

LOWER AND HIGHER COGNITIVE SKILLS AS PREDICTORS OF STUDENTS' TEST TAKING SKILLS

ELISA N. CHUA, PhD.

0000-0003-1358-9953

elisa.chua@lspu.edu.ph

Laguna State Polytechnic University
San Pablo City Laguna, Philippines

ABSTRACT

The study sought to find out the correlation between the cognitive skills and the test taking skills of college students. Using a descriptive method of research, three sets of tests that undergone reliability and validity, were utilized. To identify the relationship between the variables, regression analysis was used to consider domains of test taking skills accounted for by the cognitive skills of the students. Results revealed that the students 'need improvement' in the lower cognitive skills as to remembering, understanding, and applying; are approaching proficiency in the higher cognitive skills as to evaluating and creating, but 'needs improvement as to analyzing. The test taking skills of students in concept formation, simplicity of explanation and objectivity of observation is approaching proficiency. Furthermore, there is a high to a very high correlation between the students' cognitive skills and test taking skills: cognitive skills as to understand and analyze are predictors of test taking skills as to factual recognition; cognitive skills as to remember and evaluate are predictors of test taking skills as to concept formation; and cognitive skills is related to testing skills as to critical thinking. It can be inferred that it is imperative that the students' proficiencies in areas as to remembering, understanding, applying, analyzing, evaluating, and creating be further developed in all aspect of the teaching and learning process, since cognitive skills are correlated to test taking skills. Test taking skills should be deliberately utilized by teachers in assessing learning too.

Keywords: Cognitive skills, Test Taking Skills, Science teaching, and Students' Performance

INTRODUCTION

Education has been recognized as an important aspect of any developing country. In the National Economic and Development Authority (NEDA) 'Ambisyon Natin 2040' project, part of its framework involves the respond to the clamor for educational reforms in the Philippines. NEDA acknowledges that with the full implementation of the K12 educational system, there will be a rapid movement of reforms in education. It is also in this context, that the Commission on Higher Education (CHED) responded by facilitating the K12 transition

process, specifically on impacts related to college curriculum. CHED introduced the concept of outcomes-based education (OBE) that involves the revision of general education curriculum to support the offering of the new subjects in the senior high school. This also led to the initiative to revisit education framework that will include an outcomes-based pedagogy in the teaching and learning process.

Correlated to this, the reform in the outcomes-based education (OBE) pedagogy involves reshaping the teaching framework in higher educational institutions. Accordingly, the HEIs and SUCs initiated series of training workshops for its administrators and faculty to act in respond to these changes. The faculty as

well positively responded by openly exploiting initiatives such as adopting innovative teaching strategies, redesigning assessment tools, and enhancing students' skills.

Laguna State Polytechnic University embraces the challenges of the new curriculum. The administration has been constantly reminding its stakeholders to be agents that will transform lives and communities, one of which is by providing quality education through responsive instruction. True enough, the College of Teacher Education, LSPU-San Pablo City Campus is designated as one of the Center of Development in Region IV-A in 2016. This designation provides both opportunities and challenges to its students and faculty. As a center of development, the program may avail of financial assistance on projects that gear toward improvement, particularly innovative and cutting-edge technology. However, part of this is the challenge of maintaining and improving the quality of services being offered to its students and other stakeholders.

Thus, this research study attempted to contribute to that challenge to further serve its students. Primarily it will utilize the cognitive domains as introduced by Anderson and Krathwohl suggesting that students learn progressively from the fundamental to higher dimensions of learning (Forehand, 2010). The concept that test is considered as a cognitive task of students and involves the use of knowledge skills that shows what the students understand from the actual learning process (Dodeen, 2014). Brown, 2012 reiterated that test measures only test scores-that is, the response of a person makes to the test item. However, it is then more important to explore the factors that affect the scores of an individual. This discrete error, as an assumption, must be identified to measure the wholeness of the knowledge the student acquires during the process.

OBJECTIVES OF THE STUDY

The study sought to find out the correlation between the cognitive process skills and level of test taking skills of college students. Specifically,

to (1) describe the performance level of the students in Science as to their lower and higher cognitive skills; (2) identify the students' level of skills as to test-taking domains; and (3) determine the correlation of the students' performance as to cognitive process skills and their test taking skills level in terms of factual recognition, concept formation, critical thinking, pattern recognition, logical reasoning, simplicity of explanation, objectivity of observation and planning & organizing.

