Science Teachers' Teaching Competencies and Their Training Experience in Classroom Pedagogical Approaches

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ABSTRACT

An examination on the teachers' teaching competencies and their training experience to classroom pedagogical approaches was investigated. Specifically, it aimed to: determinethe teachers' competencies in the teaching of science; find out whether the training experience provided excellence in terms of student's performance, instructional decisions, instructional materials developed, and conduct of science investigatory project; and describe the teachers' reflective actions as evidence on their training experience. Descriptive survey research involving quantitative and qualitative methods were employed. The instruments made used of a questionnaire on teaching competencies, open-ended interview schedule, observations, documentary analysis and the teachers' reflective actions. Findings of the study revealed four key components namely: curriculum competencies, field competencies, emotional competencies, and research competencies. The identified competences are practices of the teachers' training which are a demonstrated task. Several reflective teachers' actions had positive effects on the pedagogical training experience for they were able to change their teaching methods and enhanced their teaching skills.

Keywords: Teaching competencies, pedagogy, training, reflective actions.

INTRODUCTION

In recent years, the current concern over teaching and learning at all levels of education is a commitment to improving quality teaching and students' learning. The emphasis toward excellence in education is merely to improve teaching and learning in the classroom by the school reform and the managerial strategies in educational management (Chong Lee, 2009). In a time of educational paradigm shifts, there have been many changes in the school system which include teaching methods, curriculum formats, learning styles, and the related academic policies.

For the last three decades, the Philippine educational system seemed to have lost sight of the basic function of schooling, and high expectations for the secondary program were noted ineffective due to underachieving student's performance in science, and the poor quality of teachers' teaching competencies and skills. These educational dimensions affecting teaching and learning have been documented in testimony received during training and educational conventions. On the K-12 curriculum, teachers are required to develop the essential knowledge, skills, attitudes, and values of the students to enable them to cope with these changes.

Education in the 21st century is influenced by the rapidly changing techno-socio-economic environments, especially on innovations of information and communication technologies affecting classroom teaching situations. Accordingly, teaching dominant concept had gradually changed into learning concept. The quality of education is shown by the learning outcomes of the learners specifically on academic achievement. These indicators are clearly related to resources, teachers' professional competencies, and the learning environment (Houston and Maikw, 2005).

It is known that there has been a focus on the student's learning performance, but there has also been an acknowledgment that students' learning was not likely to improve until teachers had the opportunity to support further and develop as well to increase their teaching skills.

Teaching competencies are a set of knowledge, skills, attitudes, values, beliefs and experience necessary for future, which manifests in the teachers' activities (Katane *et al.,* 2006). Teachers need to improve knowledge and skills to enhance and explore their teaching practices. In fact, teachers' professional development should be redefined for sustainability. Similarly, teachers are responsible for operating the educational system, and they need strong and efficient professional competence. The teaching competencies are divided into different dimensions namely: field competencies, research competencies, curriculum competencies,

life-long, social-cultural, emotional, information communication technologies, and environmental competencies (Carlgren, 1999).

While in most cases, the public school education had faced pressures to effect good teaching and learning, there appears to be associated with the growing sense of low-quality teaching and ineffectiveness of the whole school system. At these varying degrees, teacher educators should provide opportunities to assist teachers in their professional learning through mentoring and training so as to improve their teaching competencies.

So far, little research existed on documenting how teachers' teaching competencies are exhibited in science teaching. Thus, the present study assumed to recognize that with exposure to training and engagement to professional development, this would likely improve their pedagogical approaches and teaching competencies.
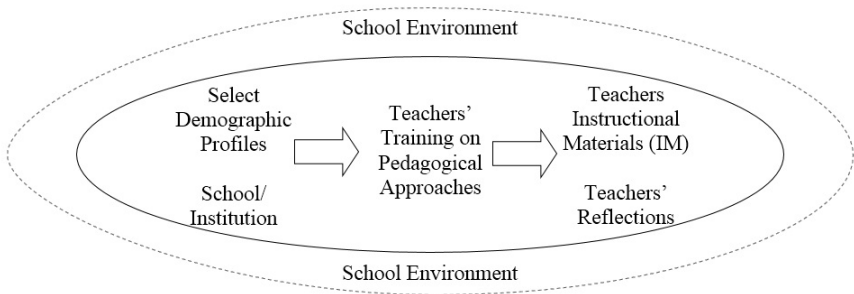
FRAMEWORK

Figure 1. The framework of the Study.

