COMPARING HIGH WITH LOW SCIENCE PERFORMANCE STUDENTS IN SOME VARIABLES OF FOURTH GRADER IN IRAN

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Abstract

Student achievement is affected by many factors in educational context. In order to compare students with high and low science performance in fourth grade of TIMSS 2007 in Iran, some variables were explored from students' level background questionnaire. A number of 449 students (197 high performance students and 252 low performance students) was selected based on cut-off point of ±1.5 standard deviation of national science Rasch score. Ten variables were extracted including classroom activity, science attitude, perception of school climate, using computer, science self-confidence, home possibilities, spending out of school time in general activities, spending out of school time in ICT related activities, perception of being safety in school and type of school. Data was analyzed by logistic regression. The results revealed that five variables including type of school, using computer, science attitude, science self-confidence, and home possibilities could differentiate effectively between high and low science performance students of fourth grade in Iran. The findings emphasized the role of family supporting and attitudinal variables in student achievement.

Keywords: science achievement, type of school, home possibilities, using computer, science self-concept.

Introduction

In educational context, many factors can determine how students achieve in school. These factors relate to general domains like student, teacher, school, family, curriculum, and so on. Many researchers tried to find these factors in perspective of modeling analysis and proposed a

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couple of models. Among the variables, personal and schooling are more popular, due to their importance for educators and parents who want students to perform better in schools and their importance for researchers who want to study about achievement.

Proposing the social-cognitive theory in 1986, Bandura introduced variables in the field of learning psychology that explained numerous learning phenomena. The cognitive orientation present in Bandura's theory and his special attention to the concept of 'self' served as a basis for introducing a lot of variables. Numerous research studies have been conducted on the relationship between self-believes and performance outcomes. In addition, the principal and widespread application of self in education has resulted to a very rapid boost in the number of studies carried out in this field. The findings of majority of these research studies indicate that there is a strong relation between self-believes and achievement and self-believes accounts for much variance in achievement. Furthermore, the role of self-believes is more prominent than other factors in achievement (Pajares and Miller, 1994; Kabiri and Kiamanesh, 2004). Some constructs introduced in social cognitive theory. Among them self variables, self-efficacy, self-concept, self-confidence and self-regulation are more popular in the self variables.

The relation between math attitude and achievement has been extensively investigated. Schreiber (2000) found that students who performed better on a mathematics test tended to have positive attitude toward math. In addition, the variables that are traditionally associated with achievement, i.e., gender, parent education, and attitude towards mathematics, were observed to find their role on mathematics achievement. Alrwais (2000) examined the relationship among the factors students' attitude toward learning, students' creativity and students' school grades and their effect on achievement. He found out that the best predictor was the students' attitude. Papanastasiou (2002) reported a direct relation between attitude and achievement on the basis of TIMSS data. Jones (2001) and Scott (2001) have also reported similar findings. Although there is a relation between attitude and achievement, this relation should not be considered definite. Accordingly, several researchers have reported no relation between attitude and achievement. Ward (2001), for instance, reported that students' attitude did not show a relationship to their achievement in Algebra.

Engweiler (2005) examined the effects of socioeconomic status (SES) on standardized test scores, using the National Educational Longitudinal. Results indicated that the strongest

influence on a student's academic achievement is their socioeconomic placement. Whereas, a meta-analysis study on SES and academic achievement showed a medium to strong SES–achievement relation. This relation, however, is moderated by the unit, the source, the range of SES variable, and the type of SES–achievement measure (Sirin, 2005).

The importance of some school related variables are examined by investigators. House (2006) examined role of two instructional approaches (active learning strategies and cooperative learning activities) in improving student science achievement. He revealed use of active learning strategies related positively to achievement test. Students who frequently engaged in cooperative learning activities tended to earn higher science test scores.

The safety of school affects school climate. In turn, the school climate causes better interactions among students and between students and teachers. This statement was showed by some researches. Gronna and Chin-Chance (1999) examined the extent to which a safe school influences individual student achievement. The study used a two-level hierarchical model that included student characteristics and school conditions used in prior research. The findings suggested that school safety had statistically significant effects on students' grade 8 reading and mathematics achievement. Controlling for student background characteristics and differences in school conditions, students who were in safer schools had higher grade 8 achievement scores than students who were in less-safe schools.

Also, it is proposed that Private schools have more authorities in decision making than public schools. In practice, studies showed more authorities in Iran (Kabiri, 2008). In his study, no comparison between these two types of schools in student achievement was done. Whereas, many researchers found that private schools have better students' performance than public schools (Chubb and Moe, 1990; Bryk, Lee, and Holland, 1993). However, Rutkowski and Rutkowski (2008) found that higher private school achievement is not uniform across educational systems or content domains analyzed in their cross-national study.

Educational Significance of the Study

Iran is one of the countries that have high standard deviation of achievement score, especially in science score in fourth grade. Thus, investigating the factors that discriminate high and low performance students will provide valuable information about effective variables.

Considering so many variables including student, teacher, and school administrator background in TIMSS, it is a good area to work on the data to find influencing factors in achievement.