METHODOLOGY

This study used descriptive design wherein data are recorded, described, interpreted, and compared. The design involves analysis of relationship between non-experimental, non-manipulative variables, events, and conditions (Best & Kahn, 2003). Results of tests were given to identify the cognitive skills and the test-taking abilities of the college students. It also used the documentary analysis for it evolved gathering of the needed information through records.

There were forty-five (45) students reviewed during the exploratory stage of the study. They were second year college students from the College of Teacher Education of the Laguna State Polytechnic University, San Pablo City Campus during the first semester of the academic year 2018-2019. The initial testing involved the participation of the sixty-one (61) second year students who were taking up General Physics I. They were given diagnostic tests and those whose performance fell under 'needs improvement' were selected as the respondents. The researcher opted to purposively select students to have the same level of performance at the start of the study. Forty-five (45) students were chosen and their cognitive skills and test taking skills were assessed during the mid-term and final examinations.

Phase 1. Diagnostic Test. The students were given a 100-item test on concepts related to Physics I, specifically Mechanics and introduction to thermodynamics.



Phase II. Cognitive Test. The major examinations were given to the students incorporating the cognitive skills, including the lower levels and the higher levels domains. The test undergone item analyses for the past three years. The reliability of the items was based on its level of difficulty and index of discrimination.

Phase III. Test Taking Skills. The pre-mid-term and pre-final tests were given a week prior to the actual major examinations. These tests incorporated the test taking skills of students on the major domains of learning.

To investigate the correlation of the skills per sub-domain the Pearson Moment Correlation was used at 0.05 level of significant. In the study, it also used the Ferguson & Tsakane (1989) scale to measure the degree of correlation among the variables. To further identify the relationship between the variables, regression analysis was used. The adjusted r^2 of 0.500 or 50 % of the variability at 95 % confidence level was used to consider domains of test taking skills accounted for by the cognitive skills of the students.

It also illustrates that most of the students are approaching proficiency in terms of remembering, evaluating, and creating. Students were assessed to be needing improvement in understanding, applying, and analyzing concepts related to General Physics. The results also revealed that above 80% of the students are not proficient on the expected skills. Subsequently, the final examination given, covering the competencies of the course, were not mastered by the students. Among the cognitive process skills, students scored lowest in applying principles and concepts.

1.1. Students' Performance as to their Lower Cognitive Skills

Table 1
Lower Cognitive Skills Mean Scores of the Students

Lower Cognitive Skills	Mean Score	SD	VI
Remember	12.31	3.72	NI
Understand	11.02	4.41	NI
Apply	9.67	5.18	NI
Average Total Score	33.0	11.85	AP

RESULTS AND DISCUSSION

1. Performance level of the students in Science as to their lower and higher cognitive skills

Figure 1 displays the cognitive process skills of the students in the different domains. It shows the frequency in graphical and numerical form.

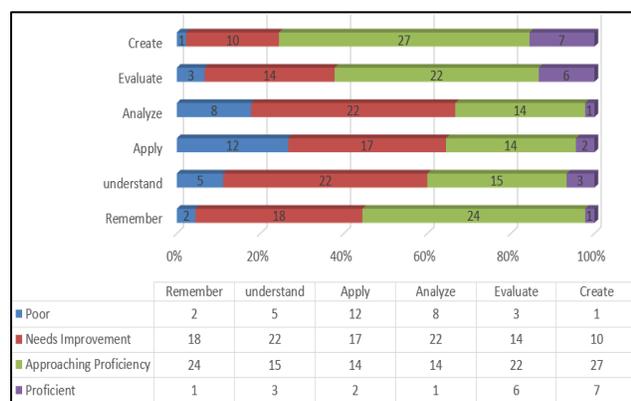


Figure 1. Cognitive Skills of Students

Table 1 illustrates the results of the cognitive test accorded to the forty-five students. The students need improvement in all lower cognitive skills as to remembering, understanding, and applying Physics Concepts. Despite the frequency shown in Figure 1, revealing that most of the students are approaching proficiency in remembering, their mean score implies that they need to enhance their awareness on theories, principles and facts governing

Physics concepts. Students need to acquire skills the theoretical or practical understanding of the concepts being discussed in class. In this study, the students were exposed to general concepts of mechanics that involve theories and laws of motion. Thus, the results suggest that the students lack understanding of the concept and have limited comprehension on how theories and principles are related, parallel or differ from each other.

