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Curriculum Designs and Misconceptions in Science among Teachers in Region X

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ABSTRACT

This descriptive study examined how Grade 8 Science teachers in Region X used various curriculum design approaches and identified misconceptions in Earth Science, Biology, Chemistry, and Physics during the 2023–2024 school year. The study assessed how often teachers applied subject-centered, learner-centered, and problem-centered designs in their teaching. It also analyzed how teacher characteristics—such as age, sex, rank, experience, specialization, education level, and attitude—affected their teaching. Involving 270 randomly selected Science teachers, the data revealed most respondents were female, aged 26–30, in Teacher 1 positions, had over 15 years of experience, majored in Biology, held college degrees, and had positive attitudes toward teaching Science. Subject-centered design was "always observed," while learner- and problem-centered designs were "most of the time observed." The findings showed Biology was the easiest subject to teach, while Physics posed the most difficulty. Teachers' profiles had no significant effect on their misconceptions. Notably, problem-centered design was seen as effective when aligned with learners' age. The study concluded that regular evaluation, assigning teachers based on their specialization, and supporting those teaching outside their field are essential. It recommended hiring DOST scholars with appropriate remuneration and addressing curriculum delivery gaps to improve Science education outcomes.

Keywords: *Curriculum Design, Misconceptions in Science*

INTRODUCTION

Background of the Study

Science teachers have always been known as competent in terms of teaching is concerned. Undoubtedly, this fact serves as an advantage among Filipinos in terms of finding job opportunities within the Philippines or abroad. However, Science curriculum has been challenged in teaching other learning areas of Science not mastered by baccalaureate requirement. Teachers teach these learning areas (Earth Science, Biology, Chemistry and Physics) per grade level assignment with only one mass training program background conducted during K-12 implementation, LAC sessions and mostly through self-study.

Previously, Science teachers were of no doubt major and minor in any four learning areas. Teachers have their diploma in Specialized Science from graduate studies and the least baccalaureate program, vertically align per degree requirement. Teachers' degrees made them as specialists in any of the four learning areas and have taught the subject according to their specialization. The adoption of the new implemented curriculum has changed the mode of assignment of teachers to Generalists: teaching Science learning areas in one grade level with only one specialization by baccalaureate requirement.

Under K-12, Spiral Progression approach is the key feature. It has greatly influenced science curriculum particularly the content and transitions of four learning areas of science, especially the science teachers. Teachers observed spiraling practice. A spiral curriculum that deals with a mile wide range of topics on various discipline requires too much from a teacher. Science teachers were still adapting to the new curriculum, they needed more time and trainings to master all the fields and to learn new teaching strategies because it is difficult to teach something, in which one does not have the necessary mastery. Learning is spiral but not teaching. They can teach other branches of

science but without the in-depth discussion because of non-specialization. The said approach was found not applicable to the needs of the learners in the other countries implementing spiral progression approach in their educational system. Teachers are having a hard time on the mandate to take the responsibility in connecting teachers and learners' existing knowledge and future learning and even determining which topic is critical in the subject taught because they are not specialist in the four fields. Identifying science strategies explore explicit techniques for teachers mastering strategies of instructional practice are mastered if the teachers are called specialist and not as generalist (Manzano, 2019).

Moreover, in Philippine setting DepEd see spiral progression approach as a solution to our education problem but sad to note that if teachers are not well equipped they will not be able to teach correctly and properly. "Teachers are susceptible to science drawback instead, alternative conceptions and misconceptions. Teachers with insecure understanding of science concepts perpetuate students' misconceptions. This is apparent when teachers teach science that is not their specialized subject. Personal misconceptions become embedded in lessons. Teachers then will resort to lessons that are more teacher talk.

According to the research, teachers' susceptibility in teaching science misconceptions is due to pre conceived ideas aside from what has been learned from formal education. Teachers lack confidence in designing lesson plans, answering queries from students and running experiments in the laboratory (Mizzi, 2020). To some extent, actual teaching and instructions are according to teachers' lesson preference and masterpiece. While others' daily lesson logs are copied from on line or from their colleague for compliance purposes only. Inadequate knowledge in the subject is one factor that causes the teacher lack of self-confidence when teaching topics that are other than their expertise (Haigh et al., 2019).

The science teachers turn into generalist leads to an imbalance as science curriculum demands expertise in all sciences. This results to teaching their "non-major" subjects or otherwise known as, a "generalist". As Alwardt (2019) emphasizes, "Transitions are inherently difficult for teachers." While trying to adjust to the change, teachers still have the obligation to give the very best instruction to the students appreciate the crucial role of teachers in educational reform.

This is the high call faced by the Philippine educational system. Our school must produce graduates who would effectively contribute to the progress of our nation to survive in the competitive edge De Leon, (2020). To address this call, we also need highly demand competent science teachers who can do the teaching-learning process on its maximum capacity even well as to the development of teaching skills. It is in this context that this study will focus to find out the- Curriculum Content and Misconceptions on selected critical areas among Science teachers in Region X.

Related Literature and Studies in Foreign Setting

One dissertation from Lindenwood University tackles specifically the transition Process When Moving from a Spiral Curriculum Alignment into a Field-Focus Science Curriculum Alignment in Middle School (2019) by Alwardt Randi Kay. Teaching Science covers 9 hours, 4 hours for lecture and 5 hours allotted time for laboratory (Wellington and Ireson, 2020). However, in Secondary 2002 BEC, Science subject has been reduced to 6 hours per week. In contrast to that, it is minimized to 4 hours per week in K to 12 Education. According to the research of Almeida et.al, (2021), Science subject comprises three kinds of classes. Lectures provide the students with an understanding of the context being covered. Lectures should be seen as period of active study. For it to be fully effective, students must read the given material ahead of time. Teachers identify topics that could represent obstacles to learning in preparing lectures.

It is vitally important for teachers to have a solid understanding of their content area to support student learning in the designated curriculum and for student learning extended out of the curriculum. A discussion of how and what science teachers need to learn over the course of their careers must be anchored in an explicit vision of quality science teaching, which needs to be grounded in aspirations for students' learning. Accordingly, teaching dominant concept had gradually changed into learning concept. The quality of education is determined 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, 2020).

