Adaptability of TIMSS Study for Developing Country: a Case Study in Mymensingh, Bangladesh

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Abstract

TIMSS and PISA are the most well-known international comparative studies. The number of participant countries has been increased and now reached more than 60 countries in the world [1][2]. The number of participants of developing countries is also increasing. However, some scholars claim that these international comparisons with single standard might not appropriate particularly for developing countries. But the number of participants of developing countries is still limited, so that substantial reports are also limited. This study aims to add substantial verification on the theoretical study by focusing on the adaptability and problem of international comparative study for developing country. The study conducted revised TIMSS test in one of the developing country, Bangladesh, which have never participated in any international comparative study.

The city of Mymensingh which has both urban and rural areas was selected. Target grade is 4th grade. The achievement test includes 21 test questions both of contents domains and cognitive domains. Each domein have more than two questions. The questionnaire includes 22 questions consisted of 8 questions about family background, 7 questions about individual background and 8 questions about schools and teachers background. The scores and answers were then analyzed by factor analysis, multiple regression analysis, and Covariance Structure Analysis with using SPSS and AMOS.

Total number of data was 30 schools and 1194 students. Result of student's questionnaires shows that most influential factors on students' achievement are "Gender" and "Parental education" and "Reading environment". From teacher's questionnaires, there are significant differences in "town and country" and "Gender of teacher". Coefficient of determination of family and individual factor is 3.4%, and school factor is 31.2 %. This means that school factor is more influential on students' achievement in Bangladesh.

Although those results are highly suggestive, there still seemed to be the possibilitiy to analyse deeply, For example, even though the most of tests style was multiple choice questions with four options, the average achievement was 5.95/ 21 (SD=2.80) and therefore the Cronbach's alpha was not so high (0.61). Some questions were unsuitable for analyze. For instance, most of the answer as "Mothers occupation" was "House wife". Those suggested that there could be a room to improve test questions in order to accommodate developing countries.

1. Introduction

The world has been globalized quickly. This globalization movement has also influenced on the education sector. Many countries join the international comparative studies to get suggestion toward their future educational plan. Trends in International Mathematics and Science Study (TIMSS) and Programme for International Student Assessment (PISA) are the most well-known international comparative studies. TIMSS research is implemented by The International Association for the Evaluation of Educational Achievement (IEA) since 1964. Recent TIMSS is implemented every 4 years from 1995, and targeting grade are 4th grade and 8th grade. PISA is implemented by Organisation for Economic Co-operation and Development (OECD) and targeting age is 15th years old.

The number of participant countries in TIMSS and PISA has been increased and now reached more than 60 countries in all over the world. The number of participants of developing countries is also increasing[1][2].However, some scholars question that these international comparisons with single standard are not so much appropriate particularly for developing countries. For instance, floor effect by low achievement and so on [3]. But the number of participants of developing countries is still limited, because of political reason, financial reason, so on[4]. So that substantial reports are also limited. This study aims to add substantial verification on the theoretical study, by seeing the adaptability and problem of international comparative study for developing country. The study conducted Revised TIMSS test in one of the developing country, Bangladesh, which have never participated in any international comparative study.

2. Methodology

This study invoked some test problems and the questionnaire regarding student and school background information in the framework of TIMSS. The city of Mymensingh was selected, where have both urban and rural areas. Target grade is 4th grade. The test problem invoked from TIMSS 2003 & 2007. The achievement test includes 21 questions both for contents domains and cognitive domains. All category have more than two problems. The questionnaire includes 22 questions consisted of 8 questions about family background, 7 questions about individual background and 8 questions about schools and teachers background.

Test problem was transrated by Science specialist in National Academy for Primary Education (NAPE), Bangladesh. Routine class teacher supported this research by implementing the test problem and questionnaire in the class. Preriminary reserch done in one school on 3rd May, 2011 and all the istruments were revised based on the result.. Main revised point was dishonest measure and understnd friendly prosess and direction. After that, main survey was conducted from 24th May to 25th Jun, 2011.

The scores and answers were then analyzed by factor analysis, multiple regression analysis and Covariance Structure Analysis by using SPSS and AMOS.

Factor analysis associated some related questions from student's and teacher's questionaire. Main efficience elements were derived from multiple regeression analysis. Structurally related elements which don't influence directry was analyzed from covariance structure analysis.

3. Data Analysis and Results

Total number of data was 30 schools and 1194 students (468 boys, 702 Girls and 24 unknowns). Table 1 shows average score of test problem and TIMSS participants avarage. Every category of average schore in target area was significantly low as compared with TIMSS average. Earth science was the highest achevement in Content domain. Life science and Physical science in content domain was simmiler score. Knowing and Applying in Cognitive domain were also simmiler scores. Reasoning was relativery low in cognitve domain, however the gapwith TIMSS was relativery low.

The eight of test problem hold deeper information in TIMSS International report. Table 2 shows the comparison of test problem between TIMSS and these eight test problems. In this table, free description type of problem relatively low achievement in target area. Test questions which already learned was only two. However, problem number 5 was relatively good achievement even though not learning yet.

In the students' family background and individual background, there were nine significant contents. These contents are gender, mother's educational background, father's educational background, home electronics number, home books number, reading time, liking Mathematic, benefitting from mathematics and benefiting from science.

School factor corrected from 30 schools. From these schools background, only teacher's gender had significant difference. This result related the number of collecting data also.

From factor analysis on student's questionnaire, there were three factors. First factor was motivation factor (Liking Mathematic, Liking Science, Benefiting from Mathematic and Benefiting from Science). Second factor was parents education (Fathers education and Mothers education), and third factor was Reading factor (Books number and Reading time). These obtained factors were used for another analysis.

Result of the multiple regression analysis and Covariance Structure Analysis of student's questionnaires shows that the most influential factors for students' achievement were "Gender"(B=0.121) and "Reading environment"(B=0.102) and "Parental education"(B=0.073). In teacher's questionnaires, there are significant difference in "Town and country"(B=0.441) and "Gender of teacher(Femail=0, mail=1)"(B=-0.343).

Parents Education (Total Effect= 0.126), Boy (Total Effect=0.125) and Reading (Total Effect=0.113) were most influenced factor in the students questionnaire by using Covariance Structure Analysis. These orders are different from Multiple Linear Regression Analysis, but factor was the same. On the

Domain		Number of questions	Average score	TIMSS Average	t value
Content domain	Life Science	7	27%	56%	55.6***
	Physical Science	8	26%	59%	70.8***
	Earth Science	6	33%	60%	43.6***
Cognitive domain	Knowing	7	33%	69%	64.5***
	Applying	8	32%	63%	55.6***
	Reasoning	6	18%	40%	48.9***
Total		21	29%	56%	70.6***
Life Science	Knowing	3	24%	63%	53.8***
	Applying	2	40%	69%	29.4***
	Reasoning	2	19%	32%	17.7***
Physical Science	Knowing	2	30%	71%	45.0***
	Applying	4	30%	59%	45.5***
	Reasoning	2	13%	47%	51.2***
Earth Science	Knowing	2	48%	74%	55.0***
	Applying	4	29%	60%	16.2***
	Reasoning	2	22%	41%	13.2***

Table 1. Average score of test problem and TIMSS participants' average
(N=1194, M=5.95, SD=2.80, Cronbachα=0.61), *** (P =< 0.001), ** (P =< 0.01), * (P =< 0.05)

Problem Number	Category	Type	Learned situation	Content domain	Cognitive domain	Average score	TIMSS Average
5	Character of Stone, Wood and Iron	Multiple-choice	Stone and wood only	Physical Science	Reasoning	1%	38%
6	Air and Burning	Multiple-choice from 4	○（Grade 3）	Physical Science	Knowing	36%	66%
10	Behavior of water, density and buoyant force	Multiple-choice from 4	Behavior of water only	Physical Science	Applying	23%	39%
11	Birth and transmission	Free description	×	Life Science	Reasoning	0%	30%
12	Heat conduction	Multiple-choice from 4	○（Grade 4）	Physical Science	Reasoning	26%	57%
13	Behavior of air and specific weight	Free description	Behavior of air only	Physical Science	Applying	6%	51%
14	Character of creature and Environment of desert	Multiple-choice from 4	Character of creature only	Life Science	Knowing	20%	68%
15	Density	Multiple-choice from 4	×	Physical Science	Applying	54%	80%

Table 2. Comparison of test problem with TIMSS （N=1194）

Analysis	Factor #	Student's Main Elements	Named of Factor	Teacher's Main Elements	Named of Factor
Factor Analysis	1st Factor	Like Science Like Math Beneficial of Science Beneficial of Math	Motivation Factor	Male Teacher Male Teachers #	Male Teacher Factor
	2nd Factor	Fathers Education Mothers Education	Parents Education Factor	Urban Index	Urban Factor
	3rd Factor	Books # Reading Time	Reading Factor	Observe Instruction Preference Subject	Teacher Motivation Factor

Analysis	Ranking	Student Factor Name	Standard Partial Regression Coefficient β	School Factor Name	Standard Partial Regression Coefficient β
Multiple	1	Boy	0.121	Urban	0.441

Analysis	Ranking	Student Factor Name	Total Effect	School Factor Name	Total Effect
Linear Regression Analysis	2	Reading	0.102	Male Teacher	-0.343
	3	Parents Education	0.073		
Analysis	Ranking	Student Factor Name	Total Effect	School Factor Name	Total Effect
Covariance Structure Analysis	1	Parents Education	0.126	Urban index	0.401
	2	Boy	0.125	Male Teacher	-0.326
	3	Reading	0.113		

Table 3. Result Outline of Analyses

other hand, school factor was almost the same in Multiple Linear Regression Analysis and Covariance Structure Analysis. Coefficient of determination of family and individual factors are 3.4%, and school factor is 31.2 % on the multiple regression analysis. It means that school factor is more influential on students' achievement in Bangladesh.

4. Discussion

These results looks nothing problem. Most of the results had significant difference. However, there are some awaiting solution in data themselves.

At first, the reliavility probrem. the most of the test problem styles were multiple choice questions wuth four options. Nevertheless, the average achievement was 5.95/ 21 (SD=2.80). Therefore the Cronbach's alpha was not so high (0.61). This number shows that students correct answer might be half luck.

Secondly, some questions were unsuitable for analysis. For instance, the occupation of mother and father is not significant different on ANOVA. In addition, ratio is concentrated in specific answer Such as mother's occupation was "Housewife" and father's occupation was "Other". Furthermore, the students' achievement of choosing "Father's occupation other" is the lowest achievement and main answer. It shows that concentrated in answering question is difficult to significant.

Those suggested that there could be a room to improve test questions in order to accommodate developing countries.

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