PERFORMANCE AND DETERMINANTS OF PROBLEM SOLVING AMONG COLLEGE PHYSICS STUDENTS

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Abstract: *The main objective of the study was to assess the performance and determinants of problem solving among college physics students. The instruments used in gathering data were the PSTS test, Attitude and Study Habits Inventory, and Teaching Strategies Inventory. Data were analyzed using weighted mean, percentage, t- test, analytic scoring scale, Pearson correlation analysis, regression analysis and ANOVA. Findings showed that most of the Physics majors have not attended Physics seminars and trainings for the last ten years. Favorable attitude towards problem solving helps students in working with tasks that involve problem solving skills. Study habits of the students promote greater effort on the part of the students to learn, thus, resulting in greater success in the problem solving. Students have average competence in the problem solving thinking skills. Problem solving performance of the students is likely to increase when students have better prior competence in English and Mathematics. Teaching strategies is associated with the students' problem solving performance. Students become better solvers when they are taught with problem solving strategies. Campus differences in problem solving thinking skills (PSTS) performance of the students exist.*

Keywords: *problem-solving, performance and determinance, problem-solving thinking skills, understanding, planning, answering*

INTRODUCTION

Background of the Study

Many students pass through their science subjects without proper understanding of the most common basic and important concepts that the subjects intended to teach (Yager,1995). Oftentimes, these students experience more serious learning difficulties in Physics than in other subjects. The very mention of the word Physics is enough to make students think of long, cruel examinations and abstract terms. Because of the perception that Physics is difficult, students often lose their interest in the subject.

The school curriculum has expanded the goals for promoting problem solving since administrators and educators are aware that it is important to equip students with the ability to solve practical problems to prepare them for real life situation(Rivera,1996).The issue is why do students lose interest in Physics? How can their interest in Physics be gained? Why do they perceive it difficult? What aspects of Physics are difficult and what other factors affect this learning difficulty?

Teaching students how to solve problems and helping them to develop an understanding of the concepts off Physics are two of the primary goals of Physics instruction. However, these two goals are difficult to achieve. It has been assumed that a problem solving should help students improve both their problem solving performance and conceptual understanding of Physics(Edgington,1995).

In this study, Chekuri (1996) reported that physics problems are stimuli derived from Phenomena whose analysis and solving requires the synthesis of different domains of knowledge. Solving problem should result in new prediction and better understanding of the phenomena. The purpose of solving classroom problems is to understand relationships among the physical relationships. While solving problems, physics principles and laws are applied through the equations that are suitable to the problems.

In science and mathematics, problem solving is found to be the most difficult and the least learned skill. The ability to solve problems is the heart of science and mathematics and is useful to the extent that it can be applied to particular situation (Brown and Elloit,1973).

Problem solving is a higher order thinking skill, which need creative thinking, critical thinking, and decision making. The thinking processes involved in problem solving include understanding the questions in the problem which also involves the ability to identify the key conditions and variables use in the understanding and solving of the problem. Problem solving also involves the ability to answer a problem after correctly implementing the solution strategy and evaluating the reasonableness of the answers.

On the other hand, Cooney(1990) emphasized the need for the teacher to provide students with the experiences of the various aspects of problem solving approaches. Research has shown that students become better problem solvers if they are taught problem solving strategies. Thus, assessment of the problem solving skills of the students in physics is essential to the teachers.

Conceptual Framework

Educators recognized that if the problem solving is successfully used and taught in the classroom the students will also successfully apply in real life situation. The experience enables the students internalize the theories learned from school though application which makes the lessons becomes meaningful to them. Recent reports suggest that only a small number of students are able to solve complex problems (Dossey,Mullis,Lidguisat and Chambers,1998). Many recent results indicate that the students poor performance in Mathematics may primarily be due to the failure of the tests themselves to measure what students know and can do in Mathematics (Kulm,1990).

Such difficulty is assumed to be attributed to assume factors. Weinburg and Engelherd (1994) contend that gender difference is significantly related to student's attitude and achievement in Physics. Females have greater concern than males. This may affect their attitude toward science because students consider sciences such as Physics to be Mathematics – related.

On the other hand, the findings of Paz (1892), Miguel (1992), Lina (1993), Tibigar (1994), Sebaste (1994) and Acerit (1991), justify the fact that, English and Mathematics subject were positively correlated to students' Physics achievement. The same is assumed in this study.

The paradigm also shows that the students study habits and IQ are possible factors related to problem solving difficulties particularly within the three problem solving thinking skills namely: Understanding the problem, planning the solution and answering the problem.