Although some studies are designed to find influencing factors on math achievement of Iranian students, there are a few researches which examine science performance. In addition, some studies concentrated only on personal variables of students. In current study, we focus on student's level variables. However, variables like school type, home possibilities and school climate are not limited to personal variables. This approach can help to find out overall perspective about influencing variables. The main purpose of current study is to detect effective variables that could differentiate between high and low performance students in science in Iran.

Method

Participants

The data was obtained from student background file (ASGIRNM4) in TIMSS 2007. There were 3833 4th grader in TIMSS 2007 in Iran, whereas, To produce two extreme groups of students 197 high and 252 low performance students were included in the study, based on ±1.5 standard deviation of national science Rasch score (M=150, SD=50) as cut off point. 39.8% of low group and 43.1% of high group were female. The age average of low group was 10.4 (SD=0.87) and 10 (SD=0.38) for high group. About 7.8 percent of students' parents of low group and 4.5 percent of high group were born in abroad.

Measure

Students' Science Performance: Ideally, any activity should be evaluated by determining the outcomes that the activity produces. In this study, the mean of science achievement score of class (national Rasch score with the mean of 150 and standard deviation of 10) was used as the criterion variable. This score was classified based on ±1.5 standard deviation of science score into two groups (low and high).

Classroom Activity: Seven items were used to measure classroom activities of students, there are, "looking and writing what is seen", "designing or planning an examination or investigation", "doing an examination or investigation", "working with other students in a small

groups on an examination or investigation", "reading a books about science", "giving an explanations for something what is studied in science" and "working problems". The answers are given in a 4-point scale (once a week, twice a month, a few times a year and never). The variable was derived by combining the seven items.

Science Attitude: Three items of "science in school" variable of student questionnaire were selected to measure science attitude. These items were "I usually do well in science", "I enjoy learning science" and "I like science". They were extracted by principal component. Data was recoded and combined to construct a single variable.

Perception of School Climate: All three items of variable 11 in student questionnaire were used as school climate. This variable was related to students' perception of school climate.

Using Computer: A derived variable in student background file was used to measure use of computer. This variable was derived with regard to students answer to computer section. The five-options of the variable were using computer "in home and school", "just in home", "just in school", "in other places other than home and school" and "do not use computer at all".

Science Self-Confidence: Five items of "science in school" variable of student questionnaire were extracted as science self-confidence measure, based on principal component analysis. These items were "I would like to do more science in school", "science is harder for me than many of my classmates", "I am just not good at science", "I learn things quickly in science" and "science is boring". Students were asked to answer 4-point scale (agree a lot, agree a little, disagree a little, and disagree a lot). Data was recoded and computed to construct a single variable.

Home Possibilities: There are nine devices to measure home possibilities. Five of them were international options (include calculator, computer, study desk, dictionary and internet connection) and four were national options (include car, camera recorder, cell phone and dishwasher). Students showed having these equipments in their home by checking yes or no. Their responses were recorded and combined to construct home possibilities variable. This variable was ranged from 0 to 9.

Spending Out of School Time in ICT Related Activities: In this factor, engaging of students in ICT activities in home was considered. Activities like spending time playing computer games

and using internet were included based on principal component analysis. Students were asked by a 5-point scale which expanded from “no time” to “4 or more hours per day”.

Spending Out of School Time in General Activities: This variable is related to other personal activities that were not included in “ICT related activities”. Extraction of items was performed by factor analysis. Four variables; doing job at home, playing sports, reading book for enjoyment and doing homework were included in this variable. Answers were gathered in 5-point scale.

Perception of having Safety in School: Five items in the questionnaire assigned to safety of school which considered being stolen, being hurt, doing things that one do not want to do, being laughed at by others and being left out of activities from others. Students were asked to show their perception of school’s safety by selecting a two-option scale (yes and no) and report what happened to them in the previous month. Answers were computed to create a variable. High value of variable shows good perception of school’s safety.

Type of School: Although type of school was not in any background questionnaires, we considered it as an explicit variable in sampling. Consequently, there were enough cases to examine it as predictor variable. Two main types of school in Iran are public and private. The main difference between them is paying school’s costs by parents in private schools. Also, the other difference is that private schools have more authorities.

Results

Nine factors were derived based on student background questionnaire including classroom activity, science attitude, perception of school climate, using computer, science self-confidence, home possibilities, spending out of school time in general activities, spending out of school time in ICT related activities, and perception of being safety in school along with type of school (private and public). These variables were extracted and computed from fourth grade student background file that merged with fourth grade achievement file of TIMSS 2007. To construct the variables, the appropriate method of handling missing data was used. Then variables were weighted to student total weight. Table 1 shows the correlation matrix of predictor variables.

Insert table 1. About here

A regression analysis was performed on science achievement as outcome and ten above-mentioned as predictors. Variables were checked for logistic regression's assumptions, especially multicollinearity, and results showed that there was not any collinearly among them. In order to compute accurate standard error according to Jackknife Repeated Replication, VesVar 4.3 software was used. Data from 449 students were analyzed: 197 high performance students and 252 low performance students.

