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ABSTRACT

This study was designed to identify characteristics of college freshmen taking mathematics courses. Students enrolled in basic algebra courses at a regional campus of a large midwestern university participated in the study. Students were administered an instrument which included a "math autobiography," the Adult Mathematics Expectation Scale (AMES), and the Adult Mathematics Attribution Scale (AMAS). A significant difference in attitude toward mathematics was found. Students who had taken at least one college course previously had a better attitude toward mathematics than those who were taking their first college mathematics course. Older students also expressed more confidence on secular mathematics tasks than did younger students. (TW)

The Adult Mathematics Learner: Attitudes, Expectations, Attributions[1]

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ABSTRACT

Many students entering college today are not traditional eighteen-year-olds straight out of high school. Our students often are older, often did not take college-prep courses in high school, often are facing occupational and family pressures unknown to the more traditional college student. If we are to design appropriate courses and curricula, if we are to plan and implement effective instructional strategies for these students, we must know more about them than just their current level of mathematical achievement.

Students enrolled in basic algebra courses at a regional campus of a large midwestern university participated in a study designed to investigate characteristics of this new and growing student population. Results indicate that certain affective variables are related to the students' age and re-entry status. It is suggested that these variables be considered as instructors interact with their students.

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The Adult Mathematics Learner: Attitudes, Expectations, Attributions

As the nation becomes increasingly aware of the desirability of life-long learning, postsecondary institutions are increasingly faced with a much more varied clientele than that to which they may have become accustomed. No longer are nearly all our entering students eighteen years old and fresh from high school. Now, our students often are older, often did not take college-prep courses in high school, often have suffered job loss or family upheavals that they perceive as having forced their return to school.

Particularly in mathematics are we finding ourselves facing students for whom we are unprepared. We believe that math learning is cumulative--that certain prerequisite facts, concepts, and procedures must be assimilated before new learning can occur. We are therefore accustomed to giving placement tests. However, these tests measure only the student's current level of mathematics achievement. They do not take into account the student's own perception of that achievement, nor of herself or himself as a mathematics learner. They do not consider the student's expectations for success at mathematical tasks, nor do they take into account the student's causal ascriptions for success and failure at such tasks.

It is possible that these perceptions, expectations, and attributions may be at least as important as current achievement level in the student's ability to profit by instruction. There seems to be ample evidence in the literature to support hypotheses positing the importance of such relationships (e.g., Smead and Chase, 1981; Shaw and Costanza 1982; Bardwell 1984; Lent, Brown, and Larkin, 1984; and Marsh, Cairns, Relich, Barnes, and Debus, 1984).

It is also possible that these perceptions, expectations, and attributions,the relationships among them, and their importance for student learning outcomes, may be different for the adult learner than for the traditional college student. Even when we only consider adult learners in a typical college classroom environment (rather than the plethora of other, less traditional educational programs and situations in which they may be found), we are considering a group which is anything but homogeneous. It is impossible to describe a "typical" adult learner with respect to age, employment status, or even educational background (Campbell, 1983). They bring a wide range of previous experience, both with the mathematical content and with the educational enterprise. They exhibit differences in such factors as general experience of academic and non-academic success and failure, time management skills or lack thereof, levels of

self-confidence and self-monitoring, amount of time, energy, and financial resources available, and so forth (Behr and Bright, 1983). They may have travelled widely divergent paths to reach our classrooms. These richly varied backgrounds mean that the internal cognitive and affective contexts within which their learning will take place are also richly varied. Their instructors must contend with these students' feelings of helplessness, their doubts of their own ability to learn, their mistrust or downright fear of school, and perhaps most challenging of all, their tendency to give up under pressure and drop out of the program (Campbell, 1983).

The objective of the present study is to investigate characteristics of this new and growing student population. We must of course know something about the entering student's educational background and current achievement level in order to place that student appropriately. More importantly, we must know how their perceptions of their mathematics backgrounds, of their expectations and attributions of success in mathematics, and of themselves as mathematics learners relate to achievement if we are to design effective instructional strategies and implement them successfully. Since it is desirable to place every student in the course most appropriate to his or her situation, and since the returning adults are coming to us from such a wide range of situations, none of them the traditional straight-out-of-high-school, it is apparent that a careful look at the adult learner population is in order.

Method

Respondents Approximately 350 students enrolled in mathematics courses at a regional campus of a large midwestern university have participated in an ongoing study of adult mathematics learners. Of them, approximately 100 were enrolled in a basic algebra course, and this is the group of respondents reported on here. Some were surveyed only at the beginning of their course, some only at the end of their course, and some both at the beginning and at the end.

Instrument Besides personal and academic demographic information sheets, the instrument developed for the study comprises three major parts:

1. The "Math Autobiography" is a set of ten sentence stems designed to elicit students' perceptions of themselves as math learners and of their own experiences with mathematics.

2. The Adult Mathematics Expectation Scale (AMES) is a set of eight Likert-type items, each containing a brief description of a mathematical task. Half the tasks are

academic in nature, half are from everyday life (referred to as secular tasks). The student was asked to imagine him- or herself in each situation, and to choose the response that would show "how you expect you would do then." The five response choices ranged from "wouldn't be able to do it at all" to "certainly can do it" for each item. Responses were summed and rescaled from -1 to 1, yielding scores indicating the student's level of expectation of success at academic and secular mathematics tasks. The AMES was designed for this study. Its reliability, as calculated by Cronbach's coefficient alpha, was 0.78, which was considered acceptable.

3. The Adult Mathematics Attribution Scale (AMAS) was patterned after the Mathematics Attribution Scale (MAS), which was developed by Fennema, Wolleat, and Pedro (1979) for use with secondary school students. The AMAS items were designed to be more suitable for college students, particularly adult college students, than those on the MAS. As on the AMES, eight mathematical situations are described; four are academic, four secular. Two situations of each type (academic or secular) are described as resulting in success, and two of each type as resulting in failure at the mathematical task. For each of the eight situations, four possible reasons are given to account for the indicated outcome (success or failure). These four reasons correspond to the ascription categories identified by attribution theorists: level of ability, level of difficulty of task, level of effort expended, and level of luck or chance factors. The respondent was asked to rate the extent to which each possible reason would apply to himself or herself in that success or failure situation, ranging from 1 (not the reason at all for me) to 5 (definitely the reason for me). Thus there are in effect 32 items, summed and rescaled on a -1 to 1 scale as for the AMES, yielding eight scores indicating the student's level of attribution of success and of failure at mathematics to each of the four "causal" areas:

SA	Success, Ability	FA	Failure, Ability
ST	Success, Task	FT	Failure, Task
SE	Success, Effort	FE	Failure, Effort
SL	Success, Luck	FL	Failure, Luck

In order to investigate the question of attributions, we here consider the student's attributional style. This variable is derived from the subscores on the AMAS. It is scaled from -1 to 1, where a value of 1 indicates a strong "mastery" orientation and -1 indicates a strong "learned helplessness" orientation (Kloosterman, 1986).

A complete copy of the instrument may be found in Lehmann (1986). Students completed the instrument anonymously;

administration required about twenty minutes during a regular class period.

Discussion of Results

Student Characteristics

A total of 98 students remained in the subject pool after illegible or incomplete survey forms were eliminated from consideration. Of the 98 respondents, 60 (61.2%) were women and 38 (38.8%) were men. Nearly half the respondents (46.9%) were age 20 or less; ages ranged from 17 to 63, with a median age of 22. Of the group of respondents age 20 or less, 52.2% were men. In fact, 63.2% of the men, but only 36.7% of the women, were under 20, and 13.3% of the women, but only 2.6% of the men, were over 35 years old.

Among the respondents, 63.3% were classified as re-entry students : those who had been out of high school two years or more before entering college, or who did not obtain a high school diploma, and for whom this was their first college math course. These students were of course older than the non-re-entry students: mean age was 27.2, while for the entire respondent group it was 24.8. The re-entry group also contained a significantly higher proportion of women than the entire group (69.4% of the re-entry group, compared to 61.2% overall) Only half the men, but 71.7% of the women, were classified as re-entry students.

In general, we can say that the respondent group has more women than men, that the women are generally older, and that they are more likely to be in a re-entry situation than are the men.