Research Paradigm

The study views that male students are more inclined to figures and they are expected to perform better in problem solving than the female students. If the attitude of the students toward problem solving is favorable, it is more likely they are interested in problem solving and will strive hard to solve it. If their study habit is good, it is more likely that the students would exert effort to acquire skills to solve world problems. If the mathematics grade of the student is high, it would mean they are good in figures. Certainly, it is likely that they could solve problem Physics word problem since Physics is a subject dealing with numbers and formulas. In addition, if their English grade is good, it implies that the students have better language skills, thus they could comprehend the word problem and they can more likely to

solve it. If the IQ of the students is average or above average, it is more likely that they could solve the problem effectively. If the educational attainment of parents is high and has much income, it is more likely that students could perform better because they have all the means to cope with the needed activities in the school. Lastly, the study views that problem solving performance of students could be affected by a lot of teachers factor like educational attainment, length of service, seminars and trainings, method and strategies used. Higher educational attainment, more years in teaching and seminars and training attended would mean that the teacher become more experienced, more knowledgeable and more skillful in teaching problem solving skills to students.

Statement of the Problem

This study aimed to assess the performance and determinants of problem solving among college students. Specifically, the study aimed to answer the following questions:

1. What is the profile of the respondents by campus and as a whole in terms of:
   A. Students
      a. Age
      b. Sex
      c. Mathematical grades
      d. English grades
      e. College Admission Test (CAT) score
      f. Attitude toward problem solving
      g. Study habits
      h. Monthly family income of parents
      i. Educational attainment of parents
   B. Teachers
      a. Age
      b. Sex
      c. Civil Status
      d. Educational qualifications
      e. Number of years teaching Physics
      f. Seminars and trainings attended
      g. Teaching Strategies

2. What are the attitudes of students toward problem solving?
3. What are the study habits of the students?
4. What is the performance of students in Problem Solving thinking Skills Test by campus or as a whole in terms of::
   a. Understanding
   b. Planning
   c. Answering
5. Is there a relationship between the students performance by campus and as a whole in the different problem solving skills and the following variables:
   A. Students
      a. Age
      b. Sex
      c. Mathematical grades
      d. English grades
      e. College Admission Test (CAT)
      f. Attitude towards bgb problem solving
      g. Study habits
      h. Monthly family income of parents
      i. Educational attainment of parents
   B. Teachers
      a. Educational qualification
      b. Number of years teaching Physics
      c. Seminars and training attended
      d. Teaching Strategies
6. Which of the student profile are significant determinants in the students' performance in Problem Solving thinking Skills Test.
7. Is there a difference in student' performance from the different campuses of the university in terms of the different problem solving thinking skill

Research Hypothesis

The study tested the following hypotheses:

1. There is no significant relationship between students' performance in each of the problem solving skills and following variables:
   a. Age
   b. Sex
   c. Mathematics grades
   d. English grades
   e. College Admission Test (CAT) score
   f. Attitude toward problem solving
   g. Study habits
   h. Monthly income of parents
   i. Educational attainment of parents
2. There is no significant difference in students' performance from the different campuses of the university in terms of the different Problem Solving Thinking Skills (PSTS).

Significance of the study

One of the most important aspects if Physics problem solving in general. This involves the application of Physics principles and equations. The ultimate aim therefore of the study is to use the findings to inform the academe on how to help attain the primary goals of Physics instruction.

The findings of the study may be useful to administrators as a basic for planning program for the development of the teaching skills of instructors to develop the problem solving skills of the students and other higher order thinking skills.

The study will also be useful to curriculum makers, science supervisors and classroom teachers to introduce innovative techniques in teaching of physics to make it less difficult and appealing to learners.

Furthermore, the findings of the study could also be useful to students since it identifies them the idea of the weak and strong points in their problem solving thinking process and to help them develop understand the concepts of Physics.

To the future researchers, the result of the study may be added whatever available in research literature on problem solving difficulties of students.

The researcher believes that although the study is intended only for the students of the Cagayan State University the result can also be used in other school.

METHODS AND PROCEDURES

Research Design

The study used the descriptive correlational method of research. Descriptive research is defined as the study is descriptive as it is assessed the performance, and determinants of problem solving among college physics students of Cagayan State University. The study was also correlational as it determined the extent of the set of variables which are associated with the use of problem solving thinking skills of the students. The independent variables included the attitude towards problem solving, study habits, Mathematics grades, English grades, CAT score, age, sex, monthly income and highest educational attainment of parents of the students and the teachers' educational qualification, number of years in teaching Physics, seminars and training attended.

Locale of the Study

The study was conducted in all the eight (8) satellites of Cagayan State University. CSU Tuguegarao City, the main campus, is situated at the capital town of Cagayan. With this present status, this town became as the commerce for it is very near to the towns of Solana, Enrile, Iguig and Piat.

Piat is famous of the shrine of Our Lady of Piat. People from other places visit the place for pilgrimage where one of the satellites of CSU is found.

