COGNITIVE DEVELOPMENT IN COLLEGE BIOLOGY LABORATORY IN RELATION TO COURSE DESIGN AND GENDER

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Abstract: This paper reports on two studies of student cognitive development conducted on the introductory non-majors biology laboratory at Southeast Missouri State University. One hypothesis was that a laboratory course designed to teach students through practice how scientific research is conducted would promote cognitive development more effectively than would a more conventional laboratory course. The second hypothesis was that gender is a predictor of cognitive ability.

Five hundred and thirty students participated in the first study, while one hundred and forty-two students participated in the second study.

In both cases, in order to test competing hypotheses about influences on student cognitive ability, step-wise multiple regression analyses were employed. This technique allows the researcher to identify which, from a set of potentially relevant independent variables (the competing hypotheses), significantly explain variance in the dependent variable (cognitive ability).

The first hypothesis was supported while the second, as the researchers expected, was rejected.

Introduction

During the last decade, there has been much discussion about the failure of college and high school science courses to emphasize or promote critical thinking, problem-solving and the process of scientific investigation (Journet, 1985a; Jungk, 1985; Koshland, 1985; Moore, 1983; Wivagg & Moore, 1985). In relation to the science curriculum, the admonition of Sagan (1974) is relevant; science is not information, science is process. Furthermore, as Lawson (1985) emphasized, "a central purpose of education is to improve students' reasoning abilities."

Formal Reasoning

In discussing the development of cognitive skills, Piaget (Inhelder & Piaget, 1958) argued that children pass through a series of stages: sensory motor, pre-operational, concrete operational, transitional, formal operational. For college students, the last three stages are important. According to Sanders (1978) concrete operational students: require reference to familiar actions, objects and observable properties to gain understanding; reason formally in only a partial and unsystematical manner, but only in a familiar context; require step-by-step instructions of lengthy procedures; are unaware of their own reasoning and inconsistencies among statements and known "facts." Formal operational students, meanwhile: can reason with concepts, relationships, abstract properties, axioms, and theories, can use symbols to express ideas; can identify variables and discover their relationships by controlled investigation; can plan lengthy procedures, given goals and appropriate resources; are aware and critical of their own reasoning and inconsistencies in it; are able to conceptualize probabilities, proportions, permutations and combinations, and propositions.

Formal Reasoning and College

McKinnon (1971) demonstrated that 50% of the students entering college are concrete operational. On a more depressing note, Blosser (1983) reported that maybe only 50% of the American population ever becomes formal in anything but a narrow area of expertise. In a study of critical thinking at the college level, Keeley and Browne (1986) reported that college students make no cognitive progress through their four year programs. It seems, then, that the achievement of formal operational thought by our students should be one of our primary educational goals.

In a review of research relating to reasoning, Piaget's theory and education, Lawson (1985) pointed out that formal reasoning, as it manifests itself in performance terms is scientific reasoning. Furthermore, Lawson (1985) referred to several studies that showed reasoning can be taught through problem-solving exercises. He further argued that formal reasoning has general applicability across disciplines in courses where critical analytical thought is required. He further noted that if, as Lawson (1980) found, the relationship between cognitive level and performance in biology courses is extremely variable, this may be because many courses do not teach or test higher level reasoning.

Formal Reasoning and Gender

A number of studies have been conducted on the role of gender in predicting some aspect of cognitive ability. An early study by Maccoby and Jacklin (1974) suggested that there is a consistent pattern wherein female high school and college students have more difficulty than their male counterparts in problems requiring spatial skills. Gray (1981) argued that this difference is a consequence of brain function. Waber (1976) argued that the differences are a function of maturation rather than gender, being a consequence of the different developmental rates of males and females. Golbeck (1986), meanwhile, argued that the experimentally demonstrated differences are due to a content bias in the tests in favor of courses males prefer rather than any difference in ability. Fox, Toben and Brody (1979), Nash (1979) and Erickson and Erickson (1984) argued further that apparent differences may be due to social rather than biological events and reflect affective rather than ability differences.

The Hypotheses

The first hypothesis tested in this study related directly to Lawson's (1985) argument that scientific reasoning requires formal operational thought. In 1985 the non-majors general biology laboratory course at Southeast Missouri State University was modified such that its primary goal was to teach students the methods, scope, and limitations of scientific inquiry. Biological content, though still important, became of secondary importance to the primary aim (see 'The Course' below). We argued that if the course is successful in its aim of teaching science, it should also promote cognitive advancement among students. This study was conducted in fall 1984 and spring 1985.

