Finding the answer behind Indonesian Student's High Level of Confidence Level in Mathematics

[Student Name Removed]

ORLA 6641.001 Adv Topics in Research Methods and Design

Teachers College

[Date]

Abstract: This secondary analysis research aimed at examining the effects of students' characteristics such as gender and socio-economics status, their achievement and their level of engagement in mathematics; classroom' characteristics such as location, class size, teacher's gender and teacher's years of experience can affect his/her students' confidence level in mathematics. The dataset is used for this analysis was taken from TIMSS 2011, which contained in the total of 5,828 8th grade students across 149 schools in Indonesia. The results show that, on average Indonesian student's confidence level in mathematics is quite high. This confidence level is most affected by the gender of the student, the student's socio-economic background, their engagement in mathematics, the class size and also their classmate's socioeconomic status. Student's achievement also has a small, significant effect on confidence level of student in mathematics.

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Introduction

Self-perception in mathematics is the perception of a student about his or her level of mathematics skill, or how confident they are in solving and tackling math problem. A good number of researches in the literature have shown a tight relationship between self-perception in mathematics and math performance and achievement (Marsh, 1990; Yoshino, 2012). In other words, students who believe that they are good at mathematics tend to excel in it. As educators, it's essential to know what factors would affect a student self-perception and more specifically, among those factors which are controlled by the student's characteristic and which are controlled by external factors, like the environment or interaction with others.

This paper examines the difference between students' confidence level in mathematics in Indonesia using TIMSS 2011 results. This study would allow educators to unpack the

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Indonesia's paradox and understand which factors contribute to the high level of confidence in mathematics of Indonesian students.

LITERATURE REVIEW

Richard J. Shavelson (1976) used in his study one of the first refined self-concept models based on the multidimensionality and hierarchical structure of self-concept. Before Shavelson, self-concept was treated as one dimension and not related to academic field. Herbert W. Marsh (1986) following the Shavelson's idea of complexity behind self-concept was the first to differentiate between external and internal comparison and used internal/external (I/E) to explain the phenomenon. External comparison is when the students think they are good at mathematics if their scores are higher than other students' scores. Internal comparison is when the students use their own mathematics score to access their academic abilities. Consequently, Marsh study found that across all age groups, females' academic self-concept was lower than males'. In his study, Marsh pointed out that the opinions of teachers and peers were unlikely to affect one's self-concept because the internal comparison is more influential than the feedback of others (Marsh, 1986). Though, one of his findings was that if one attends a school where the average students' achievement is high, they tend to devalue their achievement. In contrast to Marsh's study, Byrne and Gavin's study finding was academic achievement can raise general self-concept and this structure deteriorates as the child get older. They also found a "reciprocal relationship" between academic self-concept and achievement, Marsh's study and Byrne and Gavin's study both recognized the internal and external comparisons and their effects, though they could not confirm their universality because they researches are not cross-national.

Even until this date, there have been very limited studies in HLM cross-country analysis regarding specifically to student's confidence in mathematics. The study by Marsh and Hau

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Since there is a lack in the literature regarding to Indonesia education, most of this literature reviews are based on researches in developed countries such as United States, Australia and taken for granted that there are potentially some crucial different between Indonesia education system and others. To address this issue, we need to conduct a HLM model taken variables at the country level. However, there have been very limited researches

(2004) is one of those few. Using fifteen-year-olds in 26 countries in PISA, they found the correlation between reading achievement and math self-concept are negatively correlated even though there is a strong correlation between math and verbal achievement. Marsh and Hau (2004) also confirmed the internal/external model that academic self-concept can be explained by internal (the student's characteristics) and external (the environment), by other words, self-concept is "multidimensional." However, the limitation of their research is its generalization which comes from the fact that there only three countries out of 26 countries were non-western countries. In 2008, using TIMSS 2003 dataset, Chiu (2008) also focused on the multidimensional aspect of self-concept in math and science and its effect on students' academic achievement. He used structural equation modelling (SEM) to conduct multilevel analyses. Consequently, Chiu's finding support of Marsh's I/E model and suggests that there are strong correlations between mathematics and science achievement.

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Self-perception in mathematics is the perception of a student about his or her level of mathematics skill, or how confident they are in solving and tackling math problem. The existing studies by the aforementioned researchers demonstrated the correlation between academic self-concept and achievement. A good number of researches in the literature have shown a tight relationship between self-perception in mathematics and math performance and achievement (Marsh, 1990; Yoshino, 2012). In other words, students who believe that they are good at mathematics tend to excel in it. As educators, it's essential to know what factors would affect a student self-perception and more specifically, among those factors which are controlled by the student's characteristic and which are controlled by external factors, like the environment or interaction with others.

In this study, I want to further examine which are the strongest predictors of students' in mathematics self-concept, how those factors can vary between countries. Since most of the literature has been done in United States and other western countries, this study especially focuses on an eastern country, Indonesia. The reason behind choosing Indonesia is because even though Indonesia was in the bottom 5 in terms of both 8th grade achievements in mathematics 4th grade in Reading, the attitude toward learning those subjects, the confidence level, and the enjoyment of being in school are among the top countries that participated in TIMSS and PIRLS, 2011.

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The first predictor that greatly influences a student perception in mathematics in the western literature is gender. Many researches have produced statistical evidences of higher self-perception in math in male student than their female counterparts (Brown and Josephs, 1999; Randhawa et al., 1993). The literature suggested that even though gender may not be the source of self-perception, the end result of female being suffered from disadvantage in math self-efficacy (and therefore math performance) should be carefully considered by educators and policy makers. In addition, many other factors are based on gender as input for their outcomes such as social-expectation from their parent (Bleekr and Jacob, 2004). Ma and Kishor research in 1997, in contrast, concluded that gender differences did not influence the relationship between mathematics achievement and mathematics self-concept, the perception of family support and the perception of mathematics as a male domain. They pointed out that there were age differences, and the time spent at junior high school was particularly important for the relationship between self-concept and achievement. In addition, the study by Kurtz-Coste et al. showed the favored group (boys) is significantly impacted by parent stereotype than the less favored group (girls). Other than parents, the next important figure who influences student's

confidence is teacher. Teachers tend to give more attentions and open encouragement to male students (Einarsson and Granstrom, 2002).

In the literature, the most frequently mentioned aspect that affects self-efficacy and student's confidence in external dimension is location of the school. Two-way ANOVA was conducted on a research that shows a higher level of self-efficacy on urban children than rural children in Basak & Ghosh (2014). Jesse L. M. Wilkins' (2004) study also differentiated self-concept by the individual and by geographic region. He found that countries which showed markedly higher self-concepts had lower achievement and vice versa. Wilkins pointed out that Asian and East European students tended to have a lower self-concept than students in Middle Eastern, Western European, North and South American and Australasian countries. Wilkins's findings showed that mathematics and science self-concepts were embedded in culture, and academic achievement was not necessarily associated with the level of self-concept. This study in addition, also takes the average classroom achievement and social-economic background following Marsh study in 1986.

Research Questions

(1) To what extentt dostudents' characteristics such as gender and socio-economics status, their achievements, their level of engagement in mathematics, their perception about their teacher's expectation to do well in mathematics is associated with confidence level in Mathematics.

(2) To what extent schoolare characteristics such as location, class size, teacher's gender and teacher's years of experience associatedassociated with student confidence level in

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METHODS

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Comment [AJB5]: There are multiple English phrasing problems throughout the paper such as this. Please make sure to use a grammar checker as well as other writing resources to ensure that there are no grammar issues with all future submissions for the course.

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In the last decades, multilevel modelling (HLM) has become a popular ways to analyze data. It is often used to avoid inappropriate conclusions from the regular OLS regression with unadjusted standard errors when analyzing nested data because HLM accounts for statistical dependency by assigning each level its own statistical model that included intercept, regression coefficients and error terms (O'Dwyer and Parker, C. E, 2014). In particular, this study looks at the effects of both students' characteristics and al...

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Mathematics

METHODS

Data

First administered in 1995, the Trends in International Mathematics and Science Study (TIMSS) is an international assessment of the mathematics and science knowledge of 4th and 8th grader students around the world. International Association for the Evaluation of Education Achievement (IEA), the conductor of the study is an independent international cooperative of research centers with headquarters in Amsterdam. Its mission is the "conduct of comparative studies focusing on educational policies and practices in order to enhance learning with and across systems of educations. TIMSS 2011 is the fifth in IEA's series of international assessments of student achievement dedicated to improving teaching and learning in mathematics and science, which over 60 countries participated in. Similar to other edition of TIMSS, it consists of an assessment of mathematics and science, as well as student, teacher, and school questionnaires (Foy, P., & Olson, J. F., 2013).

The dataset given by TIMSS 2011 was useful in examination of the research questions because the dataset were collected internationally from a large sampling population and publically available. Second, with all 60 countries participated, TIMSS designed a two-stage stratified probability sampling to select schools and students, and the process of random sampling were carefully conducted in each country (Wilkins, 2004). Thus, TIMSS data is a

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(1) Student-Level (Level 1) : Yij (Individual Student's

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Comment [AJB7]: Which is it? Classroom or school? Level 2 is not clear. Please be very specific in stating what the dependent variable is, what is at each level and what are the variables of interest.

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Deleted: (2) . Classroom/School-Level (Level 2): β0j (Classroom's mean Mathematics Confidence) = γ00 + γ01(Gender of the teacher) + γ02 (Teachers' year of experience) + γ03 (Class size) + γ04 (Location) + γ05 (Classroom's SES (average amount of books per classroom) + u0j (Variations in Classroom's Confidence in Mathematics) ¶

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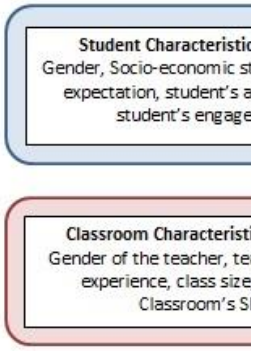

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nested dataset that can be used for HLM research method in this paper (Heck, Thomas and Tabata, 2013). However, please keep in mind that TIMSS included only one classroom per school, thus the school-level that this paper can be interpreted as classroom-level. Last but not least, TIMSS 2011 asked the students, teachers and the school principal questions that strongly related to this study, thus the dataset contained the appropriate set of variables.

The original dataset for this study consists of 5,828 8th grade students in 149 schools within Indonesia. This original dataset is the result after the merge between TIMSS student's background dataset for 8th grader and the school's background dataset and the teacher's background dataset for Indonesia. All the omitted and invalid as well as system-missing was then carefully recoded. After running the listwise deletion method using SPSS 22, the final dataset used for analysis consists of 5,484 students, which is about 94% of the original dataset. According to Strayhorn, secondary analysis is often complicated based on the amount of missing data (Strayhorn, 2009). Since the missing cases for each variable is far less than 5% and the total of missing cases in the whole dataset is only 6%, listwise deletion method would not be a problem for this study (Roth, 1994).

Instruments

The dependent variable for this study is the variable BSBGSCM (Student's confidence with mathematics) from TIMSS 2011 dataset. This variable is the scale combinations of multiple variables related to student level of confidence in mathematic using Rasch Modelling method (Foy and Olson, 2013). The higher the score the more confident each student feels toward Mathematics (M=9.56, SD=1.01). Since the variable is not normality distributed, I have tried to transform the variable by multiple techniques such as logarithm, square root and inverse but all

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Comment [AJB12]: Please make sure to follow the format in the examples provided for the class. Please list the dataset variable labels for each variable.

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Comment [AJB14]: How you have this table formatted is confusing, as (200+books) is on the same line as Teacher here. Where does it belong?

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Comment [AJB19]: Level 2 is not clear at all. Is it classroom or school?

Comment [AJB20]: Is this grand mean centered below?

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Table 1. Description of Variables (N= 5,485)¶
Variable Name
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of those techniques either did not change the skewness-level or made it even worse, thus I decide to keep the variable as it is originally from TIMSS.

For level-1 variables, the first independent variable as suggested by the literature review was the student's achievement in TIMSS 2011. According to TIMSS 2011 User Guide and previous studies, the best way to measure students' achievement is the first plausible value, BSMMAT01 (Foy and Olson, 2008; Yoshino, 2012). The scale of plausible value for TIMSS was 0-1000. Indonesia ranked in the lowest quadrant among all the country participated in TIMSS in 2011. , this this particular dataset, the range is around 99 points to 690 points, with mean equals to 401.82 points and standard deviation is 82.63 points, which is around 100 points lower than the average.

Gender variable, ITSEX was recoded so that female students are represented as 1 and male are represented 0. There are 51% of students in the dataset is female (SD=0.50). The socio-economics background of each student is multidimensional. It can consist of parents' education, occupation, income and home possessions (Yang, 2003). However, as previous literature suggested, number of books at home was used in this study as the proxy for the student's socio-economics background since they are highly correlated with the student's socio-economic background (Yoshino, 2012). Note that the number of books does not increase equally as the code increases in TIMSS. As stated in table 1 above, for example, a student who had up to 10 books was coded as 0, a student who had 11-25 books was coded as 1, and the student who had 26-100 books was coded as 2. However, the larger the numeric number can indicate that a student had more books in his or her home. Similarly, the student was also asked if he or she thinks his or her teacher expected that they will do well in Mathematics. This variable was recoded so that 0 means the strongly disagree with the statement (which means, the student

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doesn't think his/her teachers expected them to do well in mathematics) and 3 if they strongly agree. Students' achievement in mathematics was taken directly from the first plausible value in TIMSS dataset (BSMMAT01). This variable is continuous and will be grand-centered in the model. Last but not least, the engagement level variable, similar to the confidence level in math is a scale generated by TIMSS using 7 variables related to student's engagement level, like how much the student spends time doing homework per day.

