Teachers' Innovativeness and Achievements of Students in Plane Trigonometry

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Abstract: *This study was conducted to determine the relationship between teachers' innovativeness and achievement of students in Plane Trigonometry. The specific questions answered were: 1.What is the level of teacher's innovativeness when measured according to the following indicators: (a) Teaching strategies; (b) Technologically assisted instructions; (c) Developing evaluation instruments; and (d) Flexibility to new trends? 2.What is the level of achievement of students in Plane Trigonometry in terms of the following topics: (a) Angles; (b) Solving right triangle; (c) Solving oblique triangles; (d) Fundamental identities; (e)Trigonometric functions; (f) Negative angle, sum and co-functions identities; and (g) Trigonometric equations; (h) Overall? 3.Is there a significant relationship between teaching innovativeness and achievements of students in Plane Trigonometry? There were 120 Plane Trigonometry students who served as respondent of the study.Based on the findings of this study, the following conclusions were drawn: 1.The mean scores of the level of teaching innovativeness when measured according to the following indicators are as follows: teaching strategies, 3.70, high; technology assisted instruction, 3.40, moderate; development of evaluation instrument, 3.80, high; flexibility to new trends, 3.70, high, and Overall, 3.65, high. 2.The mean scores of the academic achievement of the students in Plane Trigonometry with their qualitative description are as follows: Angles, 5.22, Satisfactory; Solving Right Triangle, 3.21, Poor; Solving Oblique Triangle, 4.31, Satisfactory; Fundamental Identities,4.42 Satisfactory, Trigonometric Functions; 1.36, Very Poor; Negative Angle, .65,Very Poor; Trigonometric Equations, 1.37, Very Poor; and Overall, 2.93 Poor. 3.The computed Pearson r-value in testing the significance of the relationship between teaching innovativeness and achievement of students in Plane Trigonometry is .274, which is significant at α = 0.05 level of significance. Thus the null hypothesis was rejected. The researcher offered the following recommendations:1.School administrators should initiate the conduct of mathematics seminars, workshops and trainings to improve the innovativeness and capability of mathematics teachers. 2.Mathematics faculties are encouraged to upgrade their techniques and strategies in teaching by attending lectures, by affiliating with the different mathematics associations and societies, and conducting researches related to mathematics. 3.The Commission on Higher Education officials must integrate in the policies in the Higher Education about upgrading of college instructors of the latter's teaching strategies. 4. That both Department of Education (DepEd) and Commission on Higher Education (CHED) should jointly enhance their research and development (R&D) and faculty development to upgrade their teachers' teaching abilities and educational attainment, thus, providing them with enough knowledge and ideas in imparting new techniques in mathematics teaching. Lesson plans and syllabi must be checked and revised regularly to answer the relevant needs of students. 5. Future researchers must conduct studies about teaching innovativeness and correlate it to achievement of students in other subject areas.*

Keywords: Teachers, Teachers' Innovativeness, Achievements of Students, Plane Trigonometry

1. Introduction

Background of the Study

Lessons in Plane Trigonometry affect the experiences of the students in Mathematics class. Schools from elementary to college, whether in public or private, deal with how to enhance scientific competencies among their students by upgrading and improving the quality of teaching to help the students understand and correlate every knowledge learned in highly technological society. Teachers need to employ innovations and new ideas in order to help their students enhance their skills in a particular subject course.

In the Philippines, literacy rate has improved a lot over the last few years from 72 percent in 1960 to 94 percent in 2000. This is attributed to the increase in both the number of schools built and the level of enrollment in these schools. Not to mention the quality of literacy in terms of Trigonometry awareness. According to the National Assessment of Education Progress (1982), as mentioned by Andas (2000), the success of the economy and the survival of democracy have become more dependent than ever before on each individual's ability to master increasingly multifaceted knowledge and skills in a highly technological society. But as observed by most Filipinos, the present

education has continually declined in the sense that Filipino students are no longer globally competent in any field.