The second hypothesis concerned the role of gender as a predictor of cognitive development. We reasoned that the appearance of gender as a predictor of cognitive ability in some studies might result from an experimental failure to test competing potential influences; gender may show up as the proximate factor when the ultimate factor is some difference in male/female experience. The technique of step-wise multiple regression allows statistical control of those competing factors that are included in the model. This study was undertaken in fall 1985.

Methods

The Course

The investigative biology laboratory course had 11-14 sections serving 300-500 students per semester. Though it is a separate course, most students took the general education biology lecture course prior to or concurrently with the laboratory course. For several years the laboratory course combined conventional information-oriented descriptive laboratory activities with just a few laboratory activities that were inquiry oriented (Johnson, 1980; 1982).

In spring 1985 the laboratory was completely revised such that the entire course now became designed to provide students with experience in science and an opportunity to develop their knowledge of and skill in scientific investigation (Journet, 1985b). The course sequence now takes students initially from a series of simple activities involving predictions and tests to an experimental sequence in which they construct their own hypotheses, devise their own tests, statistically analyze their data and write reports on their investigations. For a more extensive description of the course, see Leonard, Journet & Ecklund (1988) and Journet (1992). As Lawson and Blake (1976) advised, the course offers students many opportunities to design and conduct investigations, starting from the familiar and proceeding to the more abstract.

Kolodiy (1975) noted the frequency of a discrepancy between the mental level of students and the teaching techniques employed in college courses. Lawson (1985) further warned that care must be taken with the manner in which abstract ideas are introduced lest concrete operational students be overwhelmed. When confronted with formal ideas, concrete students will fail to learn, or will simply memorize (Lawson & Renner, 1975).

The design of this course attempts to develop the investigative model sufficiently slowly that concrete operational students have time to work with and become familiar with each level of complexity before they are required to move to the next. The course design approximates the learning cycle of exploration, conceptual invention and discovery (Schneider & Renner, 1980; Renner & Stafford, 1979) employing Lawson's (1988) type III model - the hypothetico-deductive learning cycle. In this course, the biological content is the means to the end of understanding the scientific process, the goal of this learning cycle approach is for students to understand the process, scope, and limitations of scientific investigation through experience.

The Instrument

The standard means of determining the cognitive level of students is the Piagetian interview (Inhelder & Piaget, 1958) which, unfortunately, takes 30 to 90 minutes to complete. Since this study involved several hundred students, we used an instrument developed by Renner, Prickett and Renner (1977). This pencil and paper test shows a coefficient of correlation ($r = 0.62$) with the Piagetian interview. Two of the problems on the set are proportional (X_1 = Frogs and X_2 = Shadows), a third is combinational (S_3 = Rock and Scale), and the fourth involves control of variables (X_4 = Geraniums). Before answering the problem set, students were instructed to write their reasoning for solutions as well as give mathematical answers. In assessing the student responses, points were allocated to the reasoning as well as the correct solution in accordance with the guidelines of Renner, Prickett and Renner (1977). It took about five minutes to score the four-problem set of each student.

The dependent variable used in this phase of the study was the Piagetian Equivalent developed by applying Renner's equation (Renner, Prickett & Renner, 1977) to the individual student scores on each problem such that:

$$\text{STUDENT PIAGETIAN EQUIVALENT} = 2.74 + 0.261\,X_1 + 0.506\,X_2 + 0.576\,X_3 + 0.440\,X_4.$$

This Piagetian Equivalent relates to Piagetian levels in the following way: Concrete Operational 4-8, Transitional 9-11, Formal Operational 12-14.

Independent Variables

Independent variables employed in these studies are listed in Table 1. These data were collected by a questionnaire administered concurrently with the cognitive instrument.

i. Main Hypotheses:

Clearly those most relevant variables for the first hypothesis were two indicator (0 or 1) variables (Neter & Wasserman, 1974) separating the beginning of the course from course completion - one variable was completion with the Johnson manual, the other completion with the Journet manual. Since the study was conducted at the beginning and end of each semester, this resulted in two 0/1 indicator variables. Students at the beginning of either semester would be 0,0, while students at the end of the Johnson semester (fall, 1984) were 1,0, and those at the end of the Journet semester (spring 1985) were 0,1.

