Teaching *Learning and Motivation Strategies* to Enhance the Success of First-Term College Students

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Abstract

This study examined the effect of taking a *Learning and Motivation Strategies* course on GPA and retention of 351 new freshmen over their first four quarters, in comparison to 351 matched non-takers. The course taught four strategies and eight sub-strategies to help students overcome procrastination, build self-confidence, take responsibility, learn from lecture and text, write papers and manage their lives. New freshmen who took the course in their first quarter had significantly higher GPAs in each of their first four quarters, significantly higher retention (six times more likely to be retained) than did matched controls, and had higher graduation rates.

Purposes of the Study

Getting into college and then dropping out is a problem at postsecondary education institutions, even among students who enter with high school records that would appear to predict college success. On a ***national basis*** the university drop-out rate is about 25% and community college drop-out rate 50%, with the majority in both places occurring in the first year. Among urban minority students who enroll in college, 55% choose community colleges, often because of their easy accessibility, low cost, broad based admission policies, and diversity of program offerings, yet only 50% remain in school (American Association of Community

Colleges, 2002). The magnitude of the retention problem in community colleges is exacerbated by their current growth rate.

A lack of preparedness for college among graduating high school seniors is further attested to by the need for remediation that they bring with them upon college entry. McCabe (2000) reports that more than one million students nationwide (42% of first-time college goers) enroll in remedial courses annually. About two-thirds of this total is at public community colleges, and one-third from a minority group, yet even remediation does not significantly reduce the retention problem.

Innovative reforms must be implemented that remove barriers to academic success, most notably students' lack of motivation and relevant learning skills. Hadwin & Winne (1996) advocate that "institutions should provide means for students to develop adaptable strategies with which to pursue knowledge and solve problems during and after postsecondary experiences" (p. 693) which will contribute to both their abilities and motivation. Therefore, the purpose of this study was to adapt and test a program for providing entering college students training in *Learning and Motivation Strategies* that are designed to increase their achievement levels as evidenced by (1) academic performance during their first four quarters, (2) retention following their first year, and (3) graduation rate.

The unique intervention presented in this research is one that combines psychology, curriculum, and the cost-effectiveness and ubiquity of technology to provide entering college students with specific instruction that, by virtue of its content and method of delivery, enhances desire and ability to succeed academically and make educational progress. Explicit instruction in learning and motivation strategies represents a potentially promising approach for increasing academic success as manifested by grade point average, retention, and graduation rate.

Learning and motivation strategies are considered essential to being successful in college. Their importance is underscored by the fact that academic tasks at the college level tend to demand a far higher level thinking and independent learning than those encountered in secondary school (Carson, Chase, Gibson, and Hargove, 1992). A relevant general approach to teaching learning strategies, labeled "learning-to-learn" has its basis in informational and generative models of learning, and its emphasis on self-regulated and strategic learning (Simpson, Hynd, Nist, and Burrell, 1997). Building on this approach, and the work of Pintrich, McKeachie, and Lin (1987), Weinstein and Underwood (1985), and Dansereau et al. (1979), the work described here features a more integrated and focused approach, using a set of specific strategies and sub-strategies to cover a variety of learning and motivational tasks.

The research was designed to answer four questions: (1) would students taking and completing the *Learning and Motivation Strategies* course in their first academic quarter earn higher GPAs in each of the four quarters during and after the course was taken (relative to their prior cumulative GPAs) than a closely matched group of students who did not take the course in their first four quarters? (2) would first-quarter course takers be more likely to return to college the following year than their non-course-taking counterparts?, and (3) would first-quarter course-takers have a higher graduation rate than matched non-takers? Hadwin & Winne (1996) report that fewer than 3% of the over 500 articles published about motivation and learning strategies "compared students taught a study tactic to other students who studied by whatever methods they might have developed on their own" (p. 711).

Why Study First Quarter Freshmen?

One factor motivating the study of first quarter freshmen is that the performance of students during their first quarter is highly predictive of academic performance throughout their tenure at the university. For example the correlation between first quarter GPA and cumulative GPA earned at the end of first, second, third, and fourth years of study for the population of students starting their first year in autumn 2000 through autumn 2002 is 0.848, 0.713, 0.658, and 0.507 respectively. Perhaps even more indicative of the importance of first quarter performance is the relationship between first quarter GPA and graduation rates. Figure 1 shows the combined 4, 5, and 6 year graduation rates of as a function of first quarter GPA for the population of students starting their first year in autumn 2000 through autumn 2002. It is clear that helping students who need it very early during their academic tenure is crucial to their success.

Theoretical Framework

The *Learning and Motivation Strategies* program evolved from the achievement motivation model for entrepreneurship originally espoused by David McClelland (1979), but has been translated into strategies for success in education (Tuckman, 2002, 2003; Tuckman, Abry, & Smith, 2008) by including more current social-cognitive and schema theories based upon considerable research and testing. The strategies and sub-strategies, summarized in Table 1, focus on enhancing self-regulation and strategic learning and influence how students approach, carry out and evaluate a learning task. The importance of self-regulation in successful learning has been highlighted by Paris and Newman (1990), Zimmerman (2000), and Schunk (2001).

Supporting this approach is a conceptual framework for self-regulation directly addressing the issue of increasing student achievement in school that includes both a motivational and cognitive component, and two sources of influence: (a) knowledge and beliefs,

and (b) strategies (Garcia and Pintrich, 1994). Within this framework, the above strategies and sub-strategies are used as the basis for a program aimed at teaching students to meet the motivational goals of overcoming procrastination, building self-confidence, becoming more responsible, and managing their lives, and the cognitive goals of learning from lecture and text, preparing for tests, and writing papers.

- The Motivational Component: For the motivational component, particular emphasis in the *Learning and Motivation Strategies* approach is placed on the basic premise of social cognitive theory that there exists a mutually interactive relationship between thoughts, behaviors, and environmental consequences, necessitating a change in thoughts as a prerequisite to changing behavior (Bandura, 1997).

For example, in the module on procrastination, one of the 10 modules or topics that make up the course, students are taught to: (a) distinguish between rationalizations for procrastination (e.g., "I work better under pressure") and real reasons (e.g., self-doubt); (b) recognize the thoughts (e.g., "math confuses me"), feelings (e.g., fear) and behaviors (e.g., skipping class) that are provoked by potentially difficult situations (e.g., an impending math midterm); (c) overcome the tendency to procrastinate by using the four major strategies for achievement previously described; and (d) effectively manage their time by creating a specially designed "to-do checklist," a self-regulatory procedure that facilitates planning, and incorporates the first motivation strategy, "take reasonable risk," and its two sub-strategies "go for goal" and "bite-sized pieces."

In the module on building self-confidence, the four techniques taught to students: (a) regulating your emotional level, (b) seeking affirmation, (c) picking the right models, and (d)

"just doing it" are intended to create the thoughts required for successful achievement (Bandura, 1997).