In school year 2001-2002, results in Region XI showed that Davao City had low percentage means of 37.77 in the Trigonometry. Precisely, this is a very low figure to compare the considerable 68% expected mark. This is a very clear indication that the students in DavaoCity have very poor learning, as well as skills in Trigonometry, having a below average result. This implicates the need to employ innovation in teaching; particularly those that will fit the needs, interests, and abilities of the learner and will make them appreciate the subject (Berandoy, 2000).

Students equipped with the necessary skills in Trigonometry can communicate and compete in the local and global economy, Philippines schools must, therefore, provide students with the opportunity to combine the best of traditional learning with the unprecedented technological innovations. Teachers must employ innovations in the classroom learning to enhance the skills of students in Trigonometry. Hence, this study was deemed of great importance.

Theory Base

The researcher's theory is supported by Vigotsky's Theory of Innovation. Educational ideas, which are both new and sensible, such as knowledge and skills in Trigonometry, can be re-labeled as old ideas and describe them as innovations and technology. Thus, Vigotsky wrote of a "Zone of proximal development", ranging from what teachers or learners might accomplish independently on the basis of what they already know, to what they might do through instruction or learn. It asserts the way in which pupils construct ideas reflects the nature and status of a public knowledge and skills.
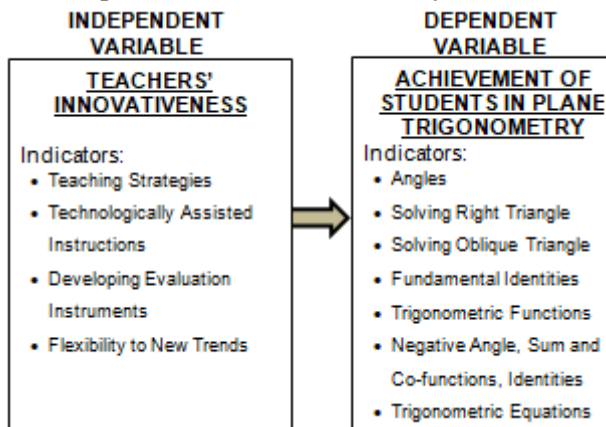
The Conceptual Framework of the Study

Figure 1: The conceptual framework of the study

The Achievement of Students in Plane Trigonometry served as the dependent variable of the study while the Teachers' Innovativeness will act on the independent variable (see Figure 1).

1.4 Significance of the Study

Knowledge gained from this investigation adds to the empirical resources that are available to educational leaders and researchers. The results of the study will be beneficial to the following:

*Administrators***:** This study may serve as a factor of their concern in supporting the teachers who are employing teaching innovations and can recommend the use of effective teaching strategies. They can also help the teachers upgrade and improve the quality of teaching.

Mathematics Teachers: The study will give them an insight on the necessity of teaching innovativeness to enhance students' skills in Trigonometry. It will also encourage them to be in constant quest for new knowledge and ideas that will help them become scientifically updated.

Mathematics Students: The learner is the most important factor in the teaching-learning process. This study could be an encouragement to them in becoming scientifically and technologically updated.

Future Researchers: This study may serve as reference to other researchers who are interested in pursuing research in the educational field. This research can be a good source of information for a researcher who likes to venture on teaching innovativeness and students' skills in other Mathematics related subject.

Scope and Limitation of the Study

The participants of the study were 120 students selected randomly from the College of Engineering, College of Education, College of Technology, College of Arts in Sciences, Evening College students taking up Plane Trigonometry during school year 2006-2007 in the University of Southeastern Philippines.

Definitions of Terms Used

Teachers. Also called school teachers or, in some contexts, educators,are persons who help others to acquire knowledge, competences or values.

Teachers' Innovativeness. It is defined as the teachers' ability to introduce something new. (The Random House Dictionary). In the researcher's study, teachers' innovativeness refers to the teachers' ability to make use of teaching strategies, technologically assisted instruction, developing evaluation instruments and flexibility to new trends.