For level-2 variables, similar to student's gender, the mathematics teacher's gender was recoded so that 0 represents male teacher and 1 represents female teacher. Overall, 57% of the all math teachers in this dataset are female. TIMSS dataset also contains a categorical variable, where the teachers reported how many years of teaching experience they have had. This variable is recoded so that 0 represents that the teacher taught less than 5 years and 3 represents that they have been teaching more than 20 years. The class size is also recorded in TIMSS and was used as one of the independent variable for level 2 as suggested by the literature. On average, there are also 37 students in one classroom, the biggest classroom is 67 and the smallest classroom was 6. This variable was later grand mean-centered. In addition, the location of the schools was recoded as dummies variables since there is no linear correlation between them. The suburban was used as the control (reference) group to compare with other locations. Finally, the average number of books at home for each class room was computed as the proxy for the average SES in each classroom. This variable, similar to the classroom size, once again can be used as school-level variable because TIMSS only include one classroom per school. All other independent variables in both level were not severely skewed, therefore transformation is not necessary.

The description of all the dependent and independent variables for both level of analysis is recorded in the table 1 below.

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Table 1. Description of Variables (N= 5,485)

Variable Name	Variable Labels	Definition and metrics	Mean	Std. Dev	Min	Max
Dependent Variable						
Confidence Level in Mathematics	BSBGSCM	Taking the "student's confidence with mathematics" variable from TIMSS 2011.	7.16	1.01	3.18	15.82
Level-1 Independent Variables						
Student's Gender (Female)	ITSEX	Male =0, Female =1	0.51	0.5	0	1
Students' home literature	BSBG04	Substitute measure of Social-Economic class (SES). Students were asked about the amount of books they have at home, with the following categories: 0= having none or fewer than a bookshelf (0-10 books) 1= having one bookshelf (11-25 books) 2= having one bookcase (26-100 books) 3= having two bookcases (101-200 books) 4= having three or more bookcases (200+books)	2.03	0.81	0	4
Teacher Expectation	BSBM15A	The student was asked to agree or disagree with the following statement " Teacher expects me to do well in Mathematics": 0=Disagree a lot 1=Disagree a little 2=Agree a little 3=Agree a lot	2.16	0.57	0	3
Student's achievement in Mathematics	BSMMAT01	Taking the first plausible value for mathematics achievement from TIMSS 2011. This variable will be grand mean centered.	401.82	82.63	99.31	689.64
Student's engagement in mathematics	BSBGEML	Scale of engagement with science lesson based on 7 items, taken from TIMSS 2011. This variable will be grand mean centered.	9.94	1.19	3.27	14.34
Level-2 Independent						

Variables						
Teacher's Gender (Female)	BTBG02	Male=0, Female=1	0.57	0.5	0	1
Teacher's years of experience	BTDG01	The teachers were asked to report how many years they have been working as teacher: 0= Less than 5 years 1= At least 5 but less than 10 2=At least 10 but less than 20 3=20 years or more	1.77	0.06	0	3
Class size[(1)]	BTBG12	The teachers were asked to report their class size. This variable will be grand-centered.	36.89	7.38	6	67
Location	BCBG05B	The location of the school (dummies): 1= Urban 2= Suburban (reference group) 3= Medium size city 4= Small town 5= Remote Rural	0.07 0.56 0.12 0.21 0.04	0.26 0.5 0.32 0.4 0.19	0 0 0 0 0	1 1 1 1 1
Classroom's average achievement[(1)]	Generated variable.	The average of math achievement in each class room.	402.83	54.74	285.99	581.61

Note: [(1)] In TIMSS 2011, each school only included one classroom with all the students in that classroom. Hence, classroom-level here can be referred to school-level (TIMSS User Guide, 2011).

Conceptual Framework and Methodology

In the last decades, multilevel modelling (HLM) has become a popular way to analyze data. It is often used to avoid inappropriate conclusions from the regular OLS regression with unadjusted standard errors when analyzing nested data because HLM accounts for statistical dependency by assigning each level its own statistical model that included intercept, regression coefficients and error terms (O'Dwyer and Parker, 2014). In particular, this study looks at the effects of both students' characteristics and also the classroom' characteristics after controlling for student-level factors, thus, an appropriate procedure for doing this analysis is the hierarchical linear model or HLM (Mertler and Vannatta, 2012; Heck, Thomas and Tabata, 2013).

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The equation for each level of analysis is listed below:

(1) Student-Level (Level-1)

$$Y_{ij} = B_{0j} + \beta_{1j} female_{ti} + \beta_{2j} books\ at\ home_{ti} + \beta_{3j} teacher's\ expectation_{ti} + \beta_{4j} student's\ achiement_{ti} + \beta_{5j} student's\ engagement_{ti} + \varepsilon_{ji}$$

(2) Classroom Level (Level 2):

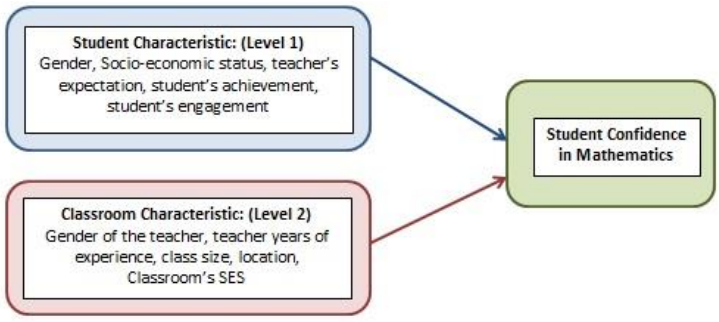
$$\beta_{0j} = \gamma_{00} + \gamma_{01} teacher\_female_j + \gamma_{02} teacher's\ years\ of\ experience_{\ j} + \gamma_{03} class\ size_j + \gamma_{04} location_j + \gamma_{05} average\ classroom\_achievement_j + u_{0j} + \varepsilon_{ij}$$

Where ε_{ji} is the variations in Students' confidence in mathematics (the overall error term), u_{0j} is the variations in school's confidence in mathematics, β_{0j} is the school's mean of mathematics confidence and Y_{ij} is the student's mathematics confidence.

The standardized coefficients are also calculated in this model following the formula by Hox (2010).

$$standardized\ coefficient = \frac{unstandardized\ coefficient\ *\ stand.dev.explanatory\ var.}{stand.dev.outcome\ var.}$$

Figure 1: Conceptual Framework Model.



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RESULTS

Three models were used to analyze the data, following Heck, Thomas and Tabata's three steps in developing multilevel model (Heck et al, 2009). The first, model A is the null model with no predictors model was included to partition the variance in the outcome into its within and between-groups components. This helps to understand how much of the variance in student's confidence in mathematics lies between the schools in the sample. Model B is the Level 1 model which analyzing data using the within-group equation and finally model C was introduced, which can be also called the between-groups intercept model.

The first model- the unconditional random effect or null model, using ML estimation gave the intercept of 9.61 for student's confidence level. This represents the average confidence level of math for all classrooms and all students. The Wald Z for classroom level in the null model was significant (Wald Z = 7.29, p <.001). In addition, the Intraclass Correlation Coefficient (ICC) was 0.16, which indicates that 16% of the total variance in Indonesia student's level of confidence in mathematics can be explained by variance between the classrooms. We expect this variance to be reduced by adding other level 1 and level 2 variables into the model, as introduced in model B, (Level-1 Variables) and model 3 (Level-2 Variables).

Model B, was introduced to answer research question 1 about the effect of students' characteristics to their science achievement. The result showed that if the student is male, have the average number of books at home, the average achievement in Mathematics, the average level of engagement in math, strongly disagree that the teacher expected them to do well in math, then the student would be expected to have the level of confidence in mathematics as 9.89. If the student is male, we expect to see .11 point of confidence drop. For each increase level of books

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Comment [AJB28]: Excellent. Well stated.

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at home, the student is expected to be .02 points increased in their confidence. The same level of confidence, 0.02 increase for every increase of 100 points they achieve in TIMSS, this perhaps consistent with the paradox pattern that we have been seeing regarding to achievement and confidence level in Indonesia. This finding suggests that even though the achievement in TIMSS, perhaps in this case significantly contributes to the student's confidence level, however only by little.

In addition, for every increase level of engagement in mathematics, the student will increase their confidence level about .43 point. One surprising finding was that if the student thinks that the teacher expected them to do well in mathematics then they will actually be less confidence about mathematics. All of these findings are significant at p<.001 level.

Model C added all the level 2 variables to the model B. The intercept showed that if the student is male,has the average number of books at home, the average achievement in Mathematics, the average level of engagement in math, strongly disagree that the teacher expected them to do well in math, furthermore the student's classroom is located in suburban, his mathematics teacher is also male, have close to 0 year of teaching experience, and the class size is close to 0 and all other students in his class have 0 books at home, then the student would be expected to have the level of confidence in mathematics as 10.84.

The only two predictors in Level-2 that were significant at p<.05 level in this model were class size and the classroom socio-economic status, as measured by the average of number of books at home from all the students in the classroom, once again this is the. For each additional student in the classroom, the confidence level in mathematics of student drop .01 and for each additional 100 points increased in classroom average achievement, the confidence level drop .41 point. This could be indicating that students from more higher-achieved classroom, where they

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Comment [AJB31]: Please provide standardized regression coefficients along with the unstandardized, following the calculations from Hox provided in class.

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Table 2: HLM Table Result¶
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Also, please provide a note as to what the numbers in the ( ) are. Following APA format they should be standard errors.

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attend class with other higher-achievers thus less confident than who attends classroom where other students in the class have lower socio-economic background.

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In total in model C, all the level two variances explained 21% of the total variance in Level-1 and 40% of the total variance in Level 2. The Wald Z test suggests that even after controlling for all the student's level independent variables, a statistically significant amount of variation in outcomes still remains both within and between classrooms. This would suggest us to find other predictors within and between classrooms/schools that beyond what have been found in the literature. Also, in model C, the standardized coefficient as calculated by Hox (2010) suggested that the most effective predictor for student's self-confidence in mathematics at the student-level is how much they engaged with mathematics in the class and at home. In the school-level, classroom-level achievement has the same medium magnitude of effect, which is 0.22.

Table 2: HLM Table Result for Indonesia

	Model A	Model B		Model C	
Intercept	9.61***	9.89***		10.84***	
	(-.04)	(-.07)		(-.30)	
Level-1 Independent Variables		Unstandardized Coeff.	Standardized Coeff.	Unstandardized Coeff.	Standardized Coeff.
Female		-.11*** (-.03)	**-.05**	-.11*** (-.03)	**-.05**
Student's SES (grandcent_books)		.02*** (-.01)	**.02**	.02*** (-.01)	**.02**
Teacher's Expectation		.16*** (-.03)	**.09**	.16*** (-.03)	**.09**
TIMSS Achievement in Mathematics (per100pts)(grandcent_score)		.02*** (.00)	**.02**	.02*** (.00)	**.02**
Student's Engagement in Mathematics (grandcent_engage)		.43*** (-.13)	**.51**	.43*** (-.13)	**.51**

Level-2 Independent Variables				
Gender of Teacher			-.04 (-.05)	
Teacher's Years of Experience			-.05 (-.03)	
Class size (grandcent_class)			-.01* (.00)	**-.07**
Urban			.14 (-.12)	
Medium Size City			.01 (-.11)	
Small Town			.08 (-.08)	
Remote Areas			.17 (-.15)	
Classroom-achievement (per 100points) – grand_class_score			-.41*** (-.12)	**-.22**
Intraclass Correlation	.16	.14	.12	
% of Level-1 Variance explained by the Model		20.75%	20.71%	
% of Level-2 Variance explained by the Model		31.77%	40.18%	

Standard Error in parentheses.

Note: *** p<0.001 * p<0.05 .

DISCUSSION

The result supported the hypothesis that students' self-confidence, self-motivation, and cognition of mastering a subject is positively related to students' mathematics achievement. The finding supported Wilkins' (2004) study which found a positive association between students' mathematics self-concept and their achievement at the individual level. This internal effect is

however much smaller than the external effect when the student attends the classroom that has other higher-achiever students. The standardized coefficient for student's level in Indonesia is .02 but the standardized coefficient for the classroom's average achievement in school-level is -.22. This means that external factor in this case is a lot more effective than internal factor. A student in Indonesia will likely to have higher level of achievement in mathematics but will likely to be less confident if he or she attends a classroom that has other classmates who also good at mathematics. To further understand this pattern perhaps I have to look more into tracking-system in Indonesia education.

Other factors in the previous literature also hold true and significant in this study. Gender, socio-economic status, as measured by the number of books at home and students' perception about their teacher's expectation of doing well in math showed positive and significant result. However, the standardized coefficient is quite small for these variables. Overall, in Indonesia boys are more confident in mathematics than girls, the students from more affluent family are more confident in mathematics, and the higher the student's perception about their teacher's expectation, the more likely they are confident in mathematics.