The general framework or model is showing the relationship between pedagogical approaches and instructional material development and teachers' reflections.

The most important concern on teaching and learning in science is when teachers can design useful instructional materials appropriate to student's level of comprehension, and the learning competencies can be displayed. In this context, the teacher's effort is to bring out active learning and student's stimulation in the process of information processing may lead to increase academic achievement, interests and motivations (Azuelo, 1991). More importantly, teachers should be equipped with a plethora of pedagogies to understand students better and

teach more effectively. A positive impact on students' attitudes/motivation and willingness to learn with effort will result when teachers change pedagogical practices in secondary classrooms incorporating factors that are related to their expression of personal interests (Ng, 2007). Thus, effective instructional pedagogies should be incorporated in teachers' in-service training to promote professional development and facilitate their change of paradigms in teaching

The subject on "competencies" has been the educators' concern on the many reforms in the field of science teacher education. In fact, they have tried to analyze the new role of science teacher by focusing on the idea of "competencies". This concept is considered relevant in all professional fields, particularly in education research.

Competence is a set of organized activities, which act on contents in a given category of the situation to solve a problem. It is the ability to carry out a specified task or activity to predetermined standards attainment. Likewise, it is a system of complex actions including knowledge, abilities, and attitudes required for successful completion of tasks (De Se Co, 2005).

On teaching and learning, the notion of competency is confined to the ability to perform a discrete task. It refers to a state of being well-qualified to perform an activity, a task on job function. The current views on the competency concept emphasize mastery of knowledge and methods, and the ability to integrate different kinds of knowledge, and to use them synergically.

Educators pointed out that one of the most critical challenges in education is the implementation and educational practices within the country's cultural and political contexts. The new K-12 curriculum recently in place in the Philippines is thought to answer the urgent need for enhancing the quality of basic education among Filipino students.

It is on this premise that educators reviewed how students learn 21st-century skills and how teachers can effectively teach them. The new sense of urgency therefore is to look at the science-learning lessons as 21st-century skills, on how these skills are taught and how students learn (Saavedra and Opter, 2012).

OBJECTIVES OF THE STUDY

The objective of this study was to examine the competencies of science teachers and their training experiences to the new pedagogical approaches to teaching. Specifically, it aimed to: 1) determine the teachers' competencies in the teaching of science; 2) find out whether the training experience provided excellence in terms of student's performance, instructional decisions, instructional materials

developed, conduct of science investigatory project; and 3) describe the teachers' reflective actions as evidence on their training experiences

METHODOLOGY

Research Design

The study utilized the descriptive survey research using quantitative and qualitative methods.

The population sample of the study involved science teachers in both elementary and high school in the Department of Education, Province of Bukidnon, who have undergone the training experience in improving teaching and learning.

The Data Gathering Procedure

There are two phases of methods used in the study:

First Phase. Before the conduct of the study, a permission with the Schools Superintendent/head was made. After the approval, a meeting was conducted by the teachers who introduce them on the main theme/objectives of the research and the expected outputs.

Second Phase. Data were gathered at two phases. First, on the quantitative data. This include the teachers' responses to a questionnaire on teaching competencies. The said questionnaire was adopted and modified which relate to the fourcomponents such as the field competencies, curriculum competencies, research competencies and emotional competencies. Second, the qualitative data included observations schedule to monitor teachers' practices in teaching science activities. Likewise reflective actions when introduced into the different pedagogy in science teaching and their effects on students' learning were examined. An open-ended questionnaire aimed at eliciting teachers' responses toward their training experiences in general. The questions were formulated by the researchers after a review of literature had been conceptualized. It also examined the instructional materials developed and used, inquiry questioning techniques, lesson plans, and other learning output during their teaching. To probe deeper like work involved, and the competencies, the teachers employed, a personal interview technique (oral and written) conducted to build up a secondary data to support the qualitative data. Further analysis was done on the instructional materials they respectively developed, students' researches conducted which included an examination of the structure components. The data were supported with photo documentation as well a video coverage in support of the research.

Data Analysis

For quantitative analysis, descriptive statistics such as the mean, frequency values, percentages was used.