K-12 generalist perspective can be looked at content knowledge concept. Defining content knowledge Joseph Schwab (2019) discussed the structure of subject knowledge. He distinguished between syntactic knowledge, that is logical structures that comprise a discipline and substantive knowledge about his subject. Its significance was evident in United States of America in 1970 when education was characterized by general, rather than subject-specific knowledge. Lee Shulman (2020) pursued identifying subject knowledge as the missing link in teacher education. He campaigned for professional recognition of teaching, arguing that like lawyers and doctors, teachers possess a specialist "knowledge based". Shulman identified seven knowledge-based components, naming one "pedagogical content knowledge" as the blend of the subject-specific content and pedagogy unique to teachers. According to him, content knowledge can be transformed by teachers' pedagogical content knowledge intelligible to students. Shulman's content knowledge is now widely accepted as a component of Schwab's substantive subject knowledge.

Educators have long argued for an approach to science education that allows students to engage in investigations and teaches few topics in greater depth. Instead, students often engage in lock-step, prescribed

experiments, and the number of scientific facts they memorize has continued to expand. As a result, teachers teach more in less time, and what students are expected to learn has widened instead of deepening (Bruer, 2019).

Barrass (2019) wrote “mistakes", "misconceptions" or misleading ideas, and "misunderstandings" or misinterpretations of facts are perpetuated by teachers and textbook authors. His study revealed that students typically exit the Biology I classroom more confident in their biological evolution knowledge but holding greater numbers of misconceptions than they initially possessed upon entering the course. Significant relationships between teachers’ acquisition of misconceptions and their bachelor’s degree field, terminal degree, and hours dedicated to evolution instruction were also revealed. In addition, the probabilities that specific biological evolution-related misconceptions were being transmitted from teachers to their students were also identified.

Furthermore, the study revealed some problematic issues concerning the teaching of biological evolution in Oklahoma’s public high school introductory biology course. Multiple factors contribute in varying degrees the acquisition and retention of teachers’ misconceptions on biological evolution. However, based on the study, teachers serve as sources of biological evolution-related misconceptions or propagators of existing misconceptions.

Science literacy is a concept that is simple in theory yet has been a challenge to describe in terms of practice. The need for science literacy is especially apparent when framed in the context of modern public controversy surrounding issues such as climate change and evolution in the United States where the battle for science literacy plays out in the media, state governments, churches, and school systems. As a result of known shortcomings of the traditional approaches tor science teaching and negative perceptions of science and, society struggles in reaching the high level of literacy. Furthermore, students entering and leaving any programs of study with inadequate or absent comprehension of science as a way of knowing the philosophical and historical frameworks of our modern understandings of science is a self-correcting set of process skills. It is a shared responsibility of teachers to ensure that science literacy is a priority and that approaches to teaching across levels strive to meet that goal.

Studies of science teachers’ content knowledge began in the 1980s. Teachers were found to hold misconceptions about many science topics. Large scale projects across sciences simultaneously revealing international commonalities in misconceptions and understanding. In a cross-cultural study, Ameh and Gunstone (2019) found that irrespective of nationality, teachers held the same misconceptions about life and physical world concepts. Research evidence suggests that maturity and additional education reduce teachers’ misconceptions relative to their students, but eliminating these are nonetheless important in planning teacher education. Teachers’ physics content knowledge has been studied more extensively than their biology and chemistry. This may be because most science teachers are not physicists, creating a non-specialist investigation. Also, many physics concepts are abstract, so are prone to misunderstandings. Faulty ideas remain unchanged and unchallenged from childhood, resulting in recycling between generations of teachers and students. Teachers’ understandings about science ideas, notably particles have been investigated. A consistent findings is that teachers are observable, macroscopic phenomena oriented rather than particle ideas. Ball and McDiarmid (2020) suggest that teachers science content knowledge is grounded in everyday and school education experiences rather than being developed through teacher education. Misconceptions about chemistry topics are also common among secondary science teachers. Kruse and Roehrig (2021) report reliance on macroscopic language rather than particle terminology to describe behaviour particles. Relatively few studies focus on teachers’ understandings on biology topics.

Appleton (2019) notes that poor content knowledge contributes to teachers low self-confidence for teaching science, and thus low quality lessons. Teachers’ prior experiences of school science influenced their confidence for teaching the subject. Khourey-Bowers and Fenk (2019) noted that, teachers’ broad and deep subject specific knowledge, awareness of common alternative conceptions and scientific models can provide rich learning opportunities for their students. The experience of a proffesor from Presidency College, Kolkata, India was indicative of learning being facilitated by locating the subject in an overall structure of the discipline. They are relevant and inclusive introductory material, provided in advance of learning material that serves to bridge the gap between what the learner already knows and what he needs to know before he can meaningfully learn the task at hand. Here, teacher was also an equal and active participant. Teaching and learning is seen as a conjoined process. The distortion of concept per se is not easily recognized by teachers. They only assume either incomplete or complete understanding of the concept. Furthermore, for teachers, teaching learning process seems to be subject centered rather than student oriented. The focus is more on transferring concepts to the students where they are expected to pre-determine set of logics and thoughts. Teachers seem to be unaware of the process involved in concept formation in a student’s mind.

Whiteburst (2020) on his speech in the White House emphasized that teaching effectiveness, performance, and student learning are directly influenced by teacher preparations through schools and state policies. The importance of preparation has an impact on the future performance of the teacher inside the classroom. The vital role of the educational background becomes one of the key factors of future success in teaching. This predetermines the probable outcomes of the learnings of students under their class. The influence of the teacher on student outcomes had been a source of question in some literature. In a report published by Hake (2000, 2020), Hestenes (1995, 2019), and Halloun (1998, 2019), they found out that students and pre-service teachers have large amount of misconceptions on Mechanics, where they attributed it to factors such as naïve belief and ineffective traditional methods of teaching the subject. Teachers who believe that their misunderstanding on forces is correct will lead to a domino effect to their

students who will be carrying the same misconception which is incompatible to complex concepts of Newtonian Mechanics.

