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COMPETENCY LEVEL OF SCIENCE TEACHERS IN TEACHING EVOLUTION: BASIS FOR TRAINING DESIGN

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ABSTRACT

The study focused on determining the competency level of science teachers in teaching evolution as a basis for training design using a mixed-method approach. The main source of data came from a random sample of thirty-three respondents, involving twenty-three junior high school biology teachers and ten senior high school biology teachers in the Narra del Norte District. Data were sourced from a researcher-made test and Focus Group Discussion (FGD). Frequency count was employed to describe the teachers' profile and a one-way ANOVA to determine the significant difference between the teachers' profile and their competency levels. A Focus Group Discussion (FGD) was utilized to determine the difficulties experienced by science teachers when teaching evolution. The results showed that the majority of respondents had six to 10 years of teaching experience and half had MA/MS units. More than half of the respondents were identified as Roman Catholics. The results showed that science teachers' competency level in teaching evolution is "experienced." It was also indicated that there is no significant difference between the teacher's profile and their competency level in teaching evolution. Furthermore, the results revealed that respondents had difficulties in teaching evolution due to religious differences, mastery of content, a lack of training programs or seminars/workshops, time allotment, instructional approaches, and a lack of educational resources. As a result, it was suggested that science teachers undergo training to strengthen their competency level in teaching evolution, which obtained a "developing level."

Keywords: Competency level, Learning competencies, Teaching evolution, Theory of Evolution

1. INTRODUCTION

The Department of Education is dedicated to providing high-quality education to all students. To keep its pledge, a series of teacher training and seminars have been held to continue to deliver effective teaching-learning methodologies. Teachers, as facilitators of students' learning, must continue to develop professionally, including their knowledge and abilities, to achieve DepEd's goal of academic excellence.

In the delivery of education, assessing teachers' competence is of high importance. Competent teachers play a major role in educational success and contribute to the formation of an effective academic system. Teachers have direct control over how classes are planned and delivered, as well as how pupils are evaluated.

One of the most important topics in undergraduate life science education is evolution. It is a significant unifying concept in science that should be emphasized in scientific education frameworks and K-12 curriculum for students. To enhance students' knowledge, it is vital to instill the concept of evolution effectively. Teaching and learning about evolution have enormous practical usefulness that extends far beyond gaining a better grasp of our world. Teaching evolution to schoolchildren is an effective approach for them to learn about the scientific method. According to research in biology education, students have a weak understanding of the fundamental evolutionary concepts. As a result, learners must acquire a solid science education that includes evolution.

Concepts about evolution are not often fully comprehended. This issue is frequently mirrored in teaching, with examples of evolutionary processes predominating over descriptions of the processes themselves, at the expense of a deeper knowledge of the theory.

Science classrooms are one of the places where evolution can be taught. Collaborations between science teachers, educators, and scientists are thus crucial to encouraging the growth of teacher understanding of evolution. The teaching of evolution was just a minor part of books—it upset certain members of the public, the truths and theory were historical, and the material was mostly geological. As a result, compromise and omission appeared to be simple. It's easy to see how an evolutionary perspective may be emphasized while still teaching biology and developing high school biology from the standpoint of a teacher. There is a need for pedagogical approaches that boost students' desire to engage in evolutionary learning, especially in cultural situations where evolutionary theory is widely contested. Even though scientists are always arguing, improving, and even disputing on the specifics of evolution, there is no scientific debate regarding whether evolution occurred and continues today.

With the mentioned issues, this study is pursued to evaluate the competence of teachers in teaching evolution and assess the mastery of content in the topic. This can further serve as a foundation for improving pedagogical methods that could enhance the acceptance and understanding of students about evolution.

1.1 Related Work

Evolution is regarded as one of the most widely held scientific theories, as well as one of the most contentious. The genesis of our species is a universal and intriguing question. Human evolution, in particular, is a topic that piques people's interest throughout the world. Although some components of evolutionary theory are widely accepted by students, researches reveal that acceptance of human evolution and the common heritage of all life on Earth is a challenge.

There are several techniques of teaching evolution, each with its own set of legal considerations. Teachers should think about how they approach teaching evolution and assess whether they are staying within legal bounds [1]. Teaching evolution aims to raise awareness of the subject. Because some individuals believe evolution contradicts widely held beliefs, teaching evolution provides educators with a fantastic opportunity to illuminate the nature of science and distinguish science from other types of human endeavor and understanding [2]. However, numerous studies have revealed that learners have a poor understanding of evolutionary theory [3].