Achievements of Students. Student achievement measures the amount of academic content a student learns in a determined amount of time. Each grade level has learning goals or instructional standards that educators are required to teach. Standards are similar to a 'to-do' list that a teacher can use to guide instruction. Student achievement will increase when quality instruction is used to teach instructional standards.

Plane Trigonometry. This refers to a branch of mathematics that focuses on the relationship between the sides and angles of a triangle. Plane trigonometry builds upon the basic concepts of Euclidean geometry, and it has applications in a variety of mathematical fields, from physics to advanced calculus.

2. Methodology

Research Method
This study made use of the descriptive correlation method. These measures of the correlation are indicators of measures of association between variables with varying levels of measurement. When the degrees of relationships are measured, this is the basically test of measurement of correlation (Fraenkel, 2003). This method was used since the researcher aimed to determine the correlation between teachers' innovativeness and the level of students' achievement in Plane Trigonometry among the college students in the University of Southeastern Philippines, DavaoCity.

The information about the teachers' innovativeness was evaluated by the mathematics college students. As regards with students' skills in Trigonometry, an achievement test in the subject was given.

Procedure of the Study

The researcher used the following procedure in conducting the study:

1) Seeking permission to conduct the study. The researcher requested permission from the officials of USEP.
2) Administration of the Plane Trigonometry achievement Test and Data The survey questionnaire was conducted to gather data on Teacher Innovativeness. Moreover, the achievement test in Plane Trigonometry was administered.
3) Retrieval of Questionnaires. The researcher personally collected and retrieved the questionnaire from the respondents.
4) Collection of Data. The data were collected, tallied, analyzed and interpreted to answer the questions asked in the Statement of the Problem.

Research Instrument

The researcher used two sets of questionnaires designed by the researcher, formulated readings bases from the related literature of the study; one, for the assessment on the level of teachers' innovativeness and another for the assessment on the level of students' achievements in Plane Trigonometry.

The questionnaire contains four indicators for teachers' innovativeness to measure its relationship to the achievements of students in Trigonometry. These are teaching strategies, technologically assisted instruction, developing evaluation instruments, and flexibility to new trends. The questionnaire for the level of students' achievements in Plane Trigonometry contained indicators such as angles, solving right triangles, solving oblique triangles, fundamental identities, trigonometric functions, negative angle, sum and co-functions, and trigonometric equations. These were presented to the adviser and to the experts for comments and suggestions for further improvement, refinement and validation.

3. Results and Discussion

Table 1: Distribution of Respondents by Colleges

Colleges	Total Population	Percent from Population
College of Education	15	13%
College of Technology	25	21%
College of Engineering	28	23%
Evening College	32	26%
Total	120	100%

The respondents of the study is shown above with the corresponding population by Colleges namely, College of Education, College of Technology, College of Engineering and Evening College.

Table 2: The Level of Achievement of Students in Plane Trigonometry

Topic	Mean Score	Qualitative Description
Angles	5.22	Satisfactory
Solving Right Triangle	3.21	Poor
Solving Oblique Triangle	4.31	Satisfactory
Fundamental Identities	4.42	Satisfactory
Trigonometric Functions	1.36	Very Poor
Negative Angle	.65	Very Poor
Trigonometric Equations	1.37	Very Poor
Overall	2.93	Poor

Table 3 showed the topics discussed in Plane Trigonometry with corresponding mean scores and qualitative descriptions.

