



Teaching Competencies of Mathematics Professors in Higher Education Institutions (HEIs) In the Province Of Capiz: Basis for Instructional Enhancement Program

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ABSTRACT: Quality education is very much dependent on the quality of the teacher. He/ She determine to a large extent what is taught, how it is taught and how learning is measured. No teacher can impart what he/ she does not know.

The main purpose of this study is to determine the teaching competencies of Mathematics professors in Higher Education Institutions (HEIs) in the province of Capiz for School Year 2013-2014. The respondents of the study were the 372 students who have taken College Mathematics, 82 Mathematics professors, and 70 supervisors in HEIs in the entire province of Capiz. Questionnaire was used for data gathering. Data were analyzed using frequency counts, percentages, means, Chi-square, Spearman rho, t-test and ANOVA.

The findings of the study revealed that most of the professors were in middle age, females, married, lived in urban areas and specialized in Mathematics. Majority of the respondents taught Algebra, have Php28,001 to Php38,000 basic monthly salary, Associate Professor 1-V, finished master degrees with doctoral units, but did not have the chance to attend to national seminars/trainings related to Mathematics.

Classroom and teaching-learning condition were rated by the respondents “Adequate” and most of them were teachers of private schools. Mathematics professors were rated by the three groups of respondents “Very Satisfactory” in their teaching competencies.

Age is the only personal profile significantly related to mastery of subject matter and basic monthly salary was significantly related to management skills. The relationship of communication skills of respondents was highly significant to those teaching Algebra and their evaluation techniques were significantly related to professors teaching Applied Mathematics. Classroom and teaching-learning conditions were highly significant in mastery of subject matter, instructional skills, communication skills, and evaluation techniques were significantly related to management skills. Age differed significantly to mastery of subject matter and instructional skills of the respondents. Supervisors, professors, and students differed in their assessment in teaching competencies of professors in terms of mastery of subject matter, instructional skills, communication skills, evaluation techniques and management skills.

An enhancement program was designed to further improve the teaching competencies of Mathematics professors of HEIs in some other subject areas.

Keywords: -Mathematics Professors, Higher Education Institutions, Enhancement Program

I. INTRODUCTION

The term “teaching competence” denotes a set of professional skills and dispositions that the professor should possess in order to carry out his/her job effectively Spilkova (2001). As supported by Articulo (2002), he pointed out that a teacher is an instrument in increasing the learner’s knowledge to the end of making him a productive and disciplined citizen. Moreover, the teacher must possess a variety of skills and not limit themselves to instruction alone. The teacher should provide activities that are relevant and interesting to the learners. The greatest factor in creating interest in Mathematics is a systematic, well-rounded, competent and inspiring teacher. The inspiring teacher must first of all be thoroughly rounded in the subject matter of Mathematics well beyond the level of any material which he is expected to teach. As mentioned by Ornstein and

Leuine (1990) that maintaining effective and good working relationship with the learners is the focal points of the teacher's competence. Furthermore, Navarro (1981) states that as professionals, the teachers are responsible for keeping themselves updated with educational trends and improving their competencies throughout their career.

Thus, assessing Mathematics professors teaching competency is vital in Higher Education Institutions to cater quality learning and education to students. Hence, this study is undertaken to find out the teaching competencies of Mathematics professors in Higher Education Institutions in the province of Capiz, whereby, results of this endeavor serves as basis for instructional enhancement program.

Statement of the study:

1. What related profile could be drawn of Mathematics professors in HEIs according to: personal, professional and school?
2. How do the respondents assess the adequacy of school facilities of HEIs in terms of classroom condition and teaching-learning condition?
3. What are the teaching competencies of Mathematics professors when taken as a whole in terms of mastery of subject matter, instructional skills, communication skills, evaluation techniques, and management skills?
4. What are the teaching competencies in terms of mastery of subject matter, instructional skills, communication skills, evaluation techniques, and management skills as assessed by: the supervisors, professors themselves and students?
5. Is there any significant relationship between teaching competencies of Mathematics professors and the three related profiles?
6. Are there significant differences in the teaching competencies of Mathematics professors when grouped according to the three related profiles?
7. Are there significant differences in the assessment of supervisors, professors, and students in the teaching competencies of Mathematics professors?
8. What competency program could be crafted for Mathematics professors based on the result of the study?

