CORRELATION BETWEEN CONFIDENCE AND PERFORMANCE OF ENGINEERING STUDENTS IN SOLID MENSURATION

Marivic G. Molina
College of Science, Pamantasan ng Lungsod ng Maynila (University of the City of Manila) Intramuros, Manila, Philippines
molinamg30@gmail.com

Alvin G. Bansil
College of Science, Pamantasan ng Lungsod ng Maynila (University of the City of Manila) Intramuros, Manila, Philippines
bansil_alvin@yahoo.com

Abstract

The study aimed to determine the correlation between the engineering students' confidence and performance in solid mensuration. The respondents of the study were 144 first-year engineering students who were selected from six different engineering degree courses through stratified random sampling. Data were collected using the (1) Confidence Level Survey (CLS), and (2) Final Departmental Exam (FDE). The results revealed a significant positive correlation between confidence in mathematics and performance in solid mensuration. A significant positive correlation between confidence and performance in solid mensuration was likewise found. Concerning correlations between students' confidence and performance in different learning competencies in solid mensuration, no significant correlation was found between confidence and

performance in determining properties of solid figures. Likewise, no significant correlation was found between the confidence and performance in solving lateral surface area. Similarly, no significant correlation was detected between the confidence and performance in solving the total surface area. Meanwhile, a positive significant correlation was yielded between the confidence and performance in solving volume. Moreover, a significant positive correlation was found between the confidence and performance in solving the other parts of solid figures. No significant correlation, however, was found between the confidence and performance in solving applied problems involving solid figures. The study concluded that the more confident the students were, the higher their performances in solid mensuration were. Conversely, less confident students were not certain in their abilities, thus resulted in the low performance in solid mensuration. Study's limitations and future scope were also discussed.

Keywords

Confidence, Engineering Students, Mathematics, Solid Mensuration, Students' Performance

1. Introduction

It has been observed that student's success in one discipline is strongly connected with their self-confidence. It should be developed to withstand the pressure and anxiety that every student encountered. Students' confidence predicts largely the development of self-confidence in the future, but also the development of success orientation and achievement (Hannula, Maijala, & Pehkonen, 2004).

Self-confidence refers to belief in one's personal worth and the likelihood of succeeding. Self-confidence is a combination of self-esteem and general self-efficacy (Neill, 2005). Briggs (2014) differentiates general self-confidence and academic self-confidence. He viewed academic self-confidence as pertaining to confidence in one's academic abilities. In the purest sense, academic self-confidence is knowing what you are good at and for some, it might be about being good in mathematics.

Mathematics is one of the highly-valued disciplines in school and at the same time the most-feared one. Earlier research showed that self-confidence had a strong correlation with mathematics achievement (Hannula, Maijala, Pehkonen, & Nurmi, 2005).

Many recent high school graduates are experiencing certain difficulties with their undergraduate math courses. This is evident to many first-year college students who were once

good in math but experience sequential failures in their undergraduate math courses. With this experience, students came to believe that they are not good at doing the math. It is upsetting to learn that these students who struggle in math are not only struggling in solving math problems, but they are also questioning their ability to do so. This lack of confidence can be more potentially damaging to students' success than any other academic challenges that arise in their educational experiences (Perdue, 2005). Nonetheless, the fact that successful completion of mathematics courses is essential to every student cannot be denied. It will bring them closer to getting a degree within their chosen field.

Engineering is one of the undergraduate degree courses a student can pursue. Engineering as defined in Wikipedia (2015) is "the application of mathematics, empirical evidence, and scientific, economic, social, and practical knowledge in order to invent, design, build, maintain, research, and improve structures, machines, tools, various device, systems, materials, and processes". This clearly shows that the role of mathematics in engineering education cannot be underestimated (Guner, 2013). Indeed, a strong aptitude for mathematics is required in engineering education. Consequently, mathematics competence likely influence students' confidence in engineering (Litzler, Samuelson, & Lorah, 2014). Yet, engineering students tend to reveal difficulties with course units based on mathematics (Alves, Rodrigues, & Rocha, 2012).

In order to develop confidence in mathematics, the opportunity to use math in a real context must be provided. So, it will be of great importance to relate math to practical matters such as buying, selling, investing or even doing household chores. One mathematics course being offered in engineering which mostly deals with practical application is called solid mensuration. Due to its practical applications studying this course is much more realistic than any other mathematics courses. "The purpose of solid mensuration is to present the fundamental and practical essentials of solid geometry in a new and concise but comprehensive manner" (Kern & Bland, 1967). Solid Mensuration is the study of various planes and solids. It is the study of height, length, area, volume and many more. The basic part of this subject is already taught in elementary and high school yet college students still find it as one of the most challenging mathematics courses. In the practice of engineering, this course was used extensively. In a university where students are known to be scholars, it was observed that though many were intelligent, still many students failed in the course solid mensuration.

Studies have revealed consistent and enduring evidence that a significant positive correlation exists between academic self-confidence and academic performance (Telbis, Helgeson, & Kingsbury, 2014; Lazar, Morony, & Lee, 2012; Al-Hebaish, 2012). However, little is known about how confidence in mathematics, in particular, confidence in solid mensuration correlates to the performance of engineering students in solid mensuration. To fill this gap, the main objective of this study was to determine if a significant correlation exists between engineering students' confidence and performance in solid mensuration.

2. Methodology

2.1 Research Design

A descriptive-correlational research design was employed in the study. The descriptive design was utilized to describe the current status of the respondents. The correlational design, on the other hand, was carried out to determine the relationship between two or among more quantitative variables from the same group of respondents. In this study, the two variables were the confidence and the performance of engineering students in solid mensuration.

2.2 Respondents

A total of 144 first-year engineering students comprised the respondents of the study. The sample size was obtained through the use of Slovin's Formula with a margin of error of 0.05. To ensure that the selected respondents had a proportional number of students from different engineering degree courses, stratified random sampling technique was used. The respondents were composed of 11 chemical engineering (BS ChE) students, 52 civil engineering (BS CE) students, and 27 computer engineering (BS CpE) students. Twenty-five (25) electronics engineering (BS ECE) students, 14 electrical engineering (BS EE) students, and 15 mechanical engineering (BS ME) students also took part in the study. These students were enrolled in solid mensuration course for the 2nd semester, SY 2015 – 2016.

2.3 Research Instruments

2.3.1 Confidence Level Survey (CLS)

The CLS questionnaire was divided into two sections: Section I: Confidence in Mathematics and Section II: Confidence in Solid Mensuration.

The nine-item statements in Section I was adopted from the survey questionnaire used by Piper (2008). Permission to adopt the questionnaire was sought and granted through email. The

researchers also adopted the method used by Piper (2008) in analyzing the data in CLS. The nine statements in Section I were divided into two categories: (a) positive statements and (b) negative statements. The positive statements are: (1) "Math is usually easy for me."; (4) "I don't usually worry about being able to solve math problems."; (6) "I have a lot of self-confidence when it comes to math."; (8) "I can usually pick out the important information in any problem and decide what to do to solve it."; and (9) "I could teach other students how to solve most of the math we have done before college." Meanwhile, the negative statements are: (2) "I feel like most of the students in my math class are better at math than me."; (3) "I get nervous or worried when a teacher asks me a question in class."; (5) "I usually get worried during a math test."; and (7) "Even if I work really hard, I still have a hard time learning new things in math." The positive statements were coded so that higher response would indicate a higher confidence level. The negative statements, however, were reverse coded so that a lower response would indicate a higher level of confidence. Means for the five positive statements and the four negative statements were computed separately. The difference between these means was likewise computed. This difference was used to determine each student's confidence level in mathematics. The difference in the score could range from -4 (very low confidence) to 4 (very high confidence). A positive difference indicates a positive confidence level while a negative difference indicates a negative confidence level. Meanwhile, a student is considered to have no tendency toward a positive or negative confidence in mathematics if the difference is zero.

Section II was a researchers-made questionnaire that was based on the coverage of solid mensuration course. The aforementioned researchers-made questionnaire underwent content validation by three mathematics experts to ensure coherence of the items in the solid mensuration syllabus. The items in Section II were based on the following learning competencies in solid mensuration: determining the properties of solid figures, solving lateral surface area of solid figures, solving the total surface area of solid figures, solving the volume of solid figures, solving the other parts of solid figures, and solving applied problems involving solid figures.

All items were responded to using a Likert-rating of 1 to 5 (Section I: 1=Strongly Disagree, 2=Disagree, 3=Unsure or no feelings one way or the other, 4=Just Agree, 5=Strongly Agree; Section II: 1=Very Not Confident, 2=Not Confident, 3= Unsure or no feelings one way or the other, 4=Confident, 5=Very Confident). In giving their responses in Section I, students were

asked to consider their past experiences in math and not just their experiences in the said school year.

In Section II, means for the entire statements was computed. Unlike in Section I, mean scores for this section are all positive. That is, the higher mean would indicate higher confidence and lower mean would indicate lower confidence. The mean score could range from 1 (very low confidence) to 5 (very high confidence) with a mean of 3 indicating no feelings one way or the other.

2.3.2 Final Departmental Exam (FDE)

To assess students' performance, the FDE, which was required to take part of the students' semester course, was utilized. The FDE was made by the researchers based on the solid mensuration syllabus. It was peer-reviewed by the researchers' colleagues and was endorsed by their mathematics department chairperson. To coordinate the test questions with the time spent, the objectives, and the level of critical thinking required by the objectives, a table of specifications (TOS) was applied. Furthermore, the 40-item multiple choice FDE were made parallel to the items of CLS Section II. The items were divided as follows: determining the properties of solid figures (6 items), solving lateral surface area of solid figures (5 items), solving the total surface area of solid figures (6 items), solving the volume of solid figures (6 items), solving the other parts of solid figures (11 items), and solving applied problems involving solid figures (6 items). The verbal interpretation for the mean score obtained in the FDE was as follows: Excellent (40), Very Good (30 – 39), Good (20 – 29), Fair (10 -19), and Poor (0 – 9).

2.4 Data Gathering Procedure

A week before the final examination week, the CLS questionnaires were administered to the respondents. Then, during the final examination week, the FDE was administered to the entire population of students who were taking solid mensuration course. However, the researchers only looked into the scores obtained by those students who were considered respondents of the study.

2.5 Statistical Analysis

The following statistical tools were employed by the researchers: (1) the mean and standard deviation, to describe the average performance and average level of confidence of the students. (2) the Pearson r (Pearson product-moment correlation), to determine the relationship between the confidence in mathematics and performance in solid mensuration; the relationship

between the confidence and performance in solid mensuration; and the relationship between the confidence and performance in the different learning competencies in solid mensuration. And, (3) the *p*-value, to determine whether the computed correlations are significant or not at 0.05 level.

3. Results and Discussion

3.1 Students' Level of Confidence in Mathematics

As shown in Table 1, the mean confidence level of the students in mathematics is -0.32 with a standard deviation of 1.03. The negative mean confidence level indicated negative confidence. This showed that the students have low confidence in mathematics.

Table 1: *Students' Level of Confidence in Mathematics*

	Mean	**Standard Deviation**	**Verbal Interpretation**
Confidence in Mathematics	-0.32	1.03	Low confidence

This agreed with the findings of Piper (2008) who found that some students posted negative confidence levels which showed that they lack confidence when it comes to mathematics. This was also evident in the results of the Trend in International Mathematics and Science Study (TIMSS) which showed that Asian students tended to have low confidence when it comes to mathematics (as cited in Mullis, Martin, & Foy, 2008). However, the study made by Parsons, Croft, and Harrison (2009) contradicts this finding. They found that most of the first-year engineering students were fairly confident in relation to mathematics.

3.2 Students' Performance in Solid Mensuration

As can be gleaned in Table 2, the mean performance of the students in solid mensuration was 18.42 with a standard deviation of 6.07. This was below the passing score of 20. The result implied that the students have fair performance in solid mensuration.

Table 2: *Students' Performance in Solid Mensuration*

	Mean	**Standard Deviation**	**Verbal Interpretation**
Performance in Solid Mensuration	18.42	6.07	Fair

This result revealed a reasonable improvement in terms of students' performance in solid mensuration as compared to the study of Borongan-Calles (2016). She found that students perform poorly in solid mensuration. She specified that the poor performance was due to their difficulty in applying systematic ways in solving the problem and using appropriate formulas.

3.3 Correlation between Confidence in Mathematics and Performance in Solid Mensuration

The results presented in Table 3 showed a significant positive correlation between confidence in mathematics and performance in solid mensuration ($r = 0.5409$, $p < 0.05$).

Table 3: *Correlation between Confidence in Mathematics and Performance in*

Solid Mensuration

Variables	Correlation Coefficient (r)	*p* - value	Interpretation
Confidence in Mathematics	0.5409	0.0000*	significant
Performance in Solid Mensuration			

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

A significant correlation between confidence and mathematical achievement was also found in earlier research (Ismail & Awang, 2010). They found that mathematics achievement is significantly associated to the higher level of self-confidence. However, the strength of association was rather weak. Furthermore, Piper (2008) also found a seemingly positive correlation between confidence and achievement in math. With just a couple noted exceptions, he indicated that students' confidence levels closely matched their achievement levels. Likewise, student confidence produced a notable association with their mathematics achievement (Parsons et al., 2009).

3.4 Students' Confidence Level in different Learning Competencies in Solid Mensuration

Table 4 showed the mean confidence level of the students in the different learning competencies in solid mensuration. As shown in the table, students have the highest mean confidence level in solving volumes of solid figures (mean = 3.45, s = 0.58). Second to the highest mean confidence level was posted in solving the lateral surface area of solid figures (mean = 3.39, s = 0.60). Third, was in solving the total surface area of solid figures (mean = 3.38, s = 0.57). Fourth to the highest mean confidence level was recorded in

determining the properties of solid figures (mean = 3.34, s = 0.55). Fifth, was in solving other parts of solid figures (mean = 3.27, s = 0.58). While the lowest mean confidence level was observed in solving applied problems involving solid figures (mean = 3.11, s = 0.65). This showed that, though students were unsure or no feelings one way or the other on all six learning competencies in solid mensuration, the least confidence level was observed in solving applied problems involving solid figures.

Table 4: *Students' Confidence Level in different Learning Competencies*

in Solid Mensuration

Learning Competencies in Solid Mensuration	Mean	Standard Deviation	Verbal Interpretation
A. Determining the properties of solid figures	3.34	0.55	Unsure or no feelings one way or the other
B. Solving the lateral surface area of solid figures	3.39	0.60	Unsure or no feelings one way or the other
C. Solving the total surface area of solid figures	3.38	0.57	Unsure or no feelings one way or the other
D. Solving the volume of solid figures	3.45	0.58	Unsure or no feelings one way or the other
E. Solving other parts of solid figures (e.g. altitude, base, etc.)	3.27	0.58	Unsure or no feelings one way or the other
F. Solving applied problems involving solid figures	3.11	0.65	Unsure or no feelings one way or the other

This observation was consistent with that of Piper's (2008), students' lack of confidence were also manifested in solving applied problems. He specified that students were more confident in straightforward mathematical activities and were less confident when a method for solving the problem was not so clear. He noted that while the students had a lot of confidence with basic math computation, students seemed to lack confidence in challenging problem-solving activities. He further emphasized that students were less confident in problem solving and mixed application problems that require more thought and analysis.

3.5 Students' Performance in different Learning Competencies in Solid Mensuration

Table 5 showed the performance of the students in different learning competencies in solid mensuration. Students got the highest mean score, 55.45% of the total number of items, in solving other parts of solid figures (mean = 6.10, s = 2.27). Second to the highest mean score, 47.33% of the total number of items, was recorded in solving total surface area of solid figures (mean = 2.84, s = 1.48). Solving lateral surface area ranked third, 47% of the total number of items, (mean = 2.35, s = 1.19). Fourth, 46.83% of the total number of items, was in determining the properties of solid figures (mean = 2.81, s = 1.30). Fifth to the highest mean score, 44.83% of the total number of items, was posted in solving volume of solid figures (mean = 2.69, s = 1.51). While the lowest mean performance, 27.17% of the total number of items, was recorded in solving applied problems involving solid figures (mean = 1.63, s = 1.10). This indicated that among the six learning competencies in solid mensuration, students were observed to perform less in solving applied problems involving solid figures.

Table 5: *Students' Performance in different Learning Competencies in Solid Mensuration*

Learning Competencies in Solid Mensuration	Mean	Standard Deviation	Total Number of items	Percentage (based on the total number of items)
A. Determining the properties of solid figures	2.81	1.30	6	46.83%
B. Solving the lateral surface area of solid figures	2.35	1.19	5	47.00%
C. Solving the total surface area of solid figures	2.84	1.48	6	47.33%
D. Solving the volume of solid figures	2.69	1.51	6	44.83%
E. Solving other parts of solid figures (e.g. altitude, base, etc.)	6.10	2.27	11	55.45%
F. Solving applied problems involving solid figures	1.63	1.10	6	27.17%

Students' poor performance in solving applied problems was clarified by Lim (2000) as cited in Laguador (2013). He found that student's weakness in solving word problems was due to making avoidable preliminary mistakes. He enumerated that some factors that prevent students from solving word problems correctly were students' carelessness, their inabilities to understand what they read, to plan and to choose suitable mathematical operations. He further emphasized that the main factors that cause students' difficulties in solving word problems were their inabilities to understand a question and their semantic skills involving symbols and meanings of terms as well as vocabulary.

3.6 Correlations between Confidence and Performance in different Learning Competencies in Solid Mensuration

Regarding the correlations between the confidence and performance in different learning competencies in solid mensuration, as shown in Table 6, no significant correlation was found between confidence and performance in determining properties of solid figures (r = 0.0979, $p > 0.05$). Likewise, no significant correlation was found between the confidence and performance in solving lateral surface area of solid figures (r = 0.0952, $p > 0.05$). Similarly, no significant correlation was detected between the confidence and performance in solving the total surface area of solid figures (r = 0.1405, $p > 0.05$).

Meanwhile, a significant positive correlation was yielded between the confidence and performance in solving the volume of solid figures (r = 0.1781, $p < 0.05$). Moreover, a significant positive correlation was found between the confidence and performance in solving the other parts of solid figures such as altitude, base, etc. (r = 0.2154, $p < 0.05$). No significant correlation, however, was found between the confidence and performance in solving applied problems involving solid figures (r = 0.0561, $p > 0.05$).

The results revealed that among the six learning competencies, significant positive correlations between confidence and performance were found in solving the volume and other parts of solid figures.

Table 6: *Correlation between Confidence and Performance in different Learning Competencies in Solid Mensuration*

Learning Competencies in Solid Mensuration	Correlation Coefficient (r)	*p* - value	Interpretation
A. Determining the properties of solid figures	0.0979	0.2432	not significant
B. Solving the lateral surface area of solid figures	0.0952	0.2564	not significant
C. Solving the total surface area of solid figures	0.1405	0.0932	not significant
D. Solving the volume of solid figures	0.1781	0.0327*	significant

Learning Competencies in Solid Mensuration	Correlation Coefficient (r)	*p* - value	Interpretation
E. Solving other parts of solid figures (e.g. altitude, base, etc.)	0.2154	0.0096*	significant
F. Solving applied problems involving solid figures	0.0561	0.5039	not significant

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

As earlier revealed in table 4 and table 5, students' confidence level in solving volume of solid figures ranked 1st while it ranked 5th in terms of performance. On the other hand, students' confidence level in solving other parts of solid figures ranked 5th while it ranked 1st in terms of performance. This showed that students who were highly confident in solving volume of solid figures perform less on the indicated learning competency. On the other hand, students who were less confident in solving other parts of solid figures perform well on the indicated learning competency. This result is in accordance with the unexpected result that was found by Terrell, Terrell, and Schneider (2010). They found that students who were often less certain about their responses, did well on the test while students who were nonetheless quite confident in their responses, did not do well on the test. This also concurred with the findings of Nahari (2014) in which high levels of confidence were paired with incorrect responses and low levels of confidence were paired with correct responses. He highlighted that students' high level of

confidence in incorrect answers was indicative of misconceptions of which the students were unaware. Students overestimating their mathematics competence often had low mathematics scores (Chiu & Klassen, 2010).

3.7 Students' Confidence Level in Solid Mensuration

As depicted from Table 7, the mean confidence level of the students in solid mensuration is 3.32 with a standard deviation of 0.37. This showed that students indicated unsure or no feelings one way or the other when it comes to their confidence in solid mensuration. This revealed that students were not certain of their abilities when it comes to solid mensuration.

Table 7: *Students' Confidence Level in Solid Mensuration*

	Mean	Standard Deviation	Verbal Interpretation
Confidence in Solid Mensuration	3.32	0.37	Unsure or no feelings one way or the other

Students' uncertainty in their abilities was also evident in the results of PISA 2003. They compared students' confidence in overcoming difficulties in particular math tasks through an index of self-efficacy in math. Based on the results of PISA 2003, on the average students in Greece, Japan, Korea, and Mexico, and in the partner countries, Brazil, Indonesia, Thailand, and Tunisia express the least self-efficacy in math (OECD, 2004).

3.8 Correlation between Confidence and Performance in Solid Mensuration

As depicted in Table 8, the results revealed a significant positive correlation between confidence and performance in solid mensuration (r = 0.2503, $p < 0.05$).

Table 8: *Correlation between Confidence and Performance in Solid Mensuration*

Variables	Correlation Coefficient (r)	*p* - value	Interpretation
Confidence in Solid Mensuration	0.2503	0.0025*	significant
Performance in Solid Mensuration			

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

Earlier studies have also revealed consistent and enduring evidence that a significant positive correlation exists between academic self-confidence and academic performance (Telbis et al., 2014; Lazar et al., 2012; Al-Hebaish, 2012). This result reaffirmed the existence of

a direct relationship between student academic confidence and consequent academic performance. This implied that as academic self-confidence increases, academic performance also increases (Zorkina & Nalbone, 2003).

4. Conclusions

The results indicated a significant positive correlation between engineering students' confidence, both in mathematics and in solid mensuration, and performance in solid mensuration. This revealed that the more confident the students were, the higher their performances in solid mensuration were. Less confident students, on the other hand, were not certain in their abilities, thus resulted in the low performance in solid mensuration. This conclusion is consistent with the results of the earlier study (Parsons, Croft, & Harrison, 2009) which stressed that students who were generally more confident and successful in mathematics were mathematically qualified students.

Some limitations of this study suggest directions to future researchers. First, the researchers focused on the determination of the existence of a significant correlation between confidence and performance in solid mensuration and did not try to investigate whether students' confidence in solid mensuration causes the change in their performance in the course. Second, the researchers revealed that students have a low confidence level in mathematics and have unsure or no feelings one way or the other when it comes to their confidence in solid mensuration. However, the possible causes of this low confidence level or uncertainty in their confidence, as well as the possible ways to boost students' confidence, were not examined. A possible way to boost students' confidence was investigated by Hakim, Cahya, Nurlaelah, and Lestari (2015). They introduced Brain-Based Learning (BBL) approach as a method of teaching mathematics to a group of 11th grade senior high school students. They found that the mathematical connection abilities and self-efficacy of these students were better than those students who underwent conventional learning. Third, the researchers considered only two variables – confidence and performance. Fourth, the researchers only involved in the study the students from six engineering degree programs and did not consider the other students from other degree programs who are also taking solid mensuration course. Last, the researchers focused on a particular mathematics course – solid mensuration.

5. Recommendations

Based on the conclusion, the following were hereby recommended as the scope of future research. First, the result of the correlation be used to further investigate confidence and performance using linear regression to check whether students' confidence in solid mensuration is a predictor of their performance in solid mensuration. Second, extend the study to the possible causes of students' lack of confidence in mathematics as well as develop methods to improve students' confidence for them to attain high academic performance. Third, add more variables such as motivation, attitude, etc. to be associated with the present variables. Fourth, increase the sample size and employ the research to other groups or disciplines. Last, consider a replication of this study in different areas of math and other academic courses.

References

Al-Hebaish, S. (2012). The Correlation between General Self-Confidence and Academic Achievement in the Oral Presentation Course. Theory and Practice in Language Studies. Theory and Practice in Language Studies, 2(1), 60-65. Retrieved April 5, 2016, from http://www.academypublication.com/issues/past/tpls/vol02/01/08.pdf

Alves, M., Rodrigues, C. S., & Rocha, A. A. (2012). Engineering Students and Mathematics Achievement: a Portuguese Case Study. Proceedings of the World Congress on Engineering, 1, 89-94. Retrieved September 30, 2015, from http://www.iaeng.org/publication/WCE2012/WCE2012_pp89-94.pdf

Borongan- Calles, A. (2016). Influence of Math Comprehension Skills to the Problem Solving Performance in Solid Mensuration among Freshmen Students of Naval State University. International Journal of Engineering Research and Development, 12(8), 15-21. Retrieved April 8, 2016, from http://www.ijerd.com/paper/vol12-issue8/Version-1/B12811521.pdf

Briggs, S. (2014). Why Self-Esteem Hurts Learning But Self-Confidence Does The Opposite. Retrieved September 5, 2015, from https://www.opencolleges.edu.au/ informed/features/self-efficacy-and-learning

Chiu, M., & Klassen, R. M. (2010). Relations of mathematics self-concept and its calibration with mathematics achievement: Cultural differences among fifteen-year-olds in 34

countries. Learning and Instruction. 20(1), 2 - 17. Retrieved August 27, 2015, from https://pure.york.ac.uk›Research›YorkResearchDatabase›Publications

Guner, N. (2013). Incoming engineering students' self-assessment of their mathematical background. Academic Journals. Educational Research and Reviews, 8(14), 1166-1176. Retrieved October 28, 2015, from http://people.math.sfu.ca/~vjungic/Guner.pdf

Hakim, L., Cahya, E., Nurlaelah, E., & Lestari, Z. (2015). The Application EQ and SQ in Learning Mathematics with Brain-Based Learning Approach to Improve Students' Mathematical Connection and Self-Efficacy in Senior High School. PEOPLE: International Journal of Social Sciences, 1(1), 542-557. Retrieved January 31, 2018, from https://grdspublishing.org/index.php/people/article/view/340/323.

Hannula, M. S., Maijala, H., Pehkonen, E., & Nurmi, A. (2005). Gender comparisons of pupil's self-confidence in mathematics learning. Nordic Studies in Mathematics Education No. 3-4. 29-42. Retrieved October 30, 2015, from https://studentportalen.uu.se/uusp-filearea-tool/download.action? nodeId=856395...

Hannula, M. S., Maijala, H., & Pehkonen, E. (2004). Development of Understanding and Self-confidence in Mathematics: Grades 5 – 8. Proceedings of the 28th Conference of the International Group for the Psychology of Mathematics Education, 2004. 3, 17 – 24. Retrieved October 30, 2015, from https://www.emis.de/proceedings/PME28/RR/RR162_Hannula.pdf

Ismail, N. A.& Awang, H. (2010). Analyzing the Relationship between Self-Confidence in Mathematics and Student's Characteristics Using Multinomial Logistic Regression. In: 4th International Research Conference, 01-03 July 2010, University of Gothenburg. (Submitted). Retrieved April 3, 2015, from http://www.iea.nl/sites/default/files/irc/IRC2010_Ismail_ Awang.pdf

Kern, W. F & Bland, B. R. (1967). Solid Mensuration. (2nd ed.) Philippines: Alfredo S Nicdao, Jr, Inc. under license from John Wiley& Sons, Inc. (Original work published 1934)

Laguador, J.M. (2013). Freshman Computer Engineering Students' Attitude Capability in Solving Solid Mensuration Major Exam Problems. International Journal of Social Science and Interdisciplinary Research 2(9). Retrieved April 3, 2016, from http://www.indianresearchjournals.com/pdf/IJSSIR/2013/September/1.pdf

Lazar, S., Morony S. & Lee, Y. P. (2012). Confidence: the best non-cognitive predictor of academic achievement? [Abstract] AN International Journal of Experimental Education Psychology, 34(1), 810-832. Retrieved April 19, 2016, from http://www.tandfonline.com/doi/abs/10.1080/01443410.2013.814194

Litzler, E., Samuelson C. C. & Lorah, J. A. (2014). Breaking it Down: Engineering Student STEM Confidence at the Intersection of Race/Ethnicity and Gender [Abstract]. Research in Higher Education, 55(8), 810-832. Retrieved May 10, 2016, from https://link.springer.com/article/10.1007/s11162-014-9333-z

Mullis, I. V. S., Martin, M. O., & Foy, P. (2008). TIMSS 2007 International Mathematics Report: Findings from IEA's Trends in International Mathematics and Science Study at the fourth and eight grades. Boston, MA: International Association for the Evaluation of Education Achievement, Boston College. Retrieved April 10, 2016, from https://timss.bc.edu/TIMSS2007/PDF/ TIMSS2007_InternationalMathematicsReport.pdf

Nahari, N. (2014). Mathematical Skills and Attitudes of First Year Engineering Students. Masters' Thesis. Retrieved March 15, 2015, from http://doras.dcu.ie/20200/1/ ThesisNoha.pdf

Neill, J. (2005). Definition of Various Self Constructs: Self-esteem, self-efficacy, self-confidence & self-concept. Retrieved August 27, 2015, from http://wilderdom.com/self/

OECD, (2004). Learning for Tomorrow's World – First Results from PISA 2003. p.136. www.oecd.org>ed>school (Accessed on March 22, 2016)

Parsons, S., Croft, T., & Harrison, M. (2009). Does students' confidence in their ability in mathematics matter? Teaching Mathematics Applications [Abstract]. An International Journal of the IMA. 28(2), 53 – 68. Retrieved April 10, 2016, from https://dspace.lboro. ac.uk/dspace-jspui/bitstream/2134/9063/1/parsons-mch-acc%2023%20jan%200920TMA %20paper%20 revised.pdf

Perdue, B. (2015, 14 August). Why we're Bad at Math: It's a Confidence Thing. [Weblog]. Retrieved 28 February 2016, from educationpost.org>Blog>The Belief Gap.

Piper, Bradley D. (2008). Attitudes, Confidence and Achievement of High-Ability Fifth Grade Math Students. Summative Projects for MA Degree. Paper 29. Retrieved February 28, 2015, from digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1025...mathmid summative

Telbis, N. M, Helgeson L & Kingsbury C. (2014) International Students' Confidence and Academic Success. Journal of International Students. 4(4), 330-341. Retrieved July 26, 2016, from https://files.eric.ed.gov/fulltext/EJ1054787.pdf

Terrell, M., Terrell, R. & Schneider, L. (2010). Assessing Engineering Students Ability to use the Mathematics they have learned. American Society for Engineering. Retrieved May 3, 2016, from http://www.math.cornell.edu/~maria/Assessing_Students_Abilities_to_Use_ the_ Mathematics_They_Have_Learned.pdf

Wikipedia. (2015). Engineering. Retrieved 3 November 2015, from https://en.wikipedia.org/w/index.php?title=Engineering

Zorkina, Y. & Nalbone, D. P. (2003). Effect of Induced Level of Confidence on College Students' Performance on a Cognitive Test. Current Research 0n Social Psychology, 8(11). Retrieved June 3, 2016, from https://uiowa.edu/crisp/volume-8-issue-11-january-6-2003