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Predicting Variables of Academic Achievement and Science Self-Concept of Students in Third Year Guidance School Based on Parents' Education Level and Attitude towards Science

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Abstract

This study was aimed at predicting variables of academic achievement and science self-concept of students in third year guidance based on parents' education level and attitude towards science. Findings of the Thamesin (2007) were used in this study. The sample of this study is 3981 students of third year guidance who answered to questionnaire of Thames 2007. Collected data were analyzed through structural equation model and results showed that only two routes, namely the direct effect of attitude towards science on science self-concept and science improvement are not significant with possibility of 95%, but the rest of the routs namely the direct effect of parental education on science advancement and attitudes toward science are significant and positive and their influence on science self-concept is negative and significant. Also, the direct influence of science development on science self-concept is positive and significant and its impact on attitude toward science is significant and negative. Moreover, the direct effect of self-concept on attitudes toward science is significant and positive and its influence on science achievement variable is negative and significant. Indirect influence of parental education variables, attitudes towards science and science self-concept on science advancement was reported significant. But, only the overall effect of parental education on the development of science is significant and overall effect of variables of attitudes to science and self-concept on development of science was reported insignificant. In addition, the overall indirect effect of parents' education and development of science on self-concept is significant and also attitude towards science has indirect and significant influence on science self-concept and its overall effect on self-concept is not significant. The general and indirect effect of variables of self-concept and development of science on attitude towards science was significant, while the overall impact of variable of parental education on the attitude to science was non-significant and its in-

direct effect was reported to be significant. The results indicated that the variables of attitude towards science, science self-concept and achievement have moderating role.

Keywords: self-concept, academic achievement, attitudes toward science

Introduction

At each education system, the amount of "academic achievement" of student is an indicator of success in scientific activities. Academic achievement rate assessment and the effective factors on it are major issues that have attracted the attention of researchers. The relationship of academic achievement and emotional variables such as self-concept is organized and described by Educational Psychologists since 1970 (Calsyn& Kenny, 1977, Chapman & et al 1981, Marsh, 1990, Marsh & Craven, 2006).

The term "self" is a concept that has always been of interest to psychologists and how ones count it has also a special place the area of one's education. In recent researches in psychology, self-concept is one of the topics that attracts a lot attention and is considered as an important topic in psychology. According to Rogers and Keli, the concept of "self" has an important role to integrate human performance. Kemez believes that preservation and maintain of "perceived self" is motivation of all behaviors. So, everyone is trying to behave in a way that matches his understanding and interpretation of oneself. This means that people are always trying to be in the same way and style that see themselves. (Kadivar,2004). Self-concept refers to individual's holistic view about himself that are formed and transformed with individual's own personal experience and other's interpretation of that experience (Kharazi, 2006). The relationship between positive self-concept with high academic achievement has been confirmed by researchers. Pintrch (1994), You (1995), Dorkin (1995) and Shell (1996) quoted from Lotfabadi (2004) have shown that people with a positive self-concept acquire more success in areas of social, scientific and occupation. Bagley (1992)in his study concluded that negative self-concept in relation to education, in stressful environment, reduces academic achievement and with positive self-concept, academic achievement will increase.

Self-concept is defined as "a person's perception of oneself" (Swiaatek, 2005). Science self-concept refers to an individual's perception of his ability to perform an optimum performance in science area or having self-confidence in learning (Wilkins, 2004).Socioeconomic status of family is an important background variable in predicting a students' academic status (Brecko et al, 2003).

In Brecko's research (2003) which conducted on math students in third and fourth, seventh and eighth –grade of primary school and senior secondary schools in Slovenia, family background students showed the strongest correlation with mathematics achievement of eight-grade students.

Home environment effects on children's attitudes toward school and their success in school .Child in family learn about importance of education and school (Koutsoulis and Campbell, 2001, Marjoribanks Banks, quoted from Van den Broeck, and Opdenakker and Van Demme, 2003). Research result of Markulidz, Hack, and Pastaziu quoted from Pahleven Sadegh and colleagues (2005) with sample of 1026 eighth-grade students of secondary schools in Cyprus on math lessons by using of Thames's data and by route analysis method indicate that students' attitudes is described with their socioeconomic backgrounds (0/29). These results are consistent with the results of Kiamanesh (2003), and Jones (2003). Attitudes are called as individuals' desirable and undesirable views about objects, people, places, events and ideas (Simpson et al, 1994, Koballa, 1995). Naturally, most of people expect that attitude and achievement arein relationship positively. Several studies have concluded that attitudes toward science have positive relationship with science academic achievement (Simpson & Oliver, 1990, Lee and Burkam, 1996, Dhindsa and Gilbert, 2003, Osborne, Simon and Collins, 2003, Papanastasiou & Zembylas, 2004). Early research in this area was influenced by

Bloom's theory on learning school where Bloom suggested that 25/0 variance in student academic achievement can be attributed to the students' attitude toward subject, and also the atmosphere of the school. However, this finding of Bloom in contrast with researches which was based on this that these variables only predict less than 5/0 of variance (Rennie and Punch, 1991). Rennie and Punch state that this result and other similar results can have the root in factors of family, school environment, and ineffective teaching of teacher. This study was conducted with investigation of effective variables on science academic achievement of Iranian students by using of data Thames's data (TIMSS). Thames's study are held every four years to assess performance of nations in science and math education in order to, the process of educational change , rate of reductions and increased student performance, and related variables to be determined.