II. RELATED LITERATURE

This study is anchored on the constructivist theories of Piaget (1980) who claims that humans are better able to understand the information they have constructed by themselves. According to him, learning is a social advancement that involves language, real world situations, and interaction among learners. The learners are considered to be the central in the learning process. Ornstein and Leuine (1990) also theorized out that teaching is a complex act this takes place in a complex environment. The quality of teachers who teach, the way they respond to students, their expectations and attitude towards students, the way they managed the classroom, their teaching methods, and general teaching behavior makes a difference.

Mathematics has been regarded as essential to liberal education. Plato maintained that proficiency in Mathematics is a prerequisite for the study of philosophy. In recent times, a good education in Mathematics has become important because of its usefulness in such careers as environmental studies, business, physical science, and Mathematics, Ramos & Demogena (1999).

Thompson (1992) stresses that teachers' beliefs are not the only factor besides teachers' knowledge influencing teachers' instructional practices. Teachers' own experiences as students could influence teachers' instructional practices. Additionally, teachers' perceptions about their students' abilities have an influence on their teaching (Forgasz & Leder, 2008). On the other hand, teachers' beliefs are a part of some researchers' models. Certain beliefs that teachers hold seem to mediate the effects of teachers' knowledge on teachers' practices. The most commonly studied beliefs are those about: the nature of Mathematics, teaching and learning Mathematics (Hill et al., 2008)

According to Cochran-Smith (2006), Teaching-learning processes, and learning to teach, can be qualified as social, contextual practices, reflecting ideologies - sets of values about the ideal teacher and citizen, and the function of schooling. Nevertheless, theoretical viewpoints, guidelines and experts practices globally, seem to indicate merging on a limited, very comprehensive teacher models, which can entail a plurality of educational aims and practices. From a "professional standpoint", there is information that develops from professional performance and from the knowledge that supports and justifies decisions and actions in the work context of Mathematics teaching. However, the teacher's training and the teacher's performance are two different issues. Several research studies relate these two issues. Eisenhart et al. (1993) identify the teacher trainees' difficulties in teaching in actual practice and analyze the way in which they contextualize the content learned at the university. This suggests a difference between the "professional knowledge" of the teacher of mathematics and the analysis of the epistemological nature of such knowledge.

III. METHODOLOGY

In line with the purpose of the study, the survey research design was employed. The participants covered the 372 students who have taken College Mathematics, 82 Mathematics professors, and 70 supervisors in HEIs in the entire province of Capiz.

Three sets of survey questionnaire were used in gathering the needed data. The items were constructed based on the PES (Performance Evaluation Survey) designed to determine the teaching competencies of the professors respondents.

The questionnaires were submitted to a panel of five experts for content validation. They were selected on their expertise in questionnaire construction, research, and in the field of Mathematics. It was pilot-tested to 30 students, 30 Mathematics instructors/professors, and 30 supervisors of Aklan State University and Northern Iloilo Polytechnic State Collegeto test the reliability of the instrument. The questionnaire was distributed personally by the researcher.

The data gathered were processed using the Statistical Package for Social Sciences (SPSS) software. In analyzing the data, frequency count, percentages, mean, Chi-square, Spearman rho, F-test and t-test were the statistical tools used in this study.

IV. RESULTS AND DISCUSSION

Profile of Mathematics Professors in HEIs in the Province of Capiz

Out of 82 professors teaching College Mathematics in HEIs, majority of them of middle age comprised 63.47% of females and 42.70% of males. Results further show that respondents were dominated by married professors wherein 63.40% of them were living in the urban areas.

As to professional variables of Mathematics professors, 80 or 97.60% are Mathematics major while one or 1.20% each for the civil engineer and mechanical engineer. As to subjects taught by Mathematics professors, 68 or 82.90% taught Algebra, while 14 or 17.10% did not teach Algebra; 46 or 56.10% did not teach Statistics, while 36 or 43.90% taught this subject. Forty two or 51.20% taught Trigonometry and 40 or 48.80% did not teach this subject. 74 or 90.20% taught Applied Mathematics and only 8 or 9.80% did not teach the subject.

The results further revealed that all professors were receiving a basic monthly salary of above poverty level. As to academic rank, majority of the professors teaching College Mathematics in HEIs are occupying the Associate Professor position. As to length of teaching experience, majority of the professors were relatively experienced and had been serving for 16 to 20 years. In terms of the highest attainment of the respondents, most of the professors were master's degree holders and only few were motivated to upgrade their educational qualifications. As to trainings/seminars attended, 62 or 75.60% never attended trainings/seminars related to the teaching of Mathematics; 14 or 17.10% attended trainings/seminars and 4 or 4.90% and 2 or 2.40%, respectively attended 6 and 7 or more trainings/seminars.