However, there is a strong effect in Level-1 between students' level of engagement in Math and their confidence-level in mathematics. The affect is positive, high and significant across students in different gender, socio-economic status, across different type of school. The result means that the more engage the student with mathematics in classroom (as TIMSS measured by number of hours spending doing mathematics per week, the number of times student participated or asking questions about mathematics in class…), the more the students feel confident about their ability to learn math. The most important message to take out from this finding is factor predicting students' confidence is not defined only based on their achievement

and other classmates' achievement, but how much they think they engage in the classroom. While improving the students' achievement, or improving the students' confidence level is often considered intangible, improving the students' engagement level is something that achievable through better curriculum and better teaching approach.

At the school-level, the most frequently mentioned aspect that affects self-efficacy and student's confidence in external dimension is location of the school. But different from Basak & Ghosh (2014) study which was done in United States; I find no significant effect of school location in students' confidence level in Indonesia. However, the intermediate variable in Basak and Ghosh (2014), the classroom size was significant at $p<.05$. In particular, I find that as the class size get bigger, the student become less confident in mathematics.

LIMITATION

Multilevel modeling is an extension of multilevel regression; thus the assumptions underlying multiple regressions (e.g., normality of residuals, lack of multicollinearity, and outliners) are applied to multilevel modelling (Raudenbush & Bryk, 2002). For example, the correlation between level of engagement in mathematics and the teacher's expectation was larger than .5 and is significant. This could contribute to opposite effect for teacher's expectation that was seen in the result for model 2 (See Appendix). In addition, even if multicollinearity was not an issue in level-1 but instead is suspected in level-2 variable (since the correlation method cannot measure level-2 variables between schools).

Thought the purpose of this study is to find factors in individual-level and school-level that can explain variance in Indonesian student's confidence level in mathematics, the study does not seem to fulfill its own mission. Student-level variables included in this study mostly do not significantly affect the students' confident; furthermore there are still 60% of the between-school

Comment [AJB37]: Before limitations, please provide a discussion section. Please place the results and findings within the broader conversation in the literature on this topic, citing the literature and walking your reader through how to interpret these results.

These two books may help with the types of language and discussion I'm looking for:

Miller, J. E. (2013) The Chicago Guide to Writing about Multivariate Analysis, Second Edition. University Of Chicago Press: Chicago. http://www.amazon.com/Chicago-Writing-Multivariate-Analysis-Publishing/dp/0226527875

Hancock & Mueller (2010) The Reviewer's Guide to Quantitative Methods in the Social Sciences. http://www.amazon.com/Reviewers-Quantitative-Methods-Social-Sciences/dp/041596508X

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variances in classroom-level and 80% of student-level variance that have not been explained. It would be also very important to find and understand the standardized coefficient for each variable to find among all the predictors what can do the best job predicting student's confidence level in mathematics.

As with any modelling approach, cross-validation and replication are required. Further examination of affective and attitudinal factors with different measures and new sample of data is likely to provide better understanding of school learning, students' achievement and also student's level of confidence. As mention in the previous section, since there is a lack in literature about Indonesia education system, perhaps the predictors was not the most influential predictors in Indonesia education context. It would be also interesting to compare to other country datasets to see whether what have been suggested in American/western literature also can hold true in other education systems. In addition, by comparing and contrasting those different predictors between external (school's characteristics) and internal (student's characteristics) between the United States and Indonesia, this study not only examine to the multidimensional aspect of self-concept but also confirm the universal of Marsh theory.

Reference

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Foy, P., & Olson, J. F. (2013). TIMSS 2011 user guide for the international database. Chestnut Hill, MA: International Study Center, Boston College.

Comment [AJB38]: This is a very good start on the Midterm. However, there are multiple issues that I encourage you to address in a rewrite.
1) Please provide a more detailed literature review to justify the study following the structure of the example journal articles provided in class.
2) Please ensure that you are following APA 6th edition formatting and structuring throughout.
3) Please note the comments throughout the methods section. There are issues throughout that make it difficult to understand exactly what you're referring to.
4) Throughout, please make sure to refrain from using passive sentence construction. Feel free to use "I", and write all sentences from an active sentence construction stance, in which a human is taking action in just about every sentence.
5) There are multiple issues throughout the results that detract from the findings. Please see the comments throughout on this.
6) Please provide a detailed discussion as noted in the comments.
7) Please make sure to check for all grammar issues and correct them before any future submissions.

Currently this paper is a B- (80%). However, through a rewrite in which you substantively address each of the issues in the assignment, I believe that this paper could become an A, or an A+. Please return a rewrite by email anytime on or before April 20.

Comment [AJB39]: REVISION:

An excellent revision of the midterm. You have substantively addressed each issue in the assignment.

Final grade on Midterm: A+ (100%)

Comment [AJB40]: This is a reference section. Please see APA format.

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Hendy, H. M., Schorschinsky, N., & Wade, B. (2014). Measurement of math beliefs and their associations with math behaviors in college students. *Psychological Assessment, 26*(4), 1225-1234. doi: 10.1037/a0037688

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Yang, Y. (2003). Dimensions of socio-economic status and their relationship to mathematics and science achievement at individual and collective level. *Scandinavian Journal of Educational Research*, *47*(1), 22041

Wilkins, J. L. M. (2004). Mathematics and science self-concept: An international investigation. *The Journal of Experimental Education*, 72(4), 331–346.

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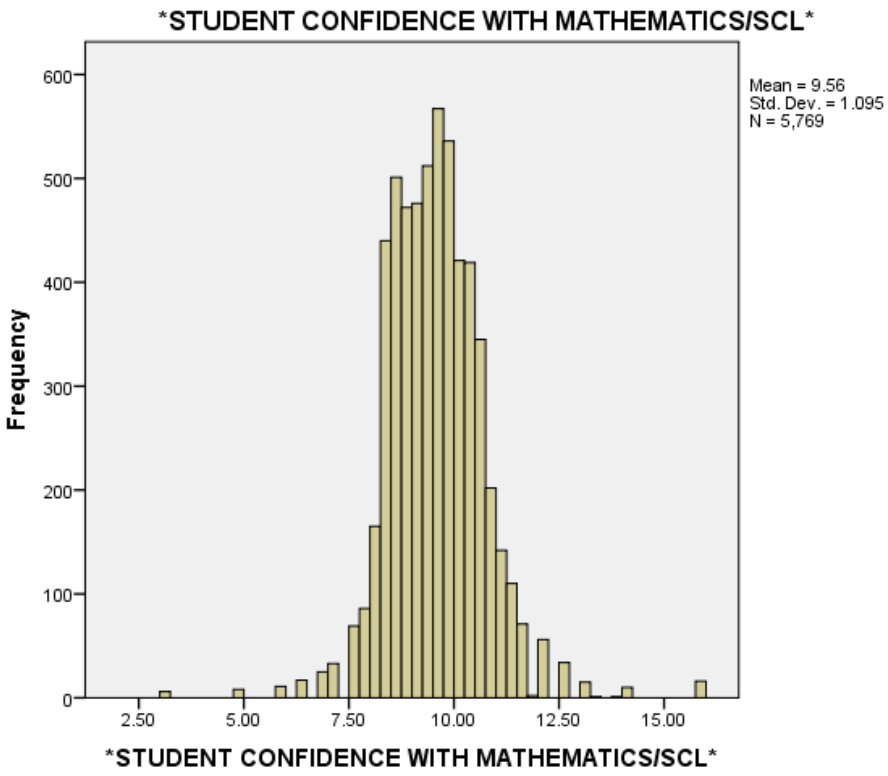
DESCRIPTIVE STATISTICS WITHOUT LISTWISE DELETION

Statistics

	STUDENT CONFIDENCE WITH MATHEMATICS/SCL	*SEX OF STUDENTS *	GEN\AMOUNT OF BOOKS IN YOUR HOME	MAT\AGREE\TEACHER EXPECTS TO DO	*1ST PLAUSIBLE VALUE MATHEMATICS *	*STUDENTS ENGAGED IN MATHEMATICS LESSONS/SCL *	GEN\SEX OF TEACHER	GEN\IMMEDIATE AREA OF SCHOOLLOCATION	GEN\NUMBER OF STUDENTS IN THE CLASS	school_books	*TEACHERS YEARS OF EXPERIENCE*
N Valid	5769	5828	5760	5760	5828	5761	5788	5788	5788	5828	5679
Missing	59	0	68	68	0	67	40	40	40	0	149
Mean	9.5608	.51	2.03	2.16	401.3503	9.9432	1.48	2.12	36.93	2.0329	2.77
Median	9.6194	1.00	2.00	2.00	400.0059	9.6346	1.00	1.00	37.00	2.0000	3.00
Skewness	.452	-.051	.840	-.294	-.050	1.230	5.712	.667	-.194	.241	-.364

Std. Error of Skewness	.032	.032	.032	.032	.032	.032	.032	.032	.032	.032	.032
Minimum	3.18	0	1	0	99.31	3.27	1	1	6	1.29	1
Maximum	15.82	1	5	3	689.64	14.34	9	5	67	2.70	4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200
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2.50
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7.50
10.00
12.50
15.00
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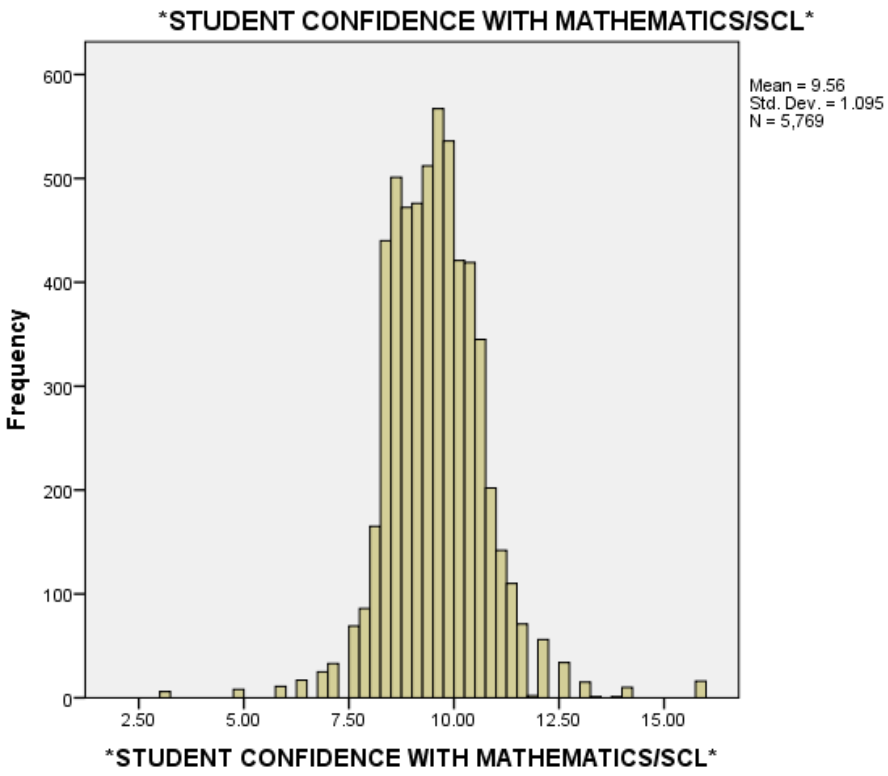
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Mean = 9.56
Std. Dev. = 1.095
N = 5,769
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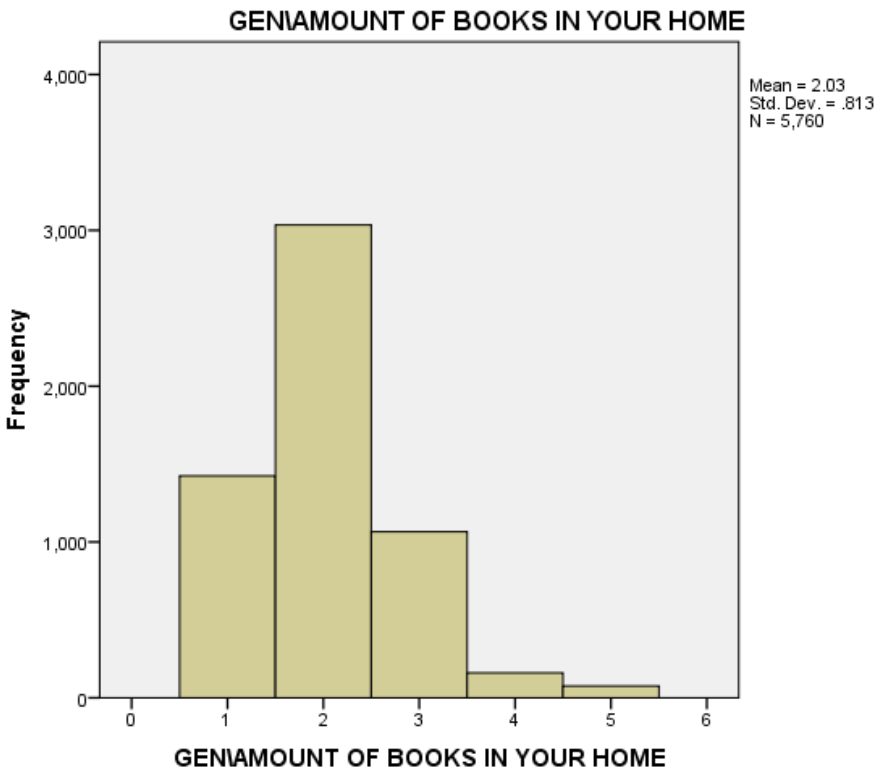
15.00
STUDENT CONFIDENCE WITH MATHEMATICS/SCL