A test of the full model with all ten predictors against a constant-only model was statistically significant, $\chi^2_{(4, N = 425)} = 83406.07$, $p < .0001$, indicating that the predictors, as a set, reliably distinguished between high and low performance students.

Table 2 reveals the regression confidents along with significant test for each of them. According to the estimate coefficients, five predictors including type of school, using computer, science attitude, science self-confidence and home possibilities reliably predicted success status. The results of study showed that five factors had significant effect on differentiating high and low performance students. These were using type of school, using computer, science attitude, science self-confidence and home possibilities. Five others variables did not show any significant effect. The regression coefficients were 2.240, 0.982, 0.639, 0.522 and 0.298, respectively.

Insert table 2. About here

Table 3 provides odds ratios of predictive variables. The odds ratios of 9.397, 2.669, 1.894, 1.686 and 1.347 for type of school, using computer, science attitude, science self-confidence and home possibilities show changes in the likelihood of working on the basis of a being successful/ unsuccessful in science achievement.

Insert table 3. About here

Thus, School type and using computer are the most important explanatory variables. The model's measures of fit show satisfactory model. Negative log-likelihood was 0.600. In addition, overall fit of the model (16.484, DF=11, 65) was acceptable.

Conclusion

This research was deigned to compare high with low 4th grade students' achievement in science performance. 449 Iranian students were selected from 3833 4th grade students, based on ±1.5 standard deviation of national science Rasch score. They were 197 high and 252 low performance students. To discriminate between those people ten variables were examined. Those variables derived from student background questionnaire and student membership to some explicit stratification variables. These variables include classroom activity, science attitude, perception of school climate, using computer, science self-confidence, home possibilities, spending out of school time in general activities, spending out of school time in ICT related activities, perception of being safety in school and type of school. The main purpose of current study was to detect effective variables that could differentiate between high and low performance students in science in Iran. The data of these variables of two groups were analyzed by logistic regression.

The results of the study revealed that five factors including type of school, using computer, science attitude, science self-confidence and home possibilities can significantly predict students' achievement. Type of school was the strongest predictor of student achievement among other variables. The fit indexes showed that model can explain adequately discrimination factors between high and low students.

The current findings confirmed the previous results of effective factors on achievement. Most of significant variables were related to good economic status of family. Among them, home possibilities had relative high correlations with other significant variables that revealed good economic status of family can be the most important factor for success in school. In Iran, people who enroll their children in private schools usually have good economic statuses. These families, usually prepare higher possibilities at home, and also prepare some facilities like computer to their children. Thus, they support their kids for success in school. However, it does not seem science self-concept and science attitudes are related to economic status of the family. These two variables contain attitudinal variables that their role had specified before. It seems that social cognitive theory can explain these findings. According to this theory the most powerful predictors of performance are those relate to believes about self. Self-concept, self-efficacy and

some attitudinal variables are some of constructs introduced by this theory. In conjunction with our results, science self-concept and science attitude can be explained by this theory.

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Table 1. Correlation matrix of predictor variables

Variables	1	2	3	4	5	6	7	8	9
1.classroom activity	1.00								
2.science attitude	.17	1.00							
3. school climate	-.36	.01	1.00						
4.using computer	-.08	.38	.31	1.00					
5.science self-confidence	-.32	-.49	.08	.02	1.00				
6.home possibilities	.15	-.32	-.21	-.30	.44	1.00			
7.spending out of school time in general activities	-.01	-.04	-.02	.14	.02	-.09	1.00		
8. safety of school	-.17	-.05	.34	.44	.06	-.1	.26	1.00	
9.type of school	-.29	.05	.19	.23	.13	-.19	.1	-.03	1.00
10.spending out of school time in ICT	-.37	-.14	.42	.64	.44	.04	.05	.41	.41

Table 2. Regression coefficients based on logistic regression analysis

Variables	Estimate	Standard error of estimate	t	Sig.
intercept	-20.096	4.386	-4.582	0.000
classroom activity	.034	.049	.685	0.495
science attitude	.639	.179	3.569	0.001
school climate	-.155	.139	-1.114	0.269
using computer	.982	.290	3.380	0.001
science self-confidence	.522	.139	3.755	0.000
home possibilities	.298	.126	2.364	0.021
spending out of school time in general activities	-.071	.137	-.516	0.607
safety of school	.123	.167	.739	0.462
type of school	2.240	.645	3.475	0.001
spending out of school time in ICT	.238	.451	.528	0.599

Table 3. Odds ratios of predictive variables

variables	odds	95% confidence interval for odds ratio	
		upper	lower
classroom activity	1.034	.938	1.141
science attitude	1.894	1.326	2.706
school climate	.856	0.649	1.13
using computer	2.669	1.496	4.761
science self-confidence	1.686	1.278	2.225
home possibilities	1.347	1.048	1.731
spending out of school time in general activities	0.932	.709	1.224
safety of school	1.131	.812	1.576
type of school	9.397	2.601	33.950
spending out of school time in ICT	1.269	.517	3.115