1.2 Students' Performance as to their Higher Cognitive Skills



Table 2
Higher Cognitive Skills Mean Scores of the Students

Higher Cognitive Skills	Mean Score	SD	VI
Analyze	10.36	4.35	NI
Evaluate	12.93	4.01	AP
Create	14.02	3.57	AP
Average Total Score	37.31	10.38	AP

Data show the higher cognitive skills of students as measured in terms of analyzing, evaluating, and creating. Among the sub-skills the students are approaching proficiency in

evaluating and creating while need improvement in analyzing. This implies that the students have developed the higher order thinking skills. These skills were also manifested during the actual conduct of the study, since most of the concept discussed in class required students to investigate and validate information by inspecting parts and relationship, explaining the cause and effect, predicting outcomes and making judgement as to reasonable outcomes and thus, preparing them to form new combinations of ideas.

2. Students' level of performance as to their test taking skills

Figure 2 is a frequency distribution of the students as to their scores in the test.

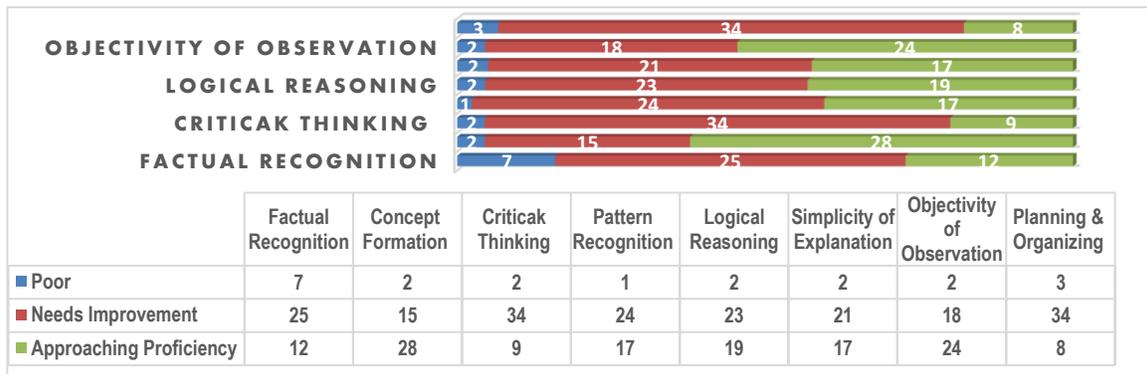


Figure 2. Test Taking Skills of Student-Respondents

Table 3 presents that among the test taking skills, students are approaching proficiency in domains such as concept formation, simplicity of explanation, and objectivity of observation. Whereas they need improvement on test taking skills particularly in factual information on factual recognition, critical thinking, pattern recognition logical reasoning and planning & organizing.

Among the domains critical thinking scored very low, suggesting that the students

have difficulties of generating new ideas through applying, analyzing, and synthesizing information from actual observations. Thomas (2011) explains that critical thinking is a crucial skill to synthesize concepts, explain reasons, and solve problems. Since in the study, the students need to create their own understanding of the idea by testing hypotheses, and present possible solution to the posited problem.

3. Correlation of the cognitive process skills and test taking skills of the students

Table 4 flashes that all the domains of cognitive skills correlated to all sub- skills of test taking at computed p value of 0.000. This indicates that the cognitive skills of students in

two dimensions; lower level and higher level, that involve thinking from the simplest to the most complex are necessary in succeeding in taking tests. The knowledge of concepts students



about facts, concepts, procedures and metacognitive are foundations for students to answer correctly test items.