GEN\AMOUNT OF BOOKS IN YOUR HOME
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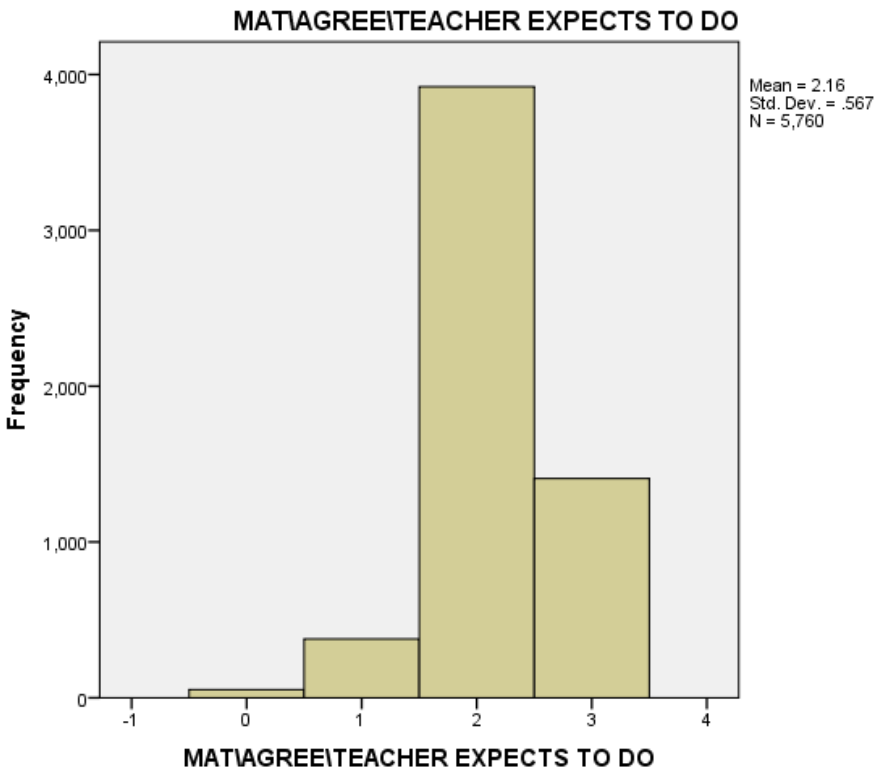
0
1
2
3
4
5
6
GEN\AMOUNT OF BOOKS IN YOUR HOME


MAT\AGREE\TEACHER EXPECTS TO DO
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N = 5,760
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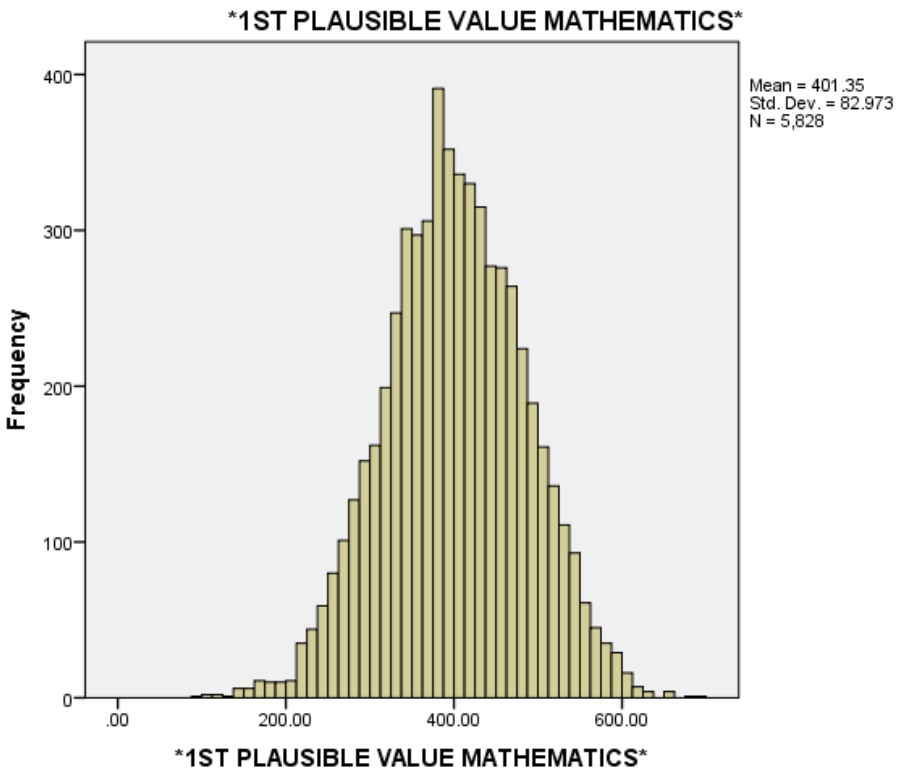
0
1
2
3
4
MAT\AGREE\TEACHER EXPECTS TO DO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Std. Dev. = 82.973
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100
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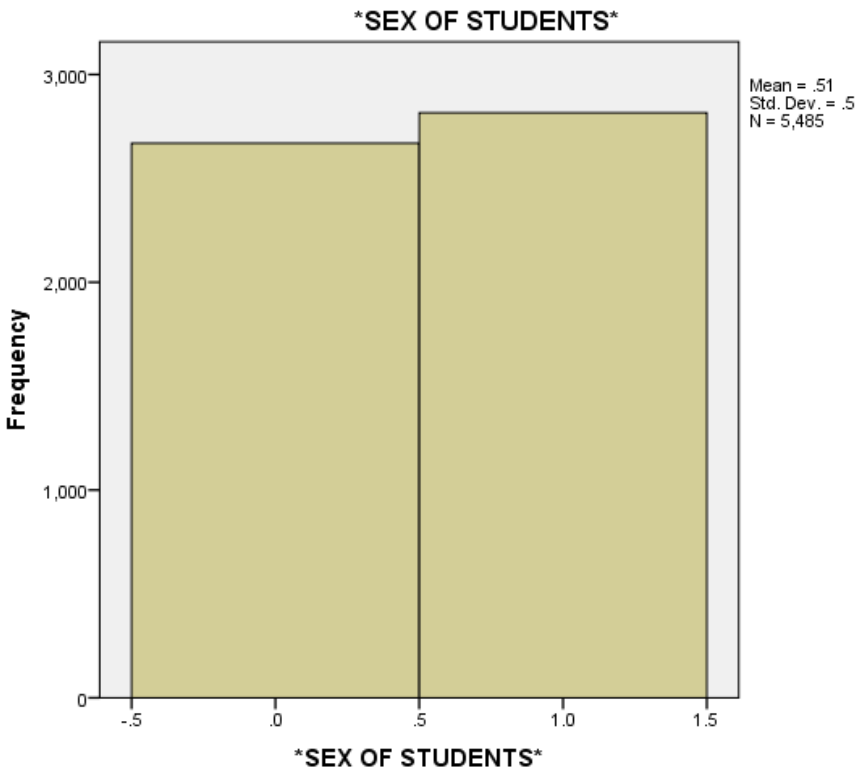
.00
200.00
400.00
600.00
1ST PLAUSIBLE VALUE MATHEMATICS


SEX OF STUDENTS
Mean = .51
Std. Dev. = .5
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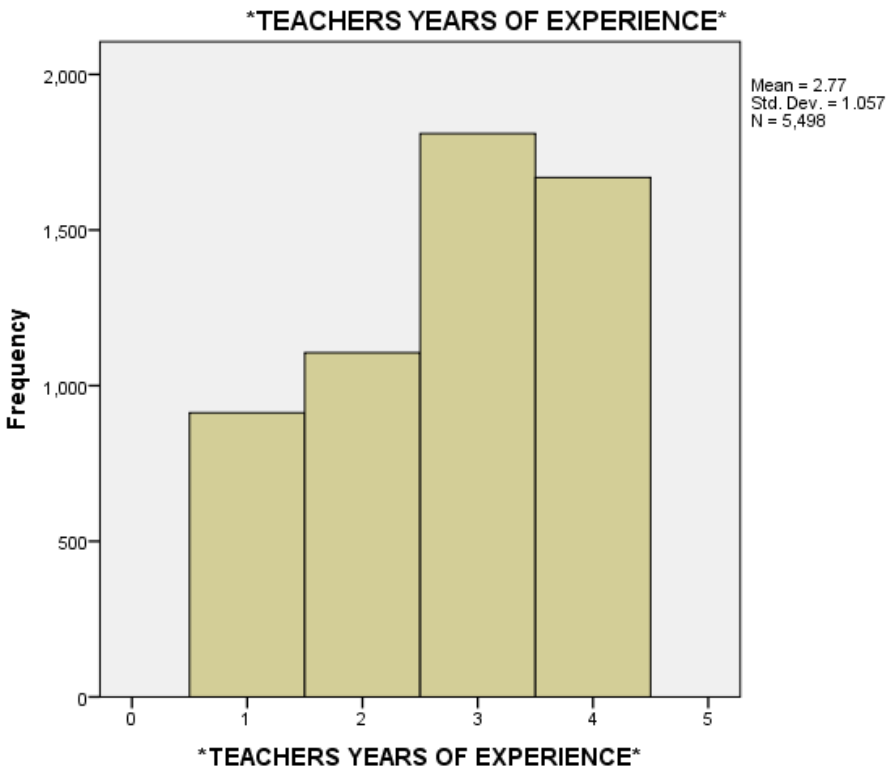
.0
.5
1.0
1.5
SEX OF STUDENTS


TEACHERS YEARS OF EXPERIENCE
Mean = 2.77
Std. Dev. = 1.057
N = 5,498
Frequency
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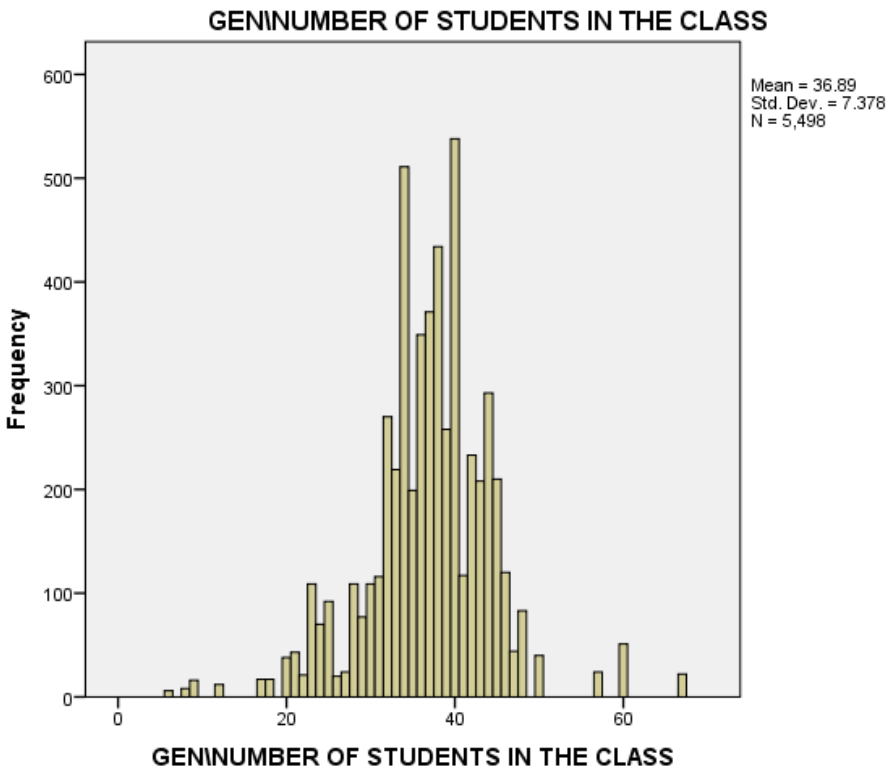
1,500
1,000
500
0
0
1
2
3
4
5
TEACHERS YEARS OF EXPERIENCE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300
200
100
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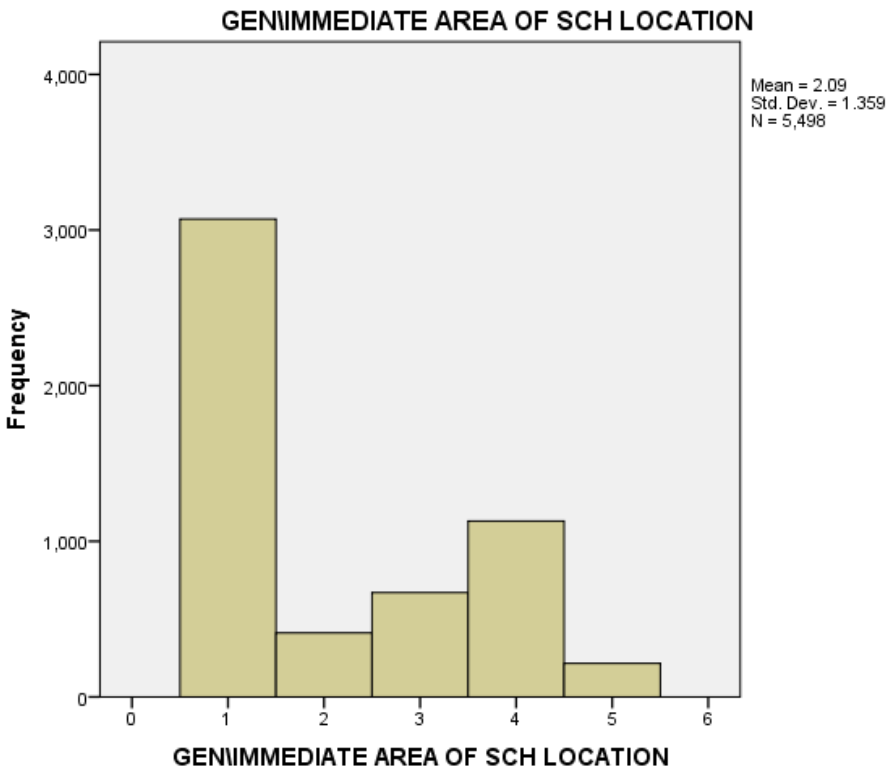
0
20
40
60
GEN\NUMBER OF STUDENTS IN THE CLASS