In the second study, where gender was included as an indicator variable, semester and manual were removed as variables since only one manual was used, and only one semester was studied. This study was conducted on students at the beginning of the course only.

ii Competing Hypotheses:

The number of college credit hours accumulated was included since it seemed reasonable to predict that experience in college would encourage critical analytical skills.

Since formal operational thought is associated with ability in science and mathematics (Lawson & Wollman, 1976; Lawson, 1985), variables measuring the number of these courses taken were added.

Current enrollment in general biology lecture was included since the successful performance of investigations in biology, and therefore success in the course, might be encouraged by the biological knowledge gained by students in the lecture course. Prior completion of general biology lecture and dropping general biology lecture were included for the same reason.

The identification of students who dropped general biology laboratory during the study allowed separation of beginning student Piagetian Equivalent into those who completed the course and those who did not. This provided an additional test of the concern that students who finished the course might have been those who started with greater cognitive abilities, rather than those whose abilities improved during the course.

Three variables representing poor academic skills were indicator variables reflecting concurrent enrollment in the remedial courses of mathematics, writing and reading. Since formal operational thought is problem-solving, and such is frequently predicated on these basic skills, it was thought that these variables might be negative predictors of cognitive level.

Science and mathematics interest were included to allow segregation of interest in these areas from number of courses taken. Lawson (1985) suggested that interest in precisely these areas is an important correlate with cognitive level.

In the miscellaneous category we included age, since Piaget's initial studies on cognitive development related to age (Inhelder & Piaget, 1958).

Prior experience with the problem set was included as an indicator variable since the same problem set was used at the beginning and the end of the course, and some of the students would, therefore, be doing the same problems twice. It was consequently important to separate this variable from simple completion of the course, the key variable in the study.

Hours spent on outside activities was included to measure the influence, if any, of student time budget on cognitive development during this course. Presumably the more serious students, and therefore those more likely to spend time studying, would benefit most from the experience.

Finally, since the study was conducted over two semesters, an indicator variable was included to reflect fall (0) or spring (1) enrollment. This allowed us to determine if student cognitive level was different between the semesters. However, this variable does present some problems in interpretation since all the Johnson manual students came from the 0 values, and all the Journet manual students came from the 1 values on this semester variable. As a result, it is impossible to separate completely semester from manual as a potential predictor; students in one semester may be different from those in the other semester in some unmeasured way that could influence their cognitive development during the semester. In order to allow interpretation of semester influences, therefore, data on the cognitive abilities of students at the beginning and ending of each semester were examined.

Protocol

Course design and cognitive development

At the beginning of each semester (Fall 1984, Spring 1985) the problem set and questionnaire were administered to half the students. Since most instructors had two sections, one of those of each was randomly selected and surveyed. The problem set and cover survey were introduced to the students by one of the investigators (ARPJ, CMS), thus insuring consistency and student anonymity. They were scored by CMS. While no names were used, the students entered a code number on each set to allow subsequent identification (by their absence) of those students who dropped by the end of the semester when the study was repeated. At the end of the semester, all students in the course (both those who had and had not taken it initially) completed both the survey and problem set, again entering their code number for the investigators to match papers.

Gender and cognitive development

This study was conducted on all students but only at the beginning of the semester. These were again administered by one of the investigators (CCY or ARPJ) and scored by CCY.

In both studies problem sets were scored only after the study was complete, without knowledge of the source of the papers. These techniques assured consistency of grading and the elimination of unconscious bias. At the end of two semesters the data were combined for the laboratory design study. The gender study was conducted in a third semester. Variables employed in the study are listed in Table 1

Non-indicator independent variables were standardized to eliminate bias due to differences in range. Step-wise multiple regression analyses were then performed with cognitive level as the dependent variable. The step-wise multiple regression analysis employed a forward selection procedure. The significance level for entry into the model was set at 0.50 while the significance level necessary for a variable to stay in the model was 0.10. In brief, the forward selection procedure works as follows: the independent variable which exhibits the strongest relationship with the dependent variable, and has a p-value less than 0.50 is incorporated into the regression model first. A second variable is then added following the same criteria. Since incorporation of each variable modifies the conditional Type II sums of squares an attempt is made at each step to remove variables that no longer meet the criteria necessary to remain in the model (SAS Institute Inc., 1982). This process of entering and removing variables continues until no additional variables can be entered or removed.

