

Teacher's Needs Analysis on Content Knowledge in Science: Basis for a Comprehensive Learning and Development Plan

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Abstract

The Department of Education aimed to provide training that is both relevant and responsive to teachers' needs to enhance their effectiveness. This study was undertaken to assess the training needs of science teachers regarding content knowledge in science, serving as the foundation for a Comprehensive Learning and Development Plan. The respondents in this study comprised science teachers from both Elementary and Secondary levels within the Division of General Santos City, Philippines. The competencies tested were aligned with the grade levels the teachers instructed, adhering to the prescribed learning competencies for each grade level. The instrument underwent rigorous validation by Learning Resource Evaluators (LRE). The study's findings revealed a clear necessity to reinforce teachers' content knowledge in identified least mastered competencies within the four science domains: Matter, Living Things, Earth and Space, and Force and Energy, across all grade levels. As a result, it is recommended that these identified competencies serve as the foundation for the development of a Comprehensive Learning and Development Plan. This plan aims to equip teachers with the necessary knowledge and skills to enhance their instructional effectiveness and ultimately improve science education.

Keywords: Teacher Needs Assessment, Learning and Development Plan

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Introduction

Science holds significant importance due to its connections with technology and industry, areas often given high priority for development from a national perspective (DepEd Order No.24, s. 2022). Its mission extends beyond imparting scientific knowledge; it aims to broaden learners' understanding of science and knowledge construction, promoting scientific literacy and responsible citizenship. Science education seeks to equip learners with the skills needed to make informed, science-based judgments and decisions, potentially impacting social health and environmental factors.

Science educators serve as the guiding lights, facilitating the teaching and learning process by conveying science concepts, instilling problem-solving skills, and teaching how to gather evidence to support ideas and decisions. Given the ever-evolving nature of science education, continuous improvement and updates in science knowledge are vital for educators to meet the changing demands and challenges in this field.

The result of the Trends in International Mathematics and Science Study (TIMSS), published by and found shows that the Philippines ranked 41st in Math and 42nd in Science out of 47 countries. The Philippines scored 297 in math and 249 in science which is significantly lower than any other country. The country also scored the lowest among all 58 participating countries for both tests. This would mean that much should be employed to raise this rank which must start with the facilitator of learning through the learning and development of science teachers.

Research indicates that teachers significantly influence students' learning outcomes. To improve education, we must improve teacher effectiveness, considering factors such as academic preparation, teaching experience, and relevant professional development programs.

The Department of Education aims to develop not just efficient but effective teachers. Ongoing training plays a pivotal role in achieving this goal, enabling teachers to learn and perform their roles more proficiently. In-service training for teachers is both a legal requirement and an ethical imperative.

DepEd Order No. 32, s. 2011, defines Training and Development (T&D) as a process that enhances individuals' knowledge, skills, and attitudes to perform their functions effectively. This includes various activities such as training, seminars, workshops, conferences, scholarships, and job-embedded learning, all involving a systematic process from assessment to program delivery.

Furthermore, DepEd Memorandum No. 050, s. 2020, underscores the significance of T&D in upskilling and reskilling teachers and school leaders, ultimately improving learning outcomes. This underlines the importance of conducting a Comprehensive Learning and Development program for Science Teachers, aligning with the department's goals. As McKinsey aptly states, "The quality of an education system cannot exceed the quality of its teachers."

In the Division of General Santos City, the Curriculum Implementation Division, particularly the Science Department, conducts an Online Test on Content Knowledge in Science as the basis for developing a Comprehensive Learning and Development Plan. The results, especially regarding the least mastered competencies, guide the topics covered in training sessions. This approach aligns with DepEd Order No. 32, s. 2011, emphasizing the importance of competence assessment, planning, resource development, and program delivery. A competency-based

approach is employed in designing Comprehensive Learning and Development for Science Teachers, encompassing competency-based assessment and training methods to enhance the quality of science education in the region.

Statement of the Problem

The study aimed to surface the least mastered competencies of teachers teaching science in both elementary and secondary schools.

Specifically, the study seeks to answer the following questions:

1. What is the profile of Science Teachers in terms of their specialization?
2. What are the least mastered competencies of Science teachers in Grades 4 to 12?
3. Based on the result how may a Comprehensive Learning and Development Plan for Science Teachers be designed?