Table 4
Correlation between Cognitive Skills and Test Taking Skills

TEST TAKING SKILLS	COGNITIVE SKILLS						
	Remember r value	Understand r value	Apply r value	Analyze r value	Evaluate r value	Create r value	Total Score
Factual Recognition	.703	.855	.797	.838	.693	.695	.884
Concept Formation	.820	.544	.576	.621	.788	.539	.738
Critical Thinking	.526	.565	.609	.467	.570	.447	.615
Pattern Recognition	.697	.774	.698	.701	.613	.575	.782
Logical Reasoning	.676	.821	.714	.697	.596	.601	.792
Simplicity of Explanation	.797	.702	.714	.626	.782	.617	.811
Objectivity of Observation	.808	.646	.704	.612	.717	.514	.768
Planning & Organizing	.589	.712	.678	.634	.652	.581	.741
Over-all	.850	.847	.827	.784	.815	.689	.925

p value=0.000

Results revealed that there is a high to a very high correlation between the sub-domains and the total scores of the students in two main variables with r values of .615 to .925. Among the domains, very high correlation was observed between the lower level cognitive skills and that of the test taking skills. The cognitive skill, remember, highly correlated with test taking skill on concept formation, simplicity of explanation

and that of objectivity of observation. The other lower cognitive skill understands and apply as well as analyze have very high correlation with factual recognition. This suggest that basic concepts and fundamental principles should be mastered by the students so that they will be able to use them in answering all types and levels of test items.

3.1 Correlation of the cognitive process skills and test taking skills of the students as in terms of factual recognition

Table 5
Correlation of Cognitive Skills and Testing Skills as to Factual Recognition

Model	Unstandardized Coefficient	Standardized Coefficients	t	Sig
	B	Beta		
Remember	.007	.021	0.170	.866
Understand	.120	.405	3.302	.002*
Apply	.039	.155	1.171	.249
Analyze	.102	.339	2.783	.006*
Evaluate	.015	.046	0.381	.706
Create	.014	.039	0.350	.728

R Squared -.827 Adjusted R Square -.800 F-Value- 30.37 Sig. -.000 Constant - .302

Table 5 displays that the computed r is 0.827 and the adjusted r² 0.800 means that 80 % of the variability in the factual recognition can be accounted for by the cognitive skills of the students and is significant .Since the F value is significant at 5% alpha level, it reveals as well that cognitive skills is related to the factual recognition skills. The data analysis shows that among the cognitive skills understanding and

analyzing data are assumed predictors of recognizing facts in test text items. This indicates that students must understand and analyze principles in Physics before they can identify what is factual and not. This skill of students will help them to identify correct answer on deceitful test items that will require them to make decisions.



3.2 Correlation of the cognitive process skills and test taking skills of the students as in terms of concept formation

Table 6
Correlation of Cognitive Skills and Testing Skills as to Concept Formation

Model	Unstandardized Coefficient	Standardized Coefficients	t	Sig
	B	Beta		
Remember	.183	.589	3.895	.000*
Understand	-.024	-.090	-.598	.553
Apply	-.008	-.037	-.229	.820
Analyze	0.15	.055	.364	.718
Evaluate	.121	.419	2.833	.007*
Create	-.023	-.070	-.514	.610
<i>R Squared - .738 Adjusted R Square -.697 F-Value - 17.876 Sig. - .000 Constant - -662</i>				

Table 6 shows that the computed r squared is 0.738 and the adjusted r^2 0.697 which means that 69.70 % of the variability in the skills related to concept formation can be accounted for by the cognitive skills of the students. This relatedness is as well shown in the computed F value significant at 0.000. Data indicate that remembering and evaluating are related to concept formation. This can be because concept formation has a significant relationship to how students understand the

concepts in Physics. This means that for students to explain principles and ideas scientifically, it will involve application of concepts that are observed in familiar day to day experiences (Ogudenzi, Madu., & Onuya, 2019). This premise suggests that, an individual need to utilize factual information, identify critical characteristics of each and evaluate them, so that they can summarize those characteristics needed to be able to form a concept.

3.3 Correlation of the cognitive process skills and test taking skills of the students as in terms of critical thinking

Table 7
Correlation of Cognitive Skills and Testing Skills as to Critical Thinking

Model	Unstandardized Coefficient	Standardized Coefficients	t	Sig
	B	Beta		
Remember	-.047	-.172	-.655	.565
Understand	-.018	-.076	-.225	.516
Apply	.083	-.585	-1.772	.823
Analyze	-.137	-.080	-.251	.804
Evaluate	-.020	-.463	-1.533	.803
Create	-.132	1.799	1.790	.133
<i>R Squared - .447 Adjusted R Square -.359 F-Value - 5.115 Sig. - .001 Constant - -262</i>				

It implies that even if not one among the cognitive skills is a predictor of test skill as to critical thinking, the computed Value 5.115 shows a significant correlation at 0.000. This can be ascribed to the nature of critical thinking it self, as described by Thomas (2011), it involves a complex process of thinking-involving identifying

facts, putting ideas together and creating own understanding from it. Critical thinking uses analysis of facts at different domains of cognitive thinking. Thus, the data suggest that all the cognitive skills are desirable to objectively respond to a test item that ask individuals to make decisions using critical thinking.