As to school-related variables, classroom facilities in HEIs were just enough to meet the needs of the students and professors alike. The professors had enough teaching-learning facilities used in the class, and majority of the respondents were professors in private schools.

Respondents generally rated both classroom and teaching-learning condition as "Adequate" with weighted means of 4.37 and 4.40, respectively.

Adequacy of School Facilities in HEIs in the Province of Capiz

As shown on Table 1, respondents generally rated both classroom and teaching-learning condition as "Adequate" with a weighted means of 4.37 and 4.40 respectively. However, if we take a closer look at the weighted means of the items on school facilities, it is reflected that blackboard had the highest weighted mean, followed by chairs and tables which registered 4.43, 4.40 and 4.39, respectively. However, space of classroom, lighting facilities and air ventilation where the items that had the lowest means of 4.30, 4.33 and 4.34, respectively.

For teaching-learning facilities, presence of course guide had the highest mean of 4.50, followed closely by teaching materials in Mathematics with a mean of 4.40 and teaching aids and services with a mean of 4.38, and the items which had the lowest mean was on lighting and ventilation. These findings on teaching-learning condition are understandably related to classroom condition.

Table 1. Adequacy of school facilities in HEIs in the province of Capiz

SCHOOL FACILITIES	WEIGHTED MEAN	VERBAL INTERPRETATION
A. Classroom Facilities		
Air Ventilation	4.30	Adequate
Lighting facilities	4.33	Adequate
Tables	4.39	Adequate
Chairs	4.40	Adequate
Space of classroom	4.34	Adequate
Blackboard	4.43	Adequate
Weighted Mean	4.37	Adequate
B. Teaching-Learning Facilities		
Presence of course guide	4.50	Adequate
Teaching aids and services	4.38	Adequate
Has teaching materials in mathematics	4.40	Adequate
Well-lighted room, and well-ventilated so as to give effective teaching-learning condition	4.33	Adequate
Weighted Mean	4.40	Adequate

Teaching Competencies of Mathematics Professors When Taken as a Whole

As to mastery of subject matter, the overall weighted mean of Mathematics professors was 4.28 interpreted as “Very Satisfactory.” The instructional skills of the Mathematics professors were generally “Very Satisfactory” as indicated by the overall weighted mean of 4.33. As to professor’s communication skills, they also received an overall weighted mean of 4.27 also interpreted as “Very Satisfactory”.

In their evaluation techniques, the professors got higher weighted means of 4.28 on using a variety of formal and informal, formal and summative assessment techniques to support the learning of important Mathematics and evaluating students achievements based on days lesson, while they got lower weighted mean on planning instruction based upon the information obtained through classroom and external assessments of each developmental level. On the professor’s management skills, they got an overall weighted mean of 4.29 interpreted as “Very Satisfactory”.

Table 2. Teaching competencies of Mathematics professors when taken as a whole

TEACHING COMPETENCIES	AS A WHOLE	
	Weighted Mean	VI
Mastery of Subject Matter	4.28	VS
Instructional Skills	4.33	VS
Communication Skills	4.27	VS
Evaluation Techniques	4.26	VS
Management Skills	4.29	VS

Teaching Competencies of Mathematics Professors as Assessed by Supervisors, Professors and Students

As to mastery of the subject matter, expectedly, Mathematics professors rated their competencies higher with an overall weighted mean of 4.49. While the supervisors and students rated them lower with an overall weighted means of 4.40 and 4.22, respectively. As to instructional skills, Mathematics professors rated their competencies “Outstanding” as indicated by the overall weighted mean of 4.57, while their supervisors and students only rated them “Very Satisfactory”. As to communication skills, the three groups of respondents almost agreed that professors already had “Very Satisfactory” competencies in organizing and consolidating their mathematical thinking through communication. Looking at the evaluation techniques of Mathematics professors, expectedly, the professors gave themselves higher over-all weighted mean of 4.53 while supervisors and students only rated their professors 4.37 and 4.17, respectively. As to management skills of the Mathematics professors, the three groups of respondents similarly rated their professor’s competencies as “Very Satisfactory”.

