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ABSTRACT

Data from the Joint Council on Economic Education's National Assessment of Economic Education (NAEE) Survey, gathered during the 1986-87 school year, provide material for a large-sample study of a broad variety of determinants of economic understanding and attitudes at the precollege level. The NAEE Survey, consisting of four questionnaires, correlates student economic achievement test scores with other student and teacher characteristics data. Direct matchings are available for student scores, student characteristics, and teacher characteristics. Using traditional "production function" analysis, the results indicate that in terms of attitudes about pedagogy, the student/teacher mismatch is a significant determinant of lower scores. Positive teacher attitudes about teaching economics were also found to play a significant role in the achievement of higher test scores. The construction of course content and method, the development of mandated economic education programs, and the assignment of teachers should be done with the recognition that student/teacher interdependencies may affect program outcomes. A 17-item bibliography is included. (JB)

Student/Teacher Interactions and Thei.' Effect on Pre-college Economic Literacy

by

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Abstract

This paper analyzes primarily the question of whether divergences of attitudes about aspects of the study of economics affect pre-college student achievement test scores. Using traditional "Production Function" analysis (Ordinary Least Squares Regression), the results indicate that at least in terms of attitudes about pedagogy, the student/teacher mismatch is a significant determinant of lower scores. Positive teacher attitudes about teaching economics were also found to play a significant role in the achievement of higher test scores. Implications for policymakers are that construction of course content and/or method, development of mandated economic education programs or assignment of teachers should be done with the recognition that student/teacher interdependencies may affect program outcomes.

Student/Teacher Interactions and Their Effect on Pre-college Economic Literacy

Traditional analyses of the determinants of economic literacy at the pre-college level utilize a "production function" approach. The analyses follow variations of the general learning models employed by McKenzie and Staff (1974), Bloom (1976), Allison (1982) and more recently the analyses of Walstad and Soper (1982) and Watts (1985) where Achievement = f(ability, attitude, effort, quality of instruction) or Understanding = f(student inputs/qualities, school system variables, teacher characteristics).

Thus the output, achievement as measured by various standard tests of economic knowledge, is "produced" by a variety of predetermined inputs.

As noted in the studies, the selection of the determinants is based not on a rigorous theoretical foundation, but on prior findings, intuition, new hypotheses and limited educational theory.

The development and dissemination of new data from the Joint Council on Economic Education's National Assessment of Economic Education Survey (NAEE), gathered during the 1986-87 school year, provides the opportunity for a large-sample study of a broader variety of determinants of economic understanding and attitudes at the pre-college level (Baumol and Highsmith, 1987).

The NAEE Survey, consisting of four questionnaires,

correlates student economic achievement test scores (Test of Economic Literacy (TEL), Form B) with other student and teacher characteristics data such that direct matchings are available for student scores, student characteristics and teacher characteristics.

This research uses the NAEE data and adopts the traditional production function approach, while recognizing its limitations, for the purposes of testing several new hypotheses and reinforcing several previous findings concerning student/teacher interactions in the economic education process.

Interactions

The Walstad and Soper (1982) and Watts (1985) analyses are typical large-sample studies which analyze several "teacher quality" aspects affecting economic literacy. In these and other studies, tests are made on the effectiveness of teacher training, teacher methods, educational setting and the Joint Council of Economic Education's Developmental Economic Education Program (DEEP). The results are not totally conclusive and indicate the need for further examination.

One area in particular need of further study is the impact that teaching processes have on student learning. Much of the early analysis, according to the survey by Siegfried and Fels (1979), found little evidence that teacher techniques significantly affect literacy test scores.

However, in a recent specification of a learning model

of teaching effectiveness, Lima (1981) hypothesizes that in any given course or learning situation, there may exist a distributional problem in discerning the effect of a specific teaching technique on student achievement. Some students may be helped by a particular teaching technique, but others may be hindered by it. In cross sectional statistical analysis, therefore, the expected value of the change in aggregate test scores may be small, leading to the erroneous conclusion that the technique has no effect at all.

In a recent study of teaching and learning styles, Charkins et al. (1985), noting this problem, argue that rather than test a single characteristic, in their case teaching style, a divergence measure linking preferred student learning styles and teacher teaching styles would be a more accurate measure. They hypothesize that the interaction between student characteristics and teacher characteristics is the factor that affects economic learning; the larger the divergence, the lower the gain in student achievement in economic understanding (and attitude) from any particular course.

Difference scores from a learning-styles questionnaire administered to teachers and students were in fact found to be statistically significant in their "production functions."

The NAEE data allow several broader tests of student-teacher linkages. In particular, does the student-teacher link found by Charkins et al. extend beyond teaching and learning styles?