Attitudes

No significant differences were found between men and women on the proportion who said they did or did not like mathematics. This was the case whether survey data was gathered at the beginning or at the end of the course. Nor was any significant relationship observed between age of respondent and expressed liking for mathematics. Moreover, among students for whom a score is available both at the beginning and at the end of the course, no significant difference appeared between the level of expressed liking at the beginning and at the end of the course. However, when respondents with only one attitude score (beginning or end of course) are included, the group difference is significant. Among the students surveyed at the beginning of their course, 22.4% said that they disliked mathematics, 25.4% said they were indifferent, and 52.2% said they liked mathematics. When surveyed at the end of the course, only 11.3% said they disliked mathematics, 9.4% said they were indifferent, and 79.2% said they liked mathematics.

A significant difference in attitude towards mathematics also appeared between respondents who were beginning their first college mathematics course and those who had taken at least one such course previously. When surveyed at the beginning of the course, only 46.5% of the inexperienced students said they liked mathematics, 23.3% expressed indifference, and 30.2% said they disliked mathematics. Among the experienced students, 65.2% said they liked mathematics, 30.4% said they were indifferent, and only 4.3% said they disliked mathematics. However, when surveyed at the end of the course, there were no attitude differences between experienced and inexperienced students.

Interpretation of these results is not perhaps as simple as it may seem. At first glance we might think that since students surveyed at the end of a course express a higher degree of liking for mathematics than do students surveyed at the beginning, therefore we may be seeing an actual improvement in students' attitudes towards mathematics as they make their way through our program. That may be the case, but the present data cannot support the improvement hypothesis. The finding of no significant difference in pre- and post-course attitude among students for whom both measures are available, coupled with the very low number of students beginning a second (or later) math course who said they disliked mathematics, suggests an alternate explanation. We may suspect that the reason post-course attitudes are so much better than pre-course attitudes is that the students who dislike mathematics when the course begins are more likely to leave the course prematurely and thus not to be surveyed at the end.

Expectations

Age bore a significant relation to expectations in the secular realm, both pre- and post-course, with older students expressing more confidence than younger students. When the tasks in question were more academic, students of all ages expressed about the same level of expectation of success. Sex also was related to expectation of success at mathematical tasks, but only on academic tasks and only when students were surveyed at the beginning of the course. Men tended to express more confidence in their likelihood of success than did women.

Unsurprisingly, expectation of success at mathematical tasks was significantly and positively related to expressed liking for mathematics. This was the case for both academic and secular mathematics tasks. The correlation appeared both among respondents surveyed at the beginning of their course and among those surveyed at the end.

Somewhat surprisingly, students who had taken a previous college mathematics course expressed higher levels of expectation of success at secular mathematical tasks than did students beginning their first college mathematics course. This may be because in general the students who have taken a previous course are older than the students who are beginning their college mathematics sequence with this course. On academic mathematical tasks there was no significant difference in expectation of success between experienced and inexperienced students.

There was a significant correlation between scores on the pre-course placement test and pre-course expectations of success at academic mathematical tasks. There was also a significant correlation between scores on the final exam in the course and post-course expectations of success at both academic and secular mathematical tasks. Apparently these students do have a fairly accurate match between their estimate of their chance of success, and their actual level of success. What we don't know is whether they are simply making an accurate prediction based on prior experience, or are in some way setting themselves up for success or failure. Is this an educated guess or a self-fulfilling prophecy?

Attributions

There were no significant sex differences in attributional style. This was the case for both academic and secular situations, and for both pre- and post-course measures of attributional style. Age, however, was related to academic attributional style. Older students exhibited a stronger mastery orientation than younger students when measured at the beginning of the course, but not at the end. When the tasks were secular, no relation appeared between attributional style and age.

Attribution style was related to the expressed liking for mathematics. Students who said they liked mathematics displayed a stronger mastery orientation than students who said they did not. This relationship appeared both among the students surveyed at the beginning of their course and among those surveyed at the end. It held both for academic and secular situations.

No significant differences in attributional style were apparent between the groups of students surveyed at the beginning of their course and those surveyed at the end. Between respondents in their first college mathematics course and those who had already taken one, there was a difference in attributional style in academic situations. The experienced students exhibited a stronger mastery orientation than did the inexperienced students. This was the case only in the group surveyed at the beginning of the

course; the post-course measures of attributional style, like the post-course measures of other variables, showed no relation to whether or not it was the students' first college mathematics course.