Table 3. Teaching competencies of Mathematics professors as assessed by Supervisors, Professors and Students

TEACHING COMPETENCIES	SUPERVISORS		PROFESSORS		STUDENTS	
	Weighted Mean	VI	Weighted Mean	VI	Weighted Mean	VI
A. Mastery of Subject Matter	4.40	VS	4.49	VS	4.22	VS
B. Instructional Skills	4.40	VS	4.57	O	4.26	VS
C. Communication Skills	4.40	VS	4.51	O	4.19	VS
D. Evaluation Technique	4.37	VS	4.53	O	4.17	VS
E. Management Skills	4.41	VS	4.54	O	4.21	VS

Relationship between Teaching Competencies of Mathematics Professors and the Three Related Profiles

Among the personal profile (Table 4), only age is significantly related to the mastery of subject matter. The same result was found in the study of Batacandolo (2013) that there was a significant relationship between the respondents’ age and their competency levels. Gender, civil status, and home location were not significantly related to the teaching competencies of the professors. The findings reflect that only subject taught showed highly significant and significant relationship. Results show that Mathematics professors teaching Algebra had higher communication skills while Mathematics professors teaching Applied Mathematics registered higher evaluation techniques where correlation was seen when data were treated statistically, but not in some other subject areas like in Trigonometry and in Statistics. The results further revealed that basic monthly salary is significantly correlated to management skills of Mathematics professors.

School-related variables such as classroom and teaching-learning conditions were highly significantly correlated to professor’s mastery of subject matter, instructional skills, communication skills, and evaluation techniques as revealed statistically on the table. Result implies that classroom and teaching-learning conditions were conducive for learning.

Table 4. Relationship between teaching competencies of Mathematics professors and the Three Related Profiles

Teaching Competencies	Personal Profile		Professional Profile		School-Related Profile			
	Age		Subject Taught		Classroom Condition		Teaching & Learning Condition	
	X ²	P-value	X ²	P-value	Spearman rho	P-value	Spearman rho	P-value
Mastery of Subject Matter	13.358*	0.038	2.399 ^{ns}	0.301	0.339**	0.002	0.290**	0.008
Instructional Skills	10.976 ^{ns}	0.089	2.399 ^{ns}	0.856	0.372**	0.001	0.425**	0.000
Communication Skills	5.43 ^{ns}	0.49	11.55**	0.003 (Algebra)	0.296**	0.007	0.353**	0.001
Evaluation Techniques	3.872 ^{ns}	0.694	6.938*	0.031 (Applied Math)	0.313**	0.004	0.329**	0.003
Management Skills	11.589 ^{ns}	0.072	Spearman rho 0.235*	0.034 (Basic salary)	0.271*	0.014	0.272*	0.014

Legend: **- highly significant* - significant^{ns} - not significant alpha set @ 0.05 level

Differences in the Teaching Competencies of Mathematics Professors when Respondents are grouped according to their Three Profile Variables

As shown on Table 5, there was a significant difference in the teaching competencies of Mathematics professors in mastery of subject matter and in instructional skills when group according to age. Results implied that middle-aged professors teaching College Mathematics are more prepared and developed a technology pedagogical content knowledge for teaching Mathematics. Result of this study is parallel with the findings of Pakalapati (2007) that age do differ significantly in their teaching competency.

Professional profile and school-related variables of the respondents were not significantly differed in the teaching competencies of Mathematics professors.

Table 5. Differences in the teaching competencies of Mathematics professors when respondents are grouped according to their Three Profile Variables

Teaching Competencies	Personal Profile Age		Professional Profile		School-Related Profile	
	F- value	P-value	F- value	P-value	F- value	P-value
Mastery of Subject Matter	3.165*	0.029	1.239 ^{ns}	0.23	0.246 ^{ns}	0.621
Instructional Skills	3.434*	0.021	0.815 ^{ns}	0.424	0.260 ^{ns}	0.612
Communication Skills	1.515 ^{ns}	0.217	-0.244 ^{ns}	0.811	0.247 ^{ns}	0.621
Evaluation Techniques	1.442 ^{ns}	0.237	-1.766 ^{ns}	0.810	2.161 ^{ns}	0.145
Management Skills	1.575 ^{ns}	0.202	1.180 ^{ns}	0.326	0.426 ^{ns}	0.516

Legend: * - significant ns - not significant alpha set @ 0.05 level

Differences among the Assessment of Supervisors, Professors, and Students in the Teaching Competencies of Mathematics Professors

Statistically, it was found out that there was a significant difference in the teaching competencies of Mathematics professors in mastery of subject matter, instructional skills, communication skills, evaluation techniques, and management skills as assessed by the supervisors, professors, and students.