GEN\IMMEDIATE AREA OF SCH LOCATION
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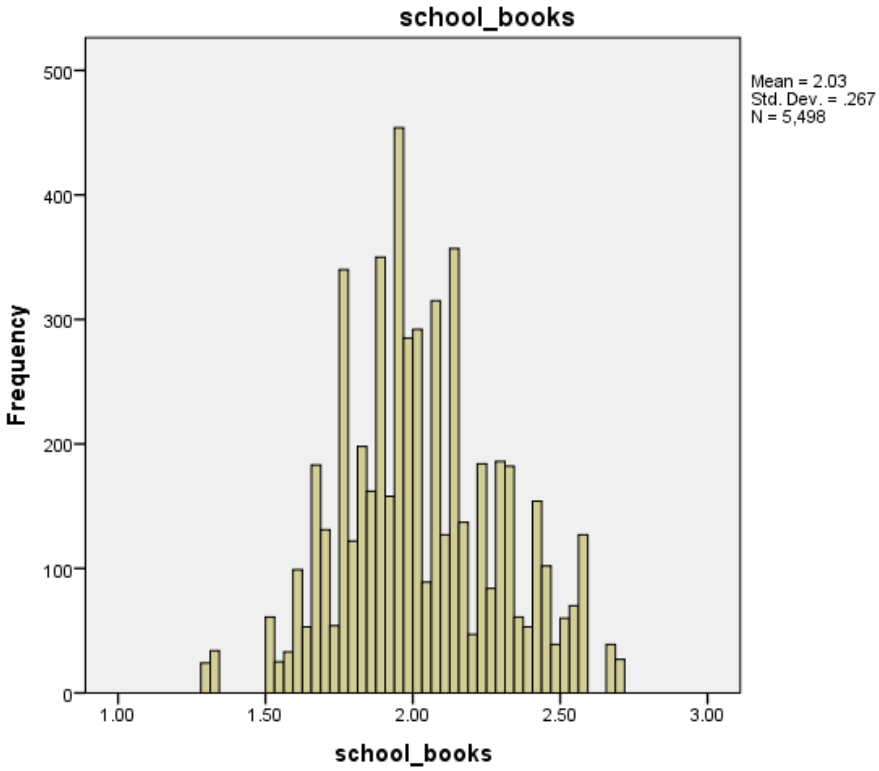
2
3
4
5
6
GEN\IMMEDIATE AREA OF SCH LOCATION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Std. Dev. = .267
N = 5,498
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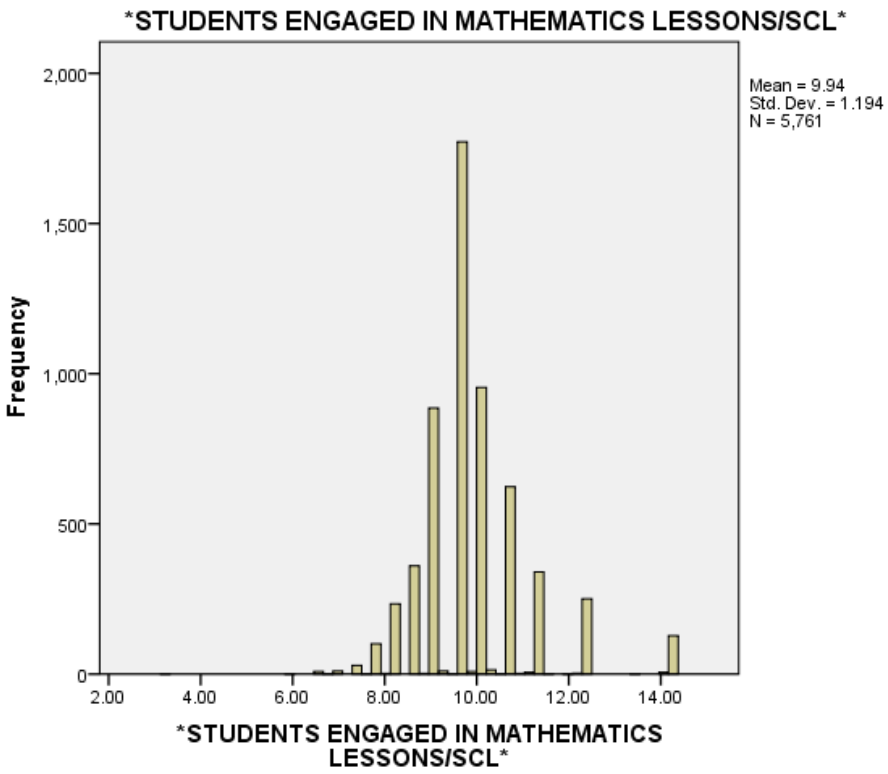
1.00
1.50
2.00
2.50
3.00
school_books

DESCRIPTIVE STATISTICS W/ LISTWISE DELETION

Statistics

		STUDENT CONFIDENCE WITH MATHEMATICS/SCL	*SEX OF STUDENTS*	GEN\AMOUNT OF BOOKS IN YOUR HOME	MAT\AGREE\TEACHER EXPECTS TO DO	*1ST PLAUSIBLE VALUE MATHEMATICS*	*STUDENTS ENGAGED IN MATHEMATICS LESSONS/SCL*	GEN\SEX OF TEACHER
N	Valid	5485	5485	5485	5485	5485	5485	5485
	Missing	0	0	0	0	0	0	0
Mean		9.5578	.51	2.03	2.16	402.8284	9.9414	.57
Std. Deviation		1.10107	.500	.811	.565	82.62516	1.19498	.496
Minimum		3.18	0	1	0	99.31	3.27	0
Maximum		15.82	1	5	3	689.64	14.34	1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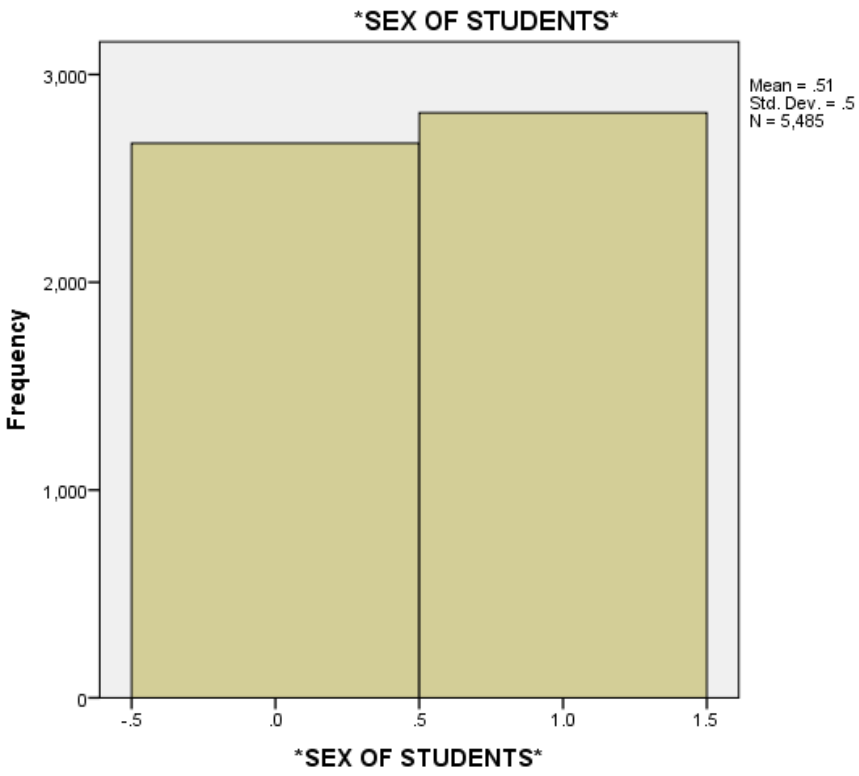
4.00
6.00
8.00
10.00
12.00
14.00
STUDENTS ENGAGED IN MATHEMATICS LESSONS/SCL


SEX OF STUDENTS
Mean = .51
Std. Dev. = .5
N = 5,485
Frequency
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1,000
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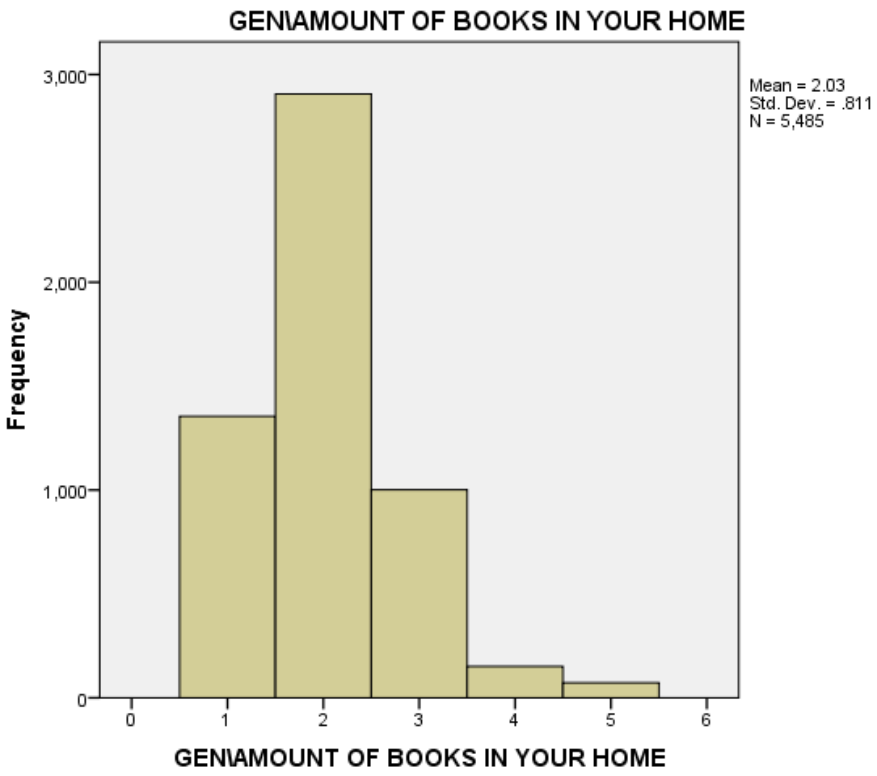
.0
.5
1.0
1.5
SEX OF STUDENTS


GEN\AMOUNT OF BOOKS IN YOUR HOME
Mean = 2.03
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N = 5,485
Frequency
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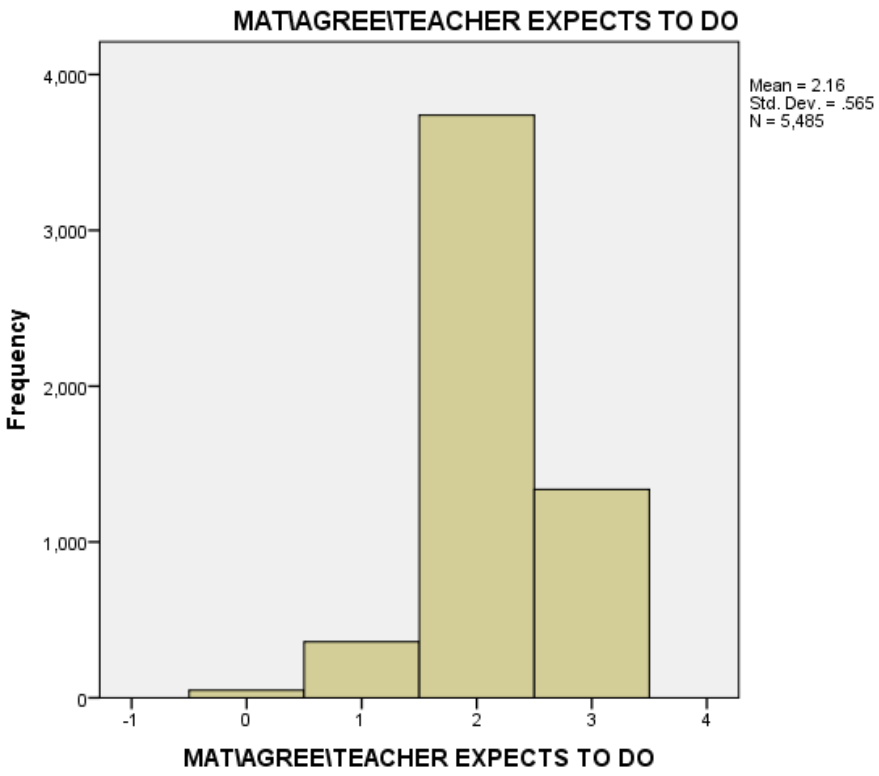
1
2
3
4
5
6
GEN\AMOUNT OF BOOKS IN YOUR HOME