Methodology

This study utilized a descriptive-survey research method. This research design was deemed appropriate to identify the least mastered competencies among science teachers in Grades 4 to 12. A survey design is an approach that offers a quantitative or numeric portrayal of trends, attitudes, or opinions within a population by examining a sample from that population.

Subsequently, a Comprehensive Learning and Development Plan was created.

Participation and Data Sources

A. All science teachers from both elementary and secondary schools participated in the competency-based online content knowledge test with a total of 932 teachers.

Data Gathering Procedures

The instrument that was used to gather the needed data was a survey questionnaire. It consisted of a 40-item test that was utilized in the online test. These items were derived from the Most Essential Learning Competencies (MELCs) per grade level. Each test covered the 4 domains in Science, including Matter, Force and Energy, Living Things, and Earth Science. The developed test was in Google Form, and the items and choices were scrambled to prevent any leakage on the test. The said instrument underwent a thorough validation process by the Learning Resource Evaluators.

Before the test was conducted, an orientation was held through Division Memorandum CID No. 73, dated 2021, titled "Orientation on the Development and Utilization of the Electronic Profiling System (EPS) and the Conduct of Training Needs Assessment for Science Teachers." This orientation aimed to achieve 100% participation of science teachers in completing the Electronic Profiling System and to ensure 100% participation of Science Teachers in the online test to assess teachers' needs in content mastery in Science. Following this, Division Memorandum CID No. 85, dated 2022, was issued regarding the Conduct of the Electronic Profiling System and Training Needs Assessment for Science Teachers. Its goal was to provide accurate basic information to science teachers and determine the training needs of teachers in Content Knowledge.

Validity

After the questions were crafted, the identified Learning Resource Evaluator in each Grade level validated the test questions. The Instrument was validated using the following criteria: 1.) clarity of direction and indicators, 2.) presentation and organization, 3.) suitability of indicators, 4.) adequacy of indicators per category, 5.) congruency to the purpose, 6.) impartiality of the researcher, and, 7.) appropriateness of the options and evaluation rating system. Through their expertise, revisions and improvements were made. The instrument would obtain an overall mean that must be good or very good for the test to be valid.

Data Analysis

Each item of the test was subjected to detailed analysis. The "Least Mastered Competencies" were identified as those competencies scoring below 75%. This indicated that the items associated with these competencies had not achieved full proficiency among teachers.

The process of identifying the least mastered competencies for each grade level was aligned with the guidelines outlined in DepEd Order 8, issued in 2015, which pertained to the "Policy Guidelines on Classroom Assessment for K to 12 Basic Education Program," as demonstrated below.

Table 1: Descriptors, Grading Scale, and Remarks

Description	Grading Scale	Remarks
Outstanding	90-100	Passed
Very Satisfactory	85-89	Passed
Satisfactory	80-84	Passed
Fairly Satisfactory	75-79	Passed
Did Not Meet Expectation	Below 75	Failed

Competencies that scored below 75% and were accompanied by the descriptor "Did not Meet Expectations" were collectively classified as the least mastered competencies. Following this classification, the identified least mastered competencies formed the foundation for planning Learning and Development initiatives aimed at supporting teachers in their professional growth.

Data Gathering Methods

Request for Permission to Conduct the Study: The study sought permission for its execution. Once approval was granted by the Schools Division Superintendent, the researcher proceeded to issue a memorandum regarding the administration of online tests for teachers.

Administration of Online Test :As the tests were administered remotely, teachers from each grade level were allocated a one-hour time frame for the examination. The test link was closed as per the predetermined schedule, in accordance with the guidelines set forth in Division Memorandum CID No. 85, issued in 2022, which pertained to the "Conduct of the Electronic Profiling System (EPS) and Training Needs Assessment for Science Teachers."

Analysis of the Results:Following the completion of the test, the collected data underwent analysis utilizing mean percentages to pinpoint the least mastered competencies.

Development of the Learning and Development (L&D) Plan: After identifying the least mastered competencies, a comprehensive 3-year Learning and Development Plan was formulated. This plan was designed to address the critical content areas identified for each grade level.

Major Findings

The main source of data were the result of the Profiling of Science Teachers and the Online Test on Content Knowledge in Science. The findings were presented sequentially vis-a-vis the statement of the problem.

Table 2: Specialization of Teachers Teaching Science

Specialization	No. of Teachers
Chemistry	9
Physics	7
Biology	237
Earth Science	3
General Science	171
Physical Science	17
General Education	238
Not Related to Science	250
Total	932

Table 2 presents data concerning the specialization of teachers responsible for teaching science subjects. The majority of science teachers, totaling 238, hold degrees in General Education. Interestingly, all of these General Education graduates are teaching Elementary Science. Additionally, there are 250 teachers whose academic backgrounds are not science-related. Among the various science-related specializations, Biological Science stands out with the highest number of teachers, reaching 273, while Physics has the lowest representation, with only 7 teachers specializing in the subject.

This data underscores the observation that a relatively small number of science major teachers are tasked with instructing science subjects in the context of basic education. As noted by Co (2021), this situation is a prevalent challenge within the educational system, where teachers frequently find themselves teaching subjects outside their areas of expertise, resulting in a mismatch between subject assignments and teacher qualifications across grade levels, from elementary to tertiary education. This phenomenon of teachers instructing subjects without the necessary educational background or training has often been overlooked.

This issue is of significant concern because even highly qualified teachers may become considerably less qualified when assigned to teach subjects for which they lack appropriate training or education. Such unqualified teaching assignments can potentially have a detrimental impact on student achievement and undermine the overall educational process. It highlights the importance of aligning teacher qualifications with their teaching assignments to ensure effective and meaningful learning experiences for students.

Table 3: Consolidated Mean Percentage Scores of Elementary Teachers per Grade Level

Grade Level	Matter	Descriptor	Force and Energy	Descriptor	Living Things	Descriptor	Earth Science	Descriptor
Grade 4	98.27	Outstanding	63.67	Did Not Meet Expectation	88.04	Very Satisfactory	72.72	Did Not Meet Expectation
Grade 5	81.92	Satisfactory	67.94	Did Not Meet Expectation	61.04	Did Not Meet Expectation	76.9	Did Not Meet Expectation
Grade 6	72.1	Fairly Satisfactory	73.13	Did Not Meet Expectation	57.95	Did Not Meet Expectation	63.9	Did Not Meet Expectation
Mean	84.1	Satisfactory	68.25	Did Not Meet Expectation	69.13	Did Not Meet Expectation	71.17	Did Not Meet Expectation

Table 3 shows the Consolidated Mean percentage scores of Elementary Teachers per Grade Level. The data reveals varying levels of performance among teachers across different grade levels in four science domains: Matter, Force and Energy, Living Things, and Earth Science. Grade 4 teachers excelled in Matter and achieved a very satisfactory performance in Living Things, but they did not meet expectations in Force and Energy and Earth Science. Grade 5 teachers achieved a satisfactory performance only in Matter, while Grade 6 students had a fairly satisfactory performance in Matter but did not meet expectations in the other domains. Across all grade levels, students generally did not meet expectations in Force and Energy, Living Things, and Earth Science.

Table 4: Consolidated Mean Percentage Scores of Secondary Teachers per Grade Level

Grade Level	Matter	Descriptor	Force and Energy	Descriptor	Living Things	Descriptor	Earth Science	Descriptor
Grade 7	71.93	Did Not Meet Expectation	77.67	Faily Satisfactory	82.17	Satisfactory	73.31	Did Not Meet Expectation
Grade 8	80.32	Satisfactory	61.62	Did Not Meet Expectation	64.02	Did Not Meet Expectation	70.71	Did Not Meet Expectation
Grade 9	65.48	Did Not Meet Expectation	70.92	Did Not Meet Expectation	72.23	Did Not Meet Expectation	83.32	Satisfactory
Grade 10	53.89	Did Not Meet Expectation	50.8	Did Not Meet Expectation	63.41	Did Not Meet Expectation	80.66	Satisfactory
Senior High School	65.56	Did Not Meet Expectation	55.45	Did Not Meet Expectation	53.46	Did Not Meet Expectation	65.09	Did Not Meet Expectation
Mean	67.44	Did Not Meet Expectation	63.29	Did Not Meet Expectation	67.06	Did Not Meet Expectation	74.74	Did Not Meet Expectation

Table 4 shows the Consolidated Mean Percentage Score of Secondary Teachers per Grade Level. The data provided reveals the performance of teachers in various grade levels across four science domains: Matter, Force and Energy, Living Things, and Earth Science. Notably, Grade 7, Grade 8, Grade 9, Grade 10, and Senior High School teachers all received descriptors indicating that they "Did Not Meet Expectation" in most of these domains.

In Grade 7, teachers did not meet the expectation in Matter and Earth Science. Grade 8 teachers fell short of expectations in all four domains, while Grade 9 teachers also did not meet expectations across the board. Grade 10 teachers performed below expectations in Matter and Force and Energy, while Senior High School teachers struggled to meet expectations in all domains.

The overall mean scores for all grade levels and domains further emphasize that, on average, teachers did not meet the expected proficiency levels in these science domains. This data suggests a widespread need for targeted interventions and improvements in science education across these grade levels to help students achieve the desired level of competency.

Conclusions

The data collected through various data-gathering instruments, including Chemistry, Physics, and Biology assessments, have consistently highlighted specific domains that require immediate attention within the context of the Online test. This observation can be attributed to the specialization or expertise of science teachers who participated in the assessment.

Firstly, Chemistry emerges as an area that demands particular focus. The performance data across different assessments within this domain consistently indicate that teachers may be facing challenges or gaps in their understanding of chemical principles and concepts. Addressing these challenges is critical to ensuring a well-rounded science education.

Secondly, Physics appears as another domain where attention is warranted. The results from Physics assessments consistently indicate that teachers may be struggling to grasp fundamental physics concepts and principles. This underscores the importance of enhancing the teaching and learning processes within this domain to improve student comprehension and proficiency in Physics.

Lastly, Biology stands out as a domain that requires careful consideration. The data consistently point to potential shortcomings in students' understanding of biological science concepts and topics. Enhancing the teaching strategies and resources in Biology is essential to promote a more comprehensive grasp of biological principles among students.

In conclusion, the data gathered through the Online test underscore the need to prioritize Chemistry, Physics, and Biology within the science curriculum. These domains have emerged as areas where students may require additional support and resources to strengthen their understanding. By addressing these specific challenges through targeted educational strategies and professional development opportunities for science teachers, educational institutions can work towards providing a more well-rounded and effective science education for students.

Recommendations

Based on the result, It is recommended to come up with a Comprehensive Learning and Development Plan. The Proposed Comprehensive Learning and Development Plan is a multifaceted and thorough strategy designed to address various crucial aspects of education. Its primary goal is to bring about positive changes in the educational landscape by concentrating on several key areas.

First and foremost, the plan emphasizes the creation of an effective learning environment. This means fostering an atmosphere where students feel motivated, engaged, and supported in their learning journey. An effective learning environment goes beyond physical spaces; it encompasses the overall culture of the educational institution, including the relationships between students, teachers, and the school community.

Secondly, the plan focuses on improving teaching-learning situations. This involves enhancing the quality of instruction, curriculum development, and assessment methods. By investing in the professional development of teachers, the plan aims to equip educators with the knowledge and skills necessary to deliver high-quality education.

Additionally, the plan places a strong emphasis on staying updated with modern instructional devices and methods. In today's rapidly evolving technological landscape, it's crucial for educational institutions to keep pace with the latest tools and techniques. This ensures that students are exposed to innovative and effective teaching methods that align with the demands of the modern world.

Lastly, the plan seeks to inspire teachers. Teaching is not just a profession; it's a vocation that requires passion and dedication. By providing support, recognition, and opportunities for growth, the plan aims to motivate and empower educators. Inspired teachers are more likely to inspire their students, creating a positive ripple effect throughout the education system.

In summary, the Proposed Learning and Development Plan is a holistic approach to education that aims to improve the overall quality of education. It recognizes that a combination of factors, including the learning environment, teaching quality, technology integration, and teacher motivation, all play a vital role in preparing students to meet the challenges of the modern world.

References

Co, A.G.E., Abella, C.R.G. and De Jesus, F.S. (2021) Teaching Outside Specialization from the Perspective of Science Teachers. Open Access Library. Journal, 8:e7725.

DepEd Order No.24, s. 2022. Adoption of the Basic Education Development Plan 2030

DepEd Order No. 32, s. 2011. Policies and Guidelines on Training and Development (T&D) Program and Activities

DepEd Memo No. 50, s. 2020. DepEd Professional Development for Teachers and School Leaders for School Year 2020-2023

Division Memorandum No. 341, s. 2023. Call for Submission of Proposal for the 2023 HRD INSET Fund and HRD Program Support Fund.

McKinsey and Company Incorporated (2007). Leadership and Management retrieved from <https://www.mckinsey.com>

TIMMS Trends in International Mathematics and Science Study. 2019. retrieved from <https://timssandpirls.bc.edu/timss2019/>

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