For qualitative data analysis, interview schedule, observations, and another instant learning behavior were used to support the data. Likewise, documentary analysis of their output of learning with a report on their reflective actions and impact of training focusing on selected aspects of the study. Triangulated findings were noted from their qualitative feedback, group discussions and the enhanced perceived levels of knowledge and skills after the training.

RESULTS AND DISCUSSION

Research Subjects of the Study

The survey responses had a total of One hundred one(101) science teachers participants within the three division of Bukidnon namely: Division of Valencia, Division of Malaybalay and Division of Bukidnon involved in the study. Of these, were forty-one (41) secondary teachers and sixty (60) elementary teachers. The distribution of the sample is presented in Table 1.

Table 1. Distribution Sample from Two Educational Levels

Educational/Level	Number of Participant
Elementary	60
Secondary	41

N=101

As presented in Table 2, the teachers and their teaching competencies' mean score was 3.56 indicating 'highly evident.' These results suggest that teaching competencies which relate to the curriculum are of great importance to teachers in the practice of their profession. The components of teachers' professional competencies can be explained as in Figure 2. The findings revealed that forty-five (45%) percent possess the knowledge about curriculum plans for teaching and learning. In the present study, the teachers were oriented on how they would play their roles more effectively such as designing, implementing the teaching materials, monitoring the student progress in science, trains and direct activities of

students, implementing the procedure for effective use of time and management of materials, facilitating the flexibility of schedules in the class. The teachers' teaching styles used included content selection, presentation and applications and the selection and modifications of existing curriculum.

The data findings reflected on field competencies to be (30%) percent of the teachers' professional competencies. It is described as the teacher's content such as the knowledge of how the teacher in science subjects is responsible for transmitting the content or lesson. It is the teacher's knowledge of instructions, methods and or pedagogy. It also expressed how the teacher communicates to the learning environment. The knowledge of assessment in the form of tests and the lesson plans prepared were appropriate for brainstorming class activities.

Further, the data resulted to twenty (20%) percent of the teachers teaching competencies was on emotional competencies. These competencies indicated the teachers' values, attitudes, and motivating aspects of science. It can help teachers become effective while monitoring students' learning. The present study adheres to the research report that teachers promote a high level of integrity incompetence and professional judgment.

On research competencies, 5% of the teacher participants carried out research in their schools. This result may be due to the lack of interests and techniques in designing and carrying out research. Some interventions affecting school science research was on the design and structure of research process, 'how to start and their knowledge of understanding affects the way investigatory projects are conducted. Teachers need time to develop, absorb, discuss and practice new knowledge to be effective. Besides, their time in handling research is a factor while teaching at the same time. These findings are consistent with the research conducted by Azuelo and Orongan (2006) that students science investigations were observed to be the least scientific. These activities challenge educators on their strength and weakness as teachers of science.

Table 2. Means Score of Teachers and their Teaching Competencies

	Teaching Competencies Indicator	Mean (n=101)	Descriptive rating
1.	Facilitates active participation in school activities such as Science fair, Math Quiz, English, TLE activities, etc. (RC)	3.76	Highly Evident
2.	Demonstrate positive regard for all students' activities in school. (EC)	3.76	Highly Evident
3.	Knowledge of instructional methods and approaches. (FC)	3.45	Evident
4.	Knowledge of specialized instructional styles and non-traditional teaching practices and procedures. (FC)	3.38	Evident
5.	Designs, implements, and evaluates teaching materials for individual and groups of students. (CC)	3.41	Evident
6.	Facilitates collaborative and consultative relationships with general education teachers and support staff to improve teaching and learning. (CC)	3.50	Evident
7.	Develops a system for monitoring student progress in the instructional setting. (CC)	3.56	Highly Evident
8.	Trains and directs the activities of students. (CC)	3.62	Highly Evident
9	Implements and interprets various types of formal and informal assessments as determined by individual student needs. (CC)	3.42	Evident
10.	Develops receptive/expressive communication skills within the learning environment.(FC)	3.51	Highly Evident
11.	Implements a procedure for effective use of time and management of materials. (CC)	3.59	Highly Evident
12.	Knowledge of teacher-made assessment procedures such as teacher-made test.(FC)	3.60	Highly Evident
13.	Implements lesson plans that are appropriate for diverse learners.(FC)	3.75	Highly Evident
14.	Facilitates the physical classroom environment that allows for flexible scheduling and transition times. (CC)	3.70	Highly Evident
15.	Teaching styles used contains content selection, presentation, reflections and applications. (CC)	3.54	Highly Evident
16.	Plan lessons with preference to whole class brainstorming activities.(FC)	3.61	Highly Evident
17.	The teaching goal is to have students work independently under his/her own initiative.(EC)	3.54	Highly Evident
18.	Teaching innovations had work well for most students but is time-consuming.(EC)	3.38	Evident
19.	Selects, adapts, or modifies core existing curriculum to make it accessible for all students. (CC)	3.37	Evident
20.	Promotes high level integrity, competence, ethics, and professional judgment. (EC)	3.78	Highly Evident
	TOTAL MEAN	3.56	Highly Evident