MAT\AGREE\TEACHER EXPECTS TO DO
Mean = 2.16
Std. Dev. = .565
N = 5,485
Frequency
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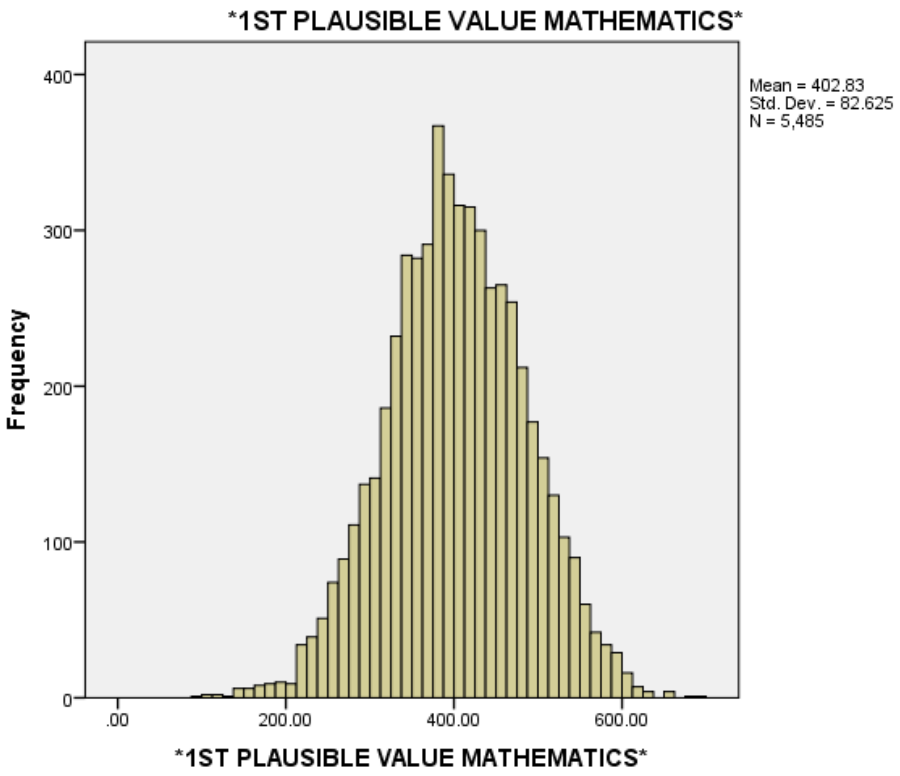
0
1
2
3
4
MAT\AGREE\TEACHER EXPECTS TO DO


1ST PLAUSIBLE VALUE MATHEMATICS
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Std. Dev. = 82.625
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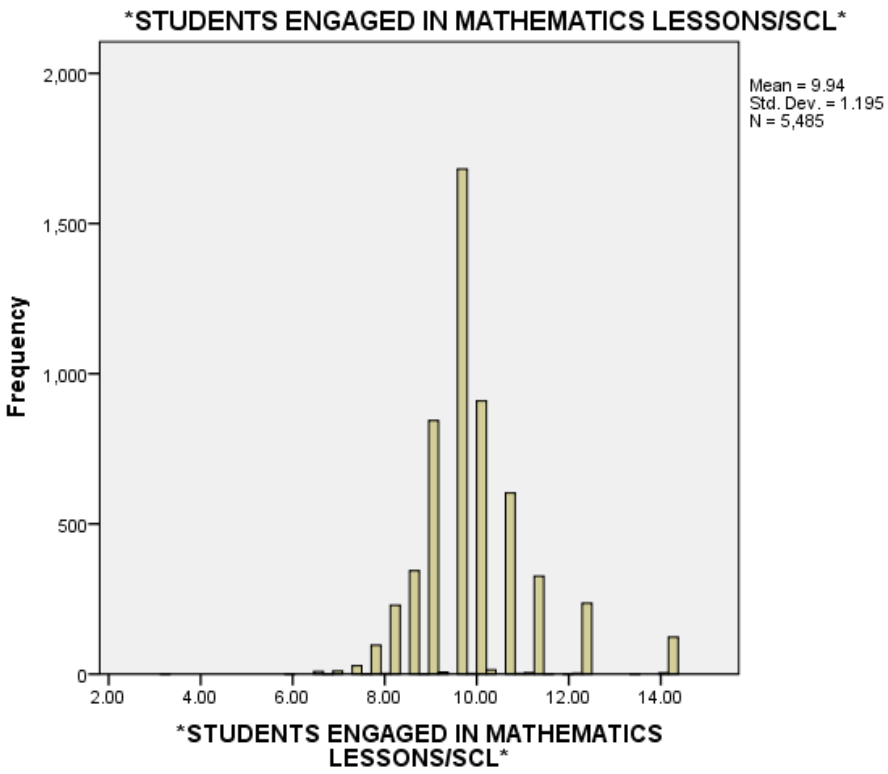
200.00
400.00
600.00
1ST PLAUSIBLE VALUE MATHEMATICS


STUDENTS ENGAGED IN MATHEMATICS LESSONS/SCL
Mean = 9.94
Std. Dev. = 1.195
N = 5,485
Frequency
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1,000
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4.00
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8.00
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12.00
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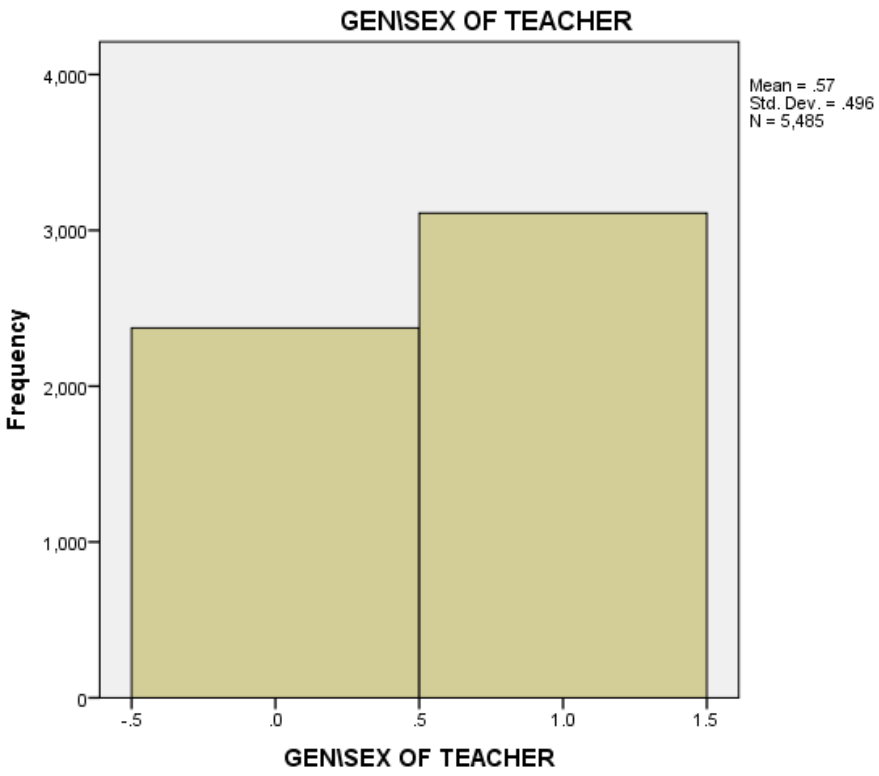
STUDENTS ENGAGED IN MATHEMATICS LESSONS/SCL


GEN\SEX OF TEACHER
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Std. Dev. = .496
N = 5,485
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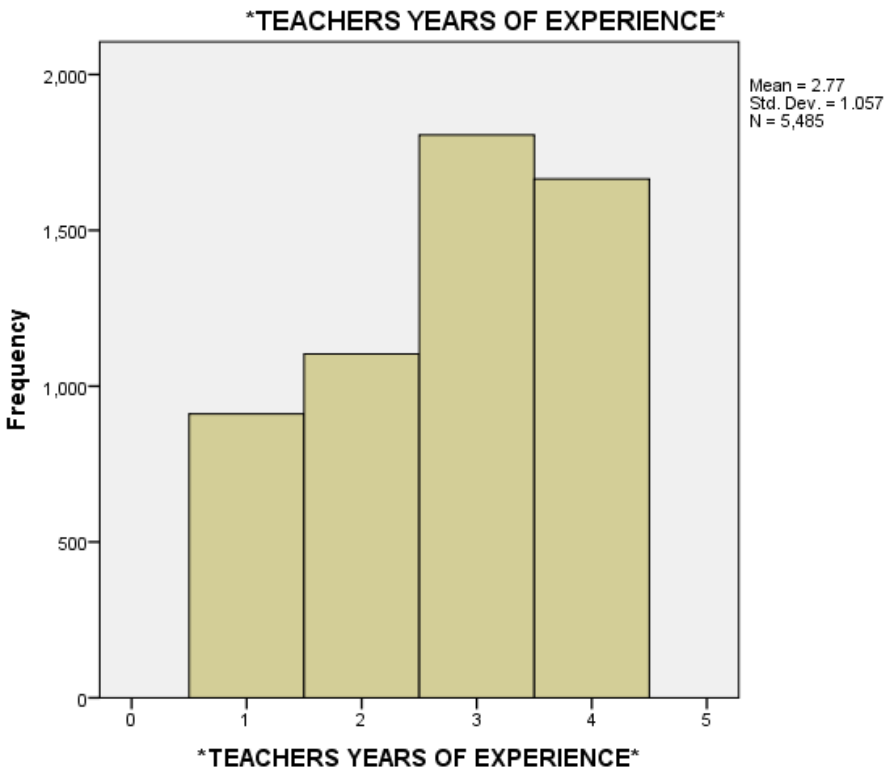
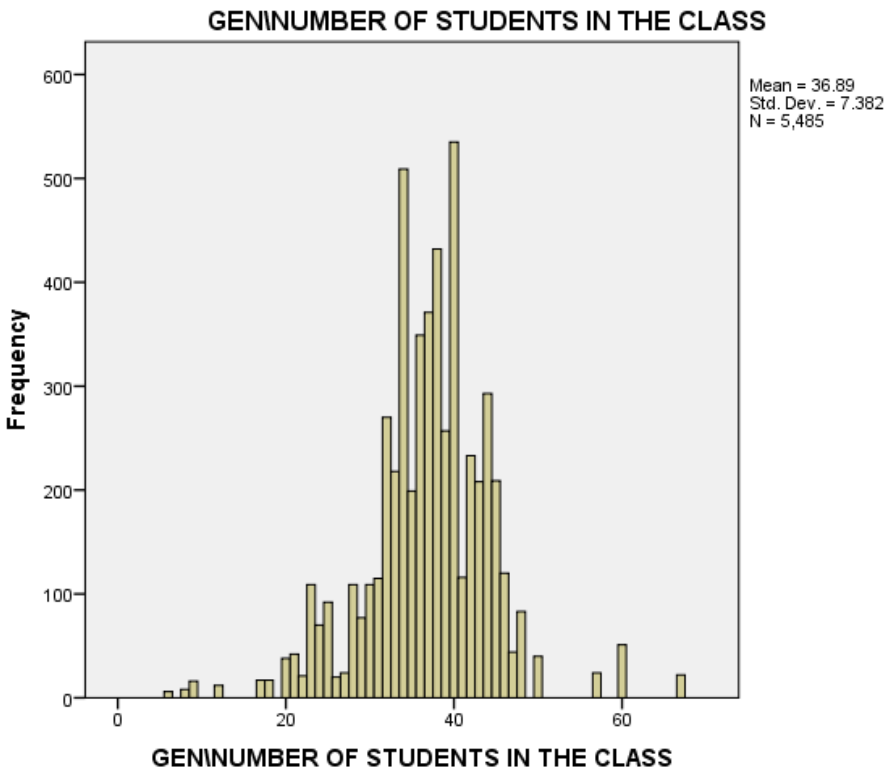
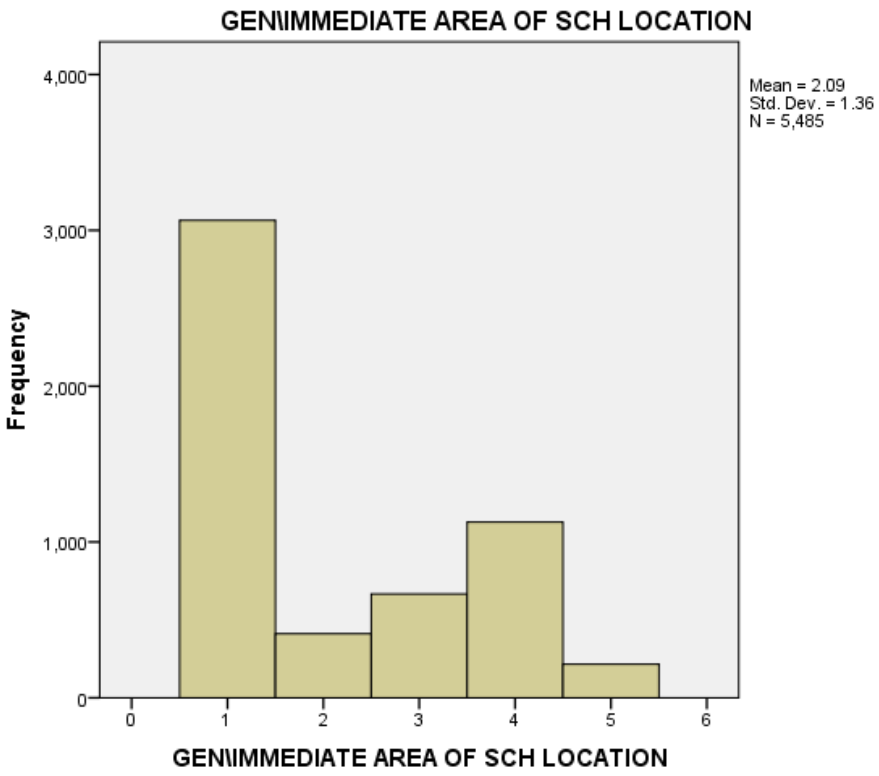
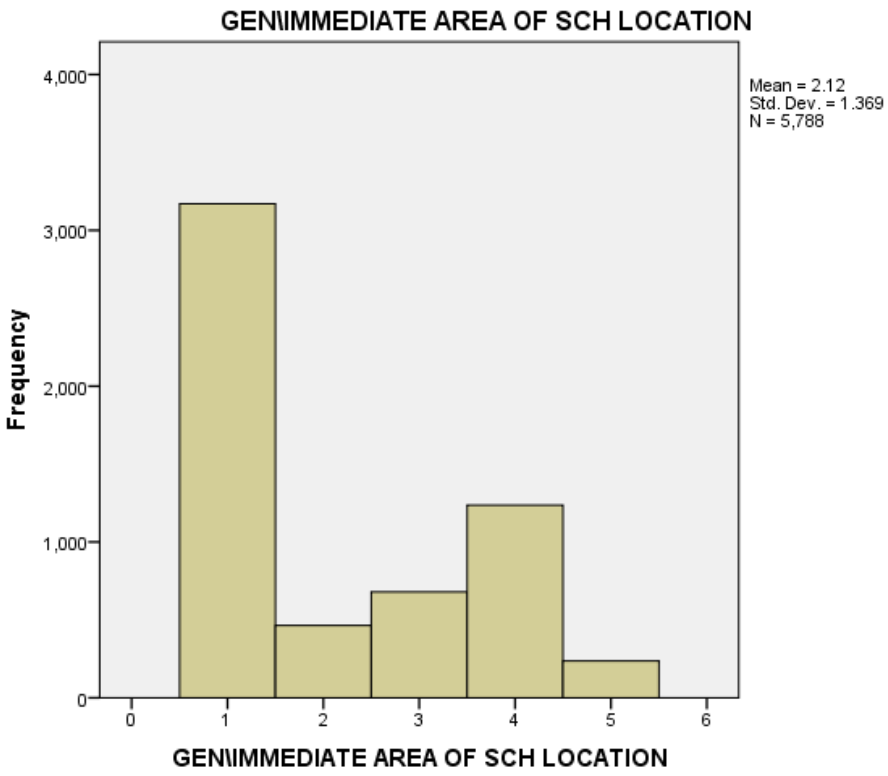
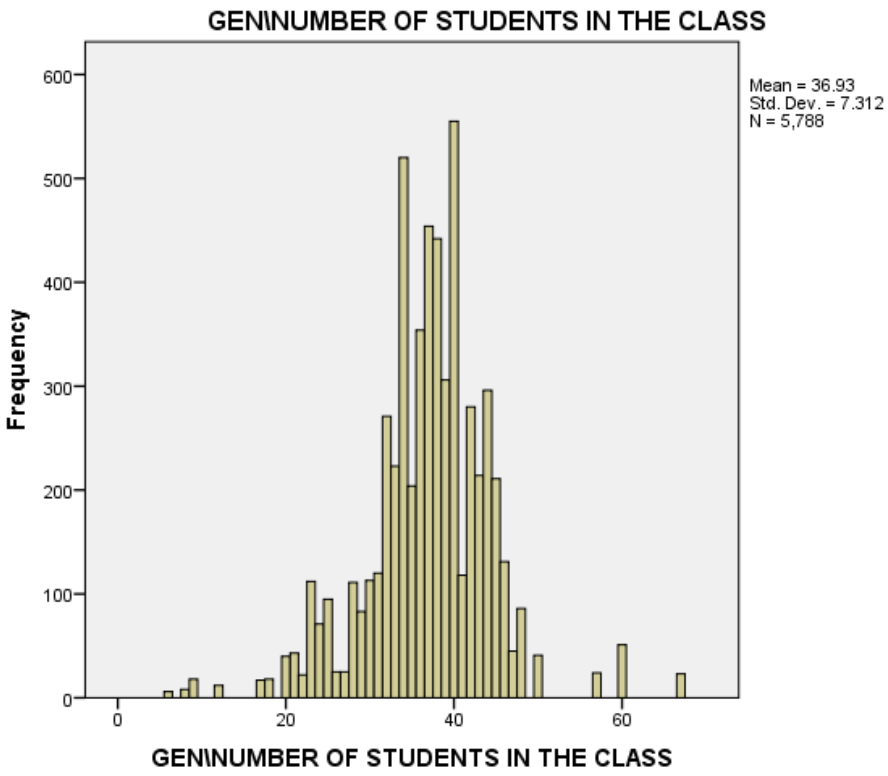
.5
1.0
1.5
GEN\SEX OF TEACHER