In teaching students to use the second explicit motivation strategy, "take responsibility" (the fifth module), causal explanations and their properties, such as those described in attribution theory (Weiner, 1986, 1995), are used to show students the importance of focusing on effort as the explanation for their outcomes. Perceptions of the *intentionality* of others' actions, based on causal explanations, also factor importantly on taking responsibility, and have been shown to be modifiable by training (Graham, 1997).

- The Cognitive Component: In this domain, the first explicit cognitive strategy, "search the environment," plays a prominent role. For example, Pressley and Wooloshyn (1995) and Mayer (2002) have described techniques for teaching students to use cognitive strategies to acquire and process information, and Mayer (1989) has shown the value of conceptual models for visualizing ways of solving problems. Robinson (1961), and Mayer (1984) relied extensively on the question-asking approach in teaching students to extract meaning from text, and Rosenshine, Meister, and Chapman (1996) reported a meta-analysis showing that teaching students to generate questions resulted in gains in comprehension. Other work has also focused on enhancing students' capability to learn from text by using outlining (e.g., Tuckman, 1993).

Zimmerman (2000) refers to "seeking information," but "search the environment" is taken to have a somewhat broader meaning, one that focuses on question asking as a generic form of information processing. For example, students are taught to view information that is either heard in lectures or read in text as "answers" to implicit questions. By making those questions explicit through the construction of a "Q & A Outline," (Tuckman et al., 2008) students learn both to schematize the information and organize it into visual forms such as

diagrams and charts. The outlines and diagrams then help students organize and store their thoughts in long-term memory in preparing for and taking tests, and in writing papers. Sahari, Tuckman, & Fletcher (1996) found that students who were trained to write outlines designed to help them schematize and organize text material demonstrated significantly greater improvement on reading comprehension tests than students not similarly trained.

The second explicit cognitive strategy, "use feedback," has traditionally focused on external or outcome feedback (Butler and Winne, 1995) which has been found, in general, to result in performance improvement (Kulhavy, 1977; Kulik and Kulik, 1988). More recent emphasis has been on internal feedback, consisting of learner judgment decisions regarding task success relative to multifaceted goals, and productivity of learning strategies relative to expected progress (Butler and Winne, 1995). The "use feedback" strategy subsumes the self-regulating areas of self-monitoring, keeping records, self-evaluation, and self-consequences (Zimmerman, 1998, 2000). Carver and Scheier (1990) and Butler & Winne (1995) see monitoring or the acquisition and use of feedback as the hub of self-regulated cognitive engagement, while Hadwin & Winne (1996) cite monitoring as an approach that "modestly" enhances student achievement.

In summary, the theoretical basis for improving the academic achievement of students is to train them in the use of motivational and cognitive strategies, or what are referred to here as *Strategies-for-Achievement*. Motivationally, the emphasis is on teaching self-regulation in the form of "taking reasonable risk" through goal setting and learning in increments, as emphasized in the work of Bandura and Zimmerman, and on "taking responsibility" through the attribution of causes to changeable and controllable factors, as described by Weiner. Cognitively, the emphasis is on teaching information processing as described by Mayer and Robinson, through the use of question-asking and conceptual and visual models of problem solving ("searching the

environment"), and "using feedback," especially internal feedback, through self-monitoring, self-evaluation, and self-consequating, as described by Zimmerman.

Instructional Design

The instructional design is also unique and innovative. Instead of instruction in a traditional class setting, the program is taught using a blended, web-based instructional model called Active Discovery And Participation thru Technology (ADAPT; Tuckman, 2002). This model for teaching a web-based course in a campus-based computer classroom combines the critical features of **traditional classroom instruction**: (1) required student attendance, (2) presence of a live instructor, (3) accompaniment of a printed textbook: *Learning and motivation strategies: Your guide to success* (2nd ed.) (Tuckman et al, 2008), with those of **computer-based instruction**: (1) class time spent doing computer-mediated activities rather than listening to lectures, (2) a large number of performance activities rather than just two or three exams, (3) self-pacing with milestones rather than a lockstep pattern. The program includes over 200 "learning/performance activities," ranging from assignments, portfolios, and papers, to postings on an online, asynchronous discussion board and spotquizzes, all of which are submitted electronically and graded by instructors.

In addition, students were required to read *A Hope in the Unseen* (Suskind, 1998), a biography of a young African American student, that describes his last year in an urban high school and first year in an Ivy League college, and write and submit four two-page papers that analyzed the young man's actions and experiences using the strategies and sub-strategies.

Method

Participants and Matching Procedure

We looked at the records of 351 students enrolled in the *Learning and Motivation Strategies* course (course-takers) during their first quarter at the university in addition to 351 matched control students (non-course-takers) matched according to quarter of enrollment, gender, ethnicity, age, high school class rank (CR), and ACT composite or SAT verbal/math composite[1](ACT). Since only a relatively small number of students take the *Learning and Motivation Strategies* course during their first quarter of enrollment, the student records used for this study covered a total of seven autumn quarter cohorts ranging from autumn 2000 through autumn 2006. Table 2 shows the distributions of course-takers and non-course-takers by quarter, gender, and ethnicity along with the populations of first quarter freshmen from which these samples were drawn. It was possible to find a one-to-one matched-control student by gender and ethnicity for each course taker and therefore these groups are collapsed in Table 1. Also, for ease of presentation, minority students – which include African American, Asian /Pacific Islander, Hispanic, and Native American – are collapsed into the Minority Student category in Table 2. However, each course taker was matched perfectly according to a specific ethnicity designation and not according to the more general Minority Student category shown in Table 2. Overall, the sample of 702 students included 45.9% women, 79.5% White, 13.4% African American, 3.1% Asian/Pacific Islander, 2.3% Hispanic, 0.3% Native American, and 1.4% Unknown.

Course takers were matched to control students according to age within the constraints of gender, ethnicity, CR, and ACT composite. The two groups were very similar according to age (M_{EPL} = 18.16, SD_{EPL} = 0.485, Md_{EPL} = 18.0; M_{CTL} = 18.18, SD_{CTL} = 0.706, Md_{CTL} = 18.0). A Kruskall-Wallace test showed no difference in median age (H = 0.14, p = 0.711) and Levene's

test showed no difference in the variability in the age distributions of two samples ($F = 0.94$, $p = 0.334$).

It was not possible to find one-to-one matches for the ability measures of CR and ACT. For CR, course-takers were matched to non-course takers according to class rank decile clusters. For ACT, seven clusters were used: 1) less than 18, 2) 18 through 23, 3) 24 and 25, 4) 26 and 27, 5) 28 through 30, 6) 31 through 33, and 7) greater than or equal to 34. Table 3 shows the means, medians, and standard deviations along with their 95% confidence intervals for ACT and CR for each year cohort year. Overall the two groups have prior ability distributions that are virtually identical. Also, to provide an indication of where in the cohort population course-takers and non-course-takers fall with respect to prior ability, Figure 2 shows median ACT and CR scores for each cohort relative to the interquartile range of the cohort populations. It can be seen that course-takers (and thus their matched controls) tend to be below the population median for all cohorts and in two cases for each ability measure below the 25th percentile in ability relative to the populations from which they are drawn.