Legend: 3.51–4.00 Highly Evident   2.51–3.50 Evident   1.51–2.50 Less Evident   1–1.50 Not Evident

RC= Research Competencies   CC=Curriculum Competencies
EC= Emotional Competencies   FC= Field Competencies

The science teachers' teaching competencies and their teaching experience of classroom pedagogical approaches include a set of identified criteria in the teaching-learning process as part of professional development. In this research, professional development specifically relates to teacher training experiences. As presented in Table 3, the students' performance (77%) obtained the highest rank. These findings have drawn similar results with Postareff *et al.* (2008) that for professional development, one must focus on subject-matter knowledge and

deepen teacher' content skills and that students' academic performance are likely to have greater positive effects on students learning.

The development of instructional materials (68%) ranks second, followed by instructional decisions (61%) rank third, and the conduct of the investigatory project (20%) ranks fourth.

The over-all data reflect how teachers connect this training experience to specific standards for teaching and learning and the kind of teaching can be achieved through setting learning goals and teaching practices.

Table 3. Percentages of Teachers' Training Experience about Criteria Set in the Teaching-Learning Process

	N	Percentage (%)	Rank
Students' Performance	78	77	1
Instructional decisions	62	61	3
Instructional materials developed	69	68	2
Conduct of investigatory project	20	20	4

The instructional materials developed by teachers are Worksheets, (55%), Teaching Guides (20%), Science Laboratory Apparatus (25%), Digital Story Telling (22%), Electronic Quiz/Assessment (19%), Modules (16%), Teaching Models (10%), Manuals and Workbooks (9%) and Websites (5%) (Table 4).

As a result, the teachers' training experience had allowed science teachers competence to develop and design their instructional materials, thus, there was understanding of how worksheets are conveniently prepared by them and used in the class. This classroom materials development recognizes the opportunity in demonstrating science learning skills and how knowledge and skills are transferred as students contextualized specific concepts.

Table 4. Percentages of Teachers' Training Experience
and Their Instructional Materials

	N	Percentage (%)	Rank
Worksheets	56	55	1
Module	16	16	6
Digital Story Telling (ICT)	22	22	4
Electronic Quiz/Assessment	19	19	6
Workbooks	9	9	8.5
Teaching Models	10	10	7
Teaching Guides	26	26	2
Manuals	9	9	8.5
Websites	5	5	10
Science Laboratory Apparatus	25	25	3

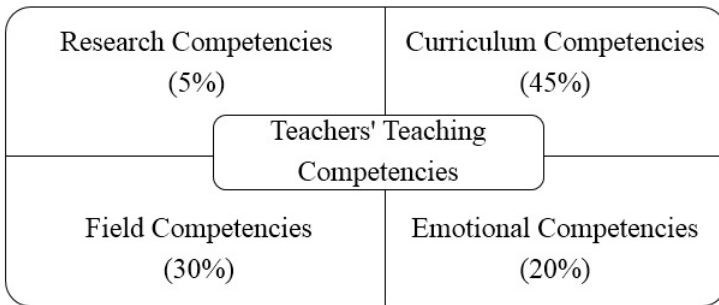| Research Competencies (5%)	Curriculum Competencies (45%)
Teachers' Teaching Competencies	
Field Competencies (30%)	Emotional Competencies (20%)

Figure 2. Components of teacher's professional competencies.

Qualitative analysis of the brief reflections of some teacher participants about the training experience:

Reflection: Teacher 1
    The training provides the teacher a good avenue to improve the teaching-learning process through a variety of activities done during the training program.

