Entry Mathematics Performance of Industrial Technology Students in One State College

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Abstract - *Competence in Mathematics is considerably an inevitable factor in the holistic development of a learner. Several studies reported different factors which lead to students' poor performance in this subject. This study generally aimed to assess the entry mathematics performance of the Bachelor of Science in Industrial Technology. Specifically, the study aimed to describe the student's profile, determine their attitudes and beliefs towards mathematics and impression to mathematics teachers towards their entry mathematics performance. It employed the descriptive research design involving eighty-seven Industrial Technology students. The findings revealed that the level of the entry mathematics performance of the students was good. It was disclosed that students have a moderately positive attitude and beliefs towards Mathematics and impressions to Mathematics teachers. Students who have shown positive attitude, beliefs and impressions to Math teachers tend to perform better. Considering the results of the study, effective strategies in teaching with meaningful intervention activities to develop positive attitudes and beliefs of the students are recommended. Thus, utilization of new innovations and technologies and integration of values formation shall be done in the teaching of mathematics to build positive attitudes and beliefs which yields to better performance and cope with the demand of IR 4.0.*

Keywords: *Industrial Technology, Mathematics Performance, Attitudes, Beliefs, Impression*

INTRODUCTION

Mathematics plays a significant role in our everyday life. It is not confined alone in acquiring numeracy and accuracy skills but it helps students improve competence and develop connections and understanding of the world they live in. Mathematics is an aid to represent and attempt to resolve problem situations in all disciplines. It is an interdisciplinary tool and language. Mathematics is not only a language and a subject in itself, but it has also a big role in fostering logical and critical thinking to the students [1].

Inside the classroom, several ways and strategies have been used by teachers to effectively inculcate the concepts and competencies of mathematics to the students. It is the significant role of the teachers and the education institutions in general to develop young minds to become productive and responsive citizens of the country. In order to attain this, the education sector continuously assesses its programs and curricular offerings to make it relevant and responsive to the need of the society, industry and the whole country in general.

Access to education is one of the highest priorities on the world's development agenda. Schooling has not delivered fully on its promise as the driver of economic success. Expanding school attainment, at the center of most development strategies, has not guaranteed better economic conditions. Policies aimed at increasing cognitive skills have themselves been disappointing. An emphasis on providing more resources while retaining the fundamental structure of schools has not had general success. Research on the other hand presents one consistent finding that teacher quality strongly influences student outcomes [2].

In the Philippines, statistics shows a declining performance of students in the National Achievement Test given to the high schools specifically in the field of mathematics. Studies revealed a poor performance of the students in the fields of Science and English. In addition, about 23,866 lecturers in the secondary level lack the required specializations. About 20 per cent of these teachers took mathematics as their area of specialization. A nationwide test was also conducted revealing that high school students had 45 to 60 per cent mastery levels on the required competencies in mathematics. This is below the 75 per cent standard set forth by the Department of Education.

Students enrolled in the Bachelor of Science in Industrial Technology are required to finish the minimum requirement of 6 units in the field of mathematics like College Algebra and Plane Trigonometry. However, it is a common observation that students encountered difficulties and problems mastering

the necessary learning competencies. These lead to have a negative attitude and poor performance in mathematics.

Student-related factors like sex, age, type of school graduated from, attitude towards mathematics, and beliefs towards mathematics have hindered students to acquire the necessary skills in the subject. In addition, teacher related factors like time spent in lesson preparation, teaching methods, teaching experience and training are limiting factors of student performance [3].

Considering the strong influence of educational institutions especially the teachers, it is imperative to look into how student's impression towards their teachers is related to their attitude, belief and performance in mathematics. Knowing student's impression to their teachers will give data for administrators to make necessary modification in order to improve mastery of students in mathematics. Educational institutions calibrate curriculum and enhance skills of teachers to foster positive and desirable outcomes in the achievement of students [4]. Educational institutions and teachers must recognize how mentor-protegee significantly transforms lives of students and guarantee quality education [5].

Assessing entry mathematics performance of students enrolling college is important. It is embodied in the learning principle that assessing their knowledge and skills when students enter college could be used as benchmark to enhance mathematics learning and assist good instructional practice. In addition, having knowledge with their competencies, teachers can decide and devise relevant and meaningful lessons and interventions that could prepare students responsive to the present era of Industrial Revolution 4.0.

It is the primary purpose of this study to analyse performance of students and investigate the factors related to their math performance as basis in the formulation of an intervention plan. The results would serve as input for teachers as transmitters of knowledge to implement intervention that will ultimately improve the delivery learning and a higher achievement of students in mathematics.

OBJECTIVES OF THE STUDY

The study is focused on assessing the entry mathematics performance of the Bachelor of Science in Industrial Technology students in Mathematics. Specifically, the study aimed to describe the profile of the respondents in terms of sex, age and type of school graduated from; determine the attitudes of students towards mathematics, mathematical beliefs and their impression to their high school mathematics teachers; identify the relationship between student performance and their attitude towards mathematics, beliefs and impression towards their mathematics teachers and determine the implication of relationship to mathematics performance.

Hypotheses

This study hypothesized that the attitude and beliefs of towards mathematics and impression to mathematics teachers are positive. Moreover, the entry mathematics performance of the students is influenced by their profile such as sex, age and type of school graduated from. It further hypothesized that students with positive attitude towards mathematics, belief in mathematics and impression to mathematics teachers are significantly related to mathematics performance.

Theoretical Framework

The study is anchored on Albert Bandura's [6] social cognitive theory. It has a connection in this study especially on the attitude and belief of students towards mathematics. This means that the belief that one person has motivates them to execute a specific task in order to attain a certain outcome.

The ability to perform and accomplish a certain mathematical task is based on one's beliefs and predisposition. Positive beliefs and predisposition on oneself in mathematics makes mathematical tasks easier, enjoyable and interesting. When students enjoy and find mathematics interesting, the better they perform in mathematics [7].

The theory is very much relevant to the present study since this theory view learning as a collaborative, interactive and social activity. Connection between the teachers, students, friends, peers and family is required in order to develop a positive learning atmosphere of the learners.

Limitations of the Study

The study is limited to the students who took the admission test and officially enrolled in the Bachelor of Science in Industrial Technology of the Ilocos Sur Polytechnic State College, Santiago Campus, Ilocos Sur, Philipines during the School Year 2017-2018. Respondents were determined using total enumeration. Eighty- seven students were considered in the study. The scores of the students were used to gauge their performance. In addition, the profile in terms of sex, age and type of school graduated from, attitude towards mathematics, beliefs towards mathematics and impression to mathematics teachers were the variables considered in the study.

METHODS

The researcher employed the descriptive method to determine implication of attitude and beliefs towards mathematics and impression to mathematics teachers to their performance. Using total enumeration, it involved 87 students who took up the admission test last April to May 2017. The study was conducted at the Ilocos Sur Polytechnic State College, Santiago Campus, Santiago, Ilocos Sur, Philippines, during the School 2017-2018. It is the only campus of the College offering Industrial Education.

An information sheet was used to gather their profile and their performance were gathered using the result of the admission test. The attitudes were measured by using Fennema-Sherman [8] Mathematics Attitude Scale. In terms of the beliefs, it was adapted from Schoenfeld's [9] previous questionnaires designed to measure mathematics beliefs.

The research proposal was submitted to the Office of the Vice President for Research and Extension and presented to a panel of experts for review. Suggestions were given for the improvement of the proposal. Upon incorporation of all the necessary corrections and recommendation, the researcher asked permission from the Office of the President to conduct and implement the study.

When permission granted, the researcher personally distributes the questionnaires containing the information sheet and the attitude and self-efficacy inventory scale. The purpose of the study was explained to students being the respondents and confidentiality was strictly considered.

After the data were gathered, it was summarized and analysed using frequency count, percentage, mean and simple correlation analysis. Significant relationship was tested at 0.05 level of significance.

Data were categorized and scales were used in the interpretation of data. In terms of the mathematics performance, the weighted scale used is presented in Table 1.

Table 1. Descriptive Rating of Mathematics Performance

Range of Scores	Descriptive Rating
21-25	Excellent
16-20	Very Good
11-15	Good
6-10	Fair
0-5	Poor

In terms of the student's attitude towards mathematics, belief and impression towards their mathematics teachers with the 5-point Likert scale values:

Table 2. Descriptive Rating of Attitudes and Beliefs Towards Mathematics and Impression to Teachers

Scale	Range	Item DR	Overall DR
5	4.21-5.00	Strongly Agree (SA)	Highly Positive (HP)
4	3.41-4.20	Agree (A)	Positive (P)
3	2.61-3.40	Moderately Agree (MA)	Moderately Positive (MP)
2	1.81-1.80	Slightly Agree (SlA)	Slightly Positive (SP)
1	1.00-1.80	Disagree (D)	Negative (N)

NOTE: DR - *Descriptive Rating*

RESULTS AND DISCUSSION

Table 3 presents the profile of the respondent in terms of sex, age and type of school graduated from. The table shows that there are more males with 81 or 93.10% of the total while only a few are female with 6 or 6.90% of the distribution. This means that there are more male students who are attracted to Industrial Technology Education than female students. This finding negates that of the reports in the Overview of the Philippine Education that there are more females than males in the higher education.

Table 3. Profile of Respondents

Profile		f	%
Sex			
	Male	81	93.10
	Female	6	6.90
	Total	**87**	**100.00**
Age			
	16-18	57	65.52
	19-21	21	24.14
	22-24	4	4.60
	25-27	1	1.15
Total		**87**	**100.00**
Type of School Graduated			
	Public	**71**	81.61
	Private	**16**	18.39
	Total	**87**	**100.00**

Moreover, the respondents are predominantly aged 16-18 with 57 or 65.62%. Twenty-one or 24.14% are aged 19-21. This means that the respondents are of normal ages for higher education. Lastly, the table shows that majority of the students enrolled in the Bachelor of Science in Industrial Technology graduated in the public schools with 71 or 81.61%. Only 16 or 18.39% graduated from the private schools. This implies that students who graduated in public schools pursue their college education in the State Colleges and Universities. They

avail affordable tuition and miscellaneous fees as compared in the private schools.

Table 4. Student's Performance in Mathematics

Range of Scores	DR	f	%
21-25	Excellent	2	2.30
16-20	Very Good	10	11.49
11-15	Good	42	48.28
6-10	Fair	33	37.93
0-5	Poor	0	0.00
TOTAL		87	100.00
Mean		11.93	
DR		Good	

Table 4 disclosed the entry mathematics performance of the students in their admission test.

It can be seen that 42 or 48.28% of the students obtained scores ranging from 11-15 with a descriptive rating of Good. The group is followed by those with scores within 11-15 or Fair level, Students with scores 16-20 tallied 10 making 11.49% of the sample. None of the students obtained a score lower than 6 or at Poor level. Only two or 2.30% of the respondents obtained a remarkable score from 21 to 25.

In the overall, the entry performance of the students is good as evidenced by the mean rating of 11.93. This means that the performance of the students is still on the acceptable level. However, the mean average indirectly states that the mathematics performance of the students' needs to be enhanced to achieve a higher level. It requires set of interventions to improve their performance and should immediately be done by mathematics teachers.

Table 5. Attitude Towards Mathematics

	Indicators	Mean	DR
1.	Mathematics is very interesting to me.	2.69	MA
2.	Mathematics is fascinating and fun.	2.87	MA
3.	I enjoy seeing how rapidly and accurately when I work out math problems.	3.02	MA
4.	Mathematics is something which I enjoy great deal.	3.00	MA
5.	I really like mathematics.	2.87	MA
6.	Mathematics is a subject in school which I have enjoyed studying.	2.85	MA
7.	I am happier in Mathematics than in any other subject.	3.31	MA
8.	I feel at ease in a Mathematics class.	3.22	MA
9.	Mathematics is as important as any other subject.	2.63	MA
10.	I feel a definite positive reaction to Mathematics.	3.10	MA
	Overall Mean	**2.95**	MP

Table 5 reflects the attitudes of the students towards mathematics.

As shown, all the items describing the attitudes of students towards mathematics have a descriptive rating of moderately agree which results to a moderate positive attitude of the students with an overall mean of 2.95. This implies that the students have a positive mental disposition towards mathematics. That is, students find mathematics as an important and interesting discipline. In teaching and learning processes of mathematics, the attitude towards mathematics is very important [10].

They moderately agree that they are happier in Mathematics than in any other subject with 3.31, feel at ease in Mathematics class with 3.22, feel definite a positive reaction to Mathematics with 3.10, enjoy seeing how rapidly and accurately when he/she works out problems with 3.02, and mathematics is something in which they enjoy great deal with 3.00. This manifests that students still enjoy learning math concepts and they feel relieve when they are in their math class.

On the other hand, items with the lowest means include mathematics is as important as any other subject with 2.63, mathematics is an interesting subject with 2.69, mathematics is a subject in school which I have enjoyed studying with 2.85, they really like mathematics with 2.87 and Mathematics is fascinating and fun with 2.87. The result suggests that students have still value math as a subject. They find it an important discipline which could be helpful as they perform things and activities in the real life. Many people have realized the importance of mathematics, not only from the point of view of getting an academic qualification at school or college but is also a subject that prepares one for the future as well, irrespective of which walk of life one chooses to be a part of [11]. Students have to perform their full potential towards mathematics courses in their school and beyond [12].

The respondents believe that they have a moderate positive attitude towards mathematics as evidenced by the computed mean of 2.95. This signifies an affirmative perception of the students towards the subject area. Students perceived Math as an important subject with equal relevance to the other subjects. They just found the subject somewhat difficult at times which brings a diminished interest and confidence [13]

Table 6 present the mean ratings on students' mathematics beliefs along self-confidence.

It can be noted that all the items along self-confidence have descriptions of moderately agree. The items with highest means are "I trust myself in mathematics" with 3.39, "I know that I can be successful in Mathematics" with 3.38 and "I am able to get a good mark in mathematics" with 3.13. This means that students have

the self-confidence and potentials to perform mathematical problems and operations. The students are certain that they can be productive citizens with the use of mathematics. In addition, the results suggest that the students believe in their own capacities and can accomplish mathematical tasks given to them by their teachers.

Table 6. Mathematics Beliefs along Self-confidence

Beliefs	Mean	DR
I am the type of person who is good in mathematics.	2.97	MA
I am able to get a good mark in mathematics.	3.13	MA
I can do difficult mathematics tasks.	3.05	MA
I trust myself in mathematics.	3.39	MA
I know that I can be successful in Mathematics.	3.38	MA
Overall Mean	**3.18**	**MP**

Moreover, the items I can do difficult mathematics tasks with 3.05 and "I am the type of person who is good in mathematics with 2.97 rated the lowest. This means that the students still believe that they can perform challenging and complex mathematics tasks. They have acquired and equipped with necessary competence and problem solving skills that makes them confident to complete mathematics exercises and problem sets.

Generally, the respondents believe that they have a moderately positive level of self- confidence as evidenced by the overall mean of 3.18. This indicates a positive belief on oneself that they can accomplish challenging mathematics tasks. They are aware and capable of and can discern what they know and what they do not know.

Table 7. Mathematics Beliefs Along Success Orientation.

Beliefs	Mean	DR
The most important in learning mathematics is to understand.	3.99	A
I prepare myself carefully for the tests.	3.89	A
In mathematics, one will be successful with diligence.	3.41	A
For me, it is very important to get a good mark in Mathematics.	3.83	A
I am anxious before mathematics tests.	3.16	MA
Overall Mean	**3.65**	**MP**

Table 7 presents the mean ratings on students' mathematics beliefs along success orientation.

It can be noted from the table that the most important consideration in learning mathematics is to understand with a mean of 3.99 followed by I prepare myself carefully for the tests with a mean of 3.89 with both descriptions of agree. This implies that to become successful in math one needs to really understand the concepts well. The students agree that they need necessary preparations and review before taking exams. Knowledge learned with understanding provides a foundation for remembering or reconstructing mathematical facts and methods, for solving new and unfamiliar problems, and for generating new knowledge [14].

In addition, it requires thorough preparation in order to become successful in a mathematics test. On the other hand, the lowest is on I am anxious before mathematics test with 3.16 described as moderately agree. This implies that students experience a feeling of uneasiness and an intense moment of fear before exams. Students felt a lot of pressure for each exam they took because each exam was crucial for their grade. The importance of each exam, then, is likely to increase students' levels of anxiety in their mathematics courses [15].

On the overall, the computed mean is 3.65 or moderately positive. This suggests that in order to become successful in math, one should hardly and diligently work on it. The students positively believed that when they are equipped with the important foundations of mathematics and armed with the necessary preparation of taking examinations, they are assured successful in learning mathematics. Learning math becomes more effective if the teacher facilitates the students to find and solve problems by applying meaningful learning [16].

Table 8 presents the impression of students to mathematics teachers.

The items with the highest means are explains the subject matter thoroughly with 4.06 and practices good time management with 3.99 with a description of agree. This indicates that teachers show highly mastery of the subject matter they are teaching. They have the necessary preparation and competence in the topics delivered in their class. In addition, teachers properly utilized the time allotted for the subject.

On the other hand, the indicators with the lowest means are teachers use varied instructional materials with 3.49 and applies the content of the subject matter with 3.72. However, these items are still assessed at agree level. This indicates that teachers utilized sufficient instructional materials suited to the learning pace of the students. In addition, it suggests that teachers provide content-base and contextualized activities in order to impart learning. Teachers' teaching method and effective strategies have major influence on students' attitudes

[17]. Teachers can do many things to facilitate the classroom learning to alleviate students' engagement level and confidence in learning mathematics [18]. They can find ways to encourage student engagement and confidence in learning mathematics [19]. This can be achieved by implementing meaningful activities embedded in real-life contexts [20].

Table 8. Impression of Students to Mathematics Teachers.

Indicators	Mean	DR
1. Explains the subject matter thoroughly.	4.06	Agree
2. Uses varied instructional materials.	3.49	Agree
3. Shows high interest and motivation in teaching the subject.	3.87	Agree
4. Applies the content of the subject matter.	3.72	Agree
5. Motivates students and direct their attention to the subject matter.	3.82	Agree
6. Demonstrates good sense of humor.	3.85	Agree
7. Practices good time management.	3.99	Agree
8. Uses good command of the language.	3.83	Agree
9. Implements proper discipline to students.	3.90	Agree
10. Applies guidance in evaluation skills.	3.90	Agree
11. Maintains eye to eye contact when talking with the students.	3.82	Agree
12. Maintains proper attire.	3.94	Agree
13. Reports regularly.	3.95	Agree
14. Respect the uniqueness of the students.	3.95	Agree
15. Encourage to learn beyond what is required.	3.92	Agree
Overall Mean	**3.87**	**Positive**

In the overall, the computed mean rating of 3.87 suggests that the students have high positive impressions to the mathematics teachers. The result implies that mathematics teachers show professionalism and proper decorum in the practice of their teaching career which made teaching impressive and extraordinary before the students. Teachers being the main actors in teaching shall be equipped with the necessary knowledge and competence so as to deliver and impart the learning they could give to their students. Good and effective teaching is a personal manner. Teachers recognize individual differences and so teachers adjust and deliver instructions based on the pace of the learners.

Table 9. Correlation Between Student Related Factors and Entry Mathematics Performance

Profile	r	Significance
Age	-0.07	p>0.05
Sex	-0.06	p>0.05
School Graduated From	0.11	p>0.05
Attitudes Towards Mathematics	0.62	p<0.05
Mathematics Beliefs	0.52	p<0.05
Impression to Mathematics Teachers	0.44	p<0.05

Table 9 shows the correlation between student related variables and entry mathematics performance.

It can be noted from the table that there are three factors which post significant correlation to the entry mathematics performance of Bachelor of Science in Industrial Technology students. Attitudes towards mathematics, with r=0.62, is positive and significantly correlated to the performance of the students. Aside from attitude towards mathematics, the mathematics performance of the students is significantly influenced by their mathematics beliefs. The relationship between these two variables is represented by r = 0.52, a positive and significant relationship.

In addition, impression to mathematics teachers posts significant relationship with mathematics performance. Students who have positive attitude and beliefs towards Mathematics tend to excel better in the subject. This means that self-belief is associated with achievement. The students do well in math activities and exercises when they sense themselves of being capable to accomplish tasks they met in their daily lives. Students' attitude towards mathematics has been a generator that is known to influence their performance in mathematics [21]. On the other hand, Kurhentanti and Santosa's [22] study revealed no significant relationship between student's disposition and belief in mathematics when correlated to student achievement in mathematics.

Lack of interest and commitment to academic work is an observed problem by most of the teachers to their students. Effective and efficient teaching largely depends on the ability of the teachers to provide meaningful and contextualized activities that would motivate students to learn and develop their attitudes towards mathematics. Students portray different values, attitudes, needs and wants. This diversity of learners requires teachers to developed activities and intervention tasks suited to the learning style and preference of the learners. With these considerations, the attitude of students towards mathematics is developed leading to a better

performance. Students had a positive attitude towards mathematics and therefore they are expected to perform better in the subject. Generally, student confidence predicts their performance. Student who likes mathematics will enjoy learning the subject, look forward to maths lessons and never find the subject as boring. This positive attitude is a recipe for high achievement in mathematics [23],[24].

Implication of Relationship to Math Performance

The findings imply that students have a positive impression to mathematics teachers. Teachers have the necessary competence and mastery of the subject matter. The utilization of varied instructional materials and management of time properly are effective mechanisms to improve students' attitudes and their beliefs towards mathematics. In addition, the provision of meaningful and enjoyable exercises and activities develop a positive outlook towards mathematics. This leads to an impressive performance of students in mathematics. This confirms the findings of Kundu [25] and Mahanta [26] showing positive correlation between attitude to mathematics and math achievement. This implies that better attitude increases likelihood and success in mathematics.

CONCLUSION AND RECOMMENDATION

Majority of the student- respondents are male, ages 16-18 and graduated from the public secondary schools.

The students have displayed a moderately positive attitude towards mathematics, mathematics beliefs and impressions to mathematics teachers. They are able to acknowledge the relevance of the subject to oneself and the contributions of the mathematics teachers in imparting knowledge and skills.

The entry mathematics performance of the students is Good. However, a significant number of "Very Good" students were noted. Students with higher and positive attitudes and beliefs towards mathematics performed better than students with lower attitudes and beliefs.

It is recommended that Mathematics instructors may seek updates with current and newest trends and motivational strategies in teaching mathematics to increase the motivational level of the students and help them develop confidence in dealing with mathematics problem. They may develop positive attitude with students and provide more worthwhile activities, which will engage active teaching- learning process and participation and involvement of students in the class. The organization of periodic seminars, workshops and math olympics for students designed to promote positive attitudes and belies of students towards mathematics shall be considered.

In addition, mathematics instructors may provide immediate interventions towards the advancement of the level of mathematics performance of the students. There should be a conducive learning environment so that students can develop strong confidence in learning mathematics which would advance to better and higher performance. The use of new innovations and technology in teaching mathematics is highly suggested to cope with the demands of Industrial Revolution 4.0.

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