TEACHERS YEARS OF EXPERIENCE
Mean = 2.77
Std. Dev. = 1.057
N = 5,485
Frequency
2,000
1,500
1,000
500
0
0
1
2
3
4
5
TEACHERS YEARS OF EXPERIENCE


GEN\NUMBER OF STUDENTS IN THE CLASS
Mean = 36.89
Std. Dev. = 7.382
N = 5,485
Frequency
600
500
400
300
200
100
0
0
20
40
60
GEN\NUMBER OF STUDENTS IN THE CLASS


GEN\IMMEDIATE AREA OF SCH LOCATION
Mean = 2.09
Std. Dev. = 1.36
N = 5,485
Frequency
4,000
3,000
2,000
1,000
0
0
1
2
3
4
5
6
GEN\IMMEDIATE AREA OF SCH LOCATION


GEN\IMMEDIATE AREA OF SCH LOCATION
Mean = 2.12
Std. Dev. = 1.369
N = 5,788
Frequency
4,000
3,000
2,000
1,000
0
0
1
2
3
4
5
6
GEN\IMMEDIATE AREA OF SCH LOCATION


GEN\NUMBER OF STUDENTS IN THE CLASS
Mean = 36.93
Std. Dev. = 7.312
N = 5,788
Frequency
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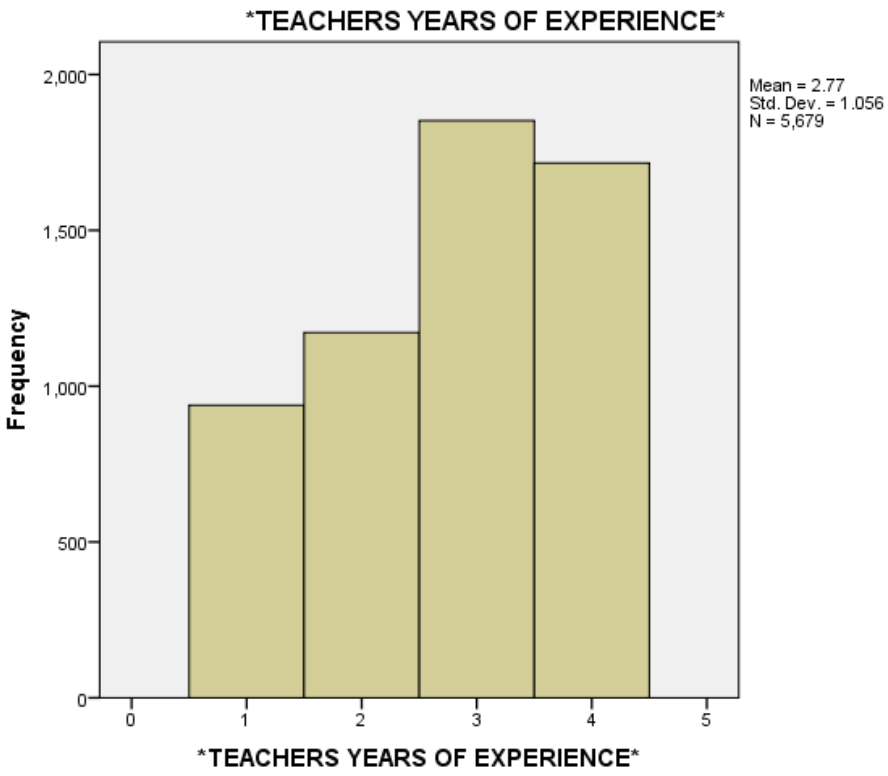
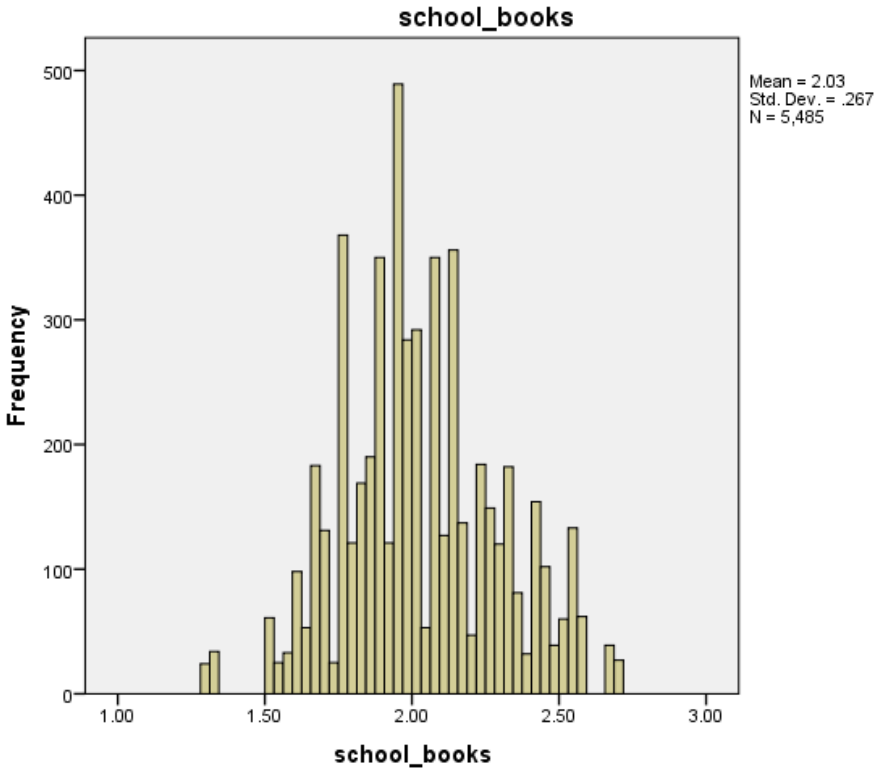
500
400
300
200
100
0
0
20
40
60
GEN\NUMBER OF STUDENTS IN THE CLASS


TEACHERS YEARS OF EXPERIENCE
Mean = 2.77
Std. Dev. = 1.056
N = 5,679
Frequency
2,000
1,500
1,000
500
0
0
1
2
3
4
5
TEACHERS YEARS OF EXPERIENCE

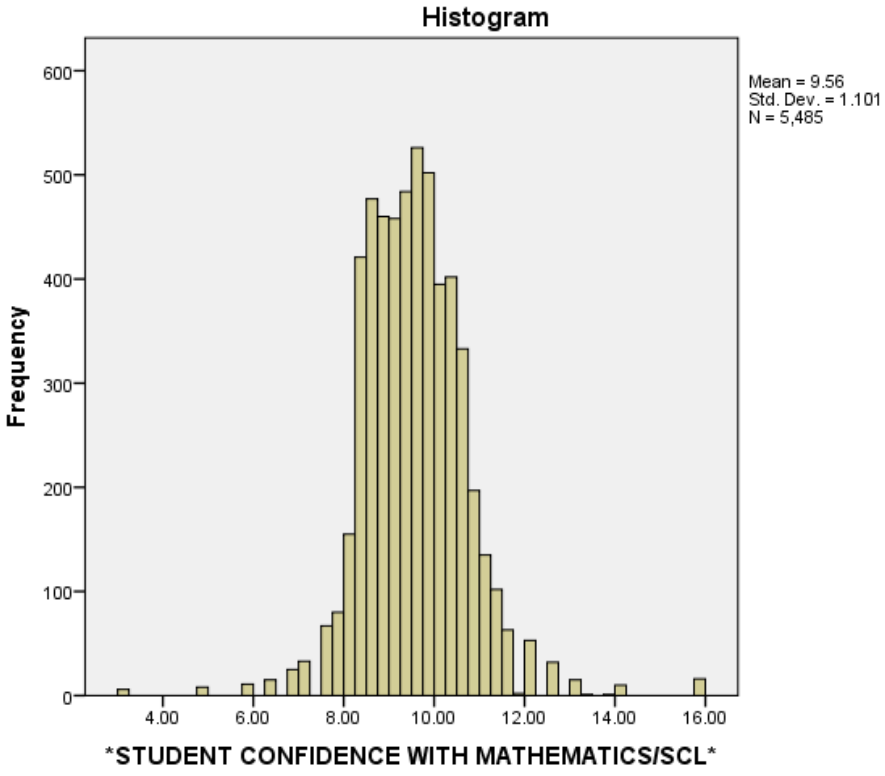

school_books
Mean = 2.03
Std. Dev. = .267
N = 5,485
Frequency
500
400
300
200
100
0
1.00
1.50
2.00
2.50
3.00
school_books