Reflection: Teacher 2

 Enhanced the knowledge and skills in teaching science. It provides also ideas on how to create instructional materials and science laboratory apparatus.

Reflection: Teacher 3

 The training helped a lot in improving the teaching style, knowing the different methods and strategies in the training. It also improved the making of instructional materials.

Reflection: Teacher 4

 Helped teachers realize they can do more than just teaching inside the classroom, to be more innovative and creative together with the students to improve learning.

Reflection: Teacher 5

 The training was very educational and fruitful. It does not only enhance our teaching expertise but also allows us to become an effective teacher meeting the demands and needs of diverse learners.

Reflection: Teacher 6

 The training was great in the sense that it gave clear insights especially in conducting activities in which students can actively participate. It was a success too since it helped us learn to develop and formulate a research title and imparted the research.

Reflection: Teacher 7

 The training enabled the teachers to improve their teaching competencies. Thus, more training and workshop in the future would be of great help to keep them updated.

Reflection: Teacher 8

 The training helped improve how to facilitate active participation of students and how to develop their critical thinking skills in the class.

Reflection: Teacher 9

 The training is very useful to all of us. It increased our knowledge on teaching using multimedia and the web as well but is not enough for us teachers to develop/improve our instructional materials.

Reflection: Teacher 10

 The training experience helped a lot in actual teaching practice and it improves strategies on how to deal with pupils to have effective teaching.

Reflection: Teacher 11

 Informative and useful in our school because we are participating the SIP contest.

Reflection: Teacher 12

Boosts the confidence not only to be inspired and a better teacher but also the whole personality. Speakers were nice and were experts in their topics.

Reflection: Teacher 13

Very substantial, informative and attainable within learners capabilities.

Reflection: Teacher 14

The training experience enhances the acquired knowledge with regards to the present work and update us on this present education curriculum.

Reflection: Teacher 15

It made us realized that science subject would be more enjoyable and meaningful if teachers made innovations in their teaching styles with the use of the latest and updated materials/educational materials.

Reflection: Teacher 16

Varied activities were introduced during the training. It helped a lot in dealing with our pupils.

Reflection: Teacher 17

Through this seminar, it positively demonstrates and train the pupils to participate in school activities especially in the science fair.

Reflection: Teacher 18

The training is indeed a comprehensive one. It helps us grow professionally and provides knowledge of techniques for the students.

Reflection: Teacher 19

Excellent. It promotes a high level of competence and helps us a lot in our professional career. It widens the horizon as a teacher.

Reflection: Teacher 20

The training enhances our teaching styles, and we learned much the teaching strategies that helped in actual teaching. Looking forward to more enhancement training.

From the study, the given reflections by some teachers with regard to their training experiences relate to the following reflective actions such as improved their actual teaching practices, informative and useful, boost their personality, attainable, acquisition of knowledge and skills, innovative in their teaching styles, acquisition of meaningful learning, rewarding and comprehensive, promote high level of competence and enhanced their teaching styles.

CONCLUSIONS

The conclusions derived from the findings of the study are the following:

The teachers identified components of teaching competencies were curriculum competencies, field competencies, emotional competencies, and research competencies. These identified competencies are practices of science teacher training which are a demonstrated capability to carry out a specific task. It is a trainable activity such as the teachers' scientific knowledge, skills, abilities, attitudes and personal orientation and pedagogical approaches which are highly important to improve teaching and learning process.

Defining teachers' competencies will contribute to the implementation of the quality of the educational system by positively affecting the teachers' training.

RECOMMENDATIONS

The following are the recommendations of the study:

A similar study should be investigated to look into significant relationships between the teachers' pedagogical approaches, the pedagogical content knowledge, and their students' learning outcome.

Teacher education should focus on understanding and application of teachers' competencies, and this should be reviewed consistently in parallel with the changes and reform in the curriculum.

At the policy level, specific consideration on the development of teaching and learning skills and capabilities as part of the curriculum and the needs assessment are needed to improve teachers' professional development.

On the whole, the implication, therefore, is that it is important for teachers in science to understand the principles, underpinning the 'competencies' which would seek to develop the learners' learning skills in class. The planned professional development to support teachers in applying approaches to learning is therefore both essential and challenging.

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