

FAMILY VARIABLES AS PREDICTORS OF MATHEMATICS AND SCIENCE SELF-CONCEPT OF STUDENTS

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Abstract

The aim of this study was to explore if there is, and to what extent, a relation between student's academic self-concept (math self, science self) and family variables which comprise: a) some SES variables like parents' educational level, number of persons at home, home items and b) activities outside school. Our study used a sample of 112 seventh-grade students from two schools selected for the TIMSS 2003 field test in Serbia. Two classes were randomly chosen in each of the schools. The study had a correlative design using TIMSS 2003 student questionnaires and mathematics and science achievement tests data. Results showed positive correlations between family variables and self-concept. Factor analysis of self-concept variables revealed four second-level factors. The first was a dimension of earth science self-concept, the second one represented biology, mathematics and earth science self-concept, the third factor concerned math and physics self-concept and the fourth related to chemistry self-concept. Regression analyses showed the most important predictors for each of the factors. General academic self - concept was best predicted by the father's educational level, amount of time spent playing with friends, and access to the Internet and some other home items. It was concluded that it is necessary to educate families about their impact on student's academic self-concept in order to prevent math and science underachievement.

INTRODUCTION

Purpose

This study investigates the relationships between family variables and a student's mathematics and science (physics, chemistry, biology and earth science) self-concept. Is there and to what extent a relation between a student's self-concept (math self-concept, science self-concept) and family variables: a) SES variables such

as educational level of parents, number of persons living at home, possession of certain home items; and b) activities outside school such as watching TV and videos, playing computer games, playing and talking with friends, doing jobs at home, working at a paid job, playing sports and reading for enjoyment.

Educational importance of the study

Academic self-concept can act as a mediator between parental educational level and other SES variables on one hand and school success on the other. There is a high positive correlation among academic self-concept, school achievement and motivation for learning. Knowledge of family background, including SES predictors of academic self-concept, could be important in planning the work with individual students in relevant school subjects, especially with underachievers.

Perspectives

Many studies illustrate the positive relation between school achievement and academic self-concept (Jones and Grieneeks, Burns, 1979, Boxtel and Monks, 1992, Opačić, 1993, Opačić and Kadijevich, 1996, Janjetović, 1996). Low self-concept tends to appear together with student's underachievement. Although academic self-concept is formed and developed in the classroom, students enter school with a pre-established concept of their abilities, competences, social acceptance, etc. Family characteristics, including socio-economic background, as well as academic self-concept are important factors of school achievement. Many studies have found a positive relation between school achievement and parents' educational level. Number of family members, living space and profession of parents have also been found to be important predictors of school achievement. The most unsuccessful students come from large families and from those with lower educational level of parents (Deliba_ić, 1970, Krneta et al., 1973, Cloward, 1974, Comelius and Cockvurn, 1978, Jovović, 1981, Božić and Bošić, 1985, Jelavić, 1985, Nikolić, 1998).

This paper explores the contribution of some SES and other family variables to student's academic self-concept in math and science domains.

METHOD

The study used a sample of 112 seventh-grade students from two schools selected for the TIMSS 2003 Field test in Serbia. One school was urban, whereas the other was sub-urban. Two classes were randomly chosen in each of the schools.

The study had a correlative design. Techniques for obtaining the data were TIMSS 2003 student questionnaires and achievement tests in mathematics and science.

The first group of variables were variables of academic self-concept (general academic self-concept, mathematics self-concept, biology, chemistry, physics and earth science self-concept). Those variables were calculated from the TIMSS 2003 Field Study Separate Science Student Questionnaire data (questions 9a-h, 14a-h, 19a-h, 24a-h, 29a-h).

The second group of variables were family variables: socioeconomic status of student taken from the same questionnaire, home items (questions 5a-p), educational level

of parents, (question 7), number of persons living at student's home (question 40) and; b) activities outside school (question 37a-g).

Gender and maths and science test achievement were set as the control variables.

Statistic techniques used in the analysis were Pearson's correlations, multiple regression, and factor analysis. Data sources used were SPSS data files from the TIMSS 2003 Field test in Serbia.

RESULTS

Results showed positive relations between certain family variables and certain domains of academic self-concept.

Factor analysis (Direct Oblimin rotation) of self-concept variables from the Student Questionnaire was performed, which revealed four factors of second-level order which represented domains of academic self-concept concerning maths and science. The first factor could be described as a dimension of earth science self-concept, the second referred primarily to items concerning biology, mathematics and earth science, the third factor concerned maths and physics self-concept and the fourth factor could be described as chemistry self-concept.

Regression analyses (Enter Method) showed the most important predictors for each of the mentioned factors.

The first factor – Earth science self-concept had the strongest correlations with father's educational level, having Internet access, having a computer at home and having cable television (Beta 0.71, 0.63, 0.62 and -0.46 respectively; p being between 0.03 and 0.00).

The most important predictors of the second factor – Biology, mathematics and earth science self-concept – were having Internet access at home, having a computer, calculator, and video recorder at home (Beta 0.84, -0.63, -0.88 and -0.40 respectively; p being between 0.03 and 0.00).

It is important to see that such home items as cable TV, computer, calculator and video recorder were negatively related to the self-concept in certain domains represented as factors number one and two. This could mean that watching TV shows and using computers or calculators do not bolster student's self-efficacy beliefs for certain school subjects, but have the opposite effect instead. This is most probably because those items are used for such activities as watching movies, playing video games. Playing video games did not contribute to the mathematics test achievement (Kadijevich and Janjetovich, 2003).

The third factor, Mathematics and physics self-concept, was predicted in the best way by the amount of time spent playing and talking with friends outside school and by the number of books at home (Beta 0.52 and 0.48 respectively; p being 0.05).

For the fourth factor – Chemistry self-concept – no statistically significant predictors were found among SES variables.

One general factor was extracted from the mentioned four factors by the principal component analysis.

The third-level factor – General maths and science self-concept – correlated most highly with having Internet access at home, having a computer at home and number of people living at student's home (Beta 0.94, 0.70 and 0.33; p being between 0.00 and 0.05). All these correlations were positive, so that it can be said that, on the general level, having (and most probably using) Internet and computers at home contributes to the student's general academic self-concept.

Similar results were obtained when the maths and science test achievement results were included in the equation, with the test achievement being the significant predictor of self-concept.

Analysis was also performed with self-concept variables computed as sums of variables, 9a-h, 14a-h, 19a-h, 24a-h, 29a-h, which represented the specific domains of self-concept in the questionnaire. The significant predictors found were similar to those mentioned for the factor variables.

CONCLUSIONS

Academic self-concept is acquired at home as well as in school. It is necessary to consider the student's SES in the evaluation of his/her achievement and in planning further work with him/her. This study found that certain variables such as educational level of parents are important for students' self concept, but that the educational level of the father is more important than that of the mother to the student's academic self concept in mathematics and science. Economic status is also important, particularly having use of Internet and computers. Some technical home items like cable TV, calculators, even computers can be negatively related to some domains of students' self concept.

Educating families about the importance of their impact on student's academic self-concept could be useful in prevention of underachievement in maths and science. Since self-concept develops over time, cooperation with the family and individual work with students could improve the self-concept and through that, the school achievement of student.

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