Attributional style was not related to students' scores on the pre-course placement test. Scores on the final exam, however, were positively and significantly correlated with level of mastery orientation measured at the end of the course, both for academic and for secular situations.

The relationship between level of expectation of success and level of mastery orientation in attributional style was positive and significant, for both academic and secular situations when respondents were surveyed at the beginning of their course, and for secular situations when they were surveyed at the end. Since the measurement instruments were so similar, however, this must be regarded as a tentative finding. It is not clear how much of the relationship is a function of the relationship between the form of the AMES and that of the AMAS.

We may summarize, then, by noting that attributional style, as here defined and measured, seems to bear little relationship to the age or sex of the students. It does seem to be related to the student's attitude towards mathematics. It also seems to be related to actual mathematics achievement, with higher-achieving students expressing a stronger mastery orientation than lower-achieving students. Attribution style may also be related to expectation of success.

Implications

It is in the mathematics education cosmology that successful experience with mathematics will engender greater confidence in future success, which will lead to greater persistence at mathematical tasks, which will result in higher levels of mathematical achievement. According to this view, we simply place students at a course level which will ensure their success, and the rest will follow naturally. The current study suggests that particularly for older re-entry students this process may be more complicated. Our task may include more than simply designing and using a placement test based on current achievement level. If the student does not feel in control of his or her own success -- if, for example, he or she tends to attribute success to the teacher's ability, or to an easy test, or to the luck of having picked the right material to study (or to leave out) -- then the student's confidence in his or her own ability to learn or to control the effort expended will not be strengthened by experience of success. If the student's current achievement level bears little or no relation to his or her confidence in

future success or to his or her feeling of mastery in mathematical situations, then providing successful experience will not necessarily lead to greater persistence.

Certainly this is not an argument against the use of placement tests. Rather, it is a recommendation that placement in an appropriate mathematics course not be seen as a guarantee of student success. Persistence on the part of the student is a necessity also, and without some expectation of success persistence is weakened.

It also seems to be the case that a positive attitude is related to expectation and to a sense of mastery, although it is not clear which is antecedent. To change another person's attitudes is notoriously difficult. Nonetheless, the attempt to do so should not be abandoned, nor should it be considered outside the scope of an instructor's task. If we see ourselves as empowering our students, as freeing them from irrelevant restrictions on their own potential -- and I think we do see ourselves in this light, though we may not usually be so explicit about it -- we are going to have to address any variable which may come between ability and achievement.

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References for Further Reading

Bardwell, R. (1984). The development and notivational function of expectations. American Educational Research Journal, 21, 461 - 472.

Buerk, D. (1985). The voices of women making meaning in mathematics. Journal of Education, 167(3), 59 - 70.

Behr, M. J., & Bright, G. W. (1983). Mathematics learning in college and beyond. Focus on Learning Problems in Mathematics, 5, 1 - 13.

Campbell, P. F. (1983). Some observations on the learning of mathematics in adult basic education centers. Focus on Learning Problems in Mathematics, 5, 25 - 34.

Fennema, E., Wolleat, P., & Pedro, J. D. (1979). Mathematics attribution scale. Journal Supplemental Abstract Service.

Kloosterman, P. (1986). Attitudinal predictors of achievement in seventh grade mathematics. Paper presented at the Eighth Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education, East Lansing MI.

Lehmann, C. E. H. (1986). Patterns of adult mathematics learners' causal attributions of success and failure at mathematical tasks (Doctoral dissertation, North Carolina State University, Raleigh, NC, 1985). Dissertation Abstracts International, 46, 3279A.

Lent, R. W., Brown, S. D., & Larkin, K. C. (1984). Relation of self-efficacy expectations to academic achievement and persistence. Journal of Counseling Psychology, 31, 356 - 362.

Marsh, H. W., Cairns, L., Relich, J., Barnes, J., & Debus, R. L. (1984). The relationship between dimensions of self-attribution and dimensions of self-concept. Journal of Educational Psychology, 76, 3 - 32.

Shaw, M. E., & Constanza, P. R. (1982). Theories of Social Psychology. New York: McGraw-Hill.

Smead, V., & Chase, C. I. (1981). Student expectations as they relate to achievement in eighth grade mathematics. Journal of Educational Research, 75, 115 - 120.