3.4 Correlation of the cognitive process skills and test taking skills of the students as in terms of pattern recognition

Table 8
Correlation of Cognitive Skills and Testing Skills as to Pattern Recognition

Model	Unstandardized Coefficient	Standardized Coefficients	t	Sig
	B	Beta		
Remember	.099	.321	1.845	.991
Understand	.122	.457	2.704	.073
Apply	.047	.205	1.125	.267
Analyze	.028	.101	.605	.549
Evaluate	-.015	-.050	-.300	.766
Create	-.047	-.142	-.929	.359

R Squared -.673 *Adjusted R Square* -.622 *F-Value*- 13.047 *Sig.*-.000 *Constant* --.618

Table 8 presents that the computed F-value is significant at 5% alpha level; this indicates that the cognitive skills of the students are related to their testing skills as to pattern recognition. The computed r is 0.673 and the adjusted r^2 0.622 which means that 62.2 % of the variability in the pattern recognition during test can be accounted for by the cognitive skills of the students. However, the results revealed that there are no specific cognitive skills that can be assumed to be a predictor of test taking skill as to pattern recognition. The pattern recognition

test-items are similar to analogy type of test, were students are asked to identify and acknowledge an involved whole containing, or embedded in, multiple independent components. Symbols and illustrations are used to create trends and patterns, and latter will ask students to make judgment to complete or eliminate a concept. This explains that pattern recognition, similarly to critical thinking, involves a wide variety of thinking skills. Thus, the domains of the cognitive skills are used by individuals in accurately recognizing patterns within the test-item.

3.5 Correlation of the cognitive process skills and test taking skills of the students as in terms of logical reasoning

Table 9
Correlation of Cognitive Skills and Testing Skills as to Logical Reasoning

Model	Unstandardized Coefficient	Standardized Coefficients	t	Sig
	B	Beta		
Remember	.075	.230	1.451	.155
Understand	.163	.592	3.732	.001*
Apply	.046	.198	1.158	.254
Analyze	.013	.046	.291	.772
Evaluate	-.022	-.072	-.467	.643
Create	-.034	-.099	-.691	.494

R Squared -.712 *Adjusted R Square* -.666 *F-Value* - 15.655 *Sig.*-.000 *Constant* --.168

Table 9 shows that the computed r squared is 0.712 and the adjusted r^2 0.666 which means that 66.60 % of the variability in the skills related to logical reasoning can be accounted for by the cognitive skills of the students. This

relatedness is as well shown in the computed F value significant at 0.000

Among the cognitive skills, understand with a t value of 3.732 at .001 significantly related to the logical reasoning test taking skill of the students. This implies that since logical



reasoning is the process of using a rational and organized step to arrive at a conclusion, a test taker must first recognize and understand concepts before making generalization.

In the actual test given to the students, logical reasoning in two forms: deduction and inductive are included. Both involved reasoning

to determine facts from conclusion and reasoning that attempts to support a determination of that conclusion. Thus, the students follow a precondition concepts that they need to understand first before making valuable decisions.

3.6 Correlation of the cognitive process skills and test taking skills of the students as in terms of simplicity of explanation

Table 10
Correlation of Cognitive Skills and Testing Skills as to Simplicity of Explanation

Model	Unstandardized Coefficient	Standardized Coefficients	t	Sig
	B	Beta		
Remember	.160	.429	2.894	.006*
Understand	.079	.251	1.694	.098
Apply	.060	.226	1.419	.164
Analyze	-.067	-.211	-1.433	.160
Evaluate	.115	.334	2.301	.027*
Create	-.038	-.097	-.724	.474
<i>R Squared -.749 Adjusted R Square -.709 F-Value - 18.890 Sig. -.000 Constant --.1.035</i>				

Table 10 illustrates that there is a correlation between cognitive skills and test taking skills as to simplicity of explanation. It can be gleamed that 74.9 % of the variability in the mentioned skill can be explained by the lower and higher cognitive skills of the students. This relatedness is shown in the computed F value significant at 0.000.

