for more research on nonacademic factors (Fowler & Boylan, 2010), there is some agreement as to the importance of student perceptions (Baeten, Dochy, & Struyven, 2013; Nair, Bennett, & Mertova, 2010), though specific research is rare. Notable exceptions include the work of Howard and Whitaker (2011), who examined students' perceptions about their shift from unsuccessful to successful performance in a DE mathematics course, and Carranza (2006), who studied perceptions of successful college graduates who overcame the odds of their at-risk status. The current study has expanded on these lines of research by investigating the perceived interferences of a broader sampling of students with various levels of success and lack of success in DE mathematics and college. We thought it important to take a holistic view of students that casts a wider net in examining both math-specific and more general factors students perceive as interferences to their success.

Methods

Participants and Setting

A total of 362 students enrolled in DE mathematics courses at a large public Hispanic-serving university in the South Central United States completed the survey. Students who were not exempt from DE coursework based on admissions data (e.g., SAT/ACT scores, veteran status) were required to take a placement test. The Texas Higher Education Assessment (THEA) and other placement tests (e.g., ACCUPLACER and COMPASS) were accepted. The institution used a cut-score of 270 on the THEA to determine placement into DE mathematics coursework. There were two levels of DE mathematics courses: Elementary Algebra (n = 63; THEA score less than 210) and Intermediate Algebra (n = 299; THEA score ranging from 210-269). The average age of students was 21.13 (SD = 5.19) and the number of students in each age group was as follows: 18-24 (n = 312); 25-34 (n = 41); and 35-56 (n = 9). There were more female (n = 224) than male (n = 138) students. The race/ethnicity of students in the sample was African American (n = 61), Caucasian (n = 148), Hispanic (n = 140), and other race/ethnicity (n = 13). The 13 students who marked other race/ethnicity indicated the following: Asian/Pacific Islander (n = 6), American Indian/Alaskan Native (n = 1), international (n = 3), and unknown (n = 3).

Procedures and Research Design

Approximately 10 weeks into the spring semester, as part of a research project on strategic learning and retention, two researchers administered a paper-and-pencil survey during class to students enrolled in developmental mathematics courses. Completing the survey was voluntary and participants earned one point of extra credit. The survey consisted of 66 Likert-type items measuring students' course effort, difficulty, interest, boredom, difficulties in college, and persistence intentions; four numeric response items measuring study time and use of learning support services; and one open-ended item that was the focus of this study. This open-ended item appeared at the end of the survey, and it asked students to "please describe any circumstances that are making it more difficult for you to reach your academic goals at [name of the university]." The current study focused on students' responses to this open-ended item designed to record students' perceptions about the factors potentially interfering with their academic success.

We used content analysis to determine the number of perceived interferences students listed in their responses to the open-ended survey item and to code these perceived interferences into specific content categories. A correlational research design was used to study relationships among the total number of academic and nonacademic perceived interferences students listed, student demographic characteristics (i.e., age, sex, and race/ethnicity), and indicators of academic success (i.e., DE mathematics course success, semester GPA, and persistence to the next long semester).

Measures

We obtained descriptive data on students' age, sex, race/ethnicity, DE mathematics course success, semester GPA, and persistence from the university's institutional research department. We measured age in years. We measured sex as male or female. We measured DE mathematics course success as success (passed the course) or lack of success (did not pass the course or withdrew from the course). Semester GPA was obtained for the spring semester that the survey was administered and could range from 0 to 4. Persistence to the next long semester was a dichotomous variable (persisted, did not persist). Students we classified as having persisted either enrolled in the following fall semester or graduated from the university beforehand. We derived the number of academic and nonacademic perceived interferences a student listed from our content analysis.

Content Analysis

In this study, we used a content analysis methodology to categorize students' open-ended responses. Content analysis has been described as "a process of identifying, coding, and categorizing primary patterns in the data" (Patton, 1990, p. 381) and involves establishing systematic and reliable procedures for categorizing words of text into content categories (Chambers, 2010; Krippendorff, 1980). The open-ended survey item used in this study allowed students to report multiple factors that they perceived as interfering with their academic success. We first determined the number of perceived interferences each student listed and then coded each unique perceived interference into a content category. Two researchers independently counted the total number of perceived interferences each student listed. We calculated inter-rater reliability for this variable by dividing the number of matches in coding by the total number of students; inter-rater reliability was 0.86. The researchers and research director discussed and resolved researcher coding that did not agree. When students listed more than one perceived interference, the responses were broken down into single perceived-interference units and later coded separately into content categories. The total number of perceived interferences that were coded into content categories was thus greater than the total sample size (total perceived interferences = 444; total sample size *N* = 362).

During the content analysis, we did not predetermine the content categories but conceptualized them as they emerged from the data (see Patton, 2002). To facilitate conceptualizing the data, we examined a random subset of 200 responses. Across students' responses, we observed broad themes (i.e., academic and nonacademic), specific categories (e.g., general strategic learning problems and economic issues), and even more specific subcategories (e.g., lack of motivation and work schedule). We decided to first categorize students' responses at a high level of specificity (subcategories) and subsequently cluster these

Table 1

Number of Perceived Interferences Coded into each Category and Subcategory

Category: Subcategory	Number of Student Responses	% of Total (*N* = 444)
Academic: Mathematics	148	33.3%
Math difficulty/low ability	22	5.0%
Math relevance	15	3.4%
Math course workload/amount of material to learn	14	3.2%
Math course as a requirement	14	3.2%
Math course materials/assignments	12	2.7%
Math course instructor	11	2.5%
Math course requirement delaying student progress	10	2.3%
Math or math course in general	10	2.3%
Math course difficulty/low ability	8	1.8%
Math course pacing	8	1.8%
Math course structure	7	1.6%
Math course learning support resources	7	1.6%
Math dislike	6	1.4%
Math miscellaneous	4	0.9%
Academic: Strategic Learning Problems	85	19.1%
Self-regulation	22	5.0%
Study methods and learning strategies	16	3.6%
Motivation	14	3.2%
Time management	9	2.0%
Balancing life with academic goals	8	1.8%
Schedule/busy/lack of time	6	1.4%
Stress/anxiety	6	1.4%
Making/finding time for studying	4	0.9%
Academic: Other	37	8.3%
College adjustment	9	2.0%
Academic miscellaneous	8	1.8%
Course load	6	1.4%
Limited English	5	1.1%
Problems with courses	4	0.9%
Transfer issues	3	0.7%
Problems with instructors	2	0.5%
Academic: College Logistics	19	4.3%
Living situation	11	2.5%
Commuting	5	1.1%
Parking	2	0.5%
Nonacademic: Economic	83	18.7%
Finances in general	36	8.1%
Work in general	18	4.1%
Work taking up time/too much work	17	3.8%
Financial aid	8	1.8%
Work as it relates to finances	3	0.7%
Economic miscellaneous	1	0.2%
Nonacademic: Familial	36	8.1%
Family	25	5.6%
Homesick	7	1.6%
Family illness	4	0.9%
Nonacademic: Personal	21	4.7%
Personal/emotional issues	12	2.7%
Personal illness	5	1.1%
Partying/alcohol/drugs	4	0.9%
Miscellaneous Student Responses	16	3.6%
Total Number of Student Responses	444	100.0%

Note. Some students listed multiple perceived interferences.

subcategories into broader categories and even broader themes. Two researchers categorized each perceived interference into a subcategory or identified it as miscellaneous (i.e., uninterpretable or as not fitting within a subcategory). We calculated inter-rater reliability for categorizing students' responses into subcategories by dividing the number of matches by the total number of perceived interferences; inter-rater reliability was .90. The research group discussed and resolved discrepancies in coding.

Secondly, we clustered each subcategory into one of seven categories: (a) mathematics, (b) strategic learning problems, (c) college logistics, (d) other academic, (e) economic, (f) familial, and (g) personal. We further organized these categories hierarchically under an academic or nonacademic theme.

Results

In the content analyses, we examined the frequency of student-perceived interferences that fell into each content category. We ran regression analyses to examine relationships among the number of academic and nonacademic interferences a student listed, demographic variables, and academic outcomes.

Content Analysis of Student-Perceived Interferences to College Success

When we coded students' responses about their perceived interferences to college success into categories, fewer than four percent ($n = 16$) of students' responses were coded as miscellaneous (i.e., the responses could not be interpreted or categorized).