Step-wise regression is a multivariate technique that allows an identification and analysis of inter-correlations among variables. It must be recognized, however, that this is a descriptive and not an experimental technique capable of identifying cause and effect. The technique suggests rather than tests or confirms relationships.

In the first study, basic univariate statistics were also computed for the dependent variable, Piagetian Equivalent, to determine:

i. the cognitive level of students at the beginning and end of each semester.

ii. for those at the beginning of the semester, the cognitive level of those who completed the course and those who dropped.

Results

i. Course Design and Cognitive Level

The step-wise multiple regression model testing course design (laboratory manual) in relation to cognitive development was significant at the $p<0.0001$ level and explained 23.85% of the variance in Piagetian Equivalent (total degrees of freedom 529).

Positive predictors of cognitive ability were science interest ($p< 0.0001$), mathematics interest ($p<0.0001$), mathematics courses ($p=0.0432$), prior experience on the instrument ($p< 0.0001$), and the Journet Manual ($p=0.0172$). Negative predictors were developmental mathematics ($p=0.0253$), developmental reading ($p=0.0572$), and semester ($p< 0.0001$).

It is important to note that the technique of step-wise multiple regression assures that each variable selected is independent of those already in the model. Thus, the initial selection of prior experience on the problem set means that subsequent variables are only selected if they covary with Piagetian Equivalent independently of prior experience. Thus, the Journet laboratory manual is selected as a significant predictor independent of the variables previously included in the model.

The results of the univariate analyses are given in Tables 2 and 3. Table 2 shows the mean cognitive measure of students as they enter and complete general biology laboratory in the two semesters of the study. Though there is not a significant difference between semesters in the final cognitive level, the selection of semester as a significant negative contributor in the step-wise regression analysis can be seen to result from the difference of students at the beginning of the course; spring students exhibit a lower cognitive level. Notice, particularly, that the spring students start lower and end higher than the fall students. Again, however, it should be noted that among the end of semester data it is impossible to separate manual from semester.

Comparison of these data with the Piagetian cognitive levels reveals that close to 50% of the entering students are concrete operational, while about 75% have yet to become formal operational - even upon completion of the course.

Table 3 presents the Piagetian Equivalent of students at the beginning of the course, divided between those who subsequently drop and those who complete the course. These data show why dropping the course did not appear as a significant predictor in the step-wise regression analysis; there is no difference between groups. This denies the argument that students with a lower cognitive level are more likely to drop the course or, conversely, that cognitive level is a predictor of course completion.

ii Gender and Cognitive Level

The multiple regression model testing the influence of gender on cognitive level is significant ($p=0.0002$) and explains 14.61% of the variance in cognitive ability (total degrees of freedom 141)

Positive predictors are number of science courses ($p=0.0028$) and mathematics interest ($p=0.0009$). Non-significant negative predictors appearing in the model were developmental reading ($p=0.1024$) and passing the lecture course ($p=0.1136$).

Discussion

i - Course Design and Cognitive Level

While 24% represents a significant amount of the variation in Piageti Equivalent explained by this model, clearly this study has omitted one or mo variables that explain most of the variability in cognitive level. The first regressi analysis revealed that prior experience on the problem set was the best statistic predictor of cognitive level as determined by performance on the problems. Th suggests the value of repetition in teaching, even without feedback.

The demonstration by Lawson, Norlund and DeVito (1975) of relationship between science interest and reasoning ability suggests that stude interest and attitude are important. In the first study, science and mathemati interest were selected early in the regression procedure as predictors of cogniti level, while only later in the cycle was the number of courses in mathemati selected.

It should be noted that the number of science and mathematics cours was not separated in this study into high school and college courses. Howeve since the course is at the introductory level, a large proportion of the students we beginning freshmen.

In view of the evidence suggesting science and mathematics attitudes a important predictors of formal reasoning (Lawson, 1985), and the fact that tl problem set itself requires some mathematical skills, it is not surprising to find th concurrent enrollment in developmental mathematics appears in the first study as negative predictor. Since manipulation with abstract ideas and symbols is tl essence of mathematics, the relationship between mathematics expertise ar cognitive level is to be expected.