Statistical Analyses

Of primary concern in this study was the assessment of potential differences between course-takers (GROUP = 1) and non-course-takers (GROUP = 0) on quarter grade point average (QGPA, on a scale of 0.00 to 4.00) and retention status (STATUS) over the course of their first four quarters (excluding summer). In addition, there was also interest in assessing if there were differences in 4, 5, and 6 year graduation rates between the groups for the autumn 2000, 2001, and 2002 cohorts.

To study group differences in QGPA and STATUS, 3-level hierarchical linear models were built to assess potential overall mean level differences as well as the potential moderation of changes over time by group. Thus, time (quarter of enrollment or QUARTER) is the level-1 variable and includes the first four quarters of enrollment. Specifically, these quarters include students' first autumn (AU1 = 0), winter (WI1 = 1), and springs quarters (SP1 = 2) and the autumn quarter of the second year (AU2 = 3). Coding AU1 as zero allows for the interpretation of initial status as performance or retention during the first quarter of enrollment. In calculating GPAs for course-takers at the end of the first quarter, the *Learning and Motivation Strategies* course grade was not included.

QUARTER is nested within student (level-2) which is nested within cohort (level-3). Even though there were only seven cohorts at level-3, differences among the cohorts with respect in prior ability seemed to necessitate the inclusion of this level to assess the proportion of variance in QGPA accounted solely on the basis of when students entered. Specifically, due to changes in policy regarding selective admissions, both ACT and CR tended to increase over the seven years included in this study. Likewise, since the year entered could also potentially affect retention status, 3-level hierarchical linear models were used to study STATUS as well. In analyzing STATUS, a logit link function was used to link retention probability to the parameter estimates. Finally, ACT and CR were included (group mean centered) with GROUP as covariates in the conditional models in order to control for prior ability. HLM 6.06 (Raudenbush, Bryk, & Congdon, 2008) was used for the hierarchical linear model analyses of QGPA and STATUS.

To study graduation rate differences between the groups, a logistic analysis was run including ACT, CR, and first quarter GPA (Academic Standing) dichotomized into 1) students in

academic difficulty (i.e. GPA <2.00) and 2) students in good academic standing (i.e. GPA >= 2.00).

Results

Quarter Grade Point Average

Table 3 shows the results of the unconditional model of QGPA as a function of quarter. It is clear that QGPA declines significantly over the first four quarters of enrollment for both groups. The fixed effect for rate suggests a 3% drop in QGPA per quarter for these students. Nevertheless, there is considerable variability of both the initial status and rate parameters, most of which is student variability. Only 3.97% and 8.00% of the variability of initials status and rate respectively is due to cohort differences. Within cohorts, the correlation between initial status and rate was -0.108 suggesting that the decrease in QGPA over quarters is somewhat attenuated (and perhaps increases slightly) as the initial QGPA decreases.

Table 4 shows the results when GROUP, CR, ACT have now been added to the model. While it was expected that GROUP, CR, ACT effects on overall QGPA mean level as well as their interaction with QUARTER would be influenced by cohort variability, an initial analysis including this variability revealed that only the intercepts of QGPA initial status and the QUARTER rate (i.e., $\tau_{\beta 00}$ and $\tau_{\beta 10}$) were significant. As such, only $\tau_{\beta 00}$ and $\tau_{\beta 10}$ are included as cohort random effects. As shown in Table 4, the within cohort variability was still highly significant after adding the covariates.

There is a significant group difference in overall mean level of QGPA after CR and ACT are taken into account (γ_{010} = 0.112, $t(698)$ = 2.235, p = 0.026). In addition, CR has a significant positive relationship with QGPA during the first quarter of enrollment (γ_{020} = 0.009, $t(698)$ =

6.687, $p < 0.0001$). However, none of the covariates affected the rate of decline in QGPA over the four quarter studied. This suggests that course-takers tend to maintain their GPA advantage over non-course-takers over their first year at the university even though their GPA is declining at the same rate. This can be seen in Figure 3 which shows QGPA decline over the four quarters in this study but with a clear difference between course-takers and non course-takers. The thin dotted line in this figure shows the quarter GPA for the cohort populations for comparison. While the populations were not analyzed it seems that the quarter GPA decline is a common phenomenon. Given that course-takers and non-course-takers are very similar in ability as measured by CR and ACT and tend to have ability levels below the median of the population, these results suggest that taking the course appears to have a significant effect in overall performance.

Retention Status

Retention status was studied as a Bernoulli random variable with STATUS = 1 indicating retention and STATUS = 0 indicating attrition for a given quarter of enrollment. Table 5 shows the results of the unconditional model for both unit-specific and population-average models. Variability of the initial status parameters is not of interest in this analysis since only 3 of the 702 students (all of whom were non-course takers) withdrew during their first quarter of enrollment. However, the variability of the rate parameter was estimated both within and between cohorts since it was expected that within and/or between cohort variability would be significant.

For the unit-specific model, the predicted retention status for both groups during the first quarter was 98.7% ($\gamma_{000} = 4.343$, $t(2806) = 18.713$, $p < 0.0001$). In addition, the retention status decreased over the four quarters studied ($\gamma_{100} = -0.670$, $t(6) = -5.978$, $p < 0.0001$). This suggests that on average the log-odds of being retained decreases by 0.67 for each increment in quarter of

enrollment. Furthermore, the odds ratio of 0.511 suggests that on average the odds of *not being retained* is almost 2 times greater for any student in these groups at quarter Q_{t+1} relative to quarter Q_t. The results are very similar for the population average model. However, not holding cohort constant, the rate parameter of -0.821 and corresponding odds ratio of 0.440 suggests a slightly higher average rate of attrition (2.27 times) for these groups over the four quarters studied. Also of interest is that while the rate parameter varied as a function of cohort ($\tau_{\beta 10}$ = 0.014, $\chi^2(695)$ =13.068, p = 0.041), the rate parameter variability within cohorts was not significant suggesting a rather stable cohort effect.

The results of the conditional model predicting retention status with GROUP, CR, and ACT added to the model are shown in Table 6. For this analysis, as in the analysis of the unconditional model, all of the parameters associated with initial status were fixed. An initial analysis that allowed all the parameters associated with rate to have random effects revealed that only the variability associated with GROUP (i.e. β_{11}) was significant. The model presented in Table 6 thus fixes all parameters except β_{11}. The within cohort rate parameter (π_1) was also allowed to vary.

After controlling for CR and ACT, there was a significant effect of GROUP on retention status across quarters (γ_{010} = 1.870, $t(2806)$ = 3.056, p = 0.003). Overall, the expected odds of being retained for an average ability course-taker are over 6 times that of a non-course taker of average ability. There were no significant effects on retention status across quarters for CR or ACT. In addition, while the coefficient for the group by quarter interaction was not significant (γ_{110} = -0.303, $t(6)$ = -1.040, p = 0.339) it reflects the somewhat faster rate of attrition for non-course takers relative to course takers shown in Figure 4. For comparison, the population retention proportions are also shown. The actual retention proportions shown in Figure 3 along

with the predicted retention probabilities (i.e. $u_{11} = 0$) for students of average ability (i.e., CR = ACT = 0) are shown in Table 7. Thus, across all four quarters of the study, course-takers of average ability maintained a significantly higher retention rate than non-course takers.