In an early analysis of the new data base, Baumol and Highsmith (1987) find that students and teachers share similar classroom goals, but that there is a divergence between students' feelings of the significance of the goals and teachers' feelings.

Like teaching-learning styles, differences in teacher goals and student goals may have an effect on the learning atmosphere. One hypothesis to be tested in this paper is that larger divergences between teachers' significance ratings of goals and students' ratings signal lower educational gains from the class.

A similar hypothesis is constructed concerning teaching pedagogy. If a student ranks a certain technique (use of simulations, for example) as not very useful and the teacher rates it highly valuable, the linkage may affect test scores.

The analysis uses divergence indices to test the hypothesized linkages of goals and/or pedagogy to TEL scores. If linkages are found to be significant factors of economic learning, greater attention should be given to perceived goals and perceptions of the usefulness of pedagogy in constructing courses and mandated programs.

The NAEE data also allow an examination of several respecifications of earlier hypotheses. There has been some recent analysis into the nature of the interrelationships of student attitudes and student achievement (Walstad, 1979, 1980). Rather than the "production" of a single output, i.e., achievement, these analyses hypothesize that economic

education produces two simultaneous outputs - economic achievement and student attitude toward the subject itself, i.e., attitude affects achievement but at the same time, achievement affects attitudes.

Furthermore, although teacher quality is included, few of the studies examine the role of teacher attitudes toward teaching economics in the production process. Schober (1984) included teacher/student achievement and student/teacher opinions about the subject of economics as simultaneous outcomes of teacher inservice training programs. Teacher workshops were found to have a significant impact on achievement scores and these scores in turn affected opinions. But teacher attitudes about teaching were not analyzed. This analysis examines the significance of teacher attitudes as a determinant of economic learning.

An additional area which has generated some interest is the examination of the significance of membership in the JCEE's Developmental Economic Education Program on economic learning. The results are again somewhat inconclusive. Watts (1985) notes that although earlier studies reported positive findings, when other school district variables are included, the binary DEEP variable is less significant in production function analysis.

Although determination of the impact of DEEP membership has been extensively analyzed, few studies examine directly the nature of the impact of state (or local) mandated programs on economic learning. The NAEE sample allows the

construction of a binary variable for this test. Since school district data are not part of the sample, the DEEP variable is not tested.

Research Specifications

The production function specification in previous studies was determined by the assumptions made concerning simultaneity of the production of attitudes and economic understanding. Psychological information theory as noted by Hodgin (1984) supports the simultaneous production hypothesis. Furthermore if simultaneous production of attitudes and understanding is posited, Johnson (1979) indicates that single equation estimation may yield biased results.

However, Chizmar and McCarney (1982) argue that cognitive and affective characteristics are determined by the same process and simultaneous equation statistical techniques such as two-stage least squares are inappropriate.

Walstad (1979) argued for the use of a multiple equation specification of the production function. However, Hodgin (1984), Schober (1984) and Walstad (1979) found no evidence that a simultaneous equation specification is justified, i.e., student achievement was found to affect attitudes, but attitudes were not found to affect achievement.

In fact, Walstad and Soper (1982) specify a single equation achievement function omitting student attitudes as a variable of analysis in the achievement equations.

Because the NAEE data have neither a pretest for

achievement in economic understanding nor a pretest for student attitude, and accepting the single equation arguments of Walstad and Soper, the model for analyzing student teacher interaction is specified as follows:

Student Achievement = f(student ability, student effort, teacher quality, teacher attitude, student-teacher interactions, environmental variables)

The sample for analysis is constructed from the NAEE survey data and includes data for twelfth grade students of teachers of economics courses in the survey. The sample, after removal of all non-economics teachers and all missing student and teacher data, consists of matched test scores, teacher questionnaire data and student questionnaire data for 1,098 students and 74 teachers of high school economics.

The analysis is performed using single equation OLS regression with the recognition that many of the survey variables are discrete and/or bounded measures which, although commonly analyzed using OLS, may require further analysis using different techniques.

The specific model to be tested is

$$Y = \sum_{i=0}^{10} \beta_i X_i + \mu_i$$ With the variables as follows:

The Endogenous Variable

Y (score) The dependent variable is the individual student's test score on the standardized Test of Economic Literacy, 2nd Edition, Form B.

The Control Exogeneous Variables

X_1 (APT) Many previous studies find student ability positively and significantly related to test scores. Since no IQ scores are available in the NAEE data and SAT or ACT scores are not available or compatible for the whole sample, the variable used here is a 0-8 categorical variable indicating the category of the student's letter grade level on courses taken in high school prior to the economics course.

X_2 (EFF) Earlier studies use number of hours of homework as a proxy variable for student effort hypothesizing a positive relationship between effort and test scores. Again a 0-6 categorical variable is used from the survey indicating a student's listed category of number of hours spent studying economics per week.