CSU Sanchez Mira – the farthest satellite of the University was then a hunting ground of the Kalingas. Located at the tip of a productive elevated region near the sea. The town was named in honor of Manuel Sanchez-Mira, Spanish brigadier – general assigned in Cagayan Valley.

Another campus is at Aparri. This town is situated at the mouth of Cagayan River (longest and largest river in the Philippines), some five hundred and ninety-six kilometers north of Manila, considered as the commercial center in Cagayan.

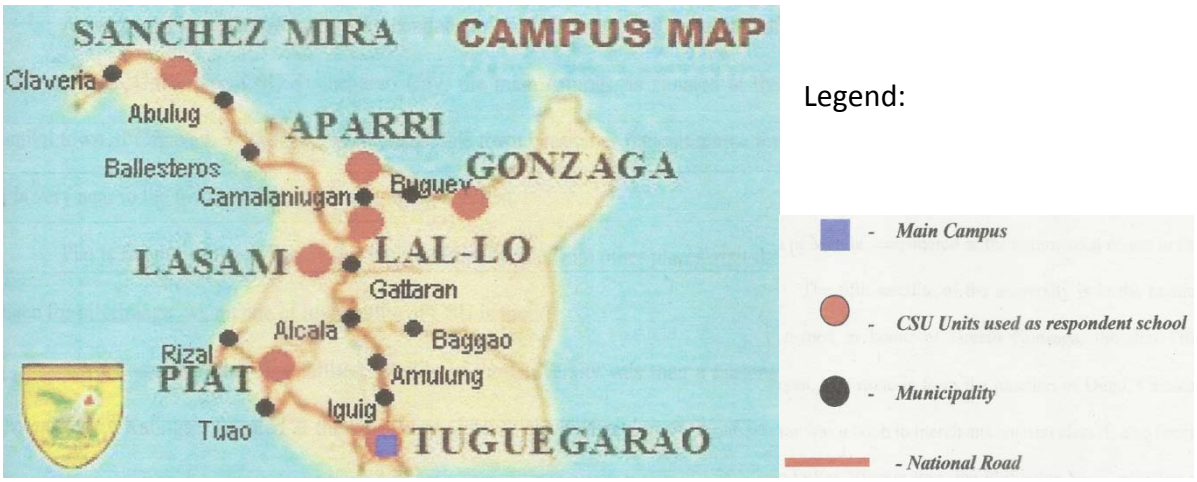
The fifth satellite of the university is in the municipality of Gonzaga. The town was named in honor of Gracio Gonzaga, the first Filipino Provincial Governor of Cagayan. The route is from the junction of Dugo, Camalaniugan before the outbreak of the war was a boon to

merchants and travelers. It also facilitated the way for excursionists going to San Vicente Port, the Philippine Navy refueling station CEZA in Sta. Ana, Cagayan.

The youngest campus known as the rising campus is at Lasam. The town which was once a part of Gattaran, but as the population increased, the people of western part of Gattaran made resolutions that it be made a separate town and it was named Lasam in honor of the late Governor HonorioLasam, the sixth Governor of Cagayan.

Finally the seventh campus where the researcher is based is Cagayan State University at Lal-lo. The school which is 2.7 kilometers away from Maharlika Highway. It is an agricultural school covering a land area of 1,727 hectares.

Lately, the school was chosen as the center of Provincial Technical Institute of Agriculture (PTIA) in region 2.



Locale of the Study

Samples and Sampling Procedures

The respondents of the study were the second year college students of the Cagayan State University. Of the total 1,100 second year students, 300 sophomores were sampled by using Slovin's formula. After knowing the desired number of respondents, the number of students to be taken by the campus was determined by stratified random sampling. The procedure provided more samples taken from campuses with more second year student population.

Systematic sampling was employed in determining the student sample per campus. The roster all of second year student per campus was obtained from the campus registrar. The list was consecutively numbered. An interval of drawing the sample was computed by the total second year student population by desired sample size for the campus. After knowing

the interval, a random start was identified by using the calculator's random number feature. After the first sample was identified, the interval was used to identify the succeeding students' samples.

Research Instruments

The following were the major instruments used in this study:

The Problem Solving Thinking Skills Test used in the study was composed of 10 items which required the students to show their work and solutions in writing. This allowed students to respond in variety of ways. In this way, students written work on a problem was used to help evaluating his performance.

The tables show the different topics covered in the test. The items were based on the existing syllabi for general physics, textbooks and references physics teachers and students are using.

The Study Habits Inventory was used to determine the respondents' habits and methods that are used to facilitate learning in items of concentration, time of schedule, resourcefulness, reading habits dependence on other and note taking procedure. It was adapted from the study of Tong , Gilbert N. 1994. The inventory consists of 12 items and each positively oriented statements were rated using the five point scale.