Students listed more academic ($n = 288$, 65%) than nonacademic ($n = 140$, 31%) perceived interferences to college success. Under the academic theme, the mathematics category had the most student responses followed by strategic learning problems, other academic interferences, and college logistics (see Table 1). Under the nonacademic theme, the economic category had the highest percentage of student responses, followed by familial and personal. We coded 71% of students' perceived interferences to college success as mathematics, strategic learning, or economics. Categories were comprised of related subcategories. For example, the mathematics category was comprised of 14 subcategories (e.g., "math difficulty / low ability" and "math relevance"). Table 1 shows the number of responses coded into each category and subcategory (contact the senior author for a 6-page supplemental appendix of content category descriptions and example responses).

Relationships Between Demographics and Student-Perceived Interferences

First, we examined descriptive statistics regarding the number of interferences students listed. Then, we investigated the relationship between each demographic variable and the number of academic and nonacademic perceived interferences students listed. For nonacademic interferences, 74% of students ($n = 266$) reported zero, 17% ($n = 62$) listed only one, and 9% ($n = 34$) listed two or more. For academic interferences, 46% of students ($n = 166$) reported zero, 36.2% ($n = 131$) reported only one, and 18% ($n = 65$) reported two or more. In total, 30% of students ($n = 108$) reported zero interferences, 38% ($n = 137$) indicated only one interference, and 32% ($n = 117$) reported two or more interferences.

One of the research questions examined how demographics related to the number of perceived interferences listed in the nonacademic and academic themes. Because perceived interferences was a count variable, we used negative binomial regression which helps adjust for problems with overdispersion (Cameron & Trivedi, 2013). We ran a separate regression model for each outcome, and we entered age, sex, race/ethnicity, and the level of the DE mathematics course as predictors. The model with demographics predicting academic interferences was not statistically significant. Although the overall model for nonacademic interferences was not statistically significant at the $p < .05$ level ($\chi^2(6) = 12.12$, $p = .059$), the regression coefficients indicated that age and sex were significant predictors of nonacademic interferences: older students listed significantly more nonacademic interferences ($b = .05$, $SE = .019$, Wald $\chi^2 = 5.67(1)$, $p < .05$) and women listed significantly more nonacademic interferences ($b = -.48$, $SE = .226$, Wald $\chi^2 = 4.43(1)$, $p < .05$).

Relationships Between Student-Perceived Interferences and Academic Outcomes

In regard to the three academic outcome variables in this study, there were more students who passed their DE mathematics course ($n = 203$, 56%), than students who did not pass the course ($n = 159$, 44%). The average semester GPA for students was 2.40 ($SD = .89$). Most students persisted to the next long semester ($n = 308$, 85%), whereas 15% of students did not persist ($n = 54$).

We examined the relationships between students' perceived interferences and three outcome variables: mathematics course success, semester GPA, and persistence to the next long semester. We entered academic and nonacademic perceived interferences as predictors of these outcomes—including mathematics course, sex, race/ethnicity, and age as covariates—and conducted separate regression analyses for each outcome. We used binary logistic regression for the two dichotomous outcomes (course success and persistence) and multiple regression for semester GPA. We did not find violations of regression assumptions in any of the analyses. Table 2 contains the results of the three regression analyses.

Table 2

Regression Analyses Predicting Academic Outcomes

Predictor	Math Course Success		Semester GPA		Persistence to the Next Long Semester	
	b	*SE*	*b*	*SE*	*b*	*SE*
Elementary Algebra	2.18**	.45	.01	.13	-.08	.40
Age	.06	.03	.02	.01	-.02	.03
Male	-.55*	.25	-.13	.10	.25	.33
African American	-.74*	.35	-.38**	.14	.47	.50
Hispanic	-.47	.26	-.18	.11	-.05	.34
Other Race/Ethnicity	.18	.67	-.03	.26	-.66	.71
Academic Interferences	-.22	.13	-.05	.05	-.01	.16
Nonacademic Interferences	-.37*	.17	-.14*	.06	-.53**	.17

Note. $^*p < .05$, $^{**}p < .01$. Multiple regression was used for predicting semester GPA and logistic regression for predicting math course success and persistence to the next long semester. Reference group for male is female. Reference group for race / ethnicity is Caucasian. Reference group for Elementary Algebra is Intermediate Algebra. A reference group is the group to which the other group(s) are compared.

Math course success. The logistic regression model for math course success was statistically significant ($\chi^2(8) = 61.94, p < .01$). In our analysis, we controlled for the math course students enrolled in and found that students enrolled in Elementary Algebra, the more basic math course, were more likely to pass the course than students enrolled in Intermediate Algebra. With regard to the other covariates in the model, men were significantly less likely to pass the course than women, and African American students were significantly less likely to pass the course than Caucasian students. Age was unrelated to math course success. Students who listed more nonacademic interferences were significantly less likely to succeed in their math course (see Table 2). The odds ratio of this effect was 0.69. The number of academic interferences students listed did not relate significantly with math course success.

Semester GPA. The multiple regression model for semester GPA was statistically significant ($F(8) = 2.31, p < .05, R^2 = .05$). The model explained 5% of the variation in semester GPA and there were two significant effects: students who listed more nonacademic interferences had significantly lower semester GPAs (see Table 2) and students who were African American had significantly lower semester GPAs than did students who were Caucasian. None of the other study variables related significantly to semester GPA.

Persistence to the next long semester. The overall logistic regression model for persistence to the next long semester was not significant at the $p < .05$ level ($\chi^2(8) = 13.36, p = .10$). However, the regression coefficient for nonacademic interferences was statistically significant (see Table 2); it suggested that students who listed more nonacademic interferences were less likely to persist to the next long semester. No other study variables related significantly to persistence.

Discussion

In total, students reported 444 factors that they perceived as interfering with their success in college and each perceived interference presents an opportunity for the institution to provide support to students. The content analysis of this study offers a framework for conceptualizing areas in which students might need additional academic and nonacademic support. The content categories spanned a wide variety of interferences including mathematics, strategic learning, college logistics, economic, personal, and familial factors (see Table 1 for a full listing). Within each content category, we identified numerous subcategories that may help educators more precisely determine specific areas in which students need support. Overall, the content analysis results suggested that students in DE mathematics courses perceive a diverse set of interferences to their college success, which include, but also stretch well beyond, their struggles with DE mathematics. The findings from this study converge with research on students' reasons for early departure from college (e.g., Bradburn & Carroll, 2002; Tinto, 1993) because students reported struggling with both academic and nonacademic factors.

Our study is unique compared to previous research on student departure because it was not retrospective; students were asked about their perceptions of factors currently interfering with their success in college. Also, it focused on all students, those who were successful and those who were unsuccessful. Moreover, we developed a hierarchical taxonomy of perceived interferences with 43 subcategories that were more comprehensive and detailed than much of the previous work in this area. In addition, we examined quantitative relationships among demographic variables, the number of perceived interferences students reported, and academic outcomes.

We found that older students and women were more likely to list nonacademic factors interfering with their success in college. Other studies examining factors related to academic outcomes have reported that older students tend to have more external obligations, such as work, caring for children, and spousal support (see Calcagno, Crosta, Bailey, & Jenkins, 2007; Horn & Carroll, 1996). In addition to the nonacademic interferences older students experience, women are more likely to be single parents and face gender stereotypes (Choy, 2002). Our results help corroborate these previous findings that nontraditionally aged students and women might experience relatively more nonacademic interferences.

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The quantitative analyses of this study also helped us identify the extent to which academic and nonacademic perceived interferences related to students' DE mathematics course success, semester GPA, and persistence to the next long semester. With regard to all three outcomes, the results consistently suggested that nonacademic perceived interferences significantly detracted from students' success. That is, students who listed more nonacademic interferences were less likely to pass their DE mathematics course, had lower semester GPAs, and were less likely to persist to the next long semester. The results suggest that institutions should focus greater attention on these factors by helping students cope with the economic, familial, and personal factors that are interfering with their success in college. This finding corroborates previous research that has stressed the importance of financial (Titus, 2006), cultural, and personal factors (Lehmann, 2007) underlying students' success in college. Interestingly, academic interferences did not predict student success in our study. This could be because the institution was doing a good job of addressing students' academic concerns, or it may be that even finer-grained measures are necessary to examine the effect of academic interferences.

Limitations

Even though we found that nonacademic perceived interferences significantly predicted academic outcomes, the effect sizes were small, explaining only a small amount of variation in academic outcomes. Moreover, our model did not take into account important traditional predictors of college success (e.g., high school GPA and SAT/ACT scores) and Likert-type assessments measuring psychosocial factors (e.g., learning strategies and motivation). Finally, conducting the study at a single institution over one semester may limit the generalizability of findings.

Implications for Practice and Future Research

The various categories of perceived interferences identified in this study (see Table 1) could help faculty, administrators, and staff broaden their awareness and appreciation of the diverse issues concerning students and lead them to generate new strategies for addressing student concerns in their teaching, advising/counseling, and program development. Given the diversity of perceived interferences that students listed, a holistic approach may be necessary to improve student success. Addressing these issues holistically may require a community of instructors, advisors, counselors, mentors, administrators, student affairs staff, learning assistance staff, and college/departmental staff who work together to monitor and addresses students' concerns in a timely fashion. Early alert systems in higher education are designed to help identify students' concerns and at-risk behaviors as well as to direct students to appropriate resources and interventions (Tampke, 2012). Research has suggested that early-alert systems that incorporate personalized feedback may help foster students' help-seeking behaviors and achievement in large gateway courses (Cai, Lewis, & Higdon, 2015). However, much work is still necessary to understand how institutions can coordinate the effective use of these systems across various academic contexts.

Some academic institutions have services that can help students address their economic, familial, and personal concerns such as counseling centers, health centers, advising/mentoring, on-campus jobs, and partnerships with the workforce and community services. Regardless of the number of available resources an institution has, getting students to use these services remains a major challenge. People who work with students directly in developmental education courses, learning assistance centers, orientation programs, FYE programs, and other related areas have an opportunity to help students facing nonacademic interferences, for example, by announcing and directing students to appropriate resources and helping to reduce stigma related to using these resources. Faculty, administrators, and staff could also work to build new resources designed to address students' nonacademic concerns.

To address students' academic and nonacademic concerns in the DE mathematics classroom, instructors might implement a metacurriculum focused on teaching students to become more strategic and self-regulated learners (see Weinstein & Acee, 2013). Incorporating a metacurriculum may involve using small chunks of class time to teach students how to use cognitive, metacognitive, and motivational/affective learning strategies and apprising students of learning assistance, advising, and counseling resources. Intervention research on attributional retraining (Hall et al., 2007), growth mindsets (Aronson, Fried, & Good, 2002), personal relevance (Acee & Weinstein, 2010; Hulleman, Godes, Hendricks, & Harackiewicz, 2010), values affirmation (Cohen & Sherman, 2014; Harackiewicz et al., 2014), and self-regulated learning (Schunk & Ertmer, 1999), have shown that brief interventions incorporated into college courses can yield substantial effects on students' course performance, especially for students who struggle. In addition to incorporating a metacurriculum, instructors could look at ways to improve their mathematics curriculum and instruction to address student concerns with areas such as the pacing of instruction, workload, task difficulty, and task relevance. Finally, alternative methods for delivering course content (e.g., online or hybrid courses and learning assistance resources) could help to address the concerns students' raised about commuting and lack of time.

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In future research, we aim to incorporate research on attribution theory and help-seeking into our model. Attribution theory addresses students' beliefs about the causes of their academic successes and failures. Attribution beliefs are categorized along three dimensions: stable versus unstable, internal versus external, and controllable versus uncontrollable. Research supports that these beliefs influence students' motivation and achievement (Weiner, 1985). Future studies should ask students to rate each perceived interference on these three dimensions. Studies should also examine the role of academic and nonacademic help-seeking on student success; the education research literature has focused primarily on academic help-seeking.

Conclusion

In order to improve student success in developmental mathematics and college, it is important to identify and address student concerns. This study contributes to research on developmental education, student retention, and student affairs by providing a broad and detailed framework of student-perceived interferences to success in college and developmental mathematics. Content analysis results showed that students identified various academic and nonacademic factors that made it more difficult to succeed in college. Results from regression analyses suggested that perceived nonacademic interferences related negatively with students' success in DE mathematics, semester GPA, and persistence to the next long semester. The findings from this study could help faculty, administrators, and staff generate a more comprehensive picture of the factors students are

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struggling with in college and in turn develop more effective and efficient approaches to supporting students. Obtaining data on student perceptions about the factors interfering with their success in college could help inform institutional self-studies and strategic planning to improve student success.

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