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# Determining Factor in Mathematics Achievements of the Freshmen College Students in an Asian Country

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## ABSTRACT

Mathematics Attitude Scale Instrument was designed to measure attitude toward learning mathematics. Motivating students to learn has been a major issue for teachers; they find it difficult to make their students enthusiastic and interested to learn mathematics since it was viewed by many students as a difficult subject. In view of this, the determinants in mathematics achievement of the 105 freshmen college students were looked into. Descriptive design was utilized. Questionnaire and grade sheets were used to gather data which were interpreted using frequency counts and percentages, weighted mean, and chi-square. Findings showed that the level of determinants in terms of confidence in learning mathematics, motivation and teaching strategies in mathematics was high; the level of mathematics achievement was good; there was a significant relationship between the respondents' mathematics achievement and the confidence and motivation in learning mathematics; while there was no significant relationship existed between the respondents' mathematical achievements and strategies in teaching mathematics. This study concludes that the learners must be motivated either intrinsically or extrinsically. High-achieving students feel more positive about their problem-solving abilities.

***Keywords*** **—** Education, mathematics achievement, confidence and motivation, descriptive, Philippines

## INTRODUCTION

Academic achievement is closely associated with learning styles and motivation. Several studies have been carried out and have identified that teaching strategies and motivation differ based on someone's needs and knowledge. Teaching strategies refer to the method used by an individual to focus and retain new and difficult information. One of the significant challenges a teacher encounters is to be tolerant and matching the teaching strategies with the students' learning styles to recognize learning differences among their students and to improve their academic achievement (Tulbure, 2012). The use of "construction" as a metaphor for learning underlies the Constructivist framework, importance, and guidance of both constructivism and social constructivism perspective widely used in education theory as cited by Amineh and Asl (2015).

Motivation is a complex and different task that excites one student which may bore another. It is essential that students need to feel competent if they are going to be motivated in mathematics. Student's confidence in his/her ability to learn mathematics can, therefore, create a positive impact on his or her mathematics achievement. Skaalvik Federici, and Klassen (2015) in their study analyzed that teacher support and student self-efficacy mediated the relations between students' grades in mathematics and different measures of mathematics motivation. Indicators of motivation were intrinsic motivation, effort, persistence, and help-seeking behavior. The relations between students' grades and motivation were partly mediated through emotional support and self-efficacy. Few studies determined that students' learning styles have a positive relationship with their motivation (Ilias, Rahman, Noor, & Saidon, 2010). Ganley and Lubienski (2016) opined that gender differences in math confidence are more significant than disparities in interest and achievement in elementary school. Structural equation models show that math performance is a consistent predictor of later confidence and interest, and there are some evidences for a reciprocal relationship between confidence and performance in middle school. Hlalele, (2012) revealed that all learners sometimes, often, or always experience mathematics anxiety in academic settings. It is, therefore, essential for teachers and authorities in education to observe its prevalence and to implement strategies toward the alleviation of the effects of mathematics anxiety.

Based on the scenarios above, other factors that contribute to the learning of mathematics should be identified. These are the reasons why the researcher conducted a study to know the determinants of mathematics achievement and their determination to learn mathematics.

## FRAMEWORK

This study was anchored on Thorndike's Connectionism theory. To be more effective, Thorndike conceived his three principal laws of learning, namely, (1) law of readiness, (2) law of exercise, and (3) law of effect.

The law of readiness states that when an organism is ready to act, the action is satisfying, inaction is annoying. A pupil who knows the answer feels satisfied if he is called. Failure to recite makes him feel disappointed. On the other hand, he feels annoyed if asked to recite when he doesn't know the answer. Generally, when a child is not ready to learn, he cannot be forced to learn. Likewise, the teacher should adopt the principles of individual differences. The easier learning tasks should be assigned to pupils of less mental ability, and the more difficult tasks should be assigned to pupils of superior mental capacity.

The law of exercise means that exercise or practice reinforces learning. This puts importance on drill, repetition, and review. Retention invariably results. Frequent practice/drill of mathematical concept if fully comprehended results to mastery.

The Bruner's Theory of Learning as cited by David (2017) focused on the problem of what people do with information to achieve generalized insights or understanding which involves three (3) simultaneous processes: (1) acquisition, (2) transformation, and (3) evaluation. The acquisition is the process of obtaining new information that can either replace or refine something previously known. Transformation is the manipulation of information to fit new situations. Evaluation is checking whether or not the learned material has been manipulated appropriately.

The acquisition of knowledge, whatever its form, is a dynamic, interactive process. A learner is a purposive participant in the knowledge-getting process who selects, structures, retains, and transforms information if the learners use information effectively; it must be translated into his terms. This means that the teacher must strive to see a problem as the learner sees it and provide information that is consistent with the learner's perspective.

## OBJECTIVES OF THE STUDY

This study aimed to: (1) determine the students' confidence in learning mathematics, motivation and the teaching strategies; (2) identify the level of mathematics achievement; (3) know the significant relationship between the mathematics achievement and the confidence in learning mathematics, motivation, and teaching strategies.

## METHODOLOGY

### Research Design

The descriptive correlation research design was utilized. The results of this study were used as bases in proposing a strategic direction for effective motivation and teaching. Likewise, the findings can pinpoint the areas of strengths and weaknesses of the respondents.

### Participants and Settings

This study used a complete enumeration of 105 freshmen students of the College of Education of the University of Eastern Philippines Laoang Campus.

### Ethics Protocol

The researcher sought permission through a letter from the office of the College Dean prior to the conduct of the study. Upon approval, questionnaires were distributed to the respondents. A full explanation of the purpose and importance of the study and how the instrument should be accomplished were explained to elicit their cooperation and enthusiasm to answer the instrument.

### Data Analysis

The data obtained were tallied, tabulated, analyzed and interpreted using appropriate statistical tools. The questionnaire was used as the main instrument adopted from Mathematics Attitude Scale designed to measure attitude toward learning mathematics patterned from the study of Mohamed, and Waheed (2011). The score of Cronbach's Alpha was used to determine the reliability of research instrument. The reliability blended survey CA was 0.924 and with established validity. The descriptive method was designed to describe the level of the determinants of learning mathematics, and mathematics achievements. On the other hand, the correlation method was used to determine the extent

to which the determinants in learning the mathematics of the respondents were related to the achievements in mathematics.

## RESULTS AND DISCUSSION

Table 1a shows that confidence in learning mathematics was high. It can be gleaned that students realized that although mathematics concepts and processes can often be difficult to understand, they are attainable if they do their best to learn them. This implies that the desire and confidence to perform well in mathematics through hard work and better study habits sustain the students' confidence that they can learn mathematics. The results have implications for educational practice and other environments that require extensive use of math.

Table 1a. Confidence in Learning Mathematics

| Statements | WM | Interpretation |
|---|---|---|
| 1. Generally, I have felt secure about attempting mathematics. | 3.82 | High |
| 2. I am sure I can do advanced work in mathematics. | 4.11 | High |
| 3. I am sure that I can learn mathematics. | 4.47 | Very High |
| 4. I think I could handle more difficult mathematics. | 3.19 | Moderately Low |
| 5. I can get good grades in mathematics. | 3.72 | High |
| 6. I have a lot of confidence when Itcomes to mathematics. | 3.21 | Moderately Low |
| 7. I am no good at math. | 4.05 | High |
| 8. I'm not the type to do well in math | 3.51 | High |
| 9. I can handle most subject well, but when it comes to math, I seem to be confused | 2.98 | Moderately Low |
| 10. Mathematics has been my worst subject | 3.44 | High |
| 11. I don't think I could do advanced in mathematics. | 3.29 | Moderately Low |
| 12. For some reason even though I study, math seems unusually hard for me | 3.06 | Moderately Low |
| **GRAND MEAN** | **3.57** | **High** |

Table 1b shows the motivation for learning mathematics was instrumental. This indicates that mathematics is enjoyable to the students, an indication that the teachers manage to present math concepts interestingly. Further, the finding suggests that the teacher should continue to make mathematics learning enjoyable.

This conforms to the TIMSS 2011 International Results in Mathematics. This report provides a rich array of information which describes the educational contexts for mathematics, including home environment support, students' backgrounds and attitudes toward mathematics, the mathematics curriculum, teachers' education and training, classroom characteristics and activities, and school contexts for mathematics learning and instruction (Mullis, Martin, Foy, P & Hooper, 2016).

Table 1b. Motivation in Learning Mathematics

| **Statements** | **WM** | **Interpretation** |
|---|---|---|
| 1. I like mathematics puzzles | 4.83 | Very favorable |
| 2. Mathematics is enjoyable to me. | 4.34 | Very favorable |
| 3. When a math problem arises that I can't immediately solve, I stick with it until I have the solution. | 4.87 | Very favorable |
| 4. Once I start trying to work on a math puzzle, I find it hard to stop. | 3.90 | Very favorable |
| 5. When a question left unanswered in math class, I continue to think about it afterward. | 4.66 | Very favorable |
| 6. Math problems test me; I can't understand immediately. | 4.50 | Very favorable |
| 7. I'll need mathematics for my future work. | 4.60 | Very favorable |
| 8. I study mathematics because I know how useful it is. | 4.78 | Very favorable |
| 9. Knowing mathematics will help me earn a living. | 4.62 | Very favorable |
| 10. Mathematics is a worthwhile and necessary subject. | 4.70 | Very favorable |
| 11. I would rather have someone give me the solution to a very math problem than have to work it out for myself. | 4.35 | Very favorable |
| 12. I do little work in mathematics as possible. | 3.64 | Favorable |
| 13. Figuring out mathematical problems do not appeal to me. | 3.66 | Favorable |
| 14. Classroom activities in math are boring. | 4.11 | Favorable |
| 15.I don't understand how some people can spend so much time on math and seem to enjoy it at | 3.49 | Favorable |
| 16. The challenge of math problems does not appeal to me. | 4.10 | Favorable |
| 17. Taking mathematics is a waste of time. | 4.65 | Very favorable |
| 18. Mathematics is of no relevance to my life. | 4.48 | Very favorable |
| 19. Mathematics will not be relevant to me in my life's work. | 4.28 | Very favorable |
| 20. I see mathematics as a subject I will rarely use in daily life as an adult. | 2.85 | Moderately favorable |
| **GRAND MEAN** | **Very favorable** | |

Table 1c shows the teacher's teaching strategies in learning mathematics were very useful. It revealed that there was a correct choice of appropriate teaching strategies which influenced much the aptitude and enthusiasm of the students. The results negate the findings of Zakaria, Zain, Ahmad, and Erlina (2012) that psychological factors such as mathematics anxiety influence mathematics achievement in students. Thus, math anxiety is one factor that affects student achievement. Therefore, teachers should strive to understand mathematics anxiety and implement teaching and learning strategies so that students can overcome their anxiety.

Further, Intaros, Inprasitha, and Srisawadi (2010) claim that in a problem solving- mathematics classroom, open approach as a teaching approach which is composed of four phases can be utilized: 1) posing open-ended problems, 2) students' self-learning, 3) whole class discussion, and 4) comparison, and summarization through connecting students' mathematical ideas that emerged in the classroom. Open-ended problems and having sessions for students to solve the problems by themselves, encourages students to create their problems and problem solving strategies.

Table 1c. Teaching Strategies in Mathematics

| Statements | | WM | Interpretation |
|---|---|---|---|
| 1. | Discussion | 4.32 | Very effective |
| 2. | Practical work/board work | 4.69 | Very effective |
| 3. | Practice and Consolidation | 4.31 | Very effective |
| 4. | Problem Solving | 4.57 | Very effective |
| 5. | Mathematical Investigation | 4.25 | Very effective |
| 6. | Cooperative Learning | 4.23 | Very effective |
| 7. | Peer Teaching | 3.64 | Effective |
| 8. | Multiple Intelligence | 3.82 | Effective |
| 9. | Values Education and Valuing Process | 4.23 | Very effective |
| 10. | Integration of Content Areas in Science and Language Teaching | 3.78 | Effective |
| 11. | Learning by Teaching | 4.06 | Effective |
| 12. | Explaining or Lecturing | 4.40 | Very effective |
| 13. | Demonstration | 4.56 | Very effective |
| 14. | Collaboration | 4.50 | Very effective |
| | GRAND MEAN | 4.39 | Very effective |

Results also showed that the level of mathematics achievement of the respondents was good; nobody was found to be on the poor level.

This supports the findings of Andinny (2013) that to achieve success in mathematics lessons is to give positive thoughts to students on the results they produce and explain to students that positive thinking is one way to achieve goals. In cultivating positive thinking about mathematics, a teacher must also pay attention to the way the delivery of the material to be easily understood as well as explaining the function or benefit of learning mathematics to make it easier to understand other lessons.

De Smedt, Noël, Gilmore, and Ansari (2013) claim that many studies tested the association between numerical magnitude processing and mathematics achievement, results differ depending on the number format used. For symbolic numbers, data are consistent and robust across studies and populations: weak performance correlates with low math achievement and dyscalculia. For non-symbolic formats, many conflicting findings have been reported.

It also revealed that to some considerable extent, confidence in learning mathematics has a significant effect on mathematics achievement. One of these beliefs is self-efficacy, being confident in one's capability for organizing and implementing the cognitive, behavioral, or social skills necessary for successful performance of a task. Student's confidence in his/her ability to learn mathematics can, therefore have a positive impact on his/her achievement in mathematics.

It is also recognized that learning outcomes cannot be achieved efficiently unless there is high learner motivation. It is essential that students need to feel competent if they are going to be motivated in mathematics. This conforms to Freiberger's, Steinmayr's, and Spinath's (2012) study that teachers' ability evaluations had an (indirect) effect on students' intrinsic motivation and achievement in math hints at the role of significant others in the development of children's academic functioning and might guide potential interventions.

According to Han, R. Capraro, and M. Capraro (2015), STEM PBL has been a critical challenge to be embedded in schools;thus the effect of STEM PBL should be examined. Low performing students showed statistically significantly higher growth rates on mathematics scores than high and middle-performing students over the three (3) years. Also, student's ethnicity and economic status were good predictors of academic achievement which implied that STEM PBLs in schools benefitted low performing students to a greater extent and decreased the achievement gap.

Lastly, findings showed that there was no significant relationship exist between the respondents' mathematics achievements and strategies in teaching mathematics. The different teaching strategies or approaches do not affect their mathematics achievement. This conforms to Kebritchi, Hirumi, and Bai (2010) study that the effects of a computer game on students' mathematics achievement and motivation, and the role of prior mathematics knowledge, computer skill, and English language skill on their achievement and motivation as they played the game skill did not play a significant role in achievement and motivation. Further, Hemmings, Grootenboer, and Kay (2011) claim that achievement in mathematics is inextricably linked to future career opportunities, therefore, understanding those factors that influence achievement is essential.

## CONCLUSIONS

Based on the results, students have more than one learning style and intrinsic motivation. The results of this study can provide useful information for improving the teaching and learning process of teachers and students.The implication of this study indicates that intrinsic motivation plays a vital role in the selection of teaching styles.

Furthermore, this will help to make teaching and learning processes run smoothly and effectively. Identifying students' learning styles and types of intrinsic motivation early in their academic career would alert the student to his or her potential academic weakness and will teach those mechanisms by which to cope and/or adapt with their ability. It is suggested that the institution has to organize seminars and training courses to help students get to know the different types of learning styles and give them the preference to choose the most suitable style to learn mathematics. Teachers also have to plan and implement activities based on students' learning styles to encourage students to participate in the classroom effectively. Selection of an appropriate learning style can increase students' motivation.

Furthermore, the student feels motivated when the content is simplified based on their cognitive level. The level of determinants in terms of confidence in learning mathematics was high, motivation and teaching strategies in useful mathematics were beneficial, mathematics achievement was good. There was a significant relationship between the respondents' mathematics achievement and the confidence and motivation in learning mathematics. A significant relationship exists between the respondents' mathematics achievement and motivation in

learning mathematics. But there was no significant relationship between the respondents' mathematics achievements and strategies in teaching mathematics.

## TRANSLATIONAL RESEARCH

The findings of this study suggest that gamification learning interventions may increase student engagement and enhance learning by exploring the impact of intrinsic and extrinsic motivation on the participation and performance of students in an online game learning intervention. These findings will be of practical interest to teaching and learning practitioners working in a range of educational contexts, and at all levels of education, who wish to increase student engagement and enhance learning.

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## LITERATURE CITED

Amineh, R. J., & Asl, H. D. (2015). Review of constructivism and social constructivism. Journal of Social Sciences, Literature, and Languages. Retrieved from https://scholar.google.com.ph/scholar?hl=en&as_sdt=0%2C5&q=Amineh%2C+R.+J.%2C+%26+Asl%2C+H.+D.+%282015%29.+Review+of+constructivism+and+social+constructivism&btnG=

Andinny, Y. (2015). Pengaruh konsep diri dan berpikir positif terhadap prestasi belajar matematika siswa. *Formatif: Jurnal Ilmiah Pendidikan MIPA*, *3*(2). Retrieved from http://dx.doi.org/10.30998/formatif.v3i2.119

David L, (2017). Discovery Learning (Bruner) in Learning Theories. Retrieved from https://www.learning-theories.com/discovery-learning-bruner.html

De Smedt, B., Noël, M. P., Gilmore, C., & Ansari, D. (2013). How do symbolic and non-symbolic numerical magnitude processing skills relate to individual

differences in children's mathematical skills? A review of evidence from brain and behavior. *Trends in Neuroscience and Education*, *2*(2), 48-55. Retrieved from https://doi.org/10.1016/j.tine.2013.06.001

Freiberger, V., Steinmayr, R., &Spinath, B. (2012). Competence beliefs and perceived ability evaluations: How do they contribute to intrinsic motivation and achievement?. Learning and Individual Differences, 22(4), 518-522. Retrieved from https://doi.org/10.1016/j.lindif.2012.02.004

Ganley, C. M., & Lubienski, S. T. (2016). Mathematics confidence, interest, and performance: Examining gender patterns and reciprocal relations. Learning and Individual Differences, 47, 182-193. Retrieved from https://doi.org/10.1016/j.lindif.2016.01.002

Han, S., Capraro, R., & Capraro, M. M. (2015). How science, technology, engineering and mathematics (STEM) project-based learning (PBL) affects high, middle, and low achievers differently: The impact of student factors on achievement. International Journal of Science and Mathematics Education, 13(5), 1089-1113. Retrieved from doi: 10.1007/s10763-014-9526-0

Hemmings, B., Grootenboer, P., & Kay, R. (2011).Predicting mathematics achievement: The influence of prior achievement and attitudes. International Journal of Science and Mathematics Education, 9(3), 691-705. Retrieved from https://doi.org/10.1007/s10763-010-9224-5

Hlalele, D. (2012). Exploring rural high school learners' experience of mathematics anxiety in academic settings. South African Journal of Education, 32(3), 255-266. Retrieved from http://dx.doi.org/10.15700/saje.v32n3a623

Ilias, K., Rahman, R. A., Noor, M. M., & Saidon, N. A. (2010). Pengaruh gaya pembelajaran terhadap motivasi dan pencapaian akademik pelajar pra ijazah sarjana muda perguruan institut pendidikan guru kampus Ipoh. *Jurnal Penyelidikan Dedikasi*, *2*, 141-153. Retrieved from https://scholar.google.com.ph/scholar?hl=en&as_sdt=0%2C5&q=Ilias%2C+K.%2C+Rahman%2C+R.+A.%2C+Noor%2C+M.+M.%2C+%26+Saidon%2C+N.+A.+%282010%29.+Pengaruh+Gaya++%09Pembelajaran+Terhadap+Motivasi+dan+

Pencapaian+Akademik+Pelajar+Pra+Ijazah++%09Sarjana+Muda+Pergurua n+Institut+Pendidikan+Guru+Kampus+Ipoh&btnG=#d=gs_cit&p=&u=% 2Fscholar%3Fq%3Dinfo%3A0Aq6hLicOhMJ%3Ascholar.google.com%2 F%26output%3Dcite%26scirp%3D0%26hl%3Den

Intaros, P., Inprasitha, M., &Srisawadi, N. (2014).Students' problem solving strategies in problem solving-mathematics classroom. Procedia-Social and Behavioral Sciences, 116(0), 119-123. doi: 10.1016/j.sbspro.2014.01.901

Kebritchi, M., Hirumi, A., &Bai, H. (2010).The effects of modern mathematics computer games on mathematics achievement and class motivation. Computers & education, 55(2), 427-443. Retrieved from https://doi.org/10.1016/j.compedu.2010.02.007

Mohamed, L. &Waheed, H. (2011). Secondary Students, Attitudes Towards Mathematics in the Selected School of Maldives. *International Journal of Humanities and Social Science, 1(15) 277-281.* Retrieved from https:// linkspringer.com/article DOI:10.1007/s13394-016-0168-0

Mullis, I. V., Martin, M. O. Foy, P., & Hooper, M. (2016). TIMSS 2015 international results in mathematics. TIMSS & PIRLS International Study Center at Boston College. Retrieved from https://scholar.google.com.ph/ scholar?hl=en&as_sdt=0%2C5&q=Mullis%2C+I.+V.%2C+Martin%2C+ M.+O.+Foy%2C+P.%2C+%26+Hooper%2C+M.+%282016%29.+TIMS S+2015+international+results+in+mathematics.&btnG=

Skaalvik, E. M., Federici, R. A., &Klassen, R. M. (2015). Mathematics achievement and self-efficacy: Relations with motivation for mathematics. International Journal of Educational Research, 72, 129-136. Retrieved from https://doi. org/10.1016/j.ijer.2015.06.008

Tulbure, C. (2012). Learning styles, teaching strategies and academic achievement in higher education: A cross-sectional investigation. Procedia-Social and Behavioral Sciences, 33, 398-402. Retrieved from https://doi.org/10.1016/j. sbspro.2012.01.151

Zakaria, E., Zain, N. M., Ahmad, N. A., &Erlina, A. (2012).Mathematics anxiety and achievement among secondary school students. American Journal of Applied Sciences, 9(11), 1828. Retrieved from doi:10.3844/ajassp.2012.1828.1832