1. N –Never
2. Se- Seldomlhb
3. So- Sometimes
4. O- Often
5. A- Always

For negative oriented statements, the scoring was revised. The Attitude towards Physics Problem Solving Inventory was used to determine the attitude of the students toward problem solving. It was adapted from Miguel, Edilberto R. 1992. The attitudinaire consist of 12 items which was used to determine the attitude of the students. Each statement was rated using the five point scale from which the respondents indicated their appraisal of his attitude toward problem solving. The categories that correspond to the five point scales were given the adjectival equivalent as follows:

5. SA – Strongly Agree
4. A - Agree
3. U - Undecided
2. PD – Partially Disagree
1. SD – Strongly Disagree

For negative statements, the scoring was revised.

The Teaching Strategies of Physics Teachers Inventory was used to determine the extent using the different strategies in the class. It was adapted from Concordia, Merlyn M. 2000. The inventory consists of 10 items and each statement was rated using the scale below:

5. Always
4. Often
3. Sometimes
2. Seldom
1. Never

Collection of Data

Permission was asked from University President to conduct the study in the campuses of the university. When the President's approval was obtained, the researcher sought the assistance of campus heads and college deans to conduct the study in their campus.

After determining the students samples, the researcher approached the subject teacher of the students to answer the research instruments. Three hours were allotted for students to respond to all the Problem Solving Thinking Skill Test, Study Habits Inventory and Attitude Inventory.

The Attitude and Study Habit inventory was administered ahead of the Problem Solving Thinking Skills Test to avoid the effect of any difficulty during the problem solving process.

The researcher requested the University President to allow the OSS Staff of Carig to release the CAT scores of the second year college students of the university particularly the respondents. The Mathematics and English grades of the respondents was obtained from the registrar per campus.

After the retrieval of the questionnaire from the respondents, answer were recorded and tabulated

Analysis of Data

The data was evaluated and tabulated before they were analyzed. The scores in each of the Problem Solving Thinking Skills were determined using the Analytic Scoring suggested by Rivera (1996).

The Analytic Scoring Scale was used to give focus on the problem solving thinking processes instead of just looking at the answer to the problem. The analytic scoring is as follows:

Understanding the Problem

0 – no single given is identified

1 – incomplete enumeration of given and key condition or variables

2 – completely identified the given, key conditions and variables

Planning a Solution

0 – no attempts or inappropriate plan

1 – partially correct plan

2 – completely corrected plan

Getting an Answer

0 – no answer

1 – partial answers

2 – correct answer and correct label

Every thinking skills has aggregate score 2 and hence worked out problem has a total point of six (6).

The attitude Inventory Test was scored using five-point scale. For positive statements, the following scale was used.

Scale

5. Strongly Agree

4. Agree

3. Undecided

2. Partially Disagree

1. Strongly Disagree

On the other hand, the negative statements were scored in the reverse manner. The following arbitrary scale was used to determine the attitude of the respondents.

1 – 1.79	-	HN
1.8 - 2.59	-	N
2.6 – 3.39	-	Neutral
3.4 – 4.19	-	P
4.2 – 5.0	-	HP

The Study Habits Inventory test and the Teaching Strategies Inventory were also scored

Scale	**Weight**
A – Always	5
O – Often	4
So – Sometimes	3
Se – Seldom	2
N – Never	1

In the assessment of the weighted mean for positive statement a criterion scale was used by the researcher. They are as follows:

Mean	**Arbitrary Scale**
4.2 – 5.0	Always
3.4 – 4.19	Often
2.6 – 3.3.9	Sometimes
1.8 – 2.59	Seldom
1.0 – 1.79	Never

On the other hand, for negative statements, the criterion in the positive statements was reversed.

The Pearson's Correlation Coefficient was used to find out the relationship between the different Problem Solving Thinking Skills Test (Understanding, Planning, and Answering) and the dependent variables: Students' Profile, Attitude Toward Problem Solving Study Habits, English Grade, Mathematics grades, CAT, monthly income and educational attainment of

parent and the teachers factors: Educational qualification. Number of years teaching physics, seminars and trainings attended and teaching strategies.

The analysis of Variables was used to test the difference in performance in Understanding the problem. Planning the solution and answering the problems of the students grouped by campus and as a whole.