Among the cognitive skills, remember and evaluate has t value of 2.894 and 2.301,

significant at .006 and .027 respectively. This indicates that remembering and evaluating concepts are predictors of skill in answering test items that requires students to explain concepts using simple and known facts. In the test items given to students, this testing skills involve them to make use of theories and principles to identify facts from fallacies, eliminate concept from a group and possible scenario or events.

3.7 Correlation of the cognitive process skills and test taking skills of the students as in terms of objectivity of observation

Table 11
Correlation of Cognitive Skills and Testing Skills as to Objectivity of Observations

Model	Unstandardized Coefficient	Standardized Coefficients	t	Sig
	B	Beta		
Remember	.237	.685	4.678	.000*
Understand	.038	.130	.866	.381
Apply	.113	.454	2.879	.007*
Analyze	-.051	-.174	-1.195	.240
Evaluate	.036	.113	.785	.437
Create	-.124	-.345	-2.598	.013*
<i>R Squared -.755 Adjusted R Square -.716 F-Value - 19.469 Sig. -.000 Constant - .006</i>				

In the data on correlation of cognitive skills to testing taking skills as to objectivity of

observations, the adjusted R is .716 indicating 71.60 % variability is accounted for the latter. An



F value of 19.469 at 0.000 shows a correlation among the cognitive skills and testing skills; to that of the skill in making objective observations. Among the cognitive skills, the ability to remember facts and the creativity of the students to synthesize this fact to make generalization of organized group of concepts are estimated to influence fair and objective noting details. This

kind of test allow students to use their cognitive senses to observe physical conditions to picture actual phenomenon and explain them based on scientific facts. In the actual test items related to graphical analysis and explaining situation based on physical environment were used.

3.8 Correlation of the cognitive process skills and test taking skills of the students as in terms of planning and organizing

Table 12
Correlation of Cognitive Skills and Testing Skills as to Planning & Organizing

Model	Unstandardized Coefficient	Standardized Coefficients	t	Sig
	B	Beta		
Remember	-.014	-.050	-.263	.794
Understand	.097	.414	2.172	.036*
Apply	.033	.164	.795	.431
Analyze	.005	.022	.115	.909
Evaluate	.075	.288	1.544	.131
Create	.003	.009	.050	.960

R Squared -.583 *Adjusted R Square* -.517 *F-Value* - 8.863 *Sig.* - .000 *Constant* - -.499

The results in Table 12 shows that understanding as a cognitive skill is interpreted as directly related to testing skill as to planning and organizing. This implies that for students to respond correctly to items that ask them to organize concepts in chronological order, integrate facts, and extract main ideas; they must first understand the concepts that are connected to one another. In the tests, Physics concept as to application of scientific method was employed to check skill of students as to planning and organizing.

CONCLUSIONS

Based on the data gathered, it can be inferred that:

1. Since cognitive skills of correlated to test taking skills, it is imperative that the students' proficiencies in areas as to remembering, understanding, applying, analyzing, evaluating, and creating be further developed in all aspect of the teaching and learning process.

2. Furthermore, test taking skills should be deliberately utilized by teachers in assessing learning.

RECOMMENDATIONS

Based on the findings and conclusion of this study, the following recommendations are offered:

1. Test matrix may be considered by the teachers incorporating both cognitive and test taking skills in preparing examination or assessment tests.
2. Results of the study may be disseminated to the faculty and administrators for their information. The data generated can be used in assessing student's skills and can be studied for future consideration.
3. Since the study was delimited to 45 student-participants and only on the subject General Physics, a replication of the study may be conducted using a bigger population and be tried out in other subject areas.

4. The tests used, both for cognitive and test taking skills, can be further refined

by undergoing them into series of reliability and validity testing

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AUTHOR'S PROFILE

Elisa N. Chua, Ph.D., is an Associate Professor V at Laguna State Polytechnic University, San Pablo City Campus, College of Teacher Education, Faculty of Graduate Studies and Applied Research.



She teaches science courses in the undergraduate program and major science subjects, methods of research and thesis writing in the graduate program. She is the former Research Services Chairperson of LSPU. She has served as thesis adviser to numerous graduate students major in Science and Technology and Educational Management. She earned her master's degree at Ateneo de Manila University and Doctor of Philosophy in Educational Management at Philippine Normal University, Manila

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