Graduation Rates

Controlling for academic ability and first quarter GPA, graduation rate for course-takers was significantly higher overall relative to non-course-takers ($\chi^2 = 10.108$, $df = 1$, $p = 0.0015$). The odds of graduating in four, five, or six years was 1.69 times higher for course-takers. As expected there was also a significant relationship between first quarter academic standing and graduation rates for all students ($\chi^2 = 15.387$, $df = 1$, $p < 0.0001$) such that the odds of graduating were 1.93 times greater for students in good academic standing their first quarter. Students with higher ACT scores also graduated at a slightly higher rate ($\chi^2 = 11.714$, $df = 1$, $p = 0.0006$), however graduation rate was not significantly related to CR ($\chi^2 = 2.461$, $df = 1$, $p = 0.1167$). There was also a significant interaction between GROUP and Academic Standing ($\chi^2 = 7.142$, $df = 1$, $p = 0.0075$). Figure 5 shows that, compared to non-course-takers, course-takers had relatively stable graduation rates across first quarter academic standing. Non-course-takers in academic difficulty had considerably lower graduation rates with only 4 of the 40 students in this group graduating. Specifically, course-takers in academic difficulty had a graduation rate 44.9% higher than non-course-takers in academic difficulty. A test of proportions revealed that the difference in graduation rates between course-takers and non-course-takers in academic difficulty was significant with a 97.5% confidence interval around the difference equal to (-0.67, -0.22). However, the difference in graduation rate between these groups in good academic standing was not significant. Specifically, while course-takers had a graduation rate 4.9% higher than non-course-takes, the 97.5% confidence interval was (-0.14, 0.04).

Educational Importance of the Study

This study has shown that first quarter low ability freshmen enrolled in the *Learning and Motivation Strategies* program 1) maintained a higher mean quarter grade point average throughout their first year and into their second year of study, 2) were more likely to be retained during this period, and 3) had higher graduation rates relative to students not enrolled in this program but of comparable ability and demographic makeup.

These results suggest that enrollment in this program helps students achieve a higher level of academic performance and persistence than would have occurred otherwise. That is, first quarter freshmen taking this course tended to fall in the bottom two quartiles of academic ability as measured by high school class rank and standardized test scores. Students with this level of academic ability tend to perform poorly and have a higher attrition rates than higher ability students. However, as shown in this study, students taking the *Learning and Motivation Strategies* course benefited from the self-regulatory strategies taught. Clearly, the strategies learned helped protect students from poorer academic performance and attrition over the course of their first year, into the second, and even increased the likelihood of graduation. With respect to this last point it is notable that the course-takers in academic difficulty during their first quarter had significantly higher graduation rates than comparable non-course-takers. These students appeared to 'buck the trend' with respect to graduation. That is, as shown in Figure 1, while the population of students in academic difficulty during their first quarter had a relatively low likelihood of graduating, students in this category enrolled in the *Learning and Motivation Strategies* course had a significantly higher likelihood of graduating than comparable students. The fact that students enrolled in this course tend to be lower ability students makes this result even more intriguing.

The results of the study clearly show the advantage to students to take a course in learning and motivation strategies during their first term at a university. Doing so appears to significantly improve their chances of earning high grades, maintaining higher grades and increasing their probability of retention. Postponing taking or not taking such a course puts new freshmen at risk in terms of both academic performance and subsequent retention. Academic and Student Life advisors should be encouraged to recommend such a course to students and their parents during orientation when first-term class schedules are being finalized.

The specific *Learning and Motivation Strategies* course evaluated in this study is available for use at other colleges and universities that do not have a course of their own. Please visit our website at http://dennislearningcenter.osu.edu and contact tuckman.5@osu.edu if you seek further information.

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Footnotes

[1]Since the majority of students had ACT composite scores and only a relatively small number of students had only SAT Verbal/Math scores, SAT Verbal/Math composite scores were converted into ACT composite scores using standard concordance tables. In all cases where students had taken a test more than once or had both and ACT composite and SAT Verbal/Math score, the highest score was used.

*Table 1. Strategies and Sub-strategies in the **Strategies-for-Achievement** Approach*

Take reasonable risk	(a) Set goals (b) Break tasks down into "bite sized pieces.
Take responsibility for your outcomes	(a) Focus your thoughts on "self" and effort" as causal explanations (b) Plan
Search the environment for information	(a) Ask questions (b) Use visualization
Use feedback	(a) Self monitor (b) Self instruct

Table 2: Population and Sample Distributions by Gender and Ethnicity

Cohort Year	Gender	Population Distribution							Course Takers and Non-Course Takers Distribution						
		Minority		White		Other		Total	Minority		White		Other		Total
		N	%	N	%	N	%		N	%	N	%	N	%	
AU00	Male	457	16.8%	2,226	81.9%	34	1.3%	2,717	2	50.0%	2	50.0%	0	0.0%	4
	Female	617	21.0%	2,301	78.4%	18	0.6%	2,936	8	80.0%	2	20.0%	0	0.0%	10
Cohort Total		**1,074**	**19.0%**	**4,527**	**80.1%**	**52**	**0.9%**	**5,653**	**10**	**71.4%**	**4**	**28.6%**	**0**	**0.0%**	**14**
AU01	Male	480	16.4%	2,358	80.8%	81	2.8%	2,919	14	20.6%	54	79.4%	0	0.0%	68
	Female	639	22.3%	2,173	76.0%	48	1.7%	2,860	16	36.4%	28	63.6%	0	0.0%	44
Cohort Total		**1,119**	**19.4%**	**4,531**	**78.4%**	**129**	**2.2%**	**5,779**	**30**	**26.8%**	**82**	**73.2%**	**0**	**0.0%**	**112**
AU02	Male	491	16.8%	2,342	80.3%	82	2.8%	2,915	16	21.6%	58	78.4%	0	0.0%	74
	Female	637	22.0%	2,216	76.6%	41	1.4%	2,894	20	25.0%	60	75.0%	0	0.0%	80
Cohort Total		**1,128**	**19.4%**	**4,558**	**78.5%**	**123**	**2.1%**	**5,809**	**36**	**23.4%**	**118**	**76.6%**	**0**	**0.0%**	**154**
AU03	Male	458	14.9%	2,555	83.1%	63	2.0%	3,076	14	17.9%	62	79.5%	2	2.6%	78
	Female	638	20.4%	2,432	77.9%	52	1.7%	3,122	12	17.1%	58	82.9%	0	0.0%	70
Cohort Total		**1,096**	**17.7%**	**4,987**	**80.5%**	**115**	**1.9%**	**6,198**	**26**	**17.6%**	**120**	**81.1%**	**2**	**1.4%**	**148**
AU04	Male	423	13.7%	2,579	83.8%	76	2.5%	3,078	4	7.4%	50	92.6%	0	0.0%	54
	Female	497	17.4%	2,299	80.6%	56	2.0%	2,852	4	8.7%	42	91.3%	0	0.0%	46
Cohort Total		**920**	**15.5%**	**4,878**	**82.3%**	**132**	**2.2%**	**5,930**	**8**	**8.0%**	**92**	**92.0%**	**0**	**0.0%**	**100**
AU05	Male	399	13.9%	2,389	83.0%	90	3.1%	2,878	4	5.4%	66	89.2%	4	5.4%	74
	Female	536	18.1%	2,337	79.1%	83	2.8%	2,956	12	18.8%	50	78.1%	2	3.1%	64
Cohort Total		**935**	**16.0%**	**4,726**	**81.0%**	**173**	**3.0%**	**5,834**	**16**	**11.6%**	**116**	**84.1%**	**6**	**4.3%**	**138**
AU06	Male	433	14.0%	2,575	83.3%	85	2.7%	3,093	4	14.3%	22	78.6%	2	7.1%	28
	Female	538	17.8%	2,413	79.7%	78	2.6%	3,029	4	50.0%	4	50.0%	0	0.0%	8
Cohort Total		**971**	15.9%	**4,988**	81.5%	**163**	2.7%	**6,122**	**8**	22.2%	**26**	72.2%	**2**	5.6%	**36**
Grand Total		**7,243**	**17.5%**	**33,195**	**80.3%**	**887**	**2.1%**	**41,325**	**134**	**19.1%**	**558**	**79.5%**	**10**	**1.4%**	**702**