As published *The Physics Teacher* in 2019, the Force Concept Inventory (FCI) authored by Hestenes, Wells, David and Swackhamer, the multiple-choice test designed to assess understanding of the most basic concepts in Newtonian Physics. It covers six fundamental concepts which include kinematics; Newton's First, Second and Third Law of Motion, falling bodies and types of forces. After showing evidence of accuracy and reliability, the FCI was widely used for evaluating instruction. In 1995, 2019, a revised 30-item FCI was developed and posted in the web. It has relatively shown free from false positives (correct answers for the wrong reasons) and has been repeatedly tested and proven free from bias (Hestenes and Halloun,; Pearce and le Roux, 2000; Scott and Savinainen, 2019a). The developers of the tool suggested that an FCI score of 80% is considered Newtonian Mastery Threshold and confirmed Newtonian Thinker; while a score of 60% is suggested as the entry threshold to Newtonian Physics. The Inventory questions are only probes for Newtonian concepts, so one should not give great weight to individual items. Hestenes and Halloun emphasized that the purpose of the FCI is to trace conceptions that normally cannot be measured using traditional methods of assessment in Physics (Halloun et al, 2019). There are occasional false positives in the responses of non-Newtonians and false negatives from Newtonians. But only true Newtonian generates a consistent pattern of Newtonian choices with an occasional lapse at most. Thus, the inventory as a whole is a good detector of Newtonian thinking (Scott and Savinainen, 2019).

Related Literature and Studies in Local Setting

At the dawn of 2015, the Philippines had undergone into a major reconstruction in its educational system in order to sustain the developmental change that the former President Benigno Aquino III had declared in Republic Act 10533, otherwise known as the "Enhanced Basic Education Act of 2013. To this effect, DepEd Order No. 31, series of 2012 was issued stipulating the guidelines in the conduct of instruction in the classroom under the K to 12 Curriculum. In its design, educational planners employed Spiral Progression approach in the delivery of the course content of individual science subjects. In this curriculum, learning competency in Earth Science, Biology, Chemistry, and Physics is divided in the 4-year Junior High School curriculum wherein every year the student progresses from simple to complex concepts. Eventually, teachers of Science should be able to master the four sciences instead of being a specialist of one science. This had caused initial pressure in the delivery of Science instructions among the teachers (Cabansag, 2019).

As of the 2018 Revision of the curriculum guide provided by DepEd, Grade 8 Science will introduce the Laws of Motion after the learner had mastered the concept of motion in their Grade 7 Science. Hence, teachers in this grade level should have a clear understanding on the fundamental concepts of the competency. Through this change, needed reforms including the selection of teachers had been implemented. As of 2015, through DepEd Order Numbers 7 and 22 (Secretary Bro. Armin A. Luistro). K-12 education aims to integrate and further institutionalize the primary objective of the K to 12 Basic Education Program, which is to enhance the overall quality of basic education in the country by hiring highly–competent teachers. The quality of the performance of teachers in the field, however, is also credited in the preparations they had in their pre-service years.

In 2018, Trends in International Mathematics and Science Study (TIMSS) revealed that the Philippine teachers hired at the time of testing has low readiness in Physics instruction compared to the other tested field of science. However, the regression result proves that there is no significant correlation with the Philippines' TIMSS Physics results and the readiness of teaching Physics. On the other hand, Monk (1999, 2019) and Hattie (2000, 2020) stated that the amount of academic capability of the teacher is a very strong factor on the student learning. The quality of instruction given by the teacher depends on how much learning they had from their training years. Thus, if capabilities to teach proper concepts are based on what they have learned and understood from their school and continuing education, misconceptions may arise in the process of their studies.

Science teachers who manage to develop students' skills in searching for answers to questions about materials and phenomena in the environment, and those who empower their students to grow in becoming a well informed decision makers in society, are considered effective teachers. These teachers are also able to evaluate their own practice and use these insights to develop challenging learner-centred experiences. In effect, a committed science teacher should be reflective, collaborative, and a lifelong learner. There are many constraints facing science education in Philippine schools.

In 2019, Garcia and Tan prepared a report on Project RISE (Rescue Initiatives in Science Education). The report describes qualified teachers as follows: 1. Those who have specialization in any science discipline (*e.g*., biology, chemistry, physics, and general science) in their undergraduate degrees; 2. Those who have undergone in-service training programs in the varied science disciplines equivalent to a major or minor; and, 3. Those with degrees in science-related professions who opted to go into teaching at the basic education level, took 18 units of foundation education subjects, and passed the licensure examination for teachers. Despite these broad categories, qualified science teachers are still lacking in the country, based on a number of reasons.

Another challenge is incongruent teaching assignments with teachers' educational background. Lack of qualified science teachers in many schools leads to the practice of assigning teachers to teach science subjects despite

their limited background. UP NISMED studied the profile of participants in their training programs through the years and found out that many teachers handling science subjects are non-science majors. They have difficulty in understanding the concepts in the identified topics in the given Science areas. These topics require a lot of visualization and use of models because the concepts are abstract. Lacking in confidence to teach these science subjects, teachers tend to focus or linger on topics they are familiar with (usually biological) and leave out the difficult ones. One probable effect of this practice is the low performance of students in international and national assessment studies. The results of the Trends International Science and Mathematics Study (TIMSS, 2003, 2018) and the National Achievement Test (Department of Education, 2003-2008 and 2018) support this observation. The UP NISMED study revealed that there was no significant difference between Grades 5 and Grades 6 students in regard to what they know and can do in Science.

One reason that was used to account for this observation is the inadequate preparation of teachers handling science subjects. Grade 6 Science has more abstract concepts and higher order thinking skills requirement than Grade 5 Science. Thus, it can be inferred that teachers' Science content background is not enough to deal with abstract concepts in a higher grade science subject. Most alarming is the result of the analysis of the TIMSS tests given to teachers. The tests revealed that many science teachers and students are incapable of assessing items that fall under conceptual understanding and analysis/reasoning, especially items under the constructed-response type.