X_3 (TEXP) Watts (1985) included the number of years of full time teaching as a measure of human capital in the production process. This variable is hypothesized to have a positive relationship on test scores and is included as the teacher experience variable - a continuous variable.

X_4 (ECHR) Walstad and Soper (1982) and Highsmith (1974) found a significant positive effect of training in economics on achievement. The number of hours of coursework in economics a teacher has listed is used here to test the hypothesized positive relationship between quality and test scores.

X_5 (LEC) Watts (1985) investigates the effect of the decay of human capital on test scores by hypothesizing a negative relationship between the number of years since last economics instruction and scores. This variable is entered as the difference between 1987 and the teacher's stated last year of economics coursework.

X_6 (FEM) Some studies in the traditional analysis (most notably MacDowell, Senn, and Soper (1977)), find that a binary variable identifying male/female students is significantly related to stock of economic knowledge similar to the TEL score. This binary variable is included in the analysis. 1= female, 0= male.

Newly Hypothesized Variables

X_7 (TATT) As noted, this is a relatively untested variable. The NAEE teacher questionnaire includes a question asking teachers to specify their degree of enthusiasm for teaching economics. A binary variable is constructed to test the significance on test scores of teacher attitudes about teaching an

economics course. (1= very enthusiastic, 0= relatively less enthusiastic).

X_8 (MAND) This variable tests for the significance of a mandated curriculum on test scores. A binary variable is constructed for the analysis. (1= mandated curriculum or materials, 0= recommended or free choice). Several hypotheses could be constructed. First, one could hypothesize that mandated programs improve instruction, and therefore improve scores. On the other hand, one could hypothesize that mandated programs and methods inhibit a teacher's ability to try unique techniques and thus lower test scores.

X_9 (GDIF) As mentioned, Charkins, et al., (1985) found that when student learning styles and teacher teaching styles differ, test scores are negatively affected. The hypothesis considered here is that this mismatch of student/teacher characteristics applies to student and teacher goals and to the use of materials as well. The following variables attempt to test this divergence. A proxy index variable is constructed to capture differences in goal agreement between student and teacher. In the survey, both were asked six coincident questions concerning the reasons for studying economics. (See Appendix A). The index variable is constructed by summing the squared value of the

difference between student and teacher response for each goal question, across all six questions. Since the categorical values for each response in the survey range from 1, not significant, to 3, very important, the maximum squared goal difference registered for each question is 4 and summed across all six questions is 24.

X_{10}(PDIF) A similar hypothesis which tests student/teacher differences in perceptions is constructed for teaching pedagogy. The data sample includes matched student/teacher responses on the use and perceived usefulness of various pedagogical devices used in the survey course. A proxy index is constructed by coordinating the scores 0-3 and summing the squared values of the difference between student and teacher response for each technique used across six techniques. (See Appendix B). Unlike earlier studies, the purpose here is not to test the effectiveness of all of the pedagogical techniques individually, but is only intended as a test of the significance of differences in student/teacher perceptions.

Empirical Results

The regression results of the analyses are presented in Table 1. Although the adjusted R^2 is relatively low, indicating an underspecified model, i.e., the variables explain less than 25% of the variations in TEL scores, it is

not seriously out of range of reported R^2's of large sample production function research. The F-test is significant. To assure that regression results are not confounded by multicolinearity, a common procedure is to compare the correlation between variables to the coefficient of correlation, R, of the model. A ratio of coefficient correlation to multiple R greater than or equal to one indicates serious multicolinearity. An examination of the correlation matrix indicates that the ratio is less than one for all combinations except teacher experience and date of last economics course. However, the analyses repeated with these variables entered alternatively did not alter the results significantly.

Table 1 also lists the estimated coefficients for the variables discussed above. Looking first at the variables garnered from other studies, i.e., the control variables, the signs on the aptitude, effort, coursework in economics and sex variables exhibit the hypothesized signs. However, among these, only the aptitude and sex variables show strongly significant evidence of affecting test scores. The results support the findings of earlier studies which show that student ability is a key determinant of variations in achievement. Furthermore, the hypothesis that a male/female difference in scores is significant cannot be rejected.