The role of semester as a significant though negative predictor cognitive level seems to be a consequence of a difference in student populatio between semesters. This difference is reflected in data on entering stude cognitive levels in the two semesters. During the spring semester the revise laboratory manual (Journet, 1985b), with an increased emphasis on the process science, was introduced. By the end of the semester, the students displayed a mea cognitive level similar (though slightly higher) to those in the previous fall wh started with a higher mean level. It must be acknowledged, however, that th design of the study prevents us from eliminating the unlikely possibility that sprin students would have increased more with the Johnson manual, or no manual at al Since we can eliminate age, course credit accumulation, and the other variables i the model as causes for such a pattern, we infer that the manual used is the mo probable explanation for the difference between semesters.

Since completion of the course with the Journet manual appears in th model, and the Johnson manual fails to appear, the primary hypothesis is supporte As Lawson (1985) suggested, these investigative activities seem to promote form reasoning.

The suggestion of a relationship between formal reasoning ability an writing (Lawson & Shepherd, 1979) is not clearly supported in this analysis sinc developmental writing fails to appear in the regression. However, inclusion enrollment in the developmental reading course as a negative predictor in th model, though this variable is just above the 5% significance level, suggests the importance of comprehension in determining the nature of a problem and then developing an answer. In a discussion of the linguistic abilities necessary for hypothetico-deductive (=formal) reasoning, Lawson, Lawson and Lawson (1984) argued that student ability to discriminate among the key terms and concepts essential to the processes of argument and investigation are prerequisites to the understanding and subsequent application of these processes. There seems to be a precision in comprehension and use of language that is essential to formal thought and which many students do not possess.

The absence of writing as a predictor in the current study may be primarily a consequence of any deficiencies in writing showing only secondarily to deficiencies in reading and comprehension, i.e., for many students, failure to comprehend the question dictated failure to answer.

The absence of science courses as a predictor in this study is interesting. This supports the argument that student formal reasoning is not promoted by the science course experience that many students have. If reasoning is the goal of education, science instructors might be encouraged to place more emphasis on developing in students an appreciation for and understanding of the process of science, as opposed to that 'facts,' vocabulary and details of scientific knowledge. However, in the smaller study on gender, science courses did appear as a positive predictor. Since McDaniel and Journet (1995) showed that high school science is also absent as a positive predictor of performance in this laboratory course, we are forced to question seriously the biological benefit that accrues to our students from their high school science experience.

The absence of college level credit hours accumulated raises similar serious questions about the role of college courses in promoting formal reasoning. This is entirely consistent with the findings of Keeley and Browne (1986). If, as Lawson (1985) suggested, achievement deficiencies in a wide range of courses correlate with poor reasoning, then we must infer that many courses testing formal reasoning are not promoting it. If critical thinking is expected of our students (in assessment, for example), then either measures should be taken in course design to promote it or we must expect high failure rates from our students and high frustration rates among our instructors.

The absence from the model of concurrent enrollment in or dropping the general biology lecture suggests that the activities in lecture are not promoting formal reasoning. In addition, this suggests that the students' exposure to the biological content of the lecture was not contributing to their ability to complete the cognitive problem set. This argues that the problem set itself was not biased to favor students with more biological background or experience.

In terms of possible content bias in either the formal concept itself or the problem set used in this analysis, these results support the suggestions of Bart (1971) and Lawson and Renner (1975) that formal thought is not content specific but has general applicability across disciplines.

Since the initial discussion of cognitive development as enunciated by

Piaget suggested an age-dependent process, the absence of age from the model is surprising. Since Piaget's studies focused on younger students (Inhelder & Piaget, 1958) maybe this population of students was simply beyond the age at which conventional maturation processes would be influencing mental ability. It is also possible that the range of variation in age of these students was insufficient to detect any age relationship. This is consistent with the findings of Lawson (1982) where concrete operational college students were more responsive to instruction than seventh graders.

That the number of hours spent on outside work or social activities fails to appear in the model should encourage students with extensive social or employment responsibilities and suggests that among those committed to attending school, reasoning level is not influenced by the amount of time students spend on such endeavors. Since the college academic experience fails to foster cognitive advancement, this is not surprising.