The qualities of good science teaching can only be defined in terms of its effects on the learner. The knowledge and skills of effective science teachers differ in fundamental respects across subjects and context. The reviewed literature and studies pointed out awareness on the empirical evidences over the performance level and misconceptions of teachers towards teaching science. Many factors were involved to obtain its attainment. This interests the researcher to undertake a similar study in order to point out confirmations and variations of the previous studies taken already.

Theoretical and Conceptual Framework

This study will make use of Jerome Bruner's constructivism theory (2016). This is used in spiral model of the K-12 curriculum. Bruner was also the main proponent of spiral constructivism theory. The theory describes learning as dynamic process where students' understanding on the concept is affected by the teacher's level of understanding. According to Haeusler (2013, 2018). The author recognizes the role of the teacher as that of translating information into a format appropriate to each learner's current state of understanding.

From a constructivist standpoint, knowledge is constructed wherein the prior experiences of the learner play a decisive role in what is constructed. Hypothesis formulated fits both previous knowledge and new experiences. These are called concepts, ideas and theories. These ideas and input are appreciated if the topic at hand involves your area of expertise directly. These personal constructs differ from the well negotiated, most viable scientific constructs of the time. And this discrepancy is called misconception or preconception or alternate conception (Bettencourt, 2017).

Learning is understood as a continuing process in which both students and teacher gain mutually. It is considered as an inter-related and inter-dependent and thus an interactive process. Science is a wide range of understanding. One cannot be totally confined into a specific learning area, there are interlinks and connections between and among sciences.

Coherence is another element this study has considered as a must. It can be observed with teachers who are specialized to teach a particular subject. A teacher who has an education degree specializing in particular science discipline, with or without a curriculum, would know what to teach. Teaching science in an integrated approach requires specific training. The spiral curriculum is an extreme design of integrating sciences in one curriculum year according to Kronthal (2012, 2017). While academic structures are found fractured, disjointed due to lack of coherence (Lederman and Chang, 1997, 2018). Research revealed that teachers tend to perform well in their school and university examinations but their education has not done to eradicate, challenge and alter deeply held ideas or faulty thinking about science concepts. Deng (2007, 2014) reflects that school science and science differ in logical, social, psychological and epistemological aspects. Hence, university science would not necessarily provide opportunities to refresh science concepts but develop more complex and specialist understanding science. Teachers would likely base their teaching on their personal experiences encountered in Science without training. This places them at risk of perpetuating misunderstandings among students.

Statement of the Problem

The main purpose of this study was to look into the utilization of curriculum designs and the misconceptions in Science among teachers in Region X, for the school year 2020-2021. The result of this study would be the basis for faculty development plan.

1. What is the profile of the respondents in terms of age, sex, position, teaching experience, field of specialization, highest educational attainment and attitude towards Science teaching?
2. What is the level of curriculum design utilized by the respondents based on subject- centered, learner-centered and problem-centered?

3. What is the level of teachers' misconception based on the following areas Earth Science (Earthquake and Faults), Biology (Mendelian Genetics), Chemistry (Periodic Table and Particle Nature of Matter) and Physics (Forces and Motion, Heat and Temperature and Electricity)?
4. How do the respondents compare on their areas of misconceptions in Science when grouped according to age, sex, position, teaching experience, field of specialization; highest educational Attainment; and attitude towards Science teaching?
5. To what extent does the curriculum design contribute to teachers' misconceptions in science?
6. Based on the findings of the study, what Developmental Plan on Science Misconceptions can be designed?

Scope and Limitation

This study was limited to the curriculum design utilization and its role in the teachers' quality of teaching through defying different misconceptions in selected topics. The study covered the public secondary school Science teachers in the 14 Divisions of Region X, in the school year 2020-2021. The researcher will employ random sampling. The researcher believes on the following eligibility criteria in choosing the research setting: the Science teachers employed in the same geographical region of the researcher. The study will investigate the utilization of curriculum design and its role in upgrading the teachers' quality of teaching.

Methodology

Research Design

A descriptive research design was used in the study. It was concerned with conditions and relationships that exist, opinions held processes, and effects that are evident. It dealt with the relationship of the variables that had universal validity. This method was appropriate because the procedure included observation and recording of events, so "it can provide wealth of information about behaviour, especially behaviours that would be difficult to study experimentally" (Smith, et al, 2020).

Essentially, it discussed the interplay of the dependent and independent variables in the study. Data were gathered and results were tabulated and interpreted. After the interpretation, the results were explained by the underlying concepts that can be related to each piece of information.

The researcher-made questionnaire was employed as the main data gathering tool in identifying and establishing the differences between and among the variables of the study.

Study Setting

This study was conducted in Select Public Secondary Schools in the fourteen divisions of Northern Mindanao for the S.Y. 2016-2017 namely: 1) Cagayan de Oro City Division; 2) Misamis Oriental Division; 3) El Salvador Division; 4) Iligan City Division; 5) Lanao Del Norte Division; 6) Ozamis City Division; 7) Misamis Occidental Division; 8) Bukidnon Division; 9) Camiguin Division; 10) Gingoog City Division; 11) Malaybalay City Division; 12) Oroquieta City Division; 13) Tangub City Division, and 14) Valencia City Division. Region X is commonly known as Northern Mindanao.

Moreover, Northern Mindanao is within the grid square of 7˚25' to 10˚30' North Latitude. It is bounded on the North by the Bohol Sea, on the South by Lanao del Sur and North Cotabato; on the West by Zamboanga provinces; and on the East by Agusan Provinces and Davao. Region 10 consists of five provinces: it is composed of the landlocked province of Bukidnon in the South; Misamis Oriental in the North; the paradise island of Camiguin in the Northeast; Lanao del Norte and Misamis Occidental in the West. It is comprised of 9 cities: Cagayan de Oro, Gingoog, El Salvador, Iligan, Malaybalay, Valencia, Ozamis, Oroquieta, and Tangub; and a total of 84 municipalities; 13 Congressional districts, and 2,022 barangays with 238 Secondary schools.