Methodology

Statistical population

Statistical population of study refers to all male and female Iranian students in third grade of guidance schools in the academic year of 2007-2008. The total number of third-grade students of guidance school in the academic year of 2007-2008 is equal to 3981 students; of this amount 2195 are male students and 1786 are female students. Data on the number of students has been achieved in collaboration with the Ministry of Education.

Sample size and sampling method

Statistical sample of study refers to all male and female Iranian students in third grade of guidance schools in the academic year of 2007-2008 that are participated in Thames's study 2007.

In sampling of Thames's study, two components of student learning and effective characteristic of teaching on learning have been considered. In this regard, school, educational grade, teacher and student are considered as potential components and units of data analysis.

Sampling method that was used in Thames's study 2007 is a two-stage cluster sampling which among the all guidance schools of the country (30,630), 181 schools were selected according to the characteristics of school size (small, large) and school type (public, private). The number of selected schools has been reported according to the separation of desired characteristics in Table 1 (The National Center Report of Thames and PIRLS's International Study, fall 2008).

Table 1. Selected Schools

Type & characteristics of school	Number of selected school
Small public schools	20
Small private schools	4
Large public schools	143
Large private schools	14
Total schools selected	181

From 181 selected schools, 3981 students responded to the questionnaires of Thames's study 2007. Sample ready to separation are included 1786 female students and 2195 male student. Furthermore, 3 students did not indicate their gender on the questionnaire.

When data were available for analysis, researcher noticed the fact that many students didn't responded to their questionnaires (student questionnaires) completely and since the data mast be complete and without missing values as much as possible, researcher by suggestion of Supervisor and Statistician and experts (Garsen) decided to remove and refinement of students' information who didn't answer to more than 5% of the questions.

Instruments

Instrument used in Thames's study 2007 can be classified into two general categories:

A. Science achievement test materials: Assessment of the science and mathematics framework in Thames 2007 is designed parallel to each other and based on two dimensions of content and cognitive. Each of these two dimensions is also consist of numerous domains. Table (2) show the percent of science test objectives of Thames 2007, assigned to the cognitive and content domain.

Table 2. Percentage of science test assigned to the cognitive and content domain

Assessment dimension	Percentage
The content dimension of science	
Bioscience	%30
Chemistry	%15
Physics	%25
Geology	%15
Environmental Science	%15
The cognitive dimension of science	
Objective knowledge	%30
Comprehension	%35
Analysis and Reasoning	%35

The above table indicates that in content dimension of science course, questions related to bioscience and physics domain allocated the maximum percentage to them, while questions related to the cognitive dimension are almost emphasized in same proportion in science achievement test.

In addition to the content and cognitive domains, scientific questions have been separately assessed by science measurement framework of Thames 2007. Scientific questions include the knowledge, skills and abilities that have assessed in asked questions and tasks in different positions associated with the content. These scientific questions cover various ranges of cognitive demands (The National Center Report of Thames and PIRLS's International Study, 2008).

B. Thames's 2007 background survey questionnaire: For complete evaluation of what Thames's academic achievement results contain and how to use them to improve student learning in math and science, it is important to understand students' learning context. Therefore, Thames's study has provided extensive information about the learning context and situation of mathematics and science through implementing a number of background survey questionnaires. Four background questionnaires in Thames's study 2007 have been used for information collecting in various levels of educational system which include:

C. Curriculum Questionnaire: Information about teaching topics and macro systems of curriculum such as approaches and processes of math and science education and issues related to country's overall program; including implementation of the public exams, support and monitor the curriculum implementation of mathematics and science, emphasized aspects of the teaching and learning of mathematics in the curriculum is in question.

D. The School Principal Questionnaire: Provide information about the curriculum and education, resources and school environment.

E. The teacher Questionnaire: Collect information on educational level, age, gender, teaching experience, knowledge building development, teacher characteristics, evaluation activities and conducted program.

F. The student Questionnaire: Give information about their family background of students and their experiences in learning mathematics and science, teachers teaching activities, resources and facilities, school conditions, interests, habits and attitudes toward math and science courses (Quoted from the National Center Report of Thames and PIRLS's International Study, fall).

Data analysis method

In order to analyze the data (information) and to test the hypotheses of the study, the structural equation modeling and LISREL software were used.

Results

To assess the hypothetical model, parameters have been initially estimated through maximum possibility method. The estimated parameters include indirect and direct effect coefficients, total coefficients are. Figure 1 shows the estimated coefficients of direct effect of model.

Numbers on routs indicate the estimated parameters. According to the Figure 1, only two routs namely direct effect of attitude toward science on science self-concept and science development with 95% are not significant. But, the rest of routs namely the direct effect of parental education on science achievement and attitudes toward science is positive and significant and their influence on science self-concept is negative and significant. Also, direct effect of self-concept on attitude toward science is significant and positive and their impact on science achievement variable is negative and significant. The amount of explained variance by available variables in model for variables of attitudes toward science, science self-concept and science achievement regularly is 0/14, 0/01 and 0/24 percent.

Evaluation of fit model is done through characteristics of fit. Generally, this study among its various characteristics of fit, Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI), Root Mean Square Error of Approximation (RMSEA) ,chi-square is reported. Table 3 shows the characteristics of goodness of fit model.

Table 3.Characteristics of goodness of fit model

Adjusted Goodness of Fit Index (AGFI)	Goodness of Fit Index (GFI)	Root Mean Square Error of Approximation (RMSEA)	Significance level	Degrees of Freedom	Chi-Square
0/85	0/90	0/16	0/00	84	9102/49

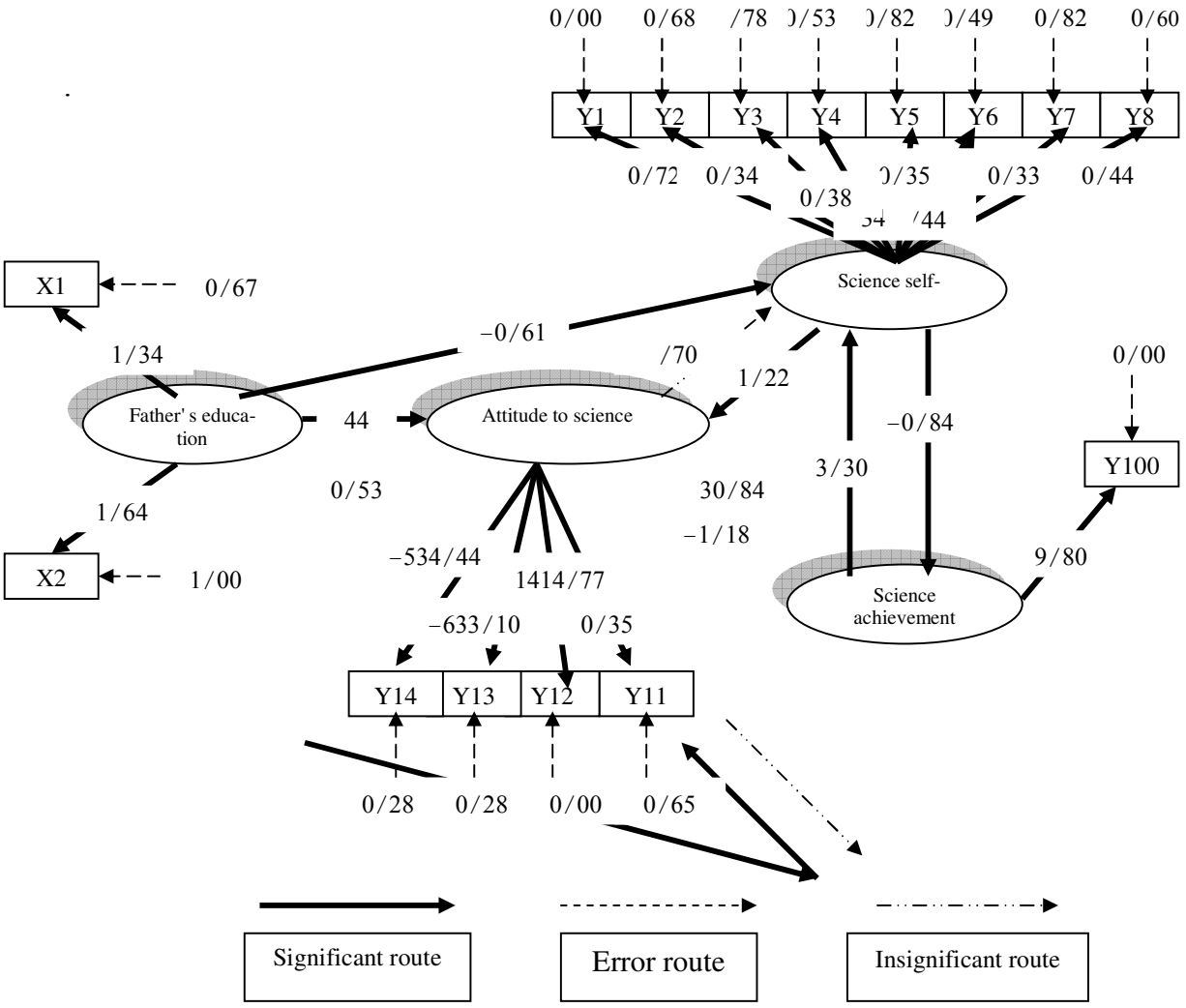

Figure 1. Estimated Coefficients of Direct Effect Of Model

Other features of the structural equation modeling analysis refer to estimate the indirect effects and total effects of variable on each other which are presented in table (4).

According to Table 1-2, the following results were obtained. Indirect influence of parental education variables, attitudes towards science and science self-concept on science achievement was reported significant, but only the overall effect of parental education on science achievement became significant and the overall effect of attitudes to science and self-concept variables were reported insignificant. In addition to this, the overall and indirect effect of parents' education and science achievement on self-concept is significant and also attitude towards science has a significant and indirect effect on science self-concept and its overall effect on science self-concept is not significant. Overall and indirect effects of variables of self-concept and science achievement on attitude towards science was significant, while the overall impact of parental education variable on the attitudes toward science was reported insignificant and its indirect effect was significant. Results indicate that the variables of attitude toward science, self-concept and science achievement have moderating role.

Error variance	R^2	**Total effects**		**Indirect effect**		**Direction of routes**
		Parameter Standard	Parameter estimation	Parameter Standard	Parameter estimation	
0/80	0/24	* 0/45 0/00 -0/01	* 0/46 0/36 -0/01	* -0/07 * -0/34 * 0/82	* -0/07 * -30/48 * 0/83	Science achievement of Parental education Attitude to science Science self concept
0/99	0/001	0/08* -0/01 * 0/53	* 0/08 -0/47 * 0/52	1/70* *-15/01 *-2/85	* 1/70 *0/00 * 0/0	Science self-concept of Parental education Attitude to science Science achievement
1/14	0/14	0/01 -0/06* * -0/09	0/00 * 0/00 * 0/00	*-38/14 *-106/62 * 104/84	* -0/44 * 0/00 * 0/00	attitude toward science of Parental education Science self concept Science achievement

Discussion

Research findings indicated that the direct effect of parental education on science achievement and attitude toward science is positive and significant. The findings are in line with the studies of Markolidz, Hack, and Pastaziyo quotes from Pahlavan Sadegh and colleagues (2005), and Jones (2003) that indicate the importance of family variables such as parental education on science achievement, attitudes toward science self-Science. Also, Reynolds & Walberg (2009)in a study that conducted by using of data of Thames's studies and concluded that the family factors , attitudes and socio-economic status of students have the greatest impact on the science achievement. This finding indicates that when the family is rich in terms of educational facilities and education level of parents and can be able to provide appropriate and favorable environment in terms of academic for students than student by benefiting from these resources and facilities can be able to strengthen and fertilize themselves in direction to scientific and educational purposes and offer and more favorable and better academic performance. These findings are consistent with results studies of Berko et al (2003), Broeck (2003), Arora& Ramirez (2003), Kiyamanesh (2008), on the base of existence of a positive relationship between family's socioeconomic status and academic achievement of students.

However, the direct effect of parental education on science self-concept is negative and significant. It can be shown that the science self-concept has a moderating role for attitudes towards science and science achievement which are correspond to the study of Malinic (2003) and Janjetovic (2003) which is based on moderating role of science self-concept.

Also, direct impact of science achieve on science self-concept is significant and positive and its impact on attitude to science is significant and negative. Dika, Granville, Singh (2002) in a study through analysis of structural equation model concluded that variables such as motivation, attitude and involvement in classroom activities as moderating variables effect on math and science academic achievement. Papanastasiou, & Zembylas, (2004) in a research entitled differential effects of science attitudes and science achievement on each other which were done by using of Thames's data, concluded that attitudes toward math and science achievement have mutually influenced each other. Also, the indirect effect of parental education variables, attitudes towards science and science self-concept on science achievement was reported significant. But only the overall effect of parental education on science achievement became significant and the overall impact of variables of attitude toward science and self-reported on science achievement was reported non-significant. These find-

ings also indicate that teachers can raise students' science achievement through reinforcement of students' self-concept and trying to build a positive attitude towards science in students. Conducted researches on investigated variables in Thames's studies represented the impact of these variables on achievement. However, in order to understand the causes of placing Iran in final ranks in Thames's studies need to further investigation. The researcher hopes that the present study and researches like that can help educational authorities in curriculum planning and decision-making.

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