On the other hand, signs on the teaching experience and knowledge decay variables are somewhat surprising. There appears to be little support for the hypothesis that a

Table 1

OLS Regression Results
Dependent Variable = TEL Test Score
(t-statistics in Parentheses)
(N = 1098)

Regressors		Coefficients	Mean X	Std. Dev.	Range
X_0 - Constant		27.258 (26.84)			
X_1	APT	1.246** (7.76)	3.40	1.55	1-8
X_2	EFF	0.421* (2.41)	2.45	1.40	0-6
X_3	TEXP	-0.267** (-7.82)	16.61	9.29	1-35
X_4	ECHR	.028 (0.93)	10.52	8.06	0-30
X_5	LEC	.005 (0.15)	10.53	8.67	0-36
X_6	FEM	-1.498** (-3.13)	.52	.50	0-1
X_7	TATT	7.004** (12.36)	.68	.46	0-1
X_8	MAND	-1.088* (-2.16)	.49	.48	0-1
X_9	GDIF	-.010 (-0.20)	6.28	5.00	0-24
X_{10}	PDIF	-.093** (-3.16)	11.33	8.11	0-54
	Adj R^2	.231			
	SEE	7.739			
	F	33.903**			

**Significant at .01 level
*Significant at .05 level

teacher's economic knowledge decay affects student test scores. But, although the teacher experience variable is significant at the .01 level, the sign of the coefficient is negative. The negative relationship between teaching experience and test scores is unexpected.

Several interpretations are possible and need further investigation. Learning models indicate that teaching effectiveness improves with experience. However, since the number of years of economics teaching experience was not tested, any conclusions drawn would be spurious. For example, teachers with more years of experience may not be the teachers with more economics training or economics teaching experience. The evidence does indicate, however, that in this sample the more experienced teachers are correlated with lower test scores. Further study may clarify the nature of the teachers' experience relative to his/her involvement in economic education.

Examination of the divergence variables PDIF and GDIF shows mixed results. Although students and teachers have different views on why to study economics (the average summed squared difference of GDIF is 6.28) and the sign is negative as hypothesized; the t-value is not significant, therefore the goal difference hypothesis cannot be supported. Although the purpose here was to examine the cumulative goal difference, a disaggregated study on each goal using separate differences may prove useful in indicating if individual goals or goal differences are significant.

Unlike goal differences, differences in the student/teacher evaluation of pedagogy are found to be significant and negatively related to test scores. The results coincide more closely with the findings of Charkins, et al.

The analysis indicates that the larger the divergence in the feelings concerning the effectiveness of pedagogical devices (textbooks, films, etc.), the lower the test score. Since student and teacher evaluations of teaching devices are perhaps more closely related to their evaluation of teaching and learning styles than to their evaluation of goals, the Lima (1981) hypothesis that the use of divergence variables is a useful approach to study student/teacher interactions cannot be rejected.

Of the remaining two new variables, the dummy variable testing the effect of state mandated curriculum or materials shows the weaker effect. The sign on the coefficient is negative and although the variable is significant at the .05 level, cautious interpretation is necessary. The results seem to indicate that state mandated programs do not improve test scores. However, more information is needed concerning the nature of the programs and the length of time the programs were in place. In addition, the analysis could be criticized on the same grounds as that in Watts (1985) in that no other school district variables were used as control factors in the analysis.

The results concerning teacher attitudes, however, indicate that an examination of student/teacher interaction

should seriously consider teacher attitudes in the analysis. This dummy variable is significant at the .01 level and has a positive sign indicating the not totally surprising result that students of teachers who enjoy teaching economics perform better on the TEL test.

Conclusions/Limitations and Future Research

The purpose of this study was not to develop a definitive set of determinants of pre-college economic literacy. The purpose was to investigate, in what could be described as the most elemental but accepted research approach, the nature of several hypotheses not fully developed in earlier studies.

A secondary purpose was to construct a usable data sample from the new NAEE data provided by the Joint Council on Economic Education. The results of the research are encouraging with respect to both purposes.

The specific results of the study support many of the previous findings using similar approaches and suggest several lines of future research.

The most informative results indicate that student/teacher interactions or divergency of feelings/opinions/evaluations cannot be overlooked as valid determinants of pre-college economic literacy. The findings on the PDIF variable indicate a need to analyze more completely the role that attitudes of students and teachers toward pedagogy play in economic literacy and in curriculum construction.

Furthermore, the study indicates that teacher attitudes

about teaching economics play a significant role in student achievement of economic literacy. Future research is needed to determine the variables that influence teacher attitudes and the nature of the relationship between economic literacy, teacher attitudes and student attitudes.

In view of the results, this study indicates that student comprehension of pre-college economic concepts may be affected significantly by a mismatch of teaching/learning interactions. Construction of course content and/or method, development of mandated economic education programs or assignment of teachers should be done with the recognition that interdependencies may affect program outcomes.

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Appendix A

Student/Teacher Goals Evaluated

Make intelligent decisions as workers, consumers, and voters
Understand American economy
Understand alternative economic systems
Learn practical skills (e.g., balancing a checkbook)
Understand current economic issues
Understand basic economic concepts and principles

Appendix B

Student/Teacher Materials Evaluated

Economic textbooks
Other reading sources
Games or simulations
Films or video tapes
Slides or filmstrips
Graphs, charts, or tables