The regression analysis was used to determine the predictors of problem solving performance of the students. For the purpose, sex, civil status, and educational attainment were coded. The following were:

Sex:

1 – Male2- Female

Civil Status

1 – Single2 – Married

Monthly Income of Parents:

1 – P 5,000 and below

2 – P 5,001 and 10,000

3 – P 10,001 and 15,000

4 – P 15,001 – 20,000

5 – P 20,001 – 30,000

6 – P 30,001 and above

Educational Attainment of Parents:

1 – Elementary5 – with Masteral Unit

2 – High school6 – Graduate in Masters Degree

3 – with units in College7 – with Ph.D. Units

4 – College Graduate8 – Graduate in Doctorial Degree

Educational Attainment for Teacher Respondents:

1 – BS Graduate

2 – BS with MA units

3 – MA Graduate

4 – MA with Ph. D. units

5 – Ph. D. Graduate

DISCUSSION OF FINDINGS

Profile of the Students

The students involved in this study were the college Physics students enrolled in the university during the 1st semester of school year 2012-2013.Most of the students are female with a total of 195 or 65 percent; 105 or 35 percent are male. These students predominantly belong to age bracket of 17 – 18 with a frequency of 225 or 75 percent; 60 or 20 percent are of age 19 – 20. This reveals that the students are at their right age for the year level in college.

As regards their Mathematics and English grades, most of the students (112 or 37.3 percent) had a GPA of 2.5 in English 11 and nearly half (92 or 30.7 percent) of the students obtained the same grade in English 12. There are 76 or 25.3 percent and 169 or 56.3 percent students with a grade of 2.25 in Mathematics 13 and 14 respectively. These findings suggest that the students don't have favorable grades in the grades in the subjects which are good foundation for better problem solving performance.

As to CAT score of the students, they are below average in both areas of language Proficiency and Numerical Analysis which are represented by 193 or 64.3 percent. The same trend was observed in the other areas. There are 212 or 70.7 percent and 208 or 69.3 percent for Verbal Proficiency and Abstract Reasoning respectively. This finding indicates that the students don't have favorable IQ which is a requirement in problem solving skills.

As regards students with parents who graduated in college, 29 or 16.7 percent have fathers with college degree, while 38 or 12.7 percent have mothers who earned a college degree. The findings indicate that the parents of the students have minimal knowledge which is a tool in helping their children to study college physics and to guide them work on physics problem sets.

In terms of monthly family income, 171 or 57 percent of the students have parents earning P5, 000 and below or 19 percent have income of P5,001 – P10,000 and 28 or 9.3 percent represents earners of P10,000 – 15,000. This means that the students' respondents mostly belong to families with average standard of living.

As to the highest educational attainment of the parents of the students respondents, less than half (131 or 43.7 percent) of the students have fathers with high school education.

Likewise, 116 or 38.7 percent have mothers who possess high school education. An almost equal percentage of students have fathers and mothers with elementary education, that is, 85 or 28.3 percent and 83 or 27.7 percent, for fathers and mothers, respectively. Fifty or 16.7 percent of the students have fathers with units in college, while 56 or 18.7 percent of them have mothers with some units in college.

Profile of the Physics Teachers

Teachers who taught Physics 11 in the eight campuses of the university during the first semester of school year 2012-2013.

Most (33.33 percent) of the teachers belong to age bracket of 45 – 50. There are 27.78 percent whose age is form 41 – 45; 16.67 percent from 36 – 40; 11.11 percent, 51 – 55; 5.56 percent each, from 31 – 33 or 56 – 60. This means that the teachers are mostly at their middle age, the stage where they could be more competent and capable to give their best in performing their teaching jobs.

As regards to sex majority (10 or 55.6 percent) of the teacher respondents are females while 8 or 44.44 percent are males. This findings reveals that the teaching profession is really female dominated.

Majority (14 or 77.78 percent) of the teachers are married while only 4 or 22.22 percent are single. These findings indicate that teacher respondents are likewise exposed to problems emanating from their family roles and responsibilities which could help them understand different behaviors of their students.

As to highest educational attainment, 9 or 50.0 percent of them have Ph.D. units; 4 or 22.20 percent are Ph.D. graduate; 5 or 27.80 percent are master degree holders. This finding indicates that physics teachers of CSU recognize the importance of pursuing graduate education not only for personal satisfaction but also for the benefit of the school.

As regards to the number of years teaching physics, majority (9 or 50 percent) have been teaching for 11 – 15 years; 4 or 22.22 percent for 16 – 20 years. Two or 11.11 percent each have either taught from 1 - 5 years or 20 years and more. One has taught for 6 -10 years. These findings suggest that physics teachers could have mastered the course content and have improved the course syllabus that integrates a merging knowledge and skills in physics.

As to physics seminars and trainings attended by the teachers, 10 or 55.56 percent have only attended once or twice; 6 or 33.33 percent with 3 – 4 attendance; 2 or 11.11 percent have 5 -6 seminars and trainings in physics. This findings reveals that the teachers keep on growing professionally in the job and want updates and innovations in the field of physics.

Attitude towards Problem Solving

Generally the students' have uncertain feelings toward problem solving as shown by the overall weighted means of 3.38. It means that they lack the self-assurance or confidence as regards working with problem solving tasks.

The students fully agree (weighted mean = 4.21) that "problem solving problem solving in physics which are related to real life phenomenon is challenge." However, they partially disagree (2.11) that "teachers should not assign problem set to students."

Students' generally agree that they enjoy solving problem in Physics (3.77); when their teachers gives them a problem they get comfortable (3.45); once they start solving a Physics problem they do not give up until they could solve it (3.72);l Physics would be more interesting if they had more problems (3.62); Problem solving with groups is more fun than doing it alone (3.89); Problem sets make Physics meaningful (4.04).

On the other hand, they are undecided on the following attitude statements: "I would rather solve only easy Problems in physics" (3.27); "I think I am good in solving problems" (3.04); "Problem solving is boring" (2.28); "Solving problem sets in Physics is a difficult exercise" (3.28).

Generally, front the above findings, students have not yet fully determined whether or not they like problem solving. As such, when they are exposed to this kind of tasks, there will always be a feeling of uncertainly, doubt, and hesitancy to work on the task as they all not confident of their work.

Study Habits of the Students

The respondents have fairly good study habits as shown by the overall weighted mean of 3.13.

As revealed in their mean assessments, student's often take down notes (3.38); jot down important concepts and key words while reading materials (3.54); and review topics which

they cannot understand (3.40). This finding indicates that students have good note taking skills. Also, they try to spend time reviewing difficult lesson.

On the other hand, students' sometimes have the tendency to daydream when trying to study (2.65); have troubled picking out the important points in the material read or studied (2.88); set aside time for daily review (3.17); got to the library to go to look for references (3.01); takes some time to get settled and "warmed-up" on the task of the study (3.04); read several books in order to finish a material (3.03); re-read the materials several times because the words don't have much meaning the first time they go over them (3.34); needs somebody to help them to go over their previous lesson (2.91); read the particular topics in the books after their teacher had discussed it on class (2.75).these findings suggest that students' find means to learn their lesson. They give extra effort to understand their lessons.

Although the students' sometimes undertake the study habits, they reveal that they want to learn. They seek understanding by taking motes, reviewing lessons, reading references, and seeking peoples' help to make them, understand the lesson.

Strategies Used by Physics Teachers

Teachers always employed varied strategies in teaching the course as shown by the overall weighed mean of 4.23. Teacher recognized the principles of variety or multiple strategies in teaching. As pointed out by experts, the use of strategy is indicated by the subject matter, level understanding of students. Availability of resources skills to be developed, and the like.

The strategies which the teachers always employed are: grouping the students in pairs or in groups of 4 or 5 in performing an exercise/activity, then asking each group to prepare a brief report on the result of their activity; using instructional materials in teaching the lesson; modeling the concept and asking the students to observe and explain the result to find out the correct patter; motivating the students to recall and formulate ideas by presenting situations parallel or similar to the new lesson to be presented and citing some relationships or comparison; presenting some generalization such as theorems, principles and postulates then asking the students to prove by giving particular examples or situations.

The teachers often use the strategies on explaining the lesson first before giving exercise for the students to apply what was taught to them; introducing the lesson giving particular examples or situations for the students to derive a rule, formula or conclusion as a

generalization; providing a complete guide steps for the students to follow how a certain lesson for the day will be learned then followed by a set of questions to test if the students were able to learn something; presenting examples or situations where students are asked to observe and investigate the activity then come up with a conclusion or derive solutions for the problem; relating the past lesson for community.

Evidently the Physics teachers recognized the value of varied and appropriate strategy that makes lessons understood better. It implies that the teachers realized that different lessons require different strategies.

PERFORMANCE OF THE STUDENTS IN THE PROBLEM SOLVING THINKING SKILL

Understanding the Problem

The perfect score in this category is 20. There are 109 or 36 percent of the students who obtained score from 6 – 10, which means they have fair understanding of the word problems. Nearly 32 percent got score from 11 – 15, indicating they have good understanding of the problems. 50 or 16.70 percent have very good understanding, while 15.70 percent poor understanding.

The mean score of 10.55 shows that most of the student could identify key conditions and variables in a problem. As shown in the index of mastery of 51.75, they fairly understand the gives and unknowns in the problem.

Planning the Solution

Planning the solution is the ability to identify the data to select a strategy to solve the problem. There are 121 or 40.30 percent of the students who obtained scores from 6 -10, which means they have fair rating in planning of the solution of the word problems. There are 31.30 percent got scores from 11 -15 indicating that they have good planning twenty six or nearly 9 percent have very good planning, while nearly 20 percent have poor planning.

The mean score for the category is 9.40 with a standard deviation of 3.90.The index of mastery is 47 percent. The findings point out that generally students find difficulty determining a strategy to solve the word problems. Some students might have understood the problem but they fail to recognize and state the givens in a mathematical form, fail to identify or derive a formula that yields the correct answer.

Answering the Problem

Answering the problem is the ability to implement/correct the solution strategy and give the answer in terms of the data of the problem. The perfect score in this category is 20. There are 122 or 44 percent of the students who obtained scores from 6 – 10, which means the students are fair in deriving the answer to word problem. Twenty – six percent got scores from 11 -15 indicating that they are good in answering the problem. Eighteen or 6 percent are very good in answering the problem, while 24 percent poor in answering the problem.

For this skill, the mean is 9.0 with a standard deviation of 7.23, while the index of mastery is 45 percent. These findings indicate that generally the students are fair in deriving the answer to the word problem. It further shows that if the students do not understand the word problem they eventually fail to strategize how to solve it, resulting to their ability to get the final correct answer. Because problem solving is multi – skill activity, there is a need for students to fully understand each of the steps involved.

Overall Performance in Problem Solving Thinking Skills

The perfect score in the test is 60. One hundred seventy or 56.60 percent of the students obtained score from 21 – 40, which indicates average skill in word problem. There are 50 or 16.70 percent of them who scored 41 – 60, or above average skill. In contrast, 80 or 26.70 percent got 1 -20, which reflects below average performance.

The mean score is 28.62 with a standard deviation of 11.82. The index of mastery is 47.72. These findings point out that student have average performance in solving word problem. The data further indicate that student could earn right score in problem solving if the different problem solving processes is given corresponding point and not merely by just looking at the final answer.

Relationship between Problem Solving Thinking Skills (PSTS) Performance and Selected Variables

The study tests the hypothesized that there is no relationship between the problem solving thinking skills (understanding, planning and answering) and the selected variables. The correlation analysis reveals that there are six variables with correlation coefficient with associated probabilities lower than 0.05 and 1 variable lower than 0.01. Thus, the null hypothesis is rejected.

Teaching strategies is significantly and positively correlated with understanding and planning the solution. This findings supports that Ragual's (1996). Pham Ngoc Phuc (1999), Kincheloe (Orlina (1985), Morales (1990), Malarial (1990), that the students would display favorable performance in Physics.

On the other hand, the students verbal and language proficiency in their CAT result and their English 13 GPA also significantly correlate with problem solving performance. Since the description of English 13 is grammar and composition, this means that if the students comprehend the word problem, they are likely to understand it, resulting to their ability to plan for the answer and consequently to arrive at the answer.

Moreover, PSTS answering the problem is positively correlated to CAT language proficiency. Numerical Analysis and their Math 14 and English 12 GPA. Thus, if students have rich prior knowledge on this area, students are likely to transfer their skills in solving word problems.

Mathematics and English performance of respondents are significantly correlated with problem solving thinking skills test. Apparently, the reading skills of the students help their understanding of the physics concepts taught. Comprehending problems is prerequisite to success in solving problems.

Generally, mathematical skills of students helped them in understanding of the concepts in physics. This finding support that Consienji's (1976), Custotio (1977), Acerit's (1991), Sebaste's (1994) and Carbonell's (1994) finding that English and Mathematics are significantly related to their physics achievement. Better reading and numeracy skills enhance student's capacity to plan solution and to answer physics problem.

Other variables like sex, age, parent's education, family income, attitude towards problem solving, study habits, English 11 and Math 13 have no significant relationship between the problem solving performances. It means that these independent variables do not significantly influence the performance of the study in solving word problem in Physics.

Sex was found to have no significant correlation with problem solving performance in Physics. This findings is contrary that of Allivia's (1984), Weinburg and Engelbert (1994) who contend that gender difference is significantly related to students' achievement in Physics.

Educational attainment and income of parent are not related top problem solving performance. This finding is contrary to that Sapla (1996), Kahle (1992), Gabuyo (1989),

Torres (1991), Mallo (1996), but supports that Pinal (1985) have higher education and who said that parents who received higher income are in a better position to provide their children with their essential needs enhance achievement.

The attitudes of students toward problem have no significant correlation with problem solving performance. This findings is contrary to that Acerit's (1991) and Alivia's (1984), and this implies that students attitude toward problem solving is independent with students problem solving performance.

Predictors of Performance of Students in Problem Solving

The study hypothesized that the English 12 grade, Teaching strategy, Math 14 grade, Verbal Intelligence, Numerical Intelligence variables do not contribute to variation in the problem solving thinking skills of Physics students. Multiple stepwise regression results shows 5 variables that significantly explain differences in problem solving thinking skills, thus, the hypothesis is rejected.

The variables can explain 16.90 percent of the total variance. English 12 grade can explain 10.4 percent of the differences, R2 being 0.104, as shown in the regression coefficient for every unit decrease in the English grade of the students, these score increases by 9.67 points. It means that language skills facilitate the comprehension of problems. The students could identify relevant information from the problem.