Research Respondents

In this study, the participants were the 270 Grade 8 Science teachers of Public Secondary Schools in Region X in SY 2020 - 2021. These respondents were presumed to have clearer views and opinions on the relations and practices on the utilization of curriculum designs and the level of misconceptions on selected topics in science. The result of this study would be the basis for a faculty developmental plan. To figure out the sample size of the respondents of this study, Multi-Stage Sampling was employed. In the first stage of this procedure, stratified Random Sampling was done by grouping the respondents into fourteen strata representing the divisions of Region X. Then in the second stage, it employed simple random sampling to have the representative per division in Region X. Below is the table reflecting the distribution of respondents.

Table A

Distribution of the Respondents by Division

Division	Respondents
Bukidnon	55
Cagayan De Oro City	37
Camiguin	14
El Salvador City	7
Gingoog City	11
Iligan City	11
Lanao Del Norte	16
Malaybalay City	16
Misamis Occidental	18
Misamis 0riental	42
Oroquieta City	9
Ozamis City	14
Tangub City	9
Valencia City	11
Total	**270**

The Research Instruments

The survey questionnaire was prepared by the researcher which had two parts designed to collect vital information and data to come up a reliable result. The first part of the instrument was the profile of the teacher-respondents. These were age, sex, position, teaching experience, field of specialization, highest educational qualification, and attitude towards teaching science. A questionnaire on Attitude towards teaching Science was adopted from Survey Monkey.com (2018) with some modifications to suit the present study. This was established to know whether the profile of the respondents affects their teaching in Science with misconceptions in teaching.

The second part was the level of the curriculum design utilized by the respondents based on the stages of subject-centered, learner-centered and problem centered. The statements were formed based on curriculum design modified and adopted from Karen Scheiwetzer (2019). This was where the level of curriculum design in Science teachers was measured and quantified according to the following scale: (4) at all times observed (3) most of the time observed (2) sometimes observed and (1) never observed.

Statistical Treatment

Frequency distribution, percentages, the mean, and standard deviation were used in establishing the profile of the respondents. The One-Way ANOVA was one of the powerful and commonly used statistical tools in analyzing data. This tool was used in analyzing the data gathered in this study. The T-test was used to determine the difference of the respondent's perceptions of the determinants of the curriculum content of the Science teachers considering the major indicators on misconceptions in some selected areas in Science.

RESULTS AND DISCUSSION

Problem 1: What is the profile of the respondents in terms of age, sex, position, teaching experience, field of specialization, highest educational attainment and attitude towards science teaching?

Table 1
Distribution of Respondents' Age

Age	Frequency	Percentage
61 years old and above	1	0.37
56 – 60 years old	2	0.74
51 – 55 years old	2	0.74
46 – 50 years old	3	1.11
41 – 45 years old	5	1.85
36 – 40 years old	15	5.56
31 – 35 years old	30	11.11
26 – 30 years old	170	62.96
25 years old and below	42	15.56
Total	**270**	**100**

Table 1 discloses the age distribution of the respondents. The highest frequency of 170 (62.96 %) of the respondents were on the age bracket of 26 to 30 years old. This holds a greater number of respondents in the given age bracket. The data imply that teachers in the public secondary schools are getting younger in age considering the demand of job and the 21st challenges besetting in educational system through K-12 program. Moreso, in Science and Technology. As noticed, teachers of young age are millennials. This group is globally minded and has technology at their fingertips that are relevant and useful in learning. Young teachers are eager to explore, discover and experiment new teaching techniques, and tend to compete globally. They have high energies and multi taskers that greatly help students in creating positive and encouraging learning environment.

According to Hauserman (2019), young teachers' views are significant simply because they represent the next generation of educators who could reshape the education system. Educators for Excellence (2019) on their survey claimed that it is noteworthy that teachers' valuable insight to what works, what holds promise, and what needs to be changed in education system will then be realized.

While respondents with the age of 61 years old obtained the lowest frequency of 2 (0.67%). As observed, age apparently does affect perceived teaching effectiveness. Data reveal that only few are already at the twilight of their teaching career. This conforms the fact since all teachers would reach the age of retirement. Teachers who are approaching their retirement age becomes more likely contented with what they can, exerting effort to be more resourceful is less valued holding the mind set of departing from the service soon. Contradictory to the old finding that as the age advances there is burnout. Age effects do not seem to increase even if they reach the former retirement ages. (Stonebraker et al., 2019).

It is said (Shilpa Rajesh Shah, 2019) that experience and age has a positive effect on teaching. The experience increased as the age advanced. Age is traditionally an asset to an individual. Another thought was that age and experience go hand in hand. As the age advanced the teacher becomes experienced and he knows where to tap the potential of the students and how to make him understand his worth.

But over a period of time, there is evolution in observations. Individuals' perceptions are changing. The impact of age is even negligible and is set aside by other intervening factors. This implies that no one can discriminate teachers in terms of their age, as long as they are teaching effectively and enthusiastically. For teaching is an art. Only few are born teachers who can surely try and possess teaching skills.

Table 2
Distribution of Respondents' Sex

Sex	Frequency	Percentage
Male	105	38.89
Female	165	61.11
Total	270	100.00

Table 2 presents the sex distribution of the respondents. It can be gleaned from the data that the highest frequency 165 (61.11%) of the respondents were female. This means that majority of the respondents are female. This is because teaching is seen as a woman's job. In contrast, data gathered show male respondents had the low frequency of 105 (38.89%), not too far from the female respondents. This breaks the usual inventory of male teachers in the teaching arena. This implies that this study did not give much importance to the gender of the teacher. There is no clear preference while many had opted more for female teachers. In one of the recent study by Bodhe et al., 2019, students do not find sex of the teacher worth discrimination.