TRANFORMATION

Original:

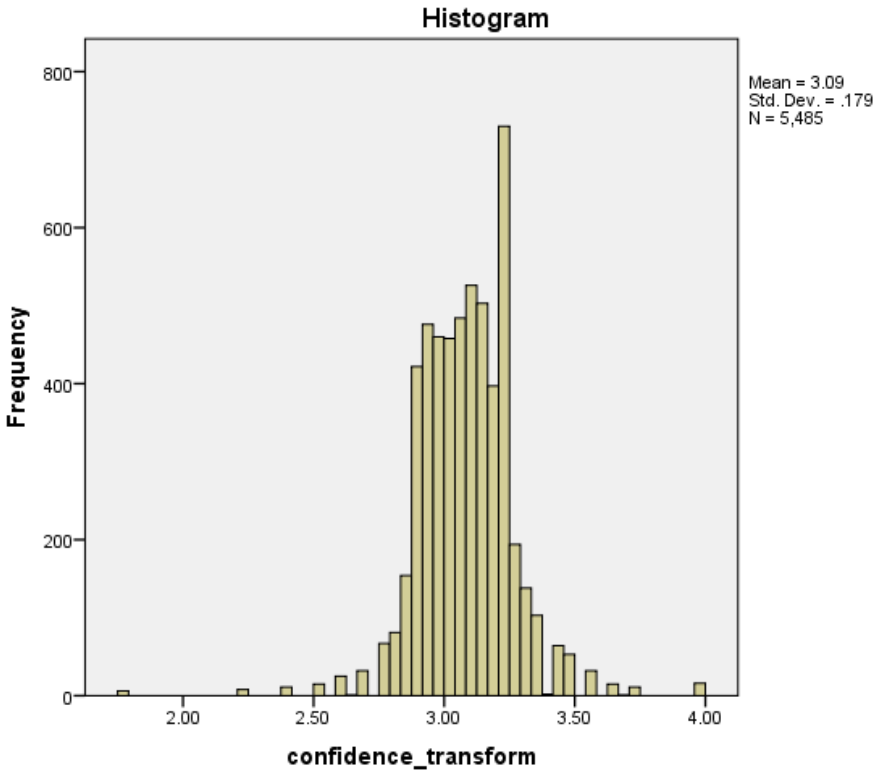
Descriptives

			Statistic	Std. Error
STUDENT CONFIDENCE WITH MATHEMATICS/SCL	Mean		9.5578	.01487
	95% Confidence Interval for Mean	Lower Bound	9.5287	
		Upper Bound	9.5870	
	5% Trimmed Mean		9.5357	
	Median		9.6194	
	Variance		1.212	
	Std. Deviation		1.10107	
	Minimum		3.18	
	Maximum		15.82	
	Range		12.64	
	Interquartile Range		1.20	
	Skewness		.462	.033
	Kurtosis		4.858	.066



Using sqrt:

Descriptives

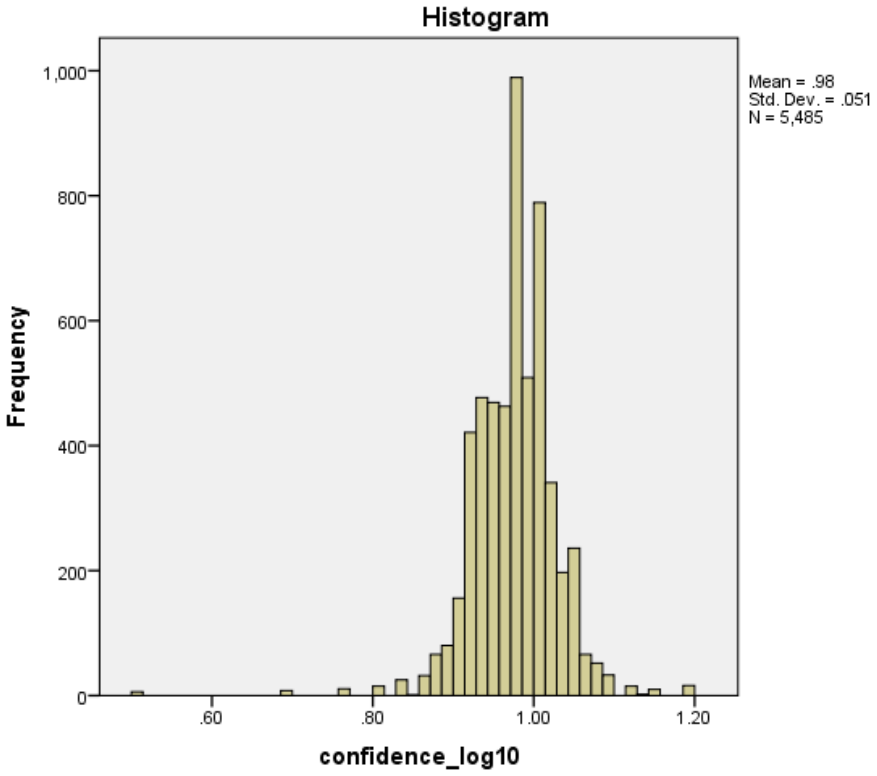


			Statistic	Std. Error
confidence_transform	Mean		3.0864	.00241
	95% Confidence Interval for Mean	Lower Bound	3.0817	
		Upper Bound	3.0911	
	5% Trimmed Mean		3.0856	
	Median		3.1015	
	Variance		.032	
	Std. Deviation		.17869	
	Minimum		1.78	
	Maximum		3.98	
	Range		2.19	
	Interquartile Range		.20	
	Skewness		-.172	.033
	Kurtosis		5.715	.066

Using log 10

Descriptives

			Statistic	Std. Error
confidence_log10	Mean		.9774	.00069
	95% Confidence Interval for Mean	Lower Bound	.9761	
		Upper Bound	.9788	
	5% Trimmed Mean		.9780	
	Median		.9831	
	Variance		.003	
	Std. Deviation		.05132	
	Minimum		.50	
	Maximum		1.20	
	Range		.70	
	Interquartile Range		.05	
	Skewness		-1.010	.033
	Kurtosis		10.389	.066



CORRELATION TEST

Correlations

		SEX OF STUDENTS	GEN\AMOUNT OF BOOKS IN YOUR HOME	MAT\AGREE\TEACHER EXPECTS TO DO	*1ST PLAUSIBLE VALUE MATHEMATICS*	*STUDENTS ENGAGED IN MATHEMATICS LESSONS/SCL*
SEX OF STUDENTS	Pearson Correlation	1	.028*	.025	.063**	.057**
	Sig. (2-tailed)		.036	.064	.000	.000
	N	5485	5485	5485	5485	5485
GEN\AMOUNT OF BOOKS IN YOUR HOME	Pearson Correlation	.028*	1	.041**	.110**	.042**
	Sig. (2-tailed)	.036		.002	.000	.002
	N	5485	5485	5485	5485	5485
MAT\AGREE\TEACHER EXPECTS TO DO	Pearson Correlation	.025	.041**	1	-.064**	.541**
	Sig. (2-tailed)	.064	.002		.000	.000
	N	5485	5485	5485	5485	5485
1ST PLAUSIBLE VALUE MATHEMATICS	Pearson Correlation	.063**	.110**	-.064**	1	-.083**
	Sig. (2-tailed)	.000	.000	.000		.000
	N	5485	5485	5485	5485	5485
STUDENTS ENGAGED IN MATHEMATICS LESSONS/SCL	Pearson Correlation	.057**	.042**	.541**	-.083**	1
	Sig. (2-tailed)	.000	.002	.000	.000	
	N	5485	5485	5485	5485	5485
GEN\SEX OF TEACHER	Pearson Correlation	-.001	.044**	-.001	.013	-.017
	Sig. (2-tailed)	.948	.001	.935	.345	.207
	N	5485	5485	5485	5485	5485
TEACHERS YEARS OF EXPERIENCE	Pearson Correlation	.010	.029*	-.012	.224**	-.064**
	Sig. (2-tailed)	.445	.030	.358	.000	.000
	N	5485	5485	5485	5485	5485
GEN\NUMBER OF STUDENTS IN THE CLASS	Pearson Correlation	.034*	.004	-.033*	.099**	-.072**
	Sig. (2-tailed)	.012	.747	.016	.000	.000
	N	5485	5485	5485	5485	5485
GEN\IMMEDIATE AREA OF SCH LOCATION	Pearson Correlation	-.005	-.027*	-.018	-.129**	.022
	Sig. (2-tailed)	.687	.046	.175	.000	.111
	N	5485	5485	5485	5485	5485

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

NULL MODEL

Estimates of Fixed Effects[a]

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	9.608120	.038794	144.171	247.671	.000	9.531442	9.684799

a. Dependent Variable: *STUDENT CONFIDENCE WITH MATHEMATICS/SCL*.

Estimates of Covariance Parameters[a]

Parameter		Estimate	Std. Error	Wald Z	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Residual		1.039393	.020128	51.640	.000	1.000683	1.079601
Intercept [subject = IDSCHOOL]	Variance	.191480	.026310	7.278	.000	.146273	.250659

a. Dependent Variable: *STUDENT CONFIDENCE WITH MATHEMATICS/SCL*.

LEVEL-1 RANDOM INTERCEPT MODEL (W/O GRAND CENTERING)

Estimates of Fixed Effects[a]

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	4.746798	.138307	4796.839	34.321	.000	4.475653	5.017943
female	-.109328	.025248	5415.356	-4.330	.000	-.158824	-.059833
books	.061497	.015919	5452.111	3.863	.000	.030290	.092704
teacher_expect	.162660	.026373	5402.754	-6.168	.000	-.214363	-.11095
score_math	.002047	.000188	4449.211	10.871	.000	.001678	.002416
engagement_math	.434329	.013043	5478.973	33.299	.000	.408759	.459900

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a. Dependent Variable: *STUDENT CONFIDENCE WITH MATHEMATICS/SCL*.

Estimates of Covariance Parameters[a]

Parameter		Estimate	Std. Error	Wald Z	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Residual		.823667	.015980	51.544	.000	.792935	.855590
Intercept [subject = IDSCHOOL]	Variance	.130656	.019279	6.777	.000	.097842	.174474

a. Dependent Variable: *STUDENT CONFIDENCE WITH MATHEMATICS/SCL*.

LEVEL-1 RANDOM INTERCEPT MODEL (WITH GRAND CENTERING)

Estimates of Fixed Effects[a]

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	9.889100	.073507	2345.966	134.533	.000	9.744954	10.033245
female	-.109328	.025248	5415.356	-4.330	.000	-.158824	-.059833
books	.061497	.015919	5452.111	3.863	.000	.030290	.092704
teacher_expect	.162660	.026373	5402.754	-6.168	.000	-.214363	-.11095
grandcent_score	.002047	.000188	4449.211	10.871	.000	.001678	.002416
grandcent_engage	.434329	.013043	5478.973	33.299	.000	.408759	.459900

a. Dependent Variable: *STUDENT CONFIDENCE WITH MATHEMATICS/SCL*.

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Estimates of Covariance Parameters[a]

Parameter		Estimate	Std. Error	Wald Z	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Residual		.823667	.015980	51.544	.000	.792935	.855590
Intercept [subject = IDSCHOOL]	Variance	.130656	.019279	6.777	.000	.097842	.174474

a. Dependent Variable: *STUDENT CONFIDENCE WITH MATHEMATICS/SCL*.

LEVEL-2 RANDOM INTERCEPT MODEL

Estimates of Fixed Effects[a]

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	10.849318	.301808	150.290	35.948	.000	10.252984	11.445652
female	-.108462	.025247	5421.992	-4.296	.000	-.157956	-.058967
books	.067536	.016055	5318.050	4.206	.000	.036061	.099010
teacher_expect	.161341	.026381	5404.282	-6.116	.000	-.213058	
grandcent_score	.002138	.000190	4711.363	11.258	.000	.001765	.002510
grandcent_engage	.433074	.013049	5470.956	33.188	.000	.407492	.458655
teacher_female	-.041987	.051951	346.783	-.808	.420	-.144167	.060192
teacher_yrs_experience	-.045538	.027231	185.197	-1.672	.096	-.099261	.008186
classsize	-.008473	.003605	184.725	-2.350	.020	-.015585	-.001360
urban	-.144843	.124411	121.228	-1.164	.247	-.391141	.101456
medium_size_city	.008019	.105923	122.040	.076	.940	-.201665	.217703
small_town	.083288	.079752	130.854	1.044	.298	-.074482	.241059
remote_rural	.169933	.148057	132.126	1.148	.253	-.122936	.462801
school_books	-.272181	.124602	133.495	-2.184	.031	-.518630	-.025731

a. Dependent Variable: *STUDENT CONFIDENCE WITH MATHEMATICS/SCL*.

Estimates of Covariance Parameters[a]

Parameter		Estimate	Std. Error	Wald Z	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Residual		.824182	.015985	51.558	.000	.793439	.856116
Intercept [subject = IDSCHOOL]	Variance	.114549	.017504	6.544	.000	.084902	.154548

a. Dependent Variable: *STUDENT CONFIDENCE WITH MATHEMATICS/SCL*.

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