Teaching strategy used by teachers can contribute 2.3 percent of the total variances. For every unit decrease in the teaching strategy score of the physics teachers, problem solving scores of students increase by 0.437 points. The findings suggest that the teacher should provide scaffolding or support for learning. The support given could be in terms of clues, reminders, encouragements, breaking the problem down into steps, providing an example, or anything else that allows the student to grow independence as a learner (Woolfolk, 2001).

Moreover, Math 14 grade can explain 2.4 percent of the differences, r2 being 0.151. As shown in the regression coefficient for every unit decrease in the Math grade of the students, these score increase by 3.73 points. It means that numerical skills facilitate the planning of the solution of the problem.

On the other hand, verbal intelligence can contribute 0.9 percent of the total variance. For every unit increase in the students' verbal proficiency, problem solving of students increases by 2.739 points. According to Cooper and Sweller, (1987); Lee and Hutchinson, (1998), students possess the knowledge of putting their problem solving plans and it logic into words and giving reasons for selecting it lead them to successful problem solving.

Finally, numerical intelligence can contribute 0.9 percent of the total variance. For every unit increase in the students' numerical intelligence, problem solving scores of students increase by 2.658 points. This findings suggest that students could develop systematic was of considering alternatives provided they have enough knowledge on numbers or Mathematics as considered to be the tool of Physics.

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary

The main objective of the study was to assess the performance and determinants of problem solving among college physics students. Specifically, the study sought to determine the following: 1) profile of the students and teacher respondents; 2) the attitude of students towards problem solving; 3) study habits of the students; 4) the performance of the students in problem solving thinking skills by campus as a whole; 5) the relationship between the students' performance in different PSTS and selected variables; 6) identify significant determinants in the students' performance in PSTS; 7) the difference in the performance of the students grouped by campus.

The study used the descriptive correlational method of research. It assessed the performance and determinants of problem solving. It was also correlational as it determined the extent of the set of variables which are associated with the use of PSTS by the students.

The instruments used in the study were the PSTS test, attitude towards physics problem solving inventory, study habits inventory and teaching strategies of physics teachers inventory. Data were analyzed using the weighted mean, percentage analytic scoring, t-test, Pearson's correlational coefficient (r), regression analysis, and the analysis of variance (ANOVA).

Two groups of respondents consisting of 18 physics teachers and 300 students were used in the study. Most of the respondents in both groups are female, 55.6 percent for teachers and

65 percent for students. Majority, (195 or 65 percent) of the students belonged toage bracket of 17-18 with parents who are mostly high school graduate and with monthly income of 500 and below.

On the other hand, majority of the teacher respondents belonged to age bracket 46-50; are married (77.78 percent); have been in the service for 11-15 years; have attended 1 or 2 seminars and trainings in Physics; however, nine or 50 percent of them are pursuing their doctoral degree.

As to the attitudes towards problem solving, students have not yet fully determined whether or not they like problem solving. With regards to their study habits, students find means by giving extra effortto learn their lessons as their teachers used variety or multiple strategies in teaching.

Majority of the students performed fairly in the different problem solving skills: understanding the problem (108 0r 36 percent); planning the solution (121 or 40.30 percent); answering the problem (132 or 44 percent). The overall mean score is 28.62, standard deviation of 11.82 and index of mastery is 47.72 which points out that students have average performance in solving word problems.

Results showed that the relationship between problem solving skills in Understanding and Planning the solution in significantly related the teaching strategies, the four areas of CAT (verbal, language, numerical, abstract), English 12 and Math 14 GPA. The students' profile, attitude towards problem solving, study habits, English and Math 13 were not related to PSTS Understanding and planning the solution of a problem. Furthermore, the relationship between the skills of answering the problem is significantly related to teaching strategies, CAT numerical and language proficiency, GPA's in English 12 and Math 14. All other variables were not related.

Finally, the performance in problem solving thinking skills (PSTS) of students grouped by campus differed significantly. The same trend was observed that in all the PSTS (Understanding, Planning and Answering), students from the three campuses perform better than students in the other campuses.

Conclusions

Based on the findings the following conclusions were drawn:

Favorable attitude towards problem solving helps students in working with tasks that involve problem solving skills. Study habits of students promote greater effort on the part of the student to learn, thus, resulting to greater success in problem solving.

Students have average competence in problem solving thinking skills. Problem solving performance of students is likely to increase when students have better prior competence in English and Mathematics.

Campus differences in problem solving thinking skills (PSTS) performance of the students exist, particularly in favor of those students of Campus A, B and C.

Recommendations

Based on the foregoing findings and conclusions, the following recommendations are given:

1. The CSU administration should device mechanisms to improve the competencies of Physics teachers.
2. Assessment of problem solving performance in the classroom should not focus only in the students answer. Teachers should give due points to the students understanding the problem and planning the solution.
3. Physics symbols and concepts should be integrated in English instruction as springboards for the students since Mathematics and English are subjects prerequisite of Physics.

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