Table 3: The Level of Innovativeness of Teachers

Item in the Questionnaire	Mean Score	Qualitative Description
A. Teaching Strategies		
1. Structional analysis, games for students as their exercises	3.40	Moderate
2. Uses of motivational techniques in teaching to draw students' interest.	3.40	Moderate
3. Develop self-guidance and problem solving skills to establish interest of the learners.	3.90	High
4. Provides some activities to enrich the daily lessons.	3.95	High
5. Makes some invention for the lessons to augment students' skills and knowledge.	3.85	High
Mean	3.70	High
B. Technologically Assisted Instructions		
1. Use chalkboard and display board.	3.00	Moderate
2. Use of films, filmstrips and film slides for further presentation.	3.50	High
3. Uses of audiovisual aids and special materials and activities can live - in a talk and reinforce it content.	3.25	Moderate
4. Uses of educational media.	3.45	Moderate
5. Use computers as an integral part of teaching.	3.80	High
Mean	**3.40**	Moderate
C. Developing Evaluation Instrument		
1. Makes significant questions, oral, quizzes and examination for the class session.	3.50	Moderate
2. Use well-constructed lesson design to develop more knowledge and good performance for the students.	3.60	High
3. Provides instruction and practice students activities	3.80	High
4. Use a program that can manage large amounts of students date, including daily attendance, grades on homework and quizzes and standardize test data.	4.10	High
5. Evaluate the student examination results as to guide the learners' improvement.	4.00	High
Mean	3.80	High
D. Flexibility to New Trends		
1. Develop different skills in student or to have them learn to work with different types of materials.	3.50	High

2. Allow learners to express their ideas and suggestions.	3.50	High
3. Present materials to the learners to experiment and apply their skills.	3.70	High
4. Adopt new scientific techniques for the students.	3.90	High
5. Uses new technologies in the classroom instructions regularly.	3.90	High
Mean	**3.70**	**High**
Overall Innovativeness	**3.65**	**High**

Table 3above shows the Level of Innovativeness of Teachers handling subject particularly Plane Trigonometry.

Table 4: Correlation between Teachers' Innovativeness and Achievement of Students in Plane Trigonometry

Variables Correlated	Computed Pearson r	Degree of Relationship	Probability Level
Innovativeness and Plane Trigonometry Achievement	0.274[s]	Low	0.003

This table discusses the Correlation between Teachers' Innovativeness of students in Plane Trigonometry.

4. Conclusions

Based on the findings of the study, the following conclusions were drawn:
1) Plane trigonometry Teachers in the University of Southeastern Philippines are highly innovative in teaching. They are creative and updated with modern trends of teaching mathematics.
2) Students in trigonometry in the entire University have obtained an overall rating of poor achievement in the subject. They have difficulty in analyzing problems in Plane Trigonometry. Their analytical and problems skills during secondary years were inadequate.
3) There is a significant relationship between teaching innovativeness and students' academic achievement in plane trigonometry. Academic achievement of students in Plane Trigonometry was affected by the teachers' innovativeness.

5. Recommendations

In the light of the findings and conclusions of the study, the following recommended:
1) School administrators should initiate the conduct of mathematics seminars, workshops and trainings to improve the innovativeness and capability of mathematics teachers.
2) Mathematics faculties are encouraged to upgrade their techniques and strategies in teaching by attending lectures, by affiliating with the different mathematics associations and societies, and conducting researches related to mathematics.
3) The Commission on Higher Education officials must integrate in the policies in the Higher Education about upgrading of college instructors of the latter's teaching strategies
4) That both Department of Education (DepEd) and Commission on Higher Education (CHED) should jointly enhance their research and development (R&D) and faculty development to upgrade their teachers' teaching abilities and educational attainment, thus, providing them with enough knowledge and ideas in imparting new techniques in mathematics teaching. Lesson plans and syllabi must be checked and revised regularly to answer the relevant needs of students.
5) Future researchers must conduct studies about teaching innovativeness and correlate it to achievement of students in other subject areas.

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Author Profile

Sandra A. Pugahanis a graduate of Bachelor of Science in Mathematics (BSMath) from Rizal Memorial Colleges (RMC), Davao City and obtained her Masters of Arts in Teaching Major in Mathematics from the University of Southeastern Philippines (USeP) in Davao City last 2007. She is currently taking Doctor of Philosophy in Mathematical Science Major in Mathematics Education from Central Mindanao University (CMU).At present, Ms. Pugahan is currently the General Manager of the University of Southeastern Philippines Multipurpose Cooperative (USePMPC), in Obrero, Davao City and a part time Instructor in Mathematics at the University of Southeastern Philippines (USeP).

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