Table 6. Differences among the assessment of Supervisors, Professors, and Students in the teaching competencies of Mathematics professors.

Teaching Competencies	F-value	P-value
Mastery of Subject Matter	6.552*	0.002
Instructional Skills	8.781*	0.000
Communication Skills	11.736*	0.000
Evaluation Techniques	9.674*	0.000
Management Skills	11.716*	0.000

Legend: *- significant alpha set @ 0.05 level

Proposed Faculty Enhancement Program Rationale

The study suggests that there is an urgent need to improve the mathematical skills of the professors teaching College Mathematics in HEIs. This is in response to the governments’ trust on both numbers and quality. In particular, the poor uptake of school students continuing mathematics; the reduced numbers of students qualifying for Higher Education courses in numerate disciplines, especially science and engineering and in Mathematics; and the under-supply of appropriately qualified Mathematics teachers, which is exacerbated by the high demand for the skills of mathematically qualified graduates.

These concerns are linked, in that the teachers of tomorrow are drawn from the students of today. The Advisory Committee on Mathematics Education (ACME) believes that radical steps need to be taken now in order to break into this closed loop. It contends that one of the most effective ways to do so and to raise the quality of mathematical provision in school would be to expand substantially Continuing Professional Development (CPD) for teachers of Mathematics. It believes this would revitalize skills throughout teaching careers. (<http://www.ctc.ca.gov/commission/agenda/2008-11/2008-11-2D.pdf>.)

In light of these, the researcher proposes a program based on the findings of this study, to awaken the sleepless logical thinking skills as professors perform their daily activities with the use of formulated learning competencies and to further enhance the teaching competencies of the professors teaching College Mathematics.

FORMULATED ENHANCEMENT PROGRAM FOR MATHEMATICS PROFESSORS

Area	Objectives	Strategies	Source of fund	Person Involved	Time Frame	Monitoring/Evaluation
Mathematics Subject	<p>Enhance the professor's proficiency in teaching Mathematics in terms of mastery of subject matter, instructional skills, communication skills, evaluation technique and management skills.</p> <p>Update mathematics professors on the latest approach/strategies in teaching Mathematics.</p> <p>Equip the professors with a set of teaching skills in order to improve his/her teaching competencies effectively.</p> <p>Appreciate the teaching of Mathematics subjects.</p> <p>Revised course syllabus in Mathematics subject if necessary.</p>	<p>Invite lecturers on different topics.</p> <p>Group discussion</p> <p>Teaching demonstration</p> <p>Critiquing</p> <p>Reviewing of the course syllabus in Mathematics subjects.</p>	<p>Faculty development plan.</p> <p>MOOE</p> <p>Registration fees of the participants.</p>	<p>Mathematics professors</p> <p>Mathematics supervisors</p> <p>Chairmen and Coordinators</p> <p>Program Chairmen and Deans</p> <p>Mathematics professors</p> <p>VP for academic Affairs</p>	<p>5 days training</p>	<p>Number of Mathematics professors involved in the training program.</p> <p>Performance evaluation of Mathematics professors every semester.</p> <p>Continuing training program if possible.</p> <p>Revision of Course Syllabus must be observed regularly to suit the needs of the clientele.</p>

V. CONCLUSION

On the basis of the findings, it is being perceived that Mathematics professors have high degree of satisfaction in their teaching competencies. Middle-aged professor respondents exhibited with the highest competencies as to their subjects being taught. However, there are some of the professors whose teaching skills need improvements especially in Statistics and Trigonometry subjects, wherein an enhancement program is necessary.

While further research is essentially needed, the researcher suggest that HEIs should allocate funds for faculty development program in the form of post graduate studies, and trainings seminars, to enhance the teaching competencies of Mathematics professors. Professional development should be differentiated according to the diverse needs of professors in mathematics because they have different pedagogical skills, mathematical knowledge and experience in teaching the subject. Mathematics professors should be innovative and responsive in integrating technology in teaching Mathematics, and acquire more knowledge of curriculum and instructional materials that integrates technology with learning mathematics.

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