The majority of teachers appear to be enthusiastic about teaching evolution. However, a large percentage of teachers are unaware of the natural selection theory. Their understanding of natural selection theory appears to be linked to their grade in Evolution selection in biology units [4]. In teaching the concept of evolution, ‒Religious Cultural Competence in Evolution Education‖ or ‒ReCCEE‖ is a framework that educators are commended to use [5]. For students, the accurate teaching of evolution is contentious critical, as it acts as an essential link between numerous concepts and emphasizes the parallels among biological concepts' diversity. [6] To establish an acceptable knowledge base among pre-service teachers and, ultimately, to promote students' acquisition of the notion of evolution, professional knowledge on evolution must be focused in university education [7].

Since improving teacher understanding of evolution and the nature of science has been difficult to attain, determining the likely implications of extending teacher knowledge of evolution as well as the nature of science on teacher preference for teaching evolution has been challenging [8]. Religious considerations and the resulting disagreements can impact students' and high school

teachers' willingness to discuss evolution [9]. In conjunction with lessons meant to explain the content of the theory of evolution, recognizing students' worries about evolution is a promising pedagogical method to teach evolution [10].

The teaching and learning of evolution concepts are not simply hampered by cultural objections. Common misunderstandings, cognitive problems, and confusing language are among the others [11]. The actual and perceived contradictions between evolutionary theory and religious perspectives are impediments to the acceptance of evolution among both instructors and students. [12]. Students learn about evolution through a variety of sources, including religion, family, classmates, and the media, in addition to instructors and other authoritative figures at school [13]. When it comes to teaching evolution, failing to recognize and address religious and cultural issues might make students with religious worldviews feel uncomfortable and excluded [14]. Professional development programs for K-12 teachers should place a greater emphasis on teaching evolution in the classroom. Two areas of research that should be addressed further are teachers' acceptance of evolution and pedagogical content understanding for teaching evolution [15].

1.2 Statement of the Problem

This study sought to find out the competency level of science teachers in teaching evolution as a basis for training design. In particular, it attempted to find answers to the following questions:

1. What is the profile of science teachers in terms of:
    1.1 educational attainment;
    1.2 religious affiliation; and
    1.3 years in teaching?
2. What is the competency level of science teachers in teaching evolution?
3. What is the significant difference between the profile of teachers in teaching evolution and their level of competency?
4. What are the difficulties faced by the science teachers in teaching evolution?
5. What training design can be proposed to improve the competency level of science teachers in teaching evolution?

2. RESEARCH METHODOLOGY

2.1 Research Design

The study employed a mixed-method approach, specifically quantitative and qualitative analysis. Mixed-methods is a type of approach in which researchers collect and analyze both quantitative and qualitative data within one study [16]. It enables researchers to look at things from many angles and discover differences between the profile of science teachers in teaching evolution and their level of competency.

2.2 Respondents

In the selection of respondents, the researchers considered the science teachers from junior and senior high schools who teach biology subjects in Narra del Norte District which was identified using a simple random sampling technique. Twenty-three (23) junior high school biology teachers and ten (10) senior high school biology teachers participated in the study.

2.3 Data Tools and Procedures

A researcher-made test and focus group discussion was used in gathering data. The instrument comprised of 30 items which consisted of six (6) learning competencies in the concept of evolution as stated in the ―K to 12 Basic Education Curriculum of the Department of Education‖ [17]. It comprises the ―general features of the history of life on Earth, including generally accepted dates and sequence of the geologic time scale and characteristics of major groups of organisms present during these periods‖, ―the mechanisms that produce a change in populations from generation to generation (e.g., artificial selection, natural selection, genetic drift, mutation, recombination)‖, ―the patterns of descent with modification from common ancestors to produce the organismal diversity observed today‖, ―the development of evolutionary thought‖, ―the evidence of evolution (e.g., biogeography, the fossil record, DNA/protein sequences, homology, and embryology)‖, and ―the evolutionary relationships among organisms using the evidence of evolution.‖ The scale and its description adapted from the ―National Competency-Based Teacher Standards-Teachers' Strengths and Needs Assessment of the Department of Education‖ was also applied by the researchers to describe the competency level.

Range		**Level of Teaching Competence**
Scale scores	**% Scores**	
3.51 – 4.00	87.51% - 100%	**Expert.** Very competent and can support other teacher's improvement
2.51 – 3.50	62.51% - 87.50%	**Experienced.** Competent in the KSA but would benefit from further training and development
1.51 – 2.50	37.51% - 62.50%	**Developing.** Fairly competent in KSA and need further training and

		development
1.00 – 1.50	25.00% - 37.50%	**Beginning.** Lacking competence in KSA and require urgent training and development

Source: National Competency-Based Teacher Standards-Teachers' Strengths and Needs Assessment

There are three (3) phases of research procedures that were followed in the study. The first phase was the drafting of the test. To realize the validity and reliability of the instrument, content validity was established and the test was pilot tested to science teachers who are not included in the study in Phase two (2). In this study, Cronbach's α was 0.74 signifying that the instrument used was reliable and valid. The last phase is the administration of the instrument to the respondents. The administration of the test and interview was done after getting the respondent's consent to participate in the study. The informed consent form was prepared by the researchers and signed by the respondents indicating their approval to voluntarily participate in the study. The administration of the test and a Focus Group Discussion (FGD) was scheduled and conducted at each respondent's respective site ensuring that all health procedures are rigorously followed. Respondents were assured that their personal information and other related matters would be treated with the utmost confidentiality and their identity would remain anonymous. Once the data were gathered, these would be tallied and treated statistically which would be considered as Phase three (3) of the study.

2.4 Data Analysis

The data obtained from the test and profile of the respondents for the quantitative part were statistically tested using Statistical Package for Social Sciences (SPSS) to facilitate the interpretation and analysis of the findings of the study. The frequency count and percentage were used to describe the teacher's profile. Moreover, to determine the possible difference between the teachers' profile and their competency levels, a one-way analysis of variance or one-way ANOVA was utilized. When it comes to respondents' qualitative responses, the researcher conducted a Focus Group Discussion (FGD) concerning the difficulties faced by the science teachers in teaching evolution. The data gathered were transcribed and presented in narratives for the qualitative part of the study.

3. RESULTS AND DISCUSSION

3. 1 Profile of The Respondents

Table 1. Profile of the Science Teachers in Terms of Educational Attainment, Religious Affiliation, and Years of Teaching

	f	*%*
Educational Attainment		
• Bachelor's Degree	10	29%
• With Units in MA/MS	17	50%
• Master's Degree	5	15%
• With Units in Doctorate Degree	2	6%
Total	34	100%
Religious Affiliation		
• Iglesia Ni Cristo	1	3%
• Aglipayan	1	3%
• Methodist	3	9%
• Baptist	4	12%
• Seventh-Day Adventist	2	6%
• Roman Catholic	21	62%
• Espiritista	1	3%
• Muslim	1	3%
Total	34	100%
Years of Teaching		
• 1 – 5	3	9%
• 6 – 10	12	35%
• 11 – 15	6	18%
• 16 – 20	5	15%
• 21 – 25	3	9%
• 26 – 30	2	6%
• 31 – 35	3	9%

Total	34	100%

Table 1 shows the profile of the science teachers. In terms of educational attainment, 50% of the respondents have units in MA/MS (n = 17). In terms of religious affiliation, more than half of the respondents were Roman Catholics (n = 21). In terms of years of teaching, most of the respondents have 6 – 10 years of experience (n = 12).

3.2 Competency Level Of Science Teachers In Teaching Evolution

Table 2. Competency Level of Science Teachers in Teaching Evolution

Learning Competencies	Mean Percentage Scores	Level of Teaching Competence	Interpretation
1. The general features of the history of life on Earth including generally accepted dates and sequence of the geologic time scale and characteristics of major groups of organisms present during these periods	82.35	Experienced	Competent in the Knowledge, Skills, and Attitude (KSA) but would benefit from further training and development
2. The mechanisms that produce a change in populations from generation to generation (e.g., artificial selection, natural selection, genetic drift, mutation, recombination)	65.88	Experienced	Competent in the Knowledge, Skills, and Attitude (KSA but would benefit from further training and development
3. The patterns of descent with modification from common ancestors to produce the organismal diversity observed today	57.06	Developing	Fairly competent in Knowledge, Skills, and Attitude (KSA) and need further training and development
4. The development of evolutionary thought	65.88	Experienced	Competent in the Knowledge, Skills, and Attitude (KSA) but would benefit from further training and development
5. The evidence of evolution (e.g., biogeography, the fossil record, DNA/protein sequences, homology, and embryology)	69.41	Experienced	Competent in the Knowledge, Skills, and Attitude (KSA) but would benefit from further training and development
6. The evolutionary relationships among organisms using the evidence of evolution.	45.88	Developing	Fairly competent in Knowledge, Skills, and Attitude (KSA) and need further training and development
Over-all Mean Percentage Score	**77.29**	**Experienced**	**Competent in the Knowledge, Skills, and Attitude (KSA) but would benefit from further training and development**

Table 2 presents the competency level of the science teachers in teaching evolution. Of the six identified learning competencies, the science teachers obtained an experienced level of teaching competence: –The general features of the history of life on Earth including generally accepted dates and sequence of the geologic time scale and characteristics of major groups of organisms present during these periods (82.35)‖, –the mechanisms that produce a change in populations from generation to generation (e.g., artificial selection, natural selection, genetic drift, mutation, recombination) (65.88)‖, –The development of evolutionary thought (65.88)‖, and –the evidence of evolution (e.g., biogeography, the fossil record, DNA/protein sequences, homology, and embryology)(69.41).‖ Two competencies obtained developing level of teaching competence: –The patterns of descent with modification from common ancestors to produce the organismal diversity observed today (57.06)‖, and –the evolutionary relationships among organisms using the evidence of evolution (45.88)‖. Remarkably, the science teachers' level of teaching competence in teaching evolution was found to be experienced with an overall mean percentage score of 77.29.

3.3 Difference Between The Profile Of Teachers In Teaching Evolution And Their Level Of Competency

Table 3. Difference between the Profile of Teachers in Teaching Evolution and their Competency Level

		Sum of Squares	df	Mean Square	F	Sig.
Religious Affiliation	Between Groups	2.588	1	2.588	1.183	.285
	Within Groups	70.029	32	2.188		
	Total	72.618	33			
Educational Attainment	Between Groups	.018	1	.018	.025	.874
	Within Groups	22.952	32	.717		
	Total	22.971	33			
Years of Teaching	Between Groups	1.280	1	1.280	.401	.531
	Within Groups	102.161	32	3.193		
	Total	103.441	33			

Table 3 reveals the difference between the profile of teachers and their competency level in teaching evolution. As gleaned from Table 3, all p-values of 0.285, 0.874, and 0.531 were greater than the significance level of 0.05. This fails to reject the null hypothesis which leads to the conclusion that there is no significant difference between the profile of the teachers and their competency level in teaching evolution.

3.4 The Difficulties Faced By The Science Teachers In Teaching Evolution

To identify the difficulties faced by the science teachers in teaching evolution, a Focus Group Discussion (FGD) was conducted. Found below were the responses of the respondents.

Differences in religion

The most recurring difficulty faced by Science teachers in teaching evolution is religion. Evolutionary theories including the origins of humans can contradict one's religious views and pose a challenge in teaching the concept of evolution. Faith is challenged, and the willingness to teach the subject is hindered. Some teachers are unable to provide the greatest possible education because evolution contradicts their beliefs and sometimes results in bias teaching.

"Teaching evolution is hard because of indifferences in religious affiliation or views. Some instances may happen when a teacher cannot give all of her best in teaching evolution which may impede the delivery of instruction and will delay student's learning because of his/her own belief regarding evolution."

"In publicly funded schools, teaching evolution is compulsory and that is my struggle as a Christian. My faith is compromised because I do not believe personally in this theory. It affects my willingness to teach the topic."

"I believe that teaching evolution conflicts with religious beliefs. Thus, it is really difficult to impart to the students the concept of evolution. Teaching evolutionary theories is against Christianity and contradicts the word of God. But despite objections, I have to teach it because it is prescribed in the K12 Curriculum."

"Because of disparities in religious beliefs, teaching evolution is difficult. I experience bias when teaching because I also have different views about evolution."

Mastery of content

The theory of evolution is one of the fundamental pillars of biology. Content mastery on evolution is also a struggle for Science teachers. According to some respondents, to achieve the best teaching and learning on the subject matter, in-depth content knowledge and understanding are required.

"The concepts enclosed in this branch of science cannot simply be mastered in a simple browse of a book on a few pages of a website/s. In-depth-content learning experiences must be done to attain an optimal grasp of the necessary knowledge on the subject matter."

"Teaching of evolution theories may sometimes result in debates and argumentations. To satisfy students' learning, a teacher must have adequate knowledge of the subject."

"Content mastery on the subject evolution is a challenge for teachers. We, teachers, should have the in-depth content knowledge to be shared with our students."

Lack of training programs or seminar-workshop

For Science teachers, lack of training programs or seminar workshops is also a problem. They claim that such provisions can support them with the necessary knowledge and background to increase their confidence when dealing with contentious evolution topics.

"*For me, a teacher can teach effectively if they are supported by training programs or any seminar/workshop about the controversial issues in evolution. There is a tendency to avoid dealing with concepts as controversial as evolution because of the poor background or lack of training which is evident in public schools."*

"I believe that adequate training can help a teacher to alleviate his/her evolution knowledge especially misconceptions on the topic and it will boost his/her confidence in tackling debatable issues when teaching evolutionary theories."

Time allotment

The provision of sufficient time in teaching evolution is also seen as a challenge to teachers. Because according to them, evolution is among the most difficult subjects to teach, ample time is required to develop teaching strategies considering several activities that will enhance understanding and acceptance of the concept.

"Because this is one of the difficult topics to teach, I need to set aside a significant amount of time to plan innovative strategies to foster understanding and acceptance of evolution."

"To enhance the student's conceptual grasp of evolution, I must consider activities such as games, models, simulations, and even real-life situations to better understand the topic which I think requires much time for a better presentation of the lesson."

Instructional approaches

The application of appropriate instructional approaches is also one of the difficulties faced by teachers in teaching evolution. According to the teachers, evolution is a difficult subject and different views arise about this topic, they must apply the most suited instructional strategies to meet the needs of the students and to attain the set lesson objectives.

"*In Biology 2, I teach evolution as one of the learning competencies, with a focus on STEM students. Because this is a difficult subject, I'm pondering how evolution should be taught and what instructional approaches may be employed to meet the needs of my students for them to favorably open themselves to multiple perspectives of disputed evolutionary ideas without indicating which side I support."*

"Applying appropriate instructional strategies in teaching evolution is quite a problem for me. Because different perspectives about this topic arise, I have to use suitable approaches to obtain the realization of lesson objectives."

Lack of Educational Resources

Because the new normal trend in education and modular distance learning is currently implemented, the availability of educational resources is also identified as a problem in teaching evolution. Reference books and other learning materials are needed to support the delivery of the topic and will eventually result in an in-depth knowledge grasp.

"*I think, one thing a teacher can effectively deliver the topic about evolution is the availability of materials especially in public schools. Students from rural areas can follow more the topic or can acquire in-depth knowledge if they have reference books and if they are supported with other learning materials for them to better understand the content since they prefer modular distance learning."*

D. The training design to improve the competency level of teachers in teaching evolution

The training design focusing on teaching competencies, specifically in teaching evolution will provide science teachers who teach biology in junior and senior high school with the needed information to master the content as well as apply the appropriate instructional approaches to meet students ' needs and attain the set lesson objectives. It is intended for all science teachers, not just those who teach biology to better understand and master the concept of evolution. Lectures, simulations, hands-on activities in evolution, and demonstration teachings will be conducted to guarantee that science teachers have a deeper and complete grasp of the topic so that they can apply what they have obtained from the training when they teach ―evolution‖.

4. CONCLUSION AND RECOMMENDATION

Based on the findings of the study, the following conclusions were drawn:

1. In terms of educational attainment, 50% of the respondents have units in MA/MS. In terms of religious affiliation, more than half of the respondents were Roman Catholics. In terms of years of teaching, most of the respondents have 6 – 10 years of experience.
2. The competency level of science teachers in teaching evolution is experienced.
3. There is no significant difference between the profile of the teachers and their competency level in teaching evolution.
4. The science teachers faced difficulties in teaching evolution such as differences in religion, mastery of content, lack of training programs or seminar-workshop, time allotment, instructional approaches, and lack of educational resources.

Based on the conclusions of the study, the following recommendations were made:

1. Science teachers should attend training and development focusing on the learning competencies which obtained ―developing level‖ to improve their teaching competence.
2. The findings of the study should be considered by school heads as baseline information in the training design for teachers in teaching evolution.
3. A follow-up study with more respondents and a broader scope of analysis should be done to investigate the competency level of teachers in teaching evolution in both rural and urban school settings.

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