Table 3: Descriptive Statistics for ACT Composite and High School Class Rank by Group

	ACT Composite Scores											
	Non-Course Takers						Course Takers					
Cohort	M	SD	95% CI For Mean	Md	95% CI For Median	95% CI For SD	M	SD	95% CI For Mean	Md	95% CI For Median	95% CI For SD
AU00	19.7	2.2	(17.7, 21.8)	19.0	(18.2, 21.5)	(1.4, 4.9)	19.6	2.0	(17.7, 21.4)	19.0	(18.2, 21.3)	(1.3, 4.4)
AU01	23.8	2.7	(23.1, 24.5)	24.5	(23.0, 25.0)	(2.3, 3.4)	23.8	2.9	(23.0, 24.6)	24.0	(23.0, 25.0)	(2.5, 3.6)
AU02	22.9	3.4	(22.1, 23.7)	23.0	(22.5, 24.0)	(2.9, 4.0)	22.5	3.5	(21.7, 23.2)	23.0	(22.0, 23,0)	(3.1, 4.2)
AU03	23.1	3.2	(22.4, 23.8)	23.0	(22.0, 24.0)	(2.7, 3.8)	23.0	3.2	(22.2, 23.7)	23.0	(22.0, 24.0)	(2.8, 3.9)
AU04	26.2	3.2	(25.3, 27.1)	27.0	(25.0, 27.3)	(2.7, 4.0)	24.6	3.0	(23.7, 25.4)	25.0	(24.0, 26.0)	(2.5, 3.7)
AU05	24.5	2.8	(23.8, 25.2)	25.0	(24.0, 26.0)	(2.4, 3.4)	24.3	2.9	(23.6, 25.0)	24.0	(23.9, 25.1)	(2.5, 3.5)
AU06	24.2	3.9	(22.2, 26.1)	24.0	(21.0, 27.0)	(2.9, 5.8)	24.2	4.2	(22.1, 26.3)	24.0	(21.5, 27.0)	(3.2, 6.3)
TOTAL	**23.9**	**3.3**	**(23.5, 24.2)**	**24.0**	**(24.0, 24.0)**	**(3.1, 3.6)**	**23.5**	**3.3**	**(23.1, 23.9)**	**24.0**	**(23.0, 24,0)**	**(3.1, 3.6)**

	High School Class Rank											
	Non-Course Takers						Course Takers					
Cohort	M	SD	95% CI For Mean	Md	95% CI For Median	95% CI For SD	M	SD	95% CI For Mean	Md	95% CI For Median	95% CI For SD
AU00	70.4	18.3	(53.6, 87.3)	74.0	(59.6, 81.3)	(11.8, 40.2)	71.0	17.4	(54.9, 87.1)	71.5	(58.1, 84.7)	(11.2, 38.3)
AU01	55.1	21.0	(49.5, 60.7)	55.2	(46.6, 63.8)	(17.7, 25.8)	55.2	21.8	(49.3, 61.0)	55.3	(47.0, 65.2)	(18.4, 26.8)
AU02	70.3	18.6	(66.0, 74.5)	75.6	(65.9, 79.0)	(16.1, 22.1)	70.0	19.2	(65.6, 74.4)	73.6	(69.7, 79.3)	(16.6, 22.9)
AU03	68.2	18.2	(63.9, 72.4)	71.0	(66.1, 77.2)	(15.6, 21.7)	68.0	17.7	(63.9, 72.1)	70.5	(66.3, 76.3)	(15.3, 21.2)
AU04	77.9	16.2	(73.2, 82.5)	80.1	(76.6, 85.8)	(13.6, 20.2)	74.8	15.3	(70.5, 79.1)	76.0	(69.5, 83.2)	(12.7, 19.0)
AU05	75.8	14.2	(72.4, 79.2)	75.7	(73.0, 80.70	(12.2, 17.1)	74.6	15.6	(70.9, 78.4)	75.9	73.4, 80.2)	(13.3, 18.7)
AU06	65.0	21.8	(54.1, 75.8)	67.0	(50.5, 83.1)	(16.4, 32.7)	65.7	22.5	(54.5, 76.9)	66.9	(52.0, 82.8)	(16.9, 33.7)
TOTAL	**69.3**	**19.3**	**(67.3, 71.3)**	**72.9**	**(69.8, 75.8)**	**(17.9, 20.8)**	**68.6**	**19.3**	**(66.6, 70.6)**	**72.2**	**(69.5, 74.9)**	**(18.0, 20.8)**

Table 4: Three-level Unconditional Model of the Analysis of Quarter Grade Point Average

$QGPA = \pi_0 + \pi_1(QUARTER) + e$

$\pi_0 = \beta_{00} + r_0$

$\pi_1 = \beta_{10} + r_1$

$\beta_{00} = \gamma_{000} + u_{00}$

$\beta_{10} = \gamma_{100} + u_{10}$

Fixed Effects		*Coefficient*	*SE*	*t-ratio(df)*	*p*
Initial Status:	γ_{000}	2.874	0.050	56.969(6)	<0.0001
Rate:	γ_{100}	-0.087	0.020	-4.264(6)	0.006

Random Effects		*Variance*	*df*	χ^2	*p*
Level 1:	e	0.250			
Level 2:	$\tau_{\pi 0}$	0.290	679	1620.881	<0.0001
	$\tau_{\pi 1}$	0.023	679	995.869	<0.0001
Level 3:	$\tau_{\beta 00}$	0.012	6	23.438	0.001
	$\tau_{\beta 10}$	0.002	6	23.729	0.001

		Percent Variance	
		Between Cohorts	Within Cohorts
Initial Status:	π_0	3.97	96.03
Rate:	π_1	8.00	92.00

Table 5: Three-level Conditional Model of the Analysis of Quarter Grade Point Average Including Group and ACT and CR Covariates

$QGPA = \pi_0 + \pi_1(QUARTER) + e$

$\pi_0 = \beta_{00} + \beta_{01}(GROUP) + \beta_{02}(CR) + \beta_{03}(ACT) + r_0$

$\pi_1 = \beta_{10} + \beta_{11}(GROUP) + \beta_{12}(CR) + \beta_{13}(ACT) + r_1$

$\beta_{00} = \gamma_{000} + u_{00}$

$\beta_{01} = \gamma_{010}; \beta_{02} = \gamma_{020}; \beta_{03} = \gamma_{030}$

$\beta_{10} = \gamma_{100} + u_{10}$

$\beta_{11} = \gamma_{110}; \beta_{12} = \gamma_{120}; \beta_{13} = \gamma_{130}$

Fixed Effects		*Coefficient*	*SE*	*t-ratio(df)*	*p*
Initial Status:	γ_{000}	2.817	0.056	49.885(6)	<0.0001
GROUP	γ_{010}	0.112	0.050	2.235(698)	0.026
CR:	γ_{020}	0.009	0.001	6.687(698)	<0.0001
ACT:	γ_{030}	0.014	0.008	1.678(698)	0.093
Rate:	γ_{100}	-0.098	0.023	-4.253(6)	0.006
GROUP:	γ_{110}	0.022	0.021	1.020(698)	0.309
CR:	γ_{120}	0.0002	0.0006	0.357(698)	0.721
ACT:	γ_{130}	0.008	0.003	2.436(698)	0.015

Random Effects		*Variance*	*df*	χ^2	*p*
Level 1:	e	0.251			
Level 2:	$\tau_{\pi 0}$	0.258	676	1507.975	<0.0001
	$\tau_{\pi 1}$	0.022	676	951.118	<0.0001
Level 3:	$\tau_{\beta 00}$	0.012	6	25.331	0.001
	$\tau_{\beta 10}$	0.002	6	23.907	0.001

		Percent Variance	
		Between Cohorts	Within Cohorts
Initial Status:	π_0	4.44	95.56
Rate:	π_1	8.33	91.67

Table 6: Three-level Unconditional Model of the Analysis of Retention Status

$P(STATUS = 1 \mid \pi) = \varphi; \ln\left(\frac{\varphi}{1-\varphi}\right) = \eta$

$\eta = \pi_0 + \pi_1(QUARTER)$

$\pi_0 = \beta_{00}$

$\pi_1 = \beta_{10} + r_1$

$\beta_{00} = \gamma_{000}$

$\beta_{10} = \gamma_{100} + u_{10}$

	Fixed Effects		*Coefficient*	*SE*	*t-ratio(df)*	*p*	*Odds Ratio*	*CI*
Unit-specific model	Initial Status:	γ_{000}	4.343	0.232	18.713(2806)	<0.0001	76.974	(43.106, 137.456)
	Rate:	γ_{100}	-0.670	0.112	-5.978(6)	<0.0001	0.511	(0.411, 0.637)
	Random Effects		*Variance*	*df*	χ^2	*p*		
	Level 2:	$\tau_{\pi 1}$	0.364	695	684.869	>0.500		
	Level 3:	$\tau_{\beta 10}$	0.014	6	13.068	0.041		

	Fixed Effects		*Coefficient*	*SE*	*t-ratio(df)*	*p*	*Odds Ratio*	*CI*
Population-average model	Initial Status:	γ_{000}	4.379	0.261	16.781(2806)	<0.0001	79.759	(47.825, 137.016)
	Rate:	γ_{100}	-0.821	0.082	-9.990(6)	<0.0001	0.440	(0.367, 0.528)

Table 7: Three-level Unconditional Model of the Analysis of Retention Status Including Group and ACT and CR Covariates

$$P(STATUS = 1 \mid \pi) = \varphi; Log\left(\frac{\varphi}{1-\varphi}\right) = \eta$$

$$\eta = \pi_0 + \pi_1(QUARTER)$$

$$\pi_0 = \beta_{00} + \beta_{01}(GROUP) + \beta_{02}(CR) + \beta_{03}(ACT)$$

$$\pi_1 = \beta_{10} + \beta_{11}(GROUP) + \beta_{12}(CR) + \beta_{13}(ACT) + r_1$$

$$\beta_{00} = \gamma_{000}; \beta_{01} = \gamma_{010}; \beta_{02} = \gamma_{020}; \beta_{03} = \gamma_{030}$$

$$\beta_{10} = \gamma_{100}$$

$$\beta_{11} = \gamma_{110} + u_{11}$$

$$\beta_{12} = \gamma_{120}; \beta_{13} = \gamma_{130}$$

	Fixed Effects		*Coefficient*	*SE*	*t-ratio(df)*	*p*	*Odds Ratio*	*CI*
Unit-specific model	Initial Status:	γ_{000}	3.791	0.260	14.592(2800)	<0.0001	44.327	(26.638, 73.765)
	GROUP	γ_{010}	1.870	0.612	3.056(2800)	0.003	6.494	(1.956, 21.556)
	CR:	γ_{020}	0.0006	0.013	0.047(2800)	0.963	1.000	(0.975, 1.027)
	ACT:	γ_{030}	0.083	0.076	1.019(2800)	0.276	1.086	(0.936, 1.261)
	Rate:	γ_{100}	-0.598	0.119	-5.043(698)	<0.0001	0.549	(0.436, 0.694)
	GROUP:	γ_{110}	-0.303	0.291	-1.040(6)	0.339	0.738	(0.388, 1.406)
	CR:	γ_{120}	0.004	0.006	0.688(698)	0.492	1.004	(0.993, 1.015)
	ACT:	γ_{130}	-0.009	0.033	-0.257(698)	0.797	0.991	(0.929, 1.058)

Random Effects		*Variance*	*df*	χ^2	*p*
Level 2:	$\tau_{\pi I}$	0.357	692	637.155	>0.500
Level 3:	$\tau_{\beta I I}$	0.128	6	21.239	0.002

Table 7: (Continued)

	Fixed Effects		*Coefficient*	*SE*	*t-ratio(df)*	*p*	*Odds Ratio*	*CI*
Population-average model	Initial Status:	γ_{000}	3.806	0.246	15.467(2800)	<0.0001	44.977	(27.766. 72.854)
	GROUP	γ_{010}	1.916	0.527	3.629(2800)	0.001	6.794	(2.414, 19.122)
	CR:	γ_{020}	0.002	0.012	0.146(2800)	0.885	1.002	(0.978, 1.026)
	ACT:	γ_{030}	0.085	0.070	1.218(2800)	0.224	1.089	(0.949, 1.250)
	Rate:	γ_{100}	-0.715	0.107	-6.682(698)	<0.0001	0.489	(0.397, 0.604)
	GROUP:	γ_{110}	-0.443	0.253	-1.756(6)	0.129	0.642	(0.367, 1.121)
	CR:	γ_{120}	0.003	0.005	0.525(698)	0.599	1.003	(0.993, 1.013)
	ACT:	γ_{130}	-0.014	0.029	-0.472(698)	0.637	0.986	(0.932, 1.044)

Table 8: Observed and Predicted Retention Percentages

Quarter	*Observed Retention Percentages*			*Predicted Retention Percentages*	
	Non-Course Takers	*Course Takers*	*Population*	*Non-Course Takers*	*Course Takers*
AU 1	99.1%	100.0%	98.3%	97.8%	99.7%
WI 1	94.0%	98.9%	97.2%	96.1%	99.2%
SP 1	90.9%	96.9%	93.7%	93.1%	97.9%
AU 2	85.5%	93.4%	90.0%	88.0%	95.1%

Figure 1: Combined Four, Five, and Six Year Graduation Rates of as a Function of First Quarter GPA for the Population of Students Starting in Autumn 2000 Through Autumn 2002

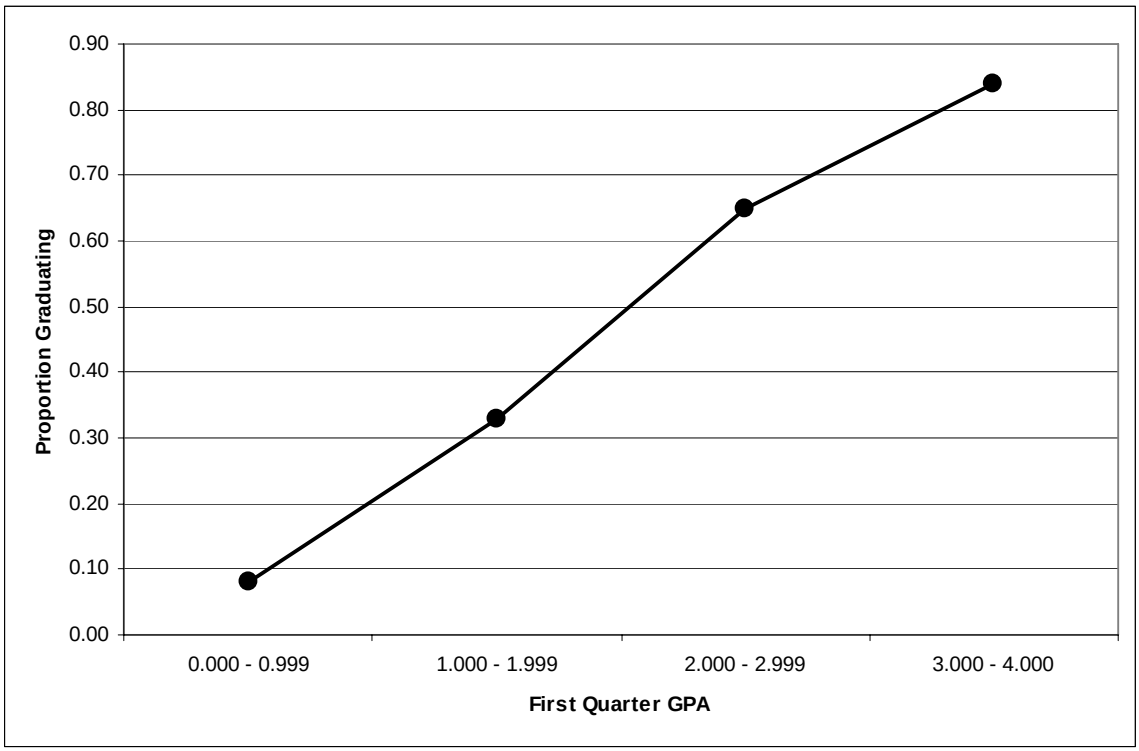
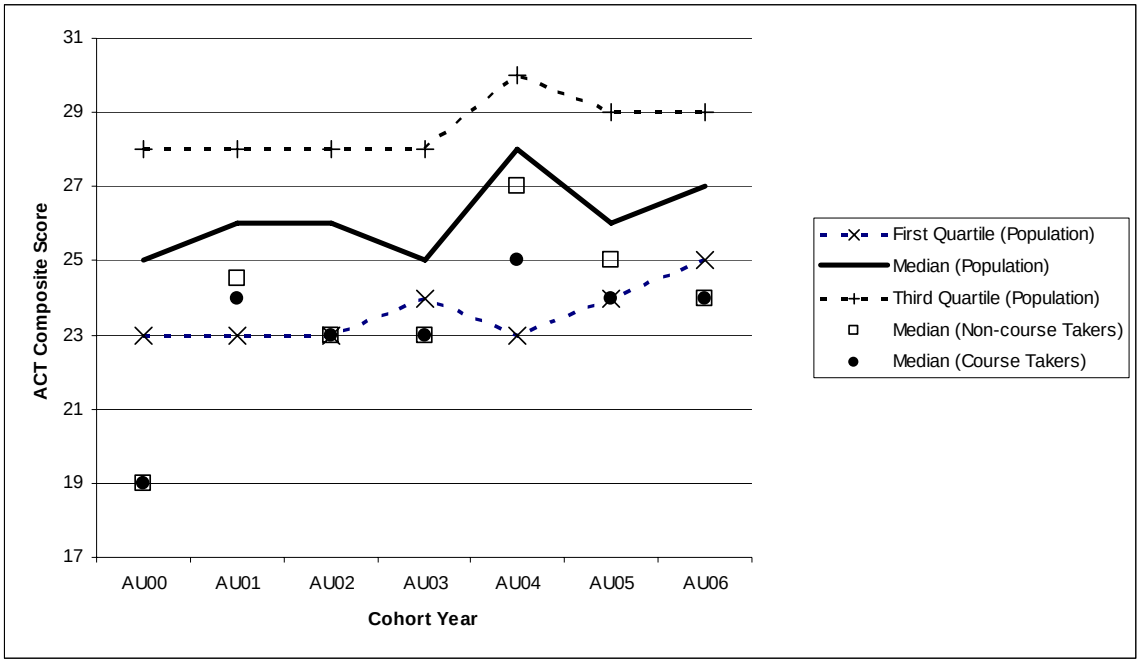


Figure 2: Population Median and Interquartile Range of Ability Measures Compared with Ability Measure of Course Takers and Non-course Takers



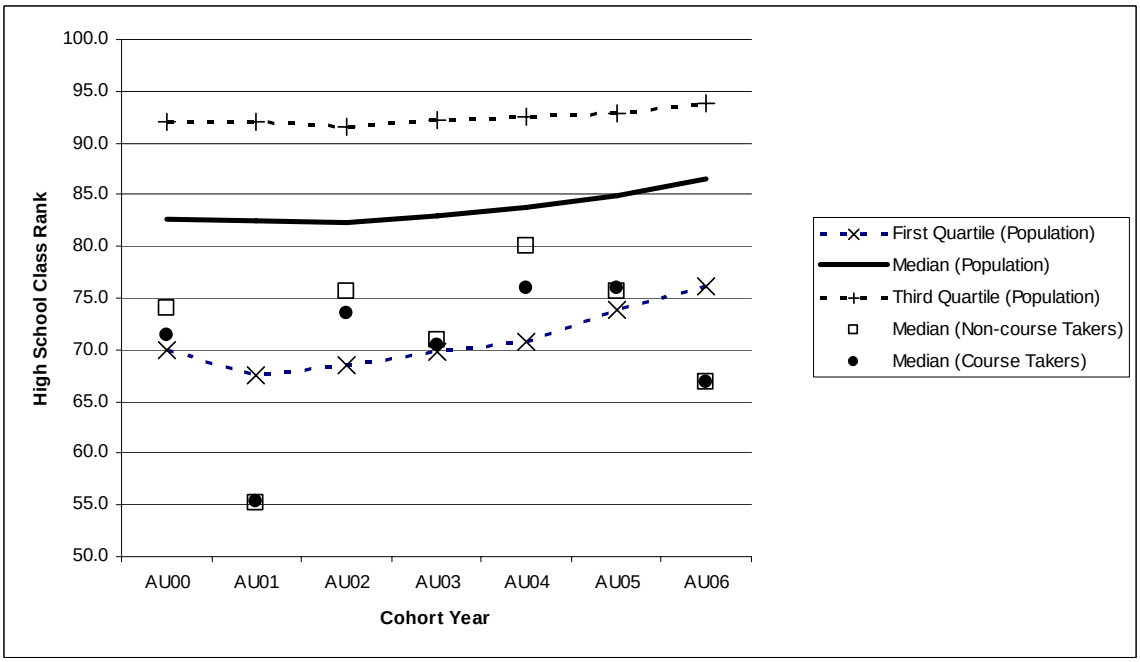


Figure 3: Quarter GPA as a Function of Quarter of Enrollment

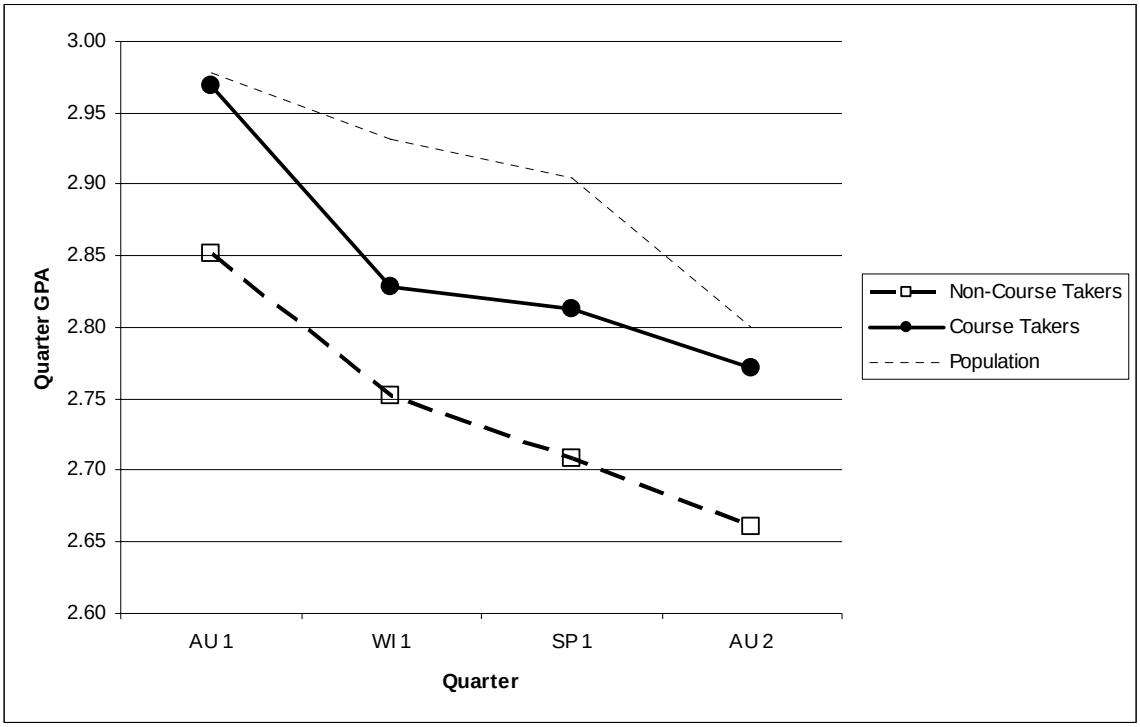


Figure 4: Proportion Retained for each Quarter of Enrollment

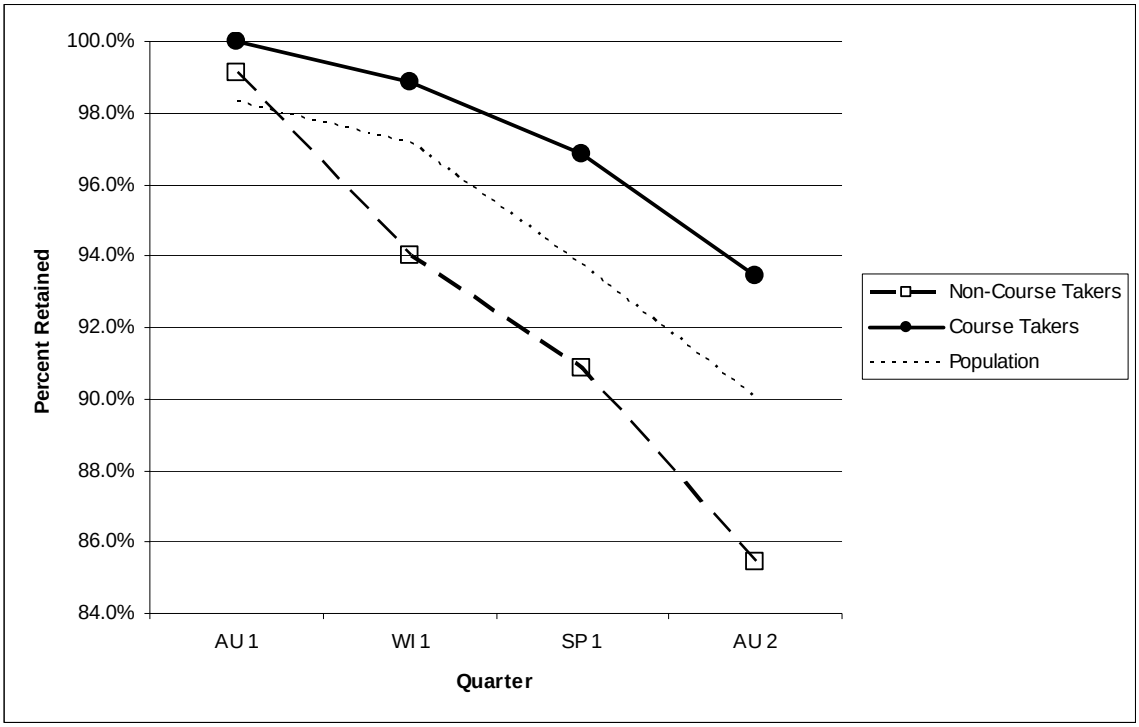


Figure 5: Proportion Graduated as a Function of First Quarter Academic Standing