The data on the cognitive level of students reflect those reported elsewhere (McKinnon, 1971) which suggest that up to 50% of the entering students are concrete operational. Indeed, in this study, over 75% of the students are not yet formal when they enter the course. In relation to this study, it is important to realize that the initial cognitive level of students who subsequently dropped the course was not different from those who subsequently completed the course. While the step-wise multiple regression suggests that the reasoning abilities of our students were enhanced by their completion of the general biology laboratory course with the Journet manual, we must recognize that the majority of them are still in the concrete operational to transitional range even at the end. As Lawson (1985) pointed out, the application by students of formal thought to novel situations seems dependent on their exposure to a diversity of formal experiences. If more of the introductory level college courses (not to mention high school courses) emphasized critical and analytical skills, perhaps cognitive development could be enhanced in a greater proportion of our introductory students. As Lawson (1985) observed, there exists a general lack of diversity in experiences offering "cognitive nourishment," the solution to which must be a greater frequency of courses with intellectual development as a goal.

The appearance of completion of the general biology laboratory as a significant statistical predictor of cognitive level supports the primary hypothesis in this study, and supports the suggestion of Lawson (1985) that investigative activities promote formal reasoning. This supports the hypothesis that an investigative laboratory course will have greater success at promoting cognitive development than a more conventional laboratory. Since Davis and Black (1982) and Moll and Allen (1982) have shown a student preference for the investigative laboratory design over the conventional design, we have another argument to support its incorporation into college curricula.

ii - Gender and Cognitive Development

In the gender study, mathematics interest again appeared as a predictor, while science courses was also present. This again supports the argument that interest is at least as important as courses taken. However, most importantly, gender does not serve as a predictor of cognitive ability. This result is consistent with our suspicion that many studies revealing a gender relationship with cognitive skills are failing to account for competing hypotheses, among which may be found the ultimate cause. These results suggest that students who are encouraged in mathematics and who take more science courses exhibit greater cognitive skills. As Erickson and Erickson (1984) noted, any perceived gender differences may simply reflect social pressures.

From these data, it is impossible to know if greater mathematics interest and more science courses lead to cognitive advancement, or if students with greater formal reasoning skills are more likely to show math interest and take science courses.

The main implication that we draw from this study is that a course promoting hypothetico-deductive reasoning through the application of scientific research techniques has a greater potential for promoting reasoning skills than does the conventional laboratory design. Secondly, and not to the surprise of any of the authors, when other potentially confounding variables are statistically factored out, gender fails as a predictor of cognitive development. The message here may be that counselors, families, peers, and instructors should encourage girls and young women to pursue the study of science and mathematics.

Table 1. Independent variables used in multiple regression

A. Educational Experience.
- Completion of laboratory course with Johnson manual *
- Completion of laboratory course with Journet manual *
- Number of college credit hours accumulated
- Number of science courses (high school and college)
- Number of mathematics courses (high school and college)
- Current enrollment in general biology lecture *
- Prior completion of general biology lecture *
- Dropped general biology lecture this semester *
- Dropped general biology laboratory this semester *

B. Poor Academic Skills.
- Developmental mathematics *
- Developmental writing *
- Developmental reading *

C. Student Perceptions of their interest
- Science interest
- Mathematics interest

D. Miscellaneous
- Age
- Experience with the problem set *
- Hours on outside activities
- Semester: Fall *
  - Spring *
- Gender

* - indicator variables.

Table 2. The initial and final Piagetian Equivalent of students in general biology laboratory compared between Fall 1984 and Spring 1985 semesters.

Sample sizes, means, standard errors, and quartiles are also given.

	FALL 1984		SPRING 1985	
	BEGINNING	END	BEGINNING	END
N	170	164	110	85
MEAN	9.083	9.701	8.411	9.879
ST.ERR.	0.124	0.129	0.164	0.174
100% Q	12.862	13.493	11.982	13.053
75% Q	10.261	10.927	9.638	11.022
50% Q	9.156	9.701	8.319	9.736
25% Q	7.831	8.529	7.044	8.938
0% Q	4.523	4.523	4.523	5.539

Table 3. The Piagetian Equivalent of students at the beginning of the semester allowing a comparison between those who drop and those who complete the course.

Sample sizes, means, standard errors, and quartiles are also given.

	FALL, 1984		SPRING, 1985	
	DROP	COMPLETING	DROP	COMPLETING
N	62	108	42	68
MEAN	9.074	9.089	8.315	8.469
ST ERR	0.201	0.158	0.257	0.214
100% Q	11.846	12.862	11.639	11.982
75% Q	10.569	10.129	9.494	9.723
50% Q	9.163	9.157	7.850	8.517
25% Q	7.958	7.746	7.076	6.955
0% Q	5.675	4.523	5.469	4.523

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