But literature points out the biased to female teachers, which may be related to variety of factors. According to Eddie Denessen, 2019, there were some differences in teachers interests towards science and technology. Male teachers reported significantly higher levels of enjoyment in teaching about science and technology than their female counterparts. Int.J.Curr.Microbiol.App.Sci (2020) cited that male and female teachers also differed in their perceived competence. Male teachers reported higher levels of competence than women, implying that teachers' enjoyment in teaching about Science and technology was linked to their perceived competencies. In the published January 2018 Article Info 7(1): 2436-2441 2437 revealed the Gender of the teacher Out of 75, 44% (33) of the students preferred ladies as teacher, whereas preference for male teacher was 27% (20) and 29% (22) of students were neutral. This observed difference between preference for ladies and gents was statistically not significant i.e. $P > 0.05$. But still many students preferred ladies as teacher and the reasons attributed were, their sincerity, hard work, efforts taken in preparing lectures, politeness and high pitch audible voice quality. Students who preferred male teacher remarked that males have better control of class, and because of their commanding nature and strictness, they involved back benchers also. Also, male teachers were observed to be effective in their work but expect female teachers to spend time, building supportive relationships with students. On the other hand, male professors earned better student evaluations if they

demonstrated competence but female professors had to demonstrate both competence and warmth to obtain the same high ratings (Shauna et al., 2019).

Table 3
Distribution of Respondents' Position

Position	Frequency	Percentage
Master Teacher III	5	1.85
Master Teacher II	15	5.56
Master Teacher I	15	5.56
Teacher III	25	9.25
Teacher II	60	22.22
Teacher I	150	55.56
Total	**270**	**100.00**

Table 3 indicates the current position/designation of the respondents. Data disclosed that the highest frequency 150 (55.56%) of the respondents were Teacher 1. This means that majority of the teachers hold a Teacher 1 position. This also reveals the number of newly hired teachers joined DepEd workforce to address the needs of K-12 Education full implementation since 2013 until now. More so, this heightens the demand for professional development such as enroll in graduate school, attend seminars and training, and upgrade strategies to improve performance that will address the demand of change in the new curriculum.

Remarkably, learning is a continuous process that promotes teachers' teaching skills, mastery of new knowledge, develop new proficiency, which in turn, help improve students' learning. Previous studies of (Kunter, Baumert & Koller, 2020) had indicated that when teachers are effective classroom managers, their students achieve at a higher level and display more interest in the class subject matter.

In addition, the government and DepEd offer limited opportunities for self-improvement of teachers such as free scholarship, research grants, free graduate studies and other improvement plans which will aid the teacher in merit promotion.

Table 4
Distribution of Respondents' Teaching Experience

Teaching Experience	Frequency	Percentage
15 years and above	5	1.85
12-14 years	10	3.73
9-11 years	20	7.41
6- 8 years	50	18.50
3-5 years	165	61.10
2 years and below	20	7.41
Total	**270**	**100.00**

Table 4 shows the distribution of respondents' teaching experience. The results show that the highest frequency 165 (61.1%) of the respondents had been teaching in 3-5 years. This means that teachers are in developmental phase of their career. It implies that majority of the teachers are developing in their classroom instruction as they build mastery skills, learn more for other Science learning areas to which they have not mastered yet ignoring whatever are the misconceptions and confusions they may encounter in the teaching career. At this stage, the teachers have to avail whatever opportunities that will intensively capacitate them and add to their instructional abilities. As noted, the productivity of these teachers increased in first five years of their career. Analysis drawn from Kini, & Podolsky (2021), study supports that teachers improve at greater rates during the first few years of their career. Teachers continue to improve at lesser rates throughout their career.

However, results show the lowest frequency of 5 (1.85%) of the respondents are teaching 15 years and above. It can be gleaned from the data above that only few respondents stayed long in the service. They may have been enriched and gained meaningful experience in the teaching profession.

According to Tara Kini, 2021, teaching experience is positively and significantly associated with teachers' effectiveness and students' achievement gains throughout a teacher's career. The gains in teacher effectiveness, as observed from their experiences are highest in teachers' initial years, but continue to develop in the second and often third decades of their careers. Of course, there is variation in teacher effectiveness at every stage of the teaching career. Teachers' effectiveness increases at a greater rate when they accumulate experience in the same grade level, subject or district.

On average, the most effective 20 years teachers are significantly more effective than the most effective first year teachers. This also supports the idea on how teaching experiences shaped the classroom teacher to be a highly caliber in their field. The Learning Policy Institute Research Brief (2021) revealed that teachers do continue to improve in their effectiveness as they gain experience in the teaching profession (Kini and Podolsky, 2021). They found out that teaching experience is, on average, positively associated with student achievement gains throughout a teacher's career. Of course, variation in teacher effectiveness exists at every stage of the teaching career: not every inexperienced teacher is, on average, less effective, and not every experienced teacher is more effective.

Table 5
Distribution of Respondents' Field of Specialization

Field of Specialization	Frequency	Percentage
General Science	30	11.11
Biology	90	33.33
Chemistry	70	25.93
Physics	80	29.63
Total	**270**	**100.00**

Table 5 shows the frequency distribution on the respondents' field of specialization. The table reveals that the highest frequency 90 (33.33%) were specialized in Biology. This means that there is the greatest number of respondents from this specialization. This implies that teachers were more inclined to teach in Biology and expected to be more positive and responsive on the area of studying living things. As noticed, newly hired teachers who are young ones are among this specialized group. They are mostly submissive and can immediately comply to the given task with utmost sincerity.

On the other hand, results show the lowest frequency of 30 (11.11%) of the respondents were specialized in General Science. This implies that teachers handling Earth Science subject were less than 20 percent of the total sample size. Among the four Science learning areas, General Science specialized respondents appear to be outnumbered among the teaching personnel. Science teachers are products of the old curriculum specializing a particular Science learning area but employed in a recent Science curriculum requiring teachers to teach the four learning areas in one grade level. Science teachers do not need to specialize in Science subject. Teachers provide teaching in four learning areas and their enjoyment in teaching varies across the said four Science learning areas. Hence, public school teachers have been found to rate the subject among the least enjoyable subjects to teach. It is therefore likely that teachers vary in the degree to which they show enthusiasm while teaching Science and Technology (Nienke Vos, 2020).

A teacher could perceive that science is a difficult subject to teach relative to other subjects because of these four learning areas that will be taught in one curriculum year, but they might have high self-efficacy with regard to their ability to teach. Context dependency is becoming an external factor instead that influence a teacher's perception of being in control and making it easier or harder to teach Science.

According to an article in an Australian Journal of Teacher Education vol. 43 Article 3, 2019, within the framework there is clear distinction made between self-efficacy and context factors. A teacher might have high self-efficacy and context factors. A teacher might have high self-efficacy and have context dependency, that is, a teacher perceives they need particular resources and materials in order to teach Science. Other possibilities could include a teacher with low self-efficacy and high context dependency.

More emphasis should be given particularly with Science and Technology and Mathematics learning content, as core subjects that are equally important in learning and development. In addition, the Department of Science and Technology (DOST) provides promising scholarship and financial grants for teachers whose focus and interest lies on Science and Technology and Mathematics learning development. The DOST-Science Education Institution merit Scholarship program under R.A No. 2067 is awarded to teachers that non major but teaching the four learning areas in Science and are willing to pursue careers in the field of Science and Technology.

Table 6
Distribution of Respondents' Highest Educational Attainment

Educational attainment	Frequency	Percentage
Doctoral degree	2	0.74
Master's degree with PhD units	5	1.85
Master's degree	10	3.70
Bachelor's degree with MA units	70	25.93
Bachelor's degree	183	67.78
Total	270	100.00

Table 6 shows the distribution of respondents in terms of educational qualification. The results show that the highest frequency 183 (67.78%) of them were college graduates. This means that majority of the respondents had the educational requirements for teachers vary depending on the desired area of teaching. It is noteworthy, that the educational requirements for teachers vary depending on the desired area that teacher are given the load. Science teaches in secondary education require at least a Master's degree. In addition to being a teacher, getting a Master's in Science Education also qualifies a teacher for a variety of roles in the education system. The educational community needs more teachers with advanced degrees to advocate for tried and true teaching practices as mentioned by Szapkiw, Spaulding, Swezey, and Wicks (2020). As these individuals re-enter the educational environment, they see the true benefits of their degrees furthering their understanding of teaching.

This training may help make someone a better candidate for a maximum preparation for the job as a Science teacher teaching in four learning areas. Apparently, as observed, teachers who are interested in making a difference in the education system strive for a higher degree option and shows exemplary performance in the learning environment. Along with a better grasp of the methods of teaching and the theories behind them, teachers would be able to tell which systems are most effective in the classroom and why. In addition, Master's programs also often include education technology coursework, so teachers would likely come away with more tools to assist students at all levels.

On the other hand, the data also suggest how difficult post graduate is particularly doctoral program with the lowest frequency of 2 (0.74%) successfully graduated with full-fledged Doctorate course. The result reveals that among the respondents only two teachers successfully finished the Doctorate program. This gives emphasis on the reality that only few of the teachers pursue in their educational upliftment. Practical reasons, as noticed, why others opted not to pursue in professional development are because it is expensive, tiring and due to additional loads of work. While it is true that teachers need to do paper works and reports needed when their main job to teach six hours in the actual classroom setting.

Education Support Partnership (2019) found that one of the biggest issues raised was the impact on the workload. The time that can be spent for the crafting of instructional materials to be used in the instruction, the making lesson plan, checking of students output has been sacrificed. These become a big factor for the teachers' pursuit of enrichment and upgrading program due to time constraint. Accordingly, employees who manage their time well are more productive, more efficient, and more likely to meet deadlines (Doyle, 2019). They focus on the most important and time-sensitive tasks and limit the amount of time wasted on non-essential duties.

Moreover, the key to managing a workload that sometimes feels out of control as to get as much control over it. (Education Support Partnership, 2018). In this competitive community where people need to strengthen their credentials in pursuit of their career advancement, few educators wish to finish and prepare for better opportunities ahead. As stated by Szapkiw, Spaulding, Swezey, and Wicks (2020), graduate persistence is shaped by personal and intellectual interaction. It could be from their unique personal economic and financial experiences growing up in the culture of poverty. It is somewhat like trying to prove something despite real life experiences that was always challenging. But still remain resilient and taught in achieving dreams.

According to Nassira Boudersa, 2020, being competent and well performing teacher is one of the most important resources in any educational institution. The teacher considered the professional agent and the most directly responsible person in the process of learning. He is the one in charge of making/helping the students learn and benefit or suffer from the quality of his teaching. Lack of professional training and professional development of teachers can be a key source for any dissatisfaction in the quality of their teaching. This is claimed to have a deep implication in education reflecting the fact that teachers should be in constant contact with research for possible future teaching innovations and incorporating new research findings in high-quality teaching. Teachers' professional training and professional development is a necessary ingredient to support innovative and beneficial teaching.

Table 7
Distribution of Respondents Attitude Towards Science Teaching

Indicators *As a teacher, I see to it that…*	Mean	Standard Deviation	Description
I feel comfortable teaching science content appropriate for my grade level.	**3.52**	**0.98**	**Strongly Agree**
Teaching of science process is important.	**3.86**	**0.89**	**Strongly Agree**
I enjoy hands-on activities in teaching science.	**2.68**	**0.63**	**Agree**
I have an easy time understanding science.	**3.46**	**0.78**	**Strongly Agree**
I like to demonstrate science phenomena in the classroom.	**3.56**	**0.72**	**Strongly Agree**
I am happy to help students construct science equipment for hands-on activities.	**3.21**	**0.85**	**Agree**
I am happy to assist students on their activity and lecture time.	**3.74**	**0.87**	**Strongly Agree**
Science is as important as the 3 R's (Re-use, Reduce and Recycle).	**3.65**	**0.86**	**Strongly Agree**
I enjoy manipulating science equipment	**3.35**	**0.89**	**Strongly Agree**
Science topics always excite me.	**3.33**	**0.81**	**Strongly Agree**
Overall	**3.44**	**0.83**	**Strongly Agree**

LEGEND: 3.28 - 4.00 = Strongly Agree
2.52 - 3.27 = Agree
1.76 - 2.51 = Disagree
1.00-1.75 = Strongly Disagree

Table 7 presents the test on the attitude of teachers towards teaching Science and relative to their demographic profile. This data were significant in order to establish link whether these moderating variables possessed by the respondents determined connections on teachers level of misconceptions that would affect students' academic performance. It can be gleaned from the result that the overall mean of 3.44 (SD 0.83) described as **"Strongly agree"** experienced by the teacher. This implies that the respondents were very much affirmative in observing and practicing the given indicators in the field of Science. In general, the teachers had a positive attitude towards teaching science. Teachers' attitudes towards teaching science are important as they influence their teaching which in turn affects student achievement and interest in the subject. The task of preparing students to participate as critical, informed and responsible citizens in a society in which science has a significant role. Teachers' attitudes towards teaching science is therefore of importance, particularly in G8 where students are starting to consolidate their ideas of science and its importance to their lives.

Positive attitude towards Science is very essential. Teachers with positive attitude towards science teaching tend to have higher scores on the survey. Teachers achievement is positively related to learning and teaching goal orientation, self efficacy and meaningful teaching (Hacieminoglu, 2020). The researcher opted to conduct this study to find out if teachers attitude towards science teaching affect teachers' misconception in Science. Cognitive theories of attitude formation tend toward more reasoned, informational approaches to forming an attitude. An attitude is formed on the basis of cognition when one comes to believe either the attitude object possesses desirable attitudes, or that the attitude object will bring about desired outcomes" (Hogg and Cooper, 2019).

The results show that motivation done by the teacher in carrying out his duties and responsibilities are the following: explain the benefits and objectives of the material taught to students, teach using various learning methods or strategies, provide opportunities for students to achieve success, and give awards or praise to students who perform tasks and perform well. The factors that influence teachers work motivation are two types, namely intrinsic motivation and extrinsic motivation. As stipulated in the Philippine constitution Article 14, Section 1 that says protect and promote the right of all the citizens to quality education at all levels and shall take appropriate steps to make such education accessible to all.

Gershenson (2020) claimed that teachers have statistically significant effects on student academic performance. Effective teaching is indeed multidimensional according to the finding of 2 studies conducted, therefore, teachers who are effective in one domain are not necessarily effective in others. In addition, teacher instability affects student motivation and enthusiasm for learning that is why it is important to identify and develop programs that will help teachers learn in depth study in other science learning areas to cope less mastery before it morphs into a larger problem such as misconceptions. (Jacobson, 2020). Children observe and learn from their teachers.

This study proves positive impact of the teacher who honestly and diligently performed their duties and responsibilities as agent of learning despite the given challenges they faced every day. Teachers are prominent figures in the educational system both statistically and in their potential for influencing educational outcomes. According to the World Bank EdStats (2019), there are 84.23 million teachers in the world across educational levels: secondary (32.12 million). Furthermore, an additional 68.8 million teachers will need to be recruited by 2030 to provide every child with elementary and secondary education (UNESCO Institute for Statistics 2019).

Blazar and Kraft (2019) disclosed that as children spend a better part of their day in educational institutions, it becomes imperative that teachers take over the responsibility of creating an ideal environment so that qualitative values can be restored. Students' attitude and behavior are predicted by teaching practices, including teachers' emotional support and classroom organization (2019).

Problem 2. What is the level of curriculum design utilized by the respondents based on the following stages subject- centered, learner-centered and problem-centered?

Table 8
Summary of Respondents' Curriculum Design Utilization

Indicator	Mean	Standard Deviation	Description
Subject-Centered	3.08	0.81	Most of the Time
Learner-Centered	2.94	0.71	Most of the Time
Problem-Centered	3.08	0.79	Most of the Time
Overall	**3.03**	**0.77**	**Most of the Time**

LEGEND: 3.28 - 4.00 = At all Times 1.76 - 2.51 = Sometimes
2.50 - 3.27 = Most of the Time 1.00 -1.75 = Never

The table revealed the distribution of respondents' curriculum design utilized the subject-centered type. Results reveal an overall mean rating of 3.08 (SD=0.81) described as **"*Most of the time*"**. This means that the respondents were affirmative on the issue of having the curriculum design in the subject area of science as being revolved on the subject matter rather than on the interests and needs of the learners. This also implies that the weight given on the content of the lessons is designed not on the account of the learning style of the students but mostly on what they need to know and learn on the given subject area. Obviously, this may cause less motivation on the part of the students as they engage with the material brought about by the teachers and that there are possibilities for students to perform less if not fall behind in class.

As mentioned by Scweitzer (2020), teachers need to create clear learning goals and outcomes. In this manner, the teachers can have the clear focus on the purpose of the curriculum that allows the teachers to plan the instruction so that the intended outcomes would be achieved. Similarly, De Leon, (2020) noted that competent science teachers are needed so that graduates could also contribute in the progress of our country in the competitive edge. This also calls for teachers who are well-equipped on the subject matter, especially on the specific area of specialization in the field of science.

The table shows the distribution of respondents curriculum design utilized the problem-centered type. Results reveal an overall mean rating of 3.08 (SD=0.79) described as **"*Most of the time*"**. This means that the respondents were able to utilize the curriculum design in science on being problem-centered. This implies that the weight given on the content of the lessons is designed on the account of teaching the students how to look at the problem and come up with the solution.

This implies that the learning materials used in the teaching process were designed to allow the students introduced or exposed to actual life situation or problem and the teacher serves as the guide in doing the step by step procedure at first then lead the learner to a completed task by his or her own. According to Vinney (2020), this concept is supported by the theory of learning by Lev Vygotsky in his Zone of Proximal Development and Scaffolding. In scaffolding, the teacher acts to extend a certain degree of support for the learner to best meet and achieve his capabilities and skills. As the learner has gained or acquired understanding on the concepts, the teacher would gradually reduce the initial extended degree of assistance and move away from the step by step direction until the learner would come up a completed task on his or her own.

However, table 8 shows the distribution of respondents curriculum design utilized the learner-centered approach. Results reveal an overall mean rating of 2.94 (SD=0.71) described as **"Most of the times".** This means that the respondents expressed a considerable utilization of curriculum design in science focused on being learner-centered.

This also implies that the weight given on the content of the lessons is designed on the account of the learning style of the students, their individual needs and interests. This takes more time and effort on the part of the teachers to create and plan instruction. As teachers are also loaded with additional tasks like paