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Tutorial Lessons in College Algebra for Students in System Technology Institute

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Abstract: *This study aimed to develop tutorial lessons in teaching college algebra to first year students in STI College Lipa with the end view of helping students to increase mathematics competence. This study employed the descriptive method of research using a teacher-made test to determine the performance of the students in college algebra. Research instrument items were based on the course syllabus of STI. Statistical tools used were frequency count, weighted mean, percentage, ranking and Kuder- Richardson Formula 20. The findings of the study revealed that 80 student-respondents had low performance in the given test with mean percentage of 68.81. This result indicated a low performance in the ten areas covered in the test. The highest mean percentage of 73.90 was in the topic Inequalities while low performance was found in Review of Elementary Algebra and Algebraic Expressions particularly in problem solving as presented in mean percentage of 62.19. Based on the findings of the study, tutorial lessons can be made to help the students overcome their difficulties in college algebra. Through teacher's encouragement, motivation and discipline, students will develop good study habits that are factors to academic success. Moreover, the school management has to address the concerns of the students especially those with learning difficulties so that they will have a guide in finishing their course. Provisions for adequate, updated and relevant instructional materials like the proposed tutorial lessons based on the needs of the students may be used in tutoring.*

Keywords: *tutorial lessons, college algebra, mathematics competence, tutoring guide*

I. INTRODUCTION

Mathematics is considered one of the major cores of cognitive learning. Starting the very first day that man learned to count, his mathematical journey already started. Considered to be as the oldest and earliest knowledge people acquire, Mathematics brings difficulties to the academic life of students. The National Achievement Test (NAT) is an annual examination administered to public and private schools throughout the country to determine the students' achievement level, strengths and weaknesses in the key subject areas. Based on the results of NAT administered by Department of Education's National Education on Testing and Research Center (NETRC) on March 2008, science and Mathematics were found to be the subjects with lowest performance for both elementary and high school students. Algebra, one of the Mathematics subjects taught in high school is also offered in college. It is part of Mathematics dealing with manipulation of expressions and solutions of equations. Since these operations are needed in all branches of mathematics, algebraic skill is a fundamental need. It is the foundation and the core of higher Mathematics because it supplies the language and patterns of reasoning used in other branches of Mathematics. Therefore, a weak foundation on this subject will cause difficulties in taking up related course. If the students revealed low performances in NAT, it follows that their performance in college algebra might also be affected.

For a variety of complex individual instructional reasons like lack of interest in numbers or the improper of resources in this subject, some students have trouble in attaining Mathematics competencies required for successful participation in school and society. As a result, they face the possibility of being undereducated and underprepared to face another higher mathematics course. Moreover, the success and failure of the learning process reflect also on the teachers' competence because they are the direct implementors. They must be creative enough to think of different techniques and strategies of teaching, where giving opportunities for the students to process, explore, enjoys and improve mathematical skills and achievement all at the same time are enhanced.

Since college Mathematics teaching nowadays is a dynamic activity involving imparting and imbibing of knowledge, it is an occasion for the teachers to draw upon their own resources and initiative so that their students will gain something from the experience of sitting in their classes. Fortunately, there are some doors open to them to increase the academic competence of students. Teacher can positively attain a higher level of literacy in mathematics through their ways of researching for the suitable instructional materials where student can motivate to like and love mathematics.

To teachers who advocate tutoring, they strongly believe that tutoring can help students learn at their own pace, learning style, and level of understanding. However, feedback and correction should be given immediately so that the remediation and enhancement activities can be given for the improvement of the student's mathematical competency. Basic understanding must also be quickly pointed out and identified to provide reinforcement activities. A more complex material can be introduced as soon as the learners are ready. Readiness is important in acquiring ninety percent accuracy in numerical competency. A number of methods like remedial teaching, Supplemental Instruction (SI) learning sessions and adjunct courses attached to high-risk core courses are being used to assist students. Similarly, tutoring can also be a help not only to obtain average performance, but also to excel in any subject like Mathematics. Tutoring sessions are structured so that tutors respond to the immediate academic needs of the students. The students approach tutors and ask for help with specific assignments or problems. The tutors respond by using instructional methodology associated with strategic tutoring whenever possible and appropriate. The tutoring session are mentoring opportunity which will guide the student through goal setting and action-planning activity.

Throughout their school careers, mathematics remains a mystery for most students. As one of the Mathematics instructors in STI College Lipa, she observed that some students found it hard to cope with college algebra. Possible reasons are the absence of entrance examination, revision of courseware in algebra and use only of prescribed college algebra book published by STI (2001). It is imperative for students to have a better understanding in college algebra since this is the foundation of other higher mathematics course. In response to the said problem, STI Central informed the dean that a study about tutorial assistance be done considering the need to help the students in their mathematics difficulties and to help STI in its desire to improve its delivery of instruction to the students, the researcher was motivated to conduct the study. It was due to these reasons, that the researcher being a mathematics instructor of STI College Lipa was challenged to formulate a tutoring guide in teaching college algebra for the first year college students.

This study aimed to develop lessons for tutorial assistance in teaching Mathematics to first year college students in STI College Lipa with the end view of helping students to increase their mathematics competence.

Specifically, this study sought answers to the following questions:

1. What is the performance of students in College Algebra test covering the following topics:
    a. Review of Elementary Algebra and Algebraic Expressions;

b. Special Products and Factoring;
c. Rational Expressions;
d. Functions and Relations;
e. Linear Equations;
f. Radicals;
g. Quadratic Equations;
h. Inequalities;
i. Variations; and
j. Progressions?

2. In what topic did the students perform relatively low?
3. What appears to be the difficulties of students in college algebra?
4. What tutorial lessons may be proposed to improve the over-all performance of students in college algebra?

II. RELATED LITERATURE

Boo (2007) studied learning style and academic performance in trigonometry of computer students in Sta. Teresa College as a basis for developing dynamic ways of conducting mathematics lectures. She found out that there were significant relationships and positive correlation between academic performance in trigonometry and students' learning styles.

Luna (2006) found out that the students who took Supervised Tutoring had an overall higher success rate than those who did not take this subject. Specifically, those who enrolled in pre-collegiate classes and took Supervised Tutoring had a success rate of 70.8 percent versus those who did not take and got only 59.4 percent. Pre- collegiate basic skills students seemed to benefit most significantly from tutoring compared to those who did not seek the service. Younger students benefited the most from tutoring as well.

Magnaye, Gelera and Cantos (2005) in their study about performance and critical thinking through mathematical problem solving in algebra revealed that there was significant relationship between the level of performance and critical thinking. Performance, according to the study depended on the level of critical thinking of the students. The study recommended the improvement of the level of performance and critical thinking of the students by increasing the students' vocabulary in mathematics, giving students different practical problems to be solved. Teachers must know the mental abilities of the students since performance in algebra depends on critical thinking and teachers should take it upon themselves to upgrade schemes on various teaching strategies to develop critical thinking of students.

Lazaro (2002) conducted a study on the effects of peer tutoring on the achievement and attitudes of students toward chemistry as a subject, participated by selected freshman college students. Achievement test was measured using a 50- item multiple-choice test given before and after the peer-tutoring program, which resulted to a higher mean score of the pretest and posttest among the experimental group as compared to the control group. Using a questionnaire, the tutees were evaluated, and it was found out that the students had a positive attitude towards peer tutoring. In peer tutoring, a cooperative rather than a competitive climate was observed, students felt confident to raise questions and they were not hesitant to voice their difficulties.

Alexander (2004) found out in her study that personality preferences were related to the perceptions of students who experienced tutorial learning services. She perceived tutoring to be an environment that allows a student to enjoy learning while in an atmosphere of structure and discipline. Thirty-two students voluntarily participated in in-depth interviews to construct participant profiles and to generate themes. The participants' perceptions of their tutoring

experiences were positive. Using experimental method, Montero (1999) studied the effectiveness of students' peer teaching activities compared with the traditional lecture demonstration technique in teaching. The pretest and posttest were administered to both experimental and control groups. Students in the experimental section performed the lesson in small groups of five students; there was no grouping in the control section, however, both groups were taught by the same teacher. As expected, a better student interaction was observed in experimental classes in each of the two lessons although it took longer time for the students to complete the lesson. It recommended that studies related to this research be made and evaluation instrument be validated for improvement.

The study of Malsi (1998) found out that the poor performance of students in science were due to lack of science books and visual aids, and absence of laboratories where students could work and the limited time allotment for making science projects. In addition, Lacambra (1997) pointed out that use of instructional modules was effective and helpful in teaching physics. His study, which focused on instructional materials and enrichment activities showed that with the use of modules, students tend to achieve higher scores in physics.

The present study was also conducted to develop tutorial lessons in College Algebra for the students in STI Lipa. However, few studies were found in the literature in which this comparison was made. Some writers compared the effects of tutorial assistance with those produced by traditional lecture style while other researchers used the proposed tutorial lessons based on the result of the teacher made-test.

The study of Boo (2007) emphasized the significance of knowing students' learning styles for the teachers to adopt their teaching styles and that academic performance was significantly related to their learning styles. The present study was similar because the respondents were both college students and aimed to get the academic performance of students needed for the development of lessons in mathematics. However, this study is different from the cited study because its focus was in determining the relationship of learning styles and performance in trigonometry.

About the method used in assisting students, the study of Luna was similar to the present study for it is all about tutoring students; the differences were that Luna's (2006) study was conducted abroad and included high school students as respondents. This study focused only on first year college students of STI Lipa, Philippines. Moreover, experimental method was used by Luna while the researcher used the descriptive method of research.

On the other hand, the study of Magnaye, Gelera and Cantos (2005) used mathematical problem-solving instruments to determine the relationship between critical thinking and level of performance, while the present study used teacher-made test covering all topics in college algebra. This was similar to the present study because it also focused on the performance of students on algebra. The present study was different in that it dealt on tutorial assistance. Montero examined whether peer teaching helped students perform better than traditional lectures, while the present study was more on conducting tutorial lessons that will help the learner.

The study of Alexander focused on the relationship between personality preferences and perceptions of students who have experienced tutorial learning services. He perceived tutoring to be an environment that allows a student to enjoy learning while in an atmosphere of structure and discipline. Hence, it bears semblance with the present study although each of the studies was conducted at different research locale.

The study of Malsi (1998) and Lacambra (1997) focused on the effectiveness of instructional methods, strategies, instructional materials and the like, while the present study developed tutorial lessons as results of poor performance in the test. The present study was different from those because it is experimental research and did not use variables like teaching strategies, instructional materials and teaching modules.

These studies were not exactly parallel to the researcher's study but then they served as guides and bases to prove that instructional materials can be considered as one means using tutorial assistance in improving the academic performance of students. As this study was not similar in its entirety to all the other reviewed studies, it can be said that this study has its own distinct personality and is therefore not a duplication of any of the cited studies.

III. METHODOLOGY

Research Design

The main purpose of the study was to design a lesson for tutorial assistance in college algebra for first year students in STI College Lipa in the first semester of school year 2007-2008. To achieve the purpose, the descriptive research design was used with a teacher made-test as instrument to find out the strength and weaknesses of the respondents in particular topics in college algebra. Best (1999) described the descriptive research as suitable for investigation to gather information about the present conditions of relationships that existed, practices that prevailed, beliefs and processes that were going on, effects that were being felt, or trends that were developing. A teacher-made test which included review of elementary algebra, algebraic expression, special products, factoring and rational expression until the topic about progressions was conducted to 80 samples of students in STI Lipa.

Subjects of the Study

The subjects of the study were taken from the total population of 160 freshman students of STI College Lipa enrolled in college algebra during the first semester of school year 2007-2008. The subjects were 50 percent of the total population determined through stratified random sampling. Eighty members were gathered from different sections of first year students of STI. Ten students from each section randomly selected through lottery method served as respondents. According to Yule and Kendall (1990), a sample must be adequate in size in order to be reliable.

Data Gathering Instrument

A teacher made test was utilized in order to gain data for the study.

1. Construction of the teacher made test

The scope and sequence that were used in planning the test in college algebra were framed using the objectives from the learning competencies and the time budget that were listed in the course syllabus made by STI. The preliminary draft covering 50-item test was constructed following the guidelines of test construction by Ebel and Frisbie (1986). The test items covered ten topics and were distributed according to the skills reflected in the Table of specifications (TOS). It is a multiple-choice type of tests, which came from the test bank, instructor's guide, student's handouts and college algebra book published by STI. Before the actual tryout, a pilot testing was conducted to the researcher's co- instructors to test the clarity of expression. Suggestions given by them in the pilot try-out were incorporated in the test.

2. Validation of teacher made test

For the first tryout, the test, which consisted of 75 items was given to 25 students who had taken college algebra. The allotted time was one and a half hours. After checking the test, item analysis was done using the U-L Index Method by Stocklein to interpret the index of difficulty and index of discrimination as suggested by Ebel and Frisbie (1986).

Difficulty Index	Interpretation
0.91 - 1.00	It is very easy, discard the item.
0.76 - 0.90	It is easy, limited in acceptability.
0.26 - 0.75	It is moderately difficult, accept the item.
0.11 - 0.25	Item is difficult, limited acceptability.
0 - 0. 10	Very difficult item, revise or discard the item.

Index of Discrimination	Interpretation
Below 0.2	Reject or revise
0.2 – 0.29	Marginal items
0.3 – 0.39	Reasonably good items
0.4 and up	Very good items

After analyzing the results of the first try out, 45 test items were retained, 11 numbers were rejected and 16 test items were revised for improvement. Selected items were revised and the second tryout was done to a new set of samples. Items were subjected for analysis to find out if the 16 test items revised were improved in terms of difficulty index and discrimination index. Five out of sixteen items were included in the first 45 test items considering the number of items listed in the TOS. Fifty items were obtained after the item analysis.

In order to test the reliability and validity of the constructed teacher-made test, the researcher presented the test questions to some Mathematics professors in Batangas State University. Suggestions were incorporated in the test for its final revision. In order to get the reliability coefficient of 0.96, Kuder-Richardson Formula 20 was used to the 50 item tests to determine high internal consistency of test items.

3. Scoring of teacher-made test

In order to interpret the level of performance of the students in the test, the percentage of scores was grouped as follows.

Percentage	Verbal Interpretation
91 – 100	Very high
81 – 9	High
71 – 80	Average
61 – 70	Low
50 – 60	Very low

4. Development of tutorial lessons

The researcher herself who happened to be a Mathematics instructor tried to find out the level of difficulty of the subject matter being taught to first year college students. Based on the result of the teacher-made test, there were some topics in College Algebra which were very difficult to understand for the students. Using the prepared syllabus of STI College Lipa, the researcher found out that the said topics could be developed as tutorial lessons. It was based on the topics that the students encountered difficulties. The topics included review of elementary algebra and algebraic expressions, special products and factoring, radicals, quadratic equations, and progressions.

Different Mathematics references such as STI College Algebra book and other related sources were used by the researcher. According to Lardizabal (1991), one way of showing teacher's creativity is to avail himself of unlimited supplies of other materials instead of depending on one textbook. The tutorial lessons were divided into seven topics. Each topic

had its general objective, specific objectives, time frame, learning concepts, style of tutoring, process of tutoring, time allotment and exercise to be solved.

Data Gathering Procedures

The researcher asked the approval of the College Administrator and Dean of STI College Lipa to conduct the study. With the permission granted, the administration of test on college algebra was done.

1. Administration of teacher made test

The researcher distributed and administered the test to the respective respondents in one classroom. The time allotted for each test was 1 ½ hours. The researcher administered and retrieved the test soon after the given time. The scores of students were computed and tabulated to find out in what topics the students showed strengths and weaknesses.

2. Statistical Treatment

Tabulated responses were analyzed using the following statistical tools.

Frequency count. This was used to determine the number of responses for each item.

Percentage. This was used to determine the magnitude of the frequency in relation to the whole or total responses.

Ranking. This was used to determine the positional importance of responses.

Mean. This was used to determine the average score of the students in the teacher made test.

Standard Deviation. This was used to determine the variation of scores of students in the teacher made
test results with respect to the mean score.

Kuder- Richardson Formula 20. This was used to determine the level of difficulty of the test items.

IV. RESULTS AND DISCUSSION

1. Performance of Students in Mathematics in Ten Topics Based on the Teacher-made Test

Performance of Students in College Algebra Test covering the Ten Topics Performance assessment is a measurement of achievement which in this study was carried out using teacher-made test. The performance of the students is revealed in the ten tables to illustrate the students' accomplishment.

1.1 Review of Elementary Algebra and Algebraic Expressions. It covers the subtopics real numbers, operations on signed numbers, properties of real numbers, basic concept on algebraic expressions and laws of exponents. Table 1 presents the level of performance of the students in the topic Review of Elementary Algebra and Algebraic Expressions.

Table 1
Performance of Students in College Algebra Test covering Review of Elementary Algebra and Algebraic Expressions

Level of Performance (Percentage)	Frequency	Percentage	Rank
Very High (90-100)	0	0	5
High (80-89)	1	1	4
Average (70-79)	10	12	3
Low (60-69)	26	33	2

Very Low (50-59)	43	54	1
Total	80	100	

It can be seen from the table that 54 percent of the 80 respondents had very low level of performance in the test followed by 33 percent of students who had low level performance. There were 12 percent of the respondents with average level of performance while one percent had high level performance. No one of the respondents attained the very high level of performance.

As based on the results respondents found the test items seemingly difficult. This happened because the students exhibited low familiarity on basic properties of real numbers, lack of understanding on the definition of irrational numbers, getting the multiplicative inverse, dividing polynomial and simplify series of operations.

To develop intellectual skills, Gagne believed that learning requires more amount of practice to have a building process. Lower-level skills provide necessary foundation for higher-level ones. He asserted that teachers must make sure that the students have all prerequisite skills and the order, which they be taught.

1.2 **Special Products and Factoring.** Factoring is the inverse process of special products. In this topic, different type of products and factoring were included. Table 2 shows the performance of students in the topic, Special Products and Factoring.

Table 2
Performance of Students in College Algebra Test covering Special Products and Factoring

Level of Performance (Percentage)	Frequency	Percentage	Rank
Very High (90-100)	1	1	5
High (80-89)	11	14	3
Average (70-79)	8	10	4
Low (60-69)	42	53	1
Very Low (50-59)	18	22	2
Total	80	100	

Eight questions were formulated in this topic. Out of 80 respondents, 50 percent had low level of performance followed by 22 percent were those students with very low-level performance. Compared to the first topic, only 10 percent had an average level and 14 percent showed high level performance. In this topic, only one percent equivalent to one student attained a very high level of performance.

As revealed in the figures, the performance of the students with respect to special product and factoring was not that good because majority had low and very low levels of performance. Many students were confused on getting the middle term of a perfect trinomial square, applying laws of exponents, getting the products of two trinomials. They also lacked knowledge in factoring and the procedure in completing the square.

In such difficulties, Ornstein (1990) suggested that practice and drill method can be employed to students who still lack basic skills on knowledge of academic subject matter before asking them to move on to other tasks or transfer their learning to a new situation.

1.3 **Rational Expressions.** Another topic included in the study was about rational expressions. It is an algebraic expression, which can be represented as a quotient of two polynomials. It involves terms of fractions, addition and subtraction of fraction. Table 3 shows the level of performance of students in college algebra test covering rational expressions.

Table 3
Performance of Students in College Algebra test covering Rational Expressions

Level of Performance (Percentage)	Frequency	Percentage	Rank
Very High (90-100)	3	4	4
High (80-89)	14	18	3
Average (70-79)	0	0	5
Low (60-69)	30	37	2
Very Low (50-59)	33	41	1
Total	80	100	

As shown in the table, most or 41 percent of the respondents had very low performance, followed by 37 percent with low level performance. Students with very high performance were ranked fourth. Nobody had average performance. Some possible reasons for these low performances were the inability of the students to get the least common denominator of rational expressions and simplifying fractional expressions.

As this meant inaccuracy in numbers, Ornstein (1990) mentioned that inaccuracy in arithmetic is costly and embarrassing. Inability to use the four fundamental processes of arithmetic accurately and lack of reasonable skills in fractions may seriously jeopardize future school and vocational success. Focus and concentrations as well as basic knowledge of fundamental processes are a must.

1.4 **Functions and Relations.** Items included in college algebra test were the kinds of functions and operations on functions. Table 4 presents the performance of the respondents in the topic, Functions and Relations.

Table 4
Performance of Students in College Algebra Test covering Functions and Relations

Level of Performance (Percentage)	Frequency	Percentage	Rank
Very High (90-100)	7	9	4
High (80-89)	23	29	2
Average (70-79)	0	0	5
Low (60-69)	28	35	1
Very Low (50-59)	22	27	3
Total	80	100	

Out of 80 respondents, 35 percent had low level performance while 29 percent had high level performance. Students with very low-level performance were 27 percent. Fourth in rank were the students with very high-level performance with nine percent of respondents.

As could be noted from the result, more than 50 percent of the respondents had low and very low performances Students may not be able to recall how to evaluate functions especially on composition of functions and to describe the domain of the function in each equation.

Relation is a set of ordered pairs while function is a set of ordered pairs (x,y) such that no two ordered pairs have the same first element. Items included in the college algebra test were the kinds of functions and operations on functions. Interestingly, the concept of a function is basic and of great importance in pure and applied mathematics. Evidently, the students did not have clear understanding of functions.

This idea conformed to Angel (2001) about teachers and other mathematics educators' beliefs that students learn more effectively when they are interested on what they learn. Therefore, continued attention be directed toward creating and reinforcing positive attitudes.

1.5 **Linear Equations.** In this topic, the respondents were asked to solve linear equation in one and two or more unknowns involving problem solving**.** Table 5 presents the level of performance of the students in the topic linear equations.

Table 5
Performance of Students in College Algebra Test covering Linear Equations

Level of Performance (Percentage)	Frequency	Percentage	Rank
Very High (90-100)	3	4	5
High (80-89)	19	24	3
Average (70-79)	18	22	4
Low (60-69)	20	25	1.5
Very Low (50-59)	20	25	1.5
Total	80	100	

It can be observed from the table that 25 percent each from the 80 respondents got low and very low performances followed by 24 percent who had high level of performance and another 22 percent of the respondents with average level performance. Only about four percent of the respondents had very high level of performance.

As could be noted from the results, 50 percent of the students attained the average, high, and very high level of performance. These values reflect average performance on test results. Familiarization on the test question or students' mastery on this topic might have contributed to this achievement.

Goldstein and Levin (1987) asserted that the student must be trained to apply discovery approach method to maintain or achieve better performance on a test. For them, it is better for students to learn how to get the answer than give the right solution to the problem. In addition to this, Lardizabal (1991) conformed that if all problems in mathematics will be solved through the discovery method, students will find mathematics a very interesting and enjoyable subject.

1.6 **Radicals.** Radicals are most used in writing formulas. One of the examples is $\frac{V}{v} = \frac{\sqrt{H}}{\sqrt{h}}$ which gives the relation of the velocities of a bouncing ball after the first bounce velocity V of height H and after the second bounce velocity v of height h. Items in the college algebra test which measured the respondents' ability to do so included questions from operations on radicals. Table 6 shows the frequency distribution based on the performance of students in the test about radicals.

Table 6
Performance of Students in College Algebra Test covering Radicals

Level of Performance (Percentage)	Frequency	Percentage	Rank
Very High (90-100)	9	11	3
High (80-89)	0	0	4.5
Average (70-79)	29	36	2
Low (60-69)	0	0	4.5
Very Low (50-59)	42	53	1
Total	80	100	

Out of 80 respondents, 53 percent had a very low level of performance followed by 36 percent students with average performance. Eleven percent of respondents had very high level of percentage. On the other hand, no one showed low and very low-level performances.

As revealed in the figures, the performance of the students with respect to this test was not good because more than half of the respondents obtained very low performance. Based on the

results, what students lacked were understanding lessons in radicals. Students found it hard to multiply radical expressions.

Birkey and Todman (2005) asserted that the key in getting and keeping students actively involved in learning lies in understanding learning preferences which can positively or negatively influence a student's performance. They mentioned that the most important thing a teacher can do is to be aware that there are diverse learning styles in the student population.

1.7 **Quadratic Equations.** A quadratic equation with one unknown is one in which the highest power of the unknown occurring is two. It can be solved in at least three ways namely: solution by factoring, solution by completing the square, and solution by quadratic formula. Table 7 presents the performance of the students on the topic, Quadratic Equations.

Table 7
Performance of Students in College Algebra Test covering Quadratic Equations

Level of Performance (Percentage)	Frequency	Percentage	Rank
Very High (90-100)	3	4	5
High (80-89)	8	10	4
Average (70-79)	21	26	3
Low (60-69)	22	27	2
Very Low (50-59)	26	33	1
Total	80	100	

It can be noticed from the table that 33 percent of the respondents had very low performance followed by 27 percent students with low performance. Third in rank with average level of performance was represented by 26 percent. Students with high and very high levels had percentages of 10 and 4, respectively.

As revealed from the table, students could have found this topic seemingly hard because of some worded problems included in the test. Students found it hard to analyze problem solving and translate the worded problem into an equation.

The ability to solve problems is a basic life skill and essential to understanding technical subjects. Sasketchawan Education (2002) cited that there are several reasons why students often fail to reach a satisfactory level of proficiency in problem solving. Students frequently suffer from fears and anxieties; especially fear or failure that hampers their efforts to solve problems. Bloom suggested that teachers must be aware of how their students process information and what strategies they use to solve the problems. He also added that teachers must accept their ways of solving problems if the answer is the same and accurate.

1.8 **Inequalities.** Inequalities are often used instead of equations to express practical results. The subtopics included in this lesson were fundamental properties of inequalities, solutions of inequalities, and linear inequalities. Table 8 shows the level of students' performance on the topic inequalities.

Table 8
Performance of Students in College Algebra Test covering Inequalities

Level of Performance (Percentage)	Frequency	Percentage	Rank
Very High (90-100)	2	2	5
High (80-89)	14	18	2
Average (70-79)	45	56	1
Low (60-69)	13	16	3
Very Low (50-59)	6	8	4
Total	80	100	

As shown in the table, most or 56 percent of the respondents had average level of performance followed by 18 percent of students with high level and two percent with very high level. This only means that the students found it easier to answer problems about inequalities since only 24 percent had low and very low performances. As revealed in the figure, students' score in this topic reflected a better performance.

In a way, the students' and motivation could have affected students' performance. According to Bandura this can happen, when test results are important to the students' academic performance. Similarly, Lupdag (1993) stressed that when a teacher motivates his class, he does to improve learning as shown in the academic performance of his students.

Another reason is the learning style of the students. According to Gardner (1998), when students become involved with their academic studies, they extend more mental energy, and this significantly enhances the learning process. He also added that learning process has much to do with student's knowledge of study skills and learning styles.

1.9 **Variations.** One of the most important and useful ideas in mathematics is the idea that two variables may be related to each other in such a way that, if one of the quantities increases or decreases, the other quantity also increases or decreases in a definite way. This idea is called variation. In this topic, it involved ratio and proportion and type of variation. Table 9 presents the level of performance of students on the topic, Variations.

Table 9
Performance of Students in College Algebra Test covering Variations

Level of Performance (Percentage)	Frequency	Percentage	Rank
Very High (90-100)	4	5	5
High (80-89)	8	10	4
Average (70-79)	20	25	2
Low (60-69)	30	38	1
Very Low (50-59)	18	22	3
Total	80	100	

Among 80 respondents, 38 percent had low level performance while 27 percent of students had very low performance ranging from 50 to 59 scores. Respondents with average performance were 25 percent. Students with very high and high performances were ranked fourth and fifth obtaining eight and five, percentages, respectively.

As further revealed in the table, the level of performance was quite low, just as the findings of Malsi (1998), which revealed poor performance of the students in the given test. He cited that some reasons for this result were due to lack of references where students could use and limited time allotment for discussions

Lacambra (1997) suggested to use instructional materials like modules or lessons because these were found out to be effective and helpful in the teaching –learning process. In addition, Ornstein also pointed out that practice material should provide a progressive continuity between learning tasks.

1.10 **Progressions.** Many situations in the field of science and mathematics involve numbers arranged in a definite order or sequence which are related to each other such as minutes in an hour, successive powers of 10, squares of integers and others. A sequence or progression is a set of numbers written in a special order by the application of a definite rule. Items in the college algebra test that measured the topic about progressions were questions about arithmetic sequence, geometric sequence and harmonic sequence. Table 10 presents the last topic about progressions.

Table 10
Performance of Students in College Algebra Test covering Progressions

Level of Performance (Percentage)	Frequency	Percentage	Rank
Very High (90-100)	6	8	4
High (80-89)	4	5	5
Average (70-79)	20	25	3
Low (60-69)	28	35	1
Very Low (50-59)	22	27	2
Total	80	100	

Out of 80 respondents, 35 percent showed low level performance followed by 27 percent of students with very low-level performance. Third in rank was 25 percent of students with average level performance followed by eight percent of students with very high level. There were five percent of the respondents with high level percentage equivalent to four students.

As the figures show, the students' performance on the test was low. Students could not determine which is the harmonic sequence and its meaning. Moreover, some students lacked mastery on different formulas to be used in solving questions related to progression. The results indicated that students were weak in formulas and mathematics vocabulary.

Magnaye, Gelera and Cantos (2005) addressed that students' performance can be improved by increasing the students' vocabulary in mathematics and giving students practical problems to be solved. Blackmore also suggested that educators can aid the learning process through varied learning styles appropriate to students' needs. Upcraft (1989) and Stewart (2005) agreed that tutoring process can be an essential aid to the institution's enhancement of both intellectual and social skills. For them, the role of tutoring gives students an opportunity to gain confidence with the help of tutors. Table 11 shows the summary of the overall performance of students in the given college algebra test.

Table 11
Over-all Performance of Students in the Given College Algebra Test

Level of Performance (Percentage)	Frequency	Percentage	Rank
Very High (90-100)	0	0	5
High (80-89)	6	8	3
Average (70-79)	24	30	2
Low (60-69)	45	56	1
Very Low (50-59)	5	6	4
Total	80	100	

The overall performance presents the summary of performance of students in the learning area. The level of academic performance of students is a means of determining the strengths and weaknesses on the topics on a certain curriculum.

It can be observed from the table, that the highest frequency of the respondents was on the students with equivalent percentage ranging from 60-69 which corresponded to 56 percent of the total respondents. This value shows that majority of the respondents had low level of performance. Also, 30 percent of students were average performers, eight percent of the respondents were very high performers, but six percent still performed very low. No one obtained very high level of performance.

There could be factors on this very low performance. Some factors are the weak foundation in mathematics in high school, lack of interest on the subject, lack of motivation to learn on the part of the teacher, lack of student assistance on the part of the school, family problems and others. Also, the absence of entrance examination may be instrumental to poor student performance. Thus, such entrance test should be implemented in order to diagnose students' capability of taking a course.

2. Topics where Students Performed Relatively Low

Teachers must first determine students' strengths and weaknesses to meet the needs of learning mathematics. The test results of such evaluation can be used to development of students' instructional materials, to group students for instruction and to decide for remedial teaching. Evaluation of students' performance is a useful tool in diagnosis, especially when teacher wants to analyze how the learner reached an answer (Reys, 1995). Table 12 summarizes the topics where the students performed relatively low in the given test.

Table 12
Topics in College Algebra where Students Performed Relatively Low

Topics	Mean Percentage	Verbal Interpretation	Standard Deviation	Rank
1 Review of Elementary Algebra and Algebraic Expressions	62.19	Low	7.84	1
2 Special Products and Factoring	66.95	Low	10.34	4
3 Rational Expressions	63.96	Low	14.14	2
4 Radicals	64.69	Low	17.20	3
5 Quadratic Equations	68.33	Low	10.05	5
6 Variations	69.48	Low	9.65	6
7 Progressions	68.65	Low	10.38	7
Over-all	68.81	Low	6.52	

It can be gleaned from the table that the students showed their lowest performance on the topic Review of Elementary Algebra and Algebraic Expressions. This topic had the lowest computed mean percentage of 62.19 with standard deviation of 7.84. This is supposed to be one of the easiest of all the topics because it deals only on reviewed lesson like real numbers, signed numbers and properties of real number. Some factors for this low achievement are lack of patience in getting the answer and the time allotment in completing the task as what Lacambra (1997) cited.

It can also be noted that the students had low performance on the topic Rational Expressions which ranked second with computed mean percentage of only 63.96 and standard deviation of 14.14. Lack of basic mathematical skills could be one reasons for the low performance on this topic. Bucu (1994) asserted that students must be encouraged to think for themselves, thus developing self-reliance. Moreover, he also mentioned that one of the best means of training students in mathematics is through discovery approach.

On the topic Radicals, the students also performed low as shown in mean percentage of 64.69 and standard deviation of 17.20. Most of the students forgot the rule in the operations of radicals. As what Ornstein (1990) pointed out, students must have a practice and drill in order to master the lesson and acquire many basic skills while doing the mathematical problems.

Students also performed low in Special Product and Factoring, Quadratic Equations, Progressions and Variations as shown in percentages ranging from 66.95 - 69.48 and standard deviation ranging from 9.65- 10.34.

What might have contributed to the students' low performance in college algebra may be related to the inadequacy of instructional materials like modules and time allotment as pointed out by Boiser (2004) and Malsi (1998). Lardizabal (1991) asserted to the use of guided discovery for the students who are rather slow. Ideally, students may be taught to improvise their own methods of discovery, but the teacher must teach them how. There is

also a need to communicate mathematical concepts precisely in the proper inductive sequence and at a level consistent with the students' abilities.

3. Difficulties of the Students in College Algebra

Students encountered difficulties in college algebra because they had inability to perform multistep procedures, to form new questions and to analyze new situations. They did not remember the proper methods to be used so as with the necessary skills on factoring, completing the square and getting the least common denominator of rational expressions. They had also difficulty in recalling formulas and important terms such as arithmetic sequence, geometric and harmonic progressions. In problem solving, student found it hard to translate word problems into a quadratic equation.

4. Tutorial Lessons in Teaching College Algebra

As the educator found out the needs of tutorial assistance in subject like College Algebra, lessons for tutorial assistance were developed for first year college students in STI-Lipa. The tutorial lessons covered the following topics: Review of Elementary Algebra and Algebraic Expressions, Special Product and Factoring, Rational Expressions, Functions and Relations, Linear Equations, Radicals, Quadratic Equations, Inequalities, Variation, and Progressions. Appropriate number of subtopics was included in each topic. With the help of these tutorial lessons, it is expected that tutor will be able to provide guidance and assistance to students in learning college algebra.

V. CONCLUSIONS AND RECOMMENDATIONS

Based on the results, the following conclusions are drawn:

1. Generally, the students manifest low performance in the teacher-made college algebra test.
2. Of the ten topics, the students have average performance on Functions and Relations, Linear Equations, Inequalities and very low performance in the remaining topics.
3. The students have difficulties on the topics Review of Elementary Algebra and Algebraic Expressions, Rational Expressions and Radicals.
4. The proposed tutorial lessons make good use of behavioral objectives in consonance with accepted tutorial guide.

The findings and conclusions paved the way for the following recommendations.

1. The developed lessons for tutorial assistance in mathematics may be tried out for validation.
2. The validated lessons for college algebra may be used in tutoring first year students to determine their usefulness.
3. A parallel study on tutorial assistance can be conducted in other Mathematics courses.

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