Boys are as good as girls? A confirmatory study from TIMSS2003 data analysis

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Abstract

The purpose of this study is to do the secondary analysis of TIMSS2003 dataset for investigating the learning differences in mathematics literacy, and for seeking out the factors that affect mathematic literacy. Besides, this research especially focuses on the gender difference in the 8th grade students' mathematics literacy. In research method, a model will be constructed and verified from the TIMSS2003 dataset by Structure Equation Modeling (SEM) to interpret the phenomenon of "boys are good at mathematics, and girls are bad at mathematics". Researcher also wants to compare Taiwan with United States students' performance. The conclusion explains the gender and culture differences in performing the mathematics literacy and learning factor.

Key Words：*gender difference, TIMSS2003, Structure Equation Modeling, mathematics literacy*

1.Introduction

"Gender Mainstreaming is a globally accepted strategy for promoting gender equality." Gender equality has become an important issue in any field and the entire world. According to many references showed that male students like studying mathematics and science and they are also good at mathematics and science. But female students seems not to studying these courses well, and don't like choosing these courses to major. Recently, researcher found some papers presented that showed different results, but even these "equality" outcomes have taught teachers and parents to courage female students to study mathematics and science, but these two courses are still make female scared. What are the factors make them have different scores by self, and if Taiwan and United Stated were also have different result? It is the main purpose in this study.

2. Literature Review

2.1 Educational or academic significance of the study

Literatures showed school education, teachers, parents and students self were the factors to explain achievement. Schibeci (1989) found the factors that affect science literacy were person characteristic, family, teachers, and classmates. Ann & Michelle (2004) investigated college students in physical course found that the factors affect gender difference were learning method, motivation, self efficiency, belief, and reasoning ability. In Wubbels & Levy (1993) research found positive relation between teacher and student can promote science learning interest and

literacy. Chang(2004) analyzed TIMSS-R found that there were 16 nations' male students got more high score than female students, and especially in Physical, Earth science, Chemical, and environment and resource issues. NAEP (National Assessment of Education Progress) during 1969~1970, 1971~1972, 1976~1977, 1981~1982, and 1985~1986 processed five times science assessments, and the results found male students were always superior to female students. Besides, SMPY (the study of Mathematically Preconscious Youth) focused on 7^{th} or 8^{th} grade gifted students, found that the number of over 600 score between male and female students were different significantly in the academic assessment.

According to above results seemed to show male students' mathematics and science literacy better than female students. Gender gaps in mathematics achievement and attitude as measured by the U.S. National Assessment of Educational Progress (NAEP) from 1990 to 2003, they found that gender gaps favoring males: (1) were generally small but had not diminished across reporting years, (2) were largest in the areas of measurement, number and operations (in Grades 8 and 12) and geometry (in Grade 12), (3) tended to be concentrated at the upper end of the score distributions, and (4) were most consistent for White, high-SES students and non-existent for Black students. In addition, we found that female students' attitudes and self-concepts related to mathematics continued to be more negative than those of male students.

Furthermore, the gender difference in the top quarter group got more significantly. Dee (2007) found the gender gaps in student outcomes focused on the interactions between students and teachers. Within-student comparisons indicate that assignment to a same-gender teacher significantly improves the achievement of both girls and boys as well as teacher perceptions of student performance and student engagement with the teacher's subject. Roslyn & Anthony (2006) explore the sources of gender variations in African American middle school students' academic performance, and examine the contributions of family, school, and individual factors to academic outcomes. Findings indicate that although there are no gender differences in achievement in 2nd grade, differences become evident by middle school, with females obtaining higher test scores and grades than males. And males' test scores are more likely to be affected by peers, educational attitudes, school structure, and school climate. Females' test scores are more likely to be influenced by family socioeconomic status and cultural capital. Cokley & Moore(2007) indicated that ethnic identity and racial centrality were negatively related to academic achievement for male students and positively related to academic achievement and academic self-concept for female students.

Lietz, P. (2006) Differences emerged between assessment programs, with recent Australian Studies, the National Assessment of Educational Progress Studies (NAEP) and the Programme for International Student Assessment (PISA) reporting greater gender differences. Female secondary students performed 0.19 standard deviation units above their male peers. De Fraine, Van Damme & Onghena (2007) investigated the development of academic self-concept and language achievement from Grade 7 to Grade 12 by repeated assessment of 2826 Flemish

adolescents in 50 secondary schools. Latent growth curve modeling showed that both girls and boys experience a declining academic self-concept during the period of secondary education and that girls declined at a faster rate.

In this study, researcher will discuss if following factors could explain mathematics literacy between gender and culture: self confidence, learning behaviors, learning purposes, homework time, and time use.

3. Method of Data Analysis

3.1 Perspective or theoretical framework

In this study, Taiwan students and United Stated students are the study subjects, in every group be separated to two groups by gender. Researcher wants to compare male with female students' literacy in mathematics, and compare western with eastern countries' students performance to check this model if fitted. The initial framework is as Figure 1.

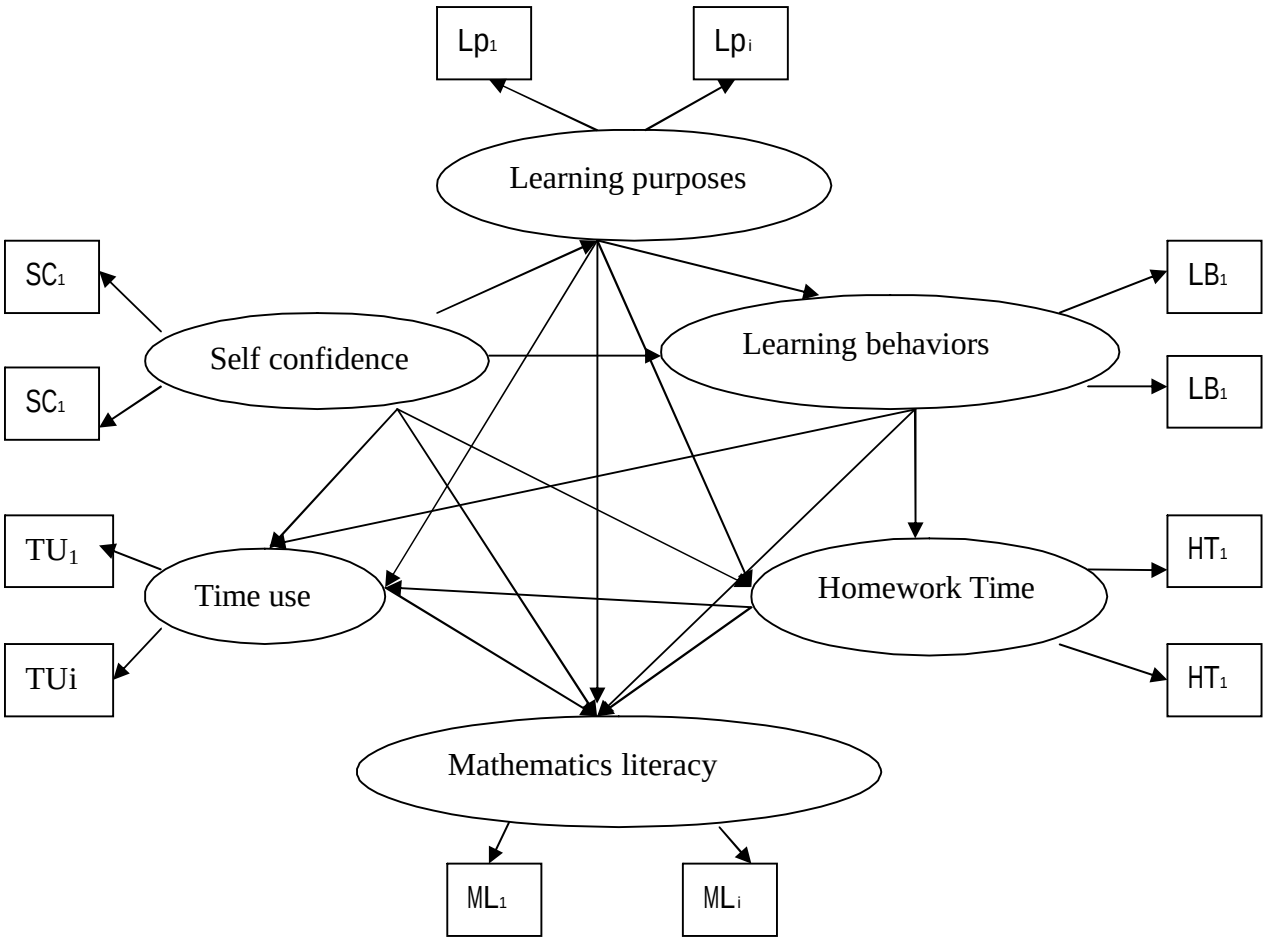


Figure 1 assumed framework

Following are hypotheses of this research:

A. Do student' mathematics self confidence, learning purposes, learning behaviors, time use for mathematics study and do homework time can explain mathematics literacy?
   Hypothesis: Student' mathematics literacy could be explained by mathematics self confidence, learning purposes, learning behaviors, time use for mathematics study and do homework time.
B. Is difference gender student' mathematics literacy also difference?
   Hypothesis: Difference gender student' mathematics literacy are not difference.
C. Is difference culture student' mathematics literacy also difference?
   Hypothesis: Difference culture student' mathematics literacy are not difference.

3.2 Methods, techniques, or modes of inquiry

As the method of this study, a model will be constructed and verified based on the TIMSS2003 database by Structure Equation Modeling (SEM) to interpret the phenomenon of "high mathematics self confidence and anticipation, high mathematics literacy" existed in eastern countries: Taiwan and western countries: United States. Second, it also verifies the gender difference if existed.

3.3 Data sources

The original dataset of TIMSS2003 was downloaded from internet of "IES NATIONAL CENTER for EDUCATION STATISTICS", the website is http://nces.ed.gov/timss/datafiles.asp. And this research focused on comparison discussion of United States and Taiwan's 8 grade students. There are 4767 valid subjects from Taiwan and 7625 from United States. The total valid subjects and female students, male students' number are shown in Table 1.

Table 1 research subjects

	Valid N	Gender
USA(United States)	**7625**	**boys:3,626** **girls:3,999**
TWN(Taiwan)	**4767**	**boys: 2,408** **girls: 2,359**

4. Discussion and Results

According to the above hypotheses, and outcomes are as the Figure 2 to Figure 7.

4.1 Students' mathematics literacy discussion and structure model

The following structure models explain nation and gender differences in performing the mathematics literacy in their self concept and anticipation.

First, from t-test of standardized math raw score, Taiwan students' score are the same as United States'. But the structure model has little difference in relationship of self-confidence and homework time.

Table 2 Statistics

	COUNTRY ID	N	M	SD	SD Error
*STANDARDIZED MATH	Taiwan	4767	50.85196	9.712788	.140676
RAW SCORE (50,10)*	United Stated	7625	50.62563	9.964317	.114111

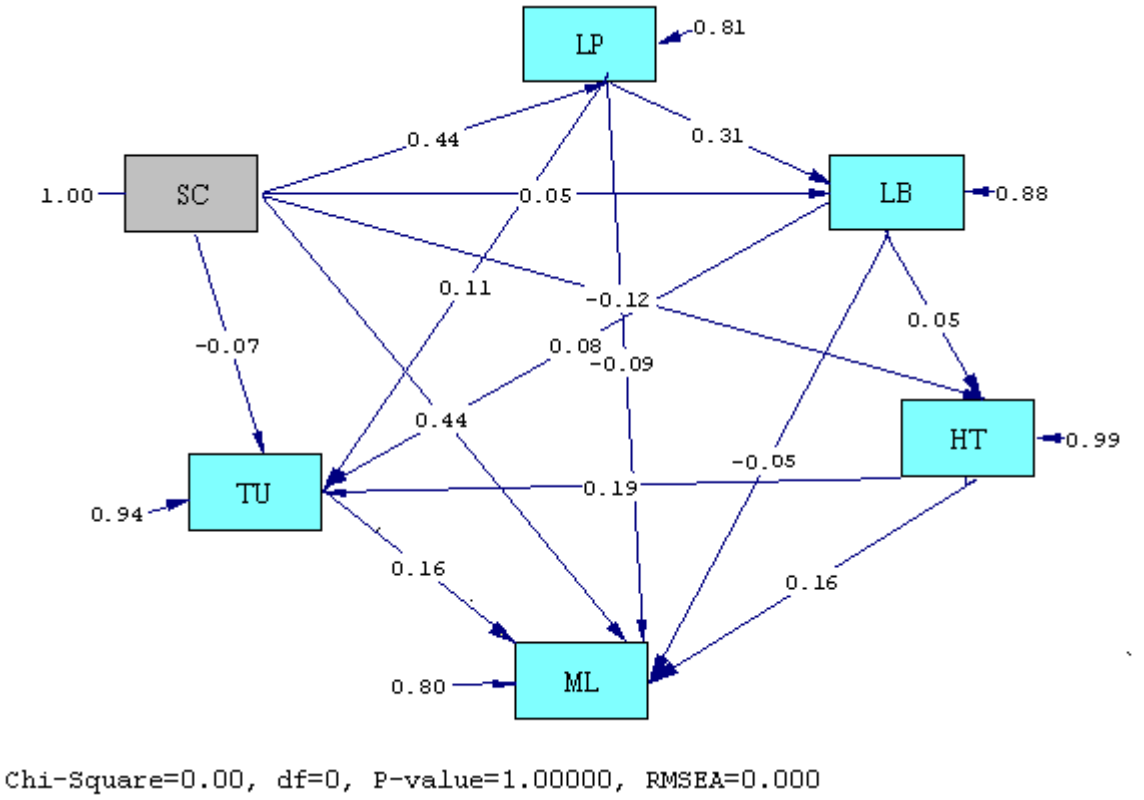
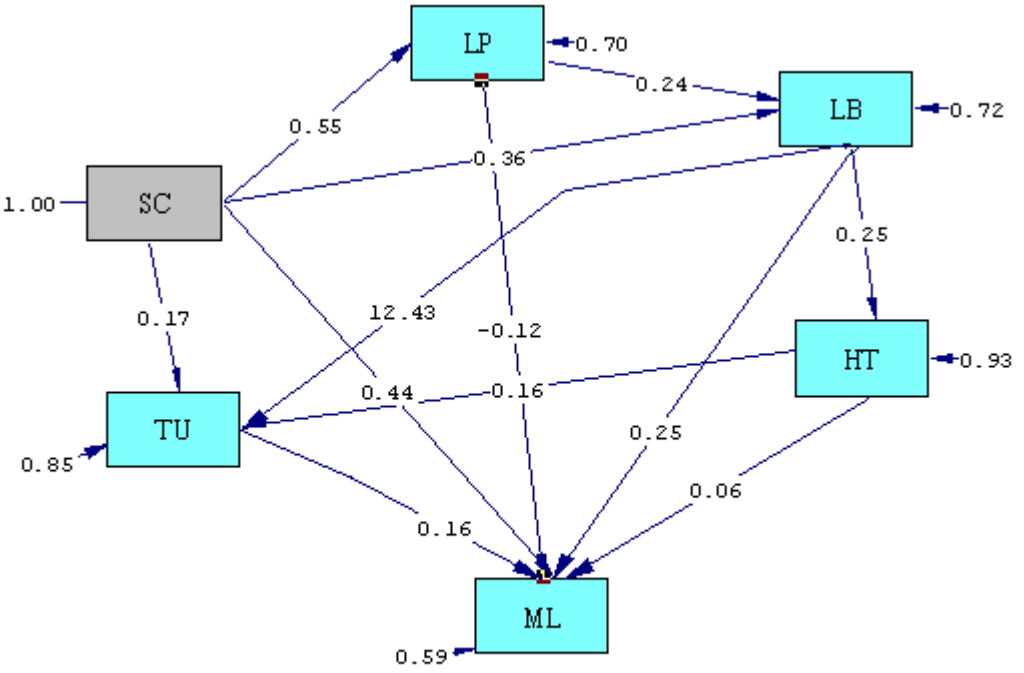


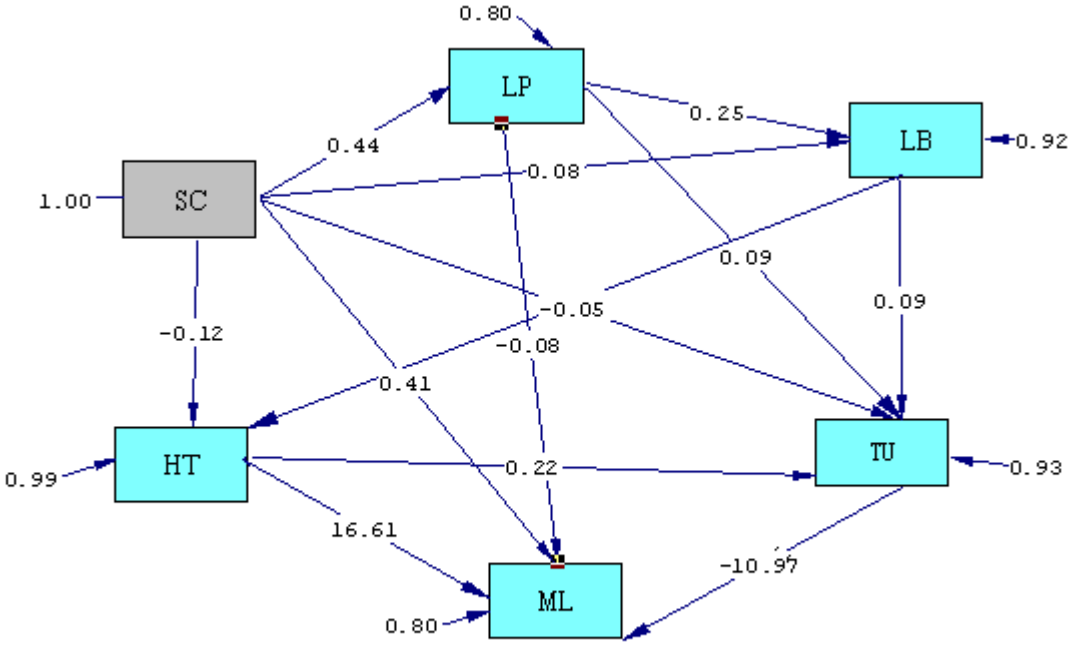
Figure2 All students' mathematics literacy structure model in United States



Chi-Square=0.00, df=0, P-value=1.00000, RMSEA=0.000

Figure3 All students' mathematics literacy structure model in Taiwan

4.2 Female students' mathematics literacy structure model



Chi-Square=0.00, df=0, P-value=1.00000, RMSEA=0.000

Figure4 Female students' mathematics literacy structure model in United States

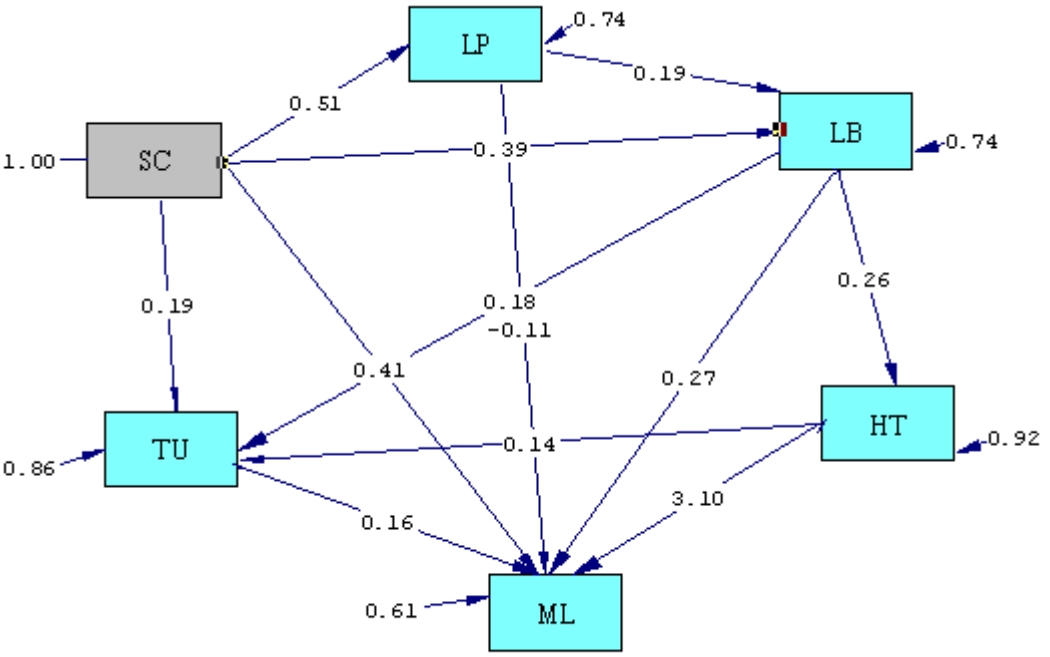


Figure5 Female students' mathematics literacy structure model in Taiwan

4.3 Male students' mathematics literacy structure model

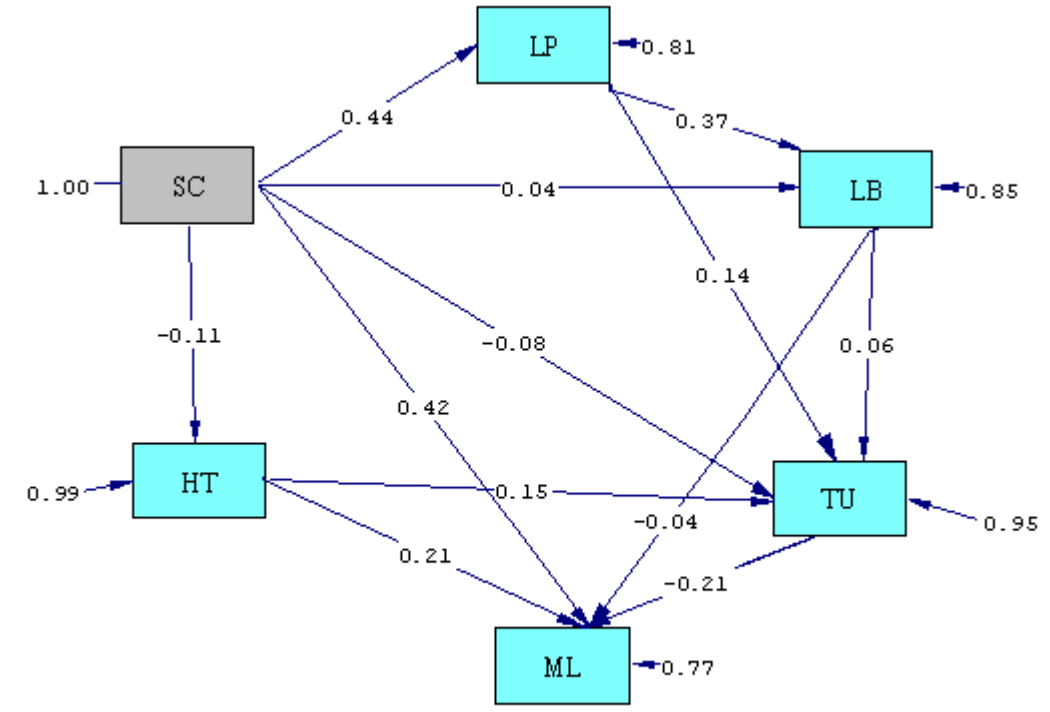


Figure6 Male students' mathematics literacy structure model in United States

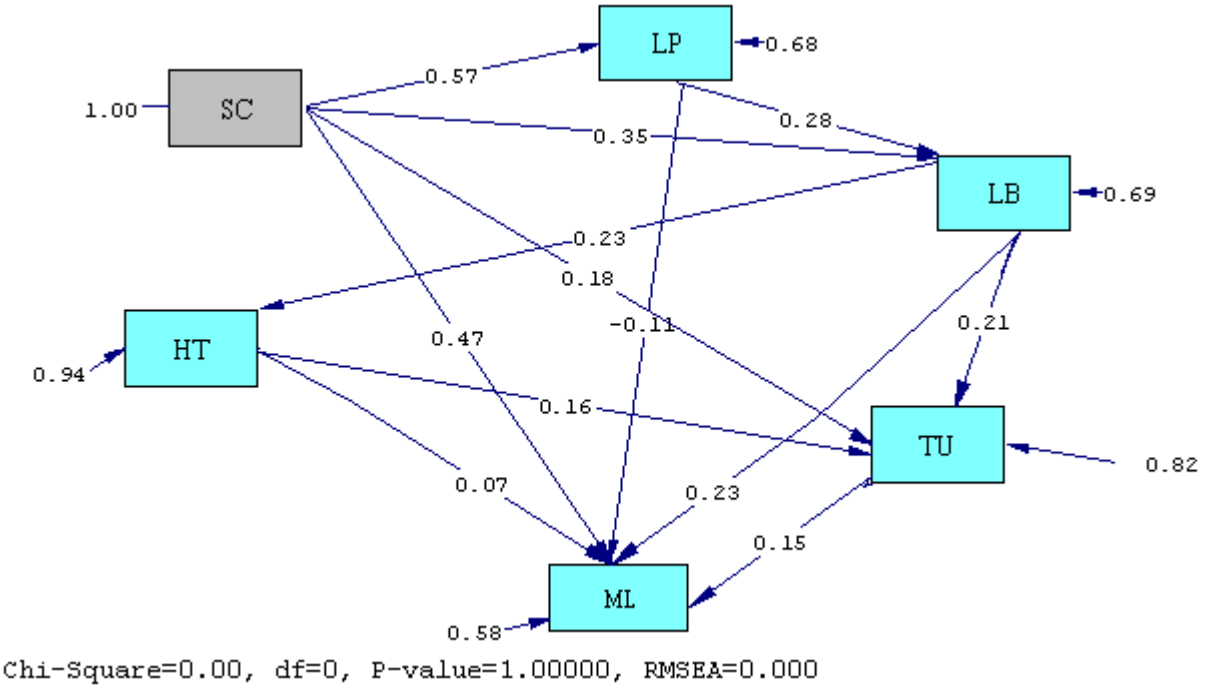


Figure7 Male students' mathematics literacy structure model in Taiwan

It is a worldwide value to reinforce gender equality, and male and female students should also be treated with justice. Researcher hope the implication of the findings may benefit Taiwanese secondary students' mathematics learning and assists parents or caretakers, secondary school tutors and mathematics teachers to promote students' self learning capability, and cheer female students on when they are about to give up in mathematics learning especially.

5. Conclusions

Based on the findings of this research, it shows that Taiwan students have the same grade with United States. Even the grades are not significant difference, but Taiwan's students' self confidence could explain more in learning purposes and learning behaviors, and especially for Taiwan female students.

Finally, the results will explain the gender differences in performing the mathematics literacy in their self confidence and anticipation, and some suggestions for educational policy making and decision will be proposal based on these results. It is a worldwide value to reinforce gender equality, and male and female students should also be treated with justice. Researcher hope the implication of the findings may benefit Taiwanese secondary students' scientific literacy and assists parents or caretakers, secondary school tutor and scientific teachers to promote students' self learning capability, and cheer female students on when they are about to give up in mathematics learning especially. The implication of the findings may promote students' lifelong learning capability and benefit Taiwan

youngsters, parents, teachers, and principals. Furthermore, school teachers should re-check the items to see if it is suitable for the students' learning and ability level. Hopefully, this could promote high quality tests for students, and then this could help teachers diagnose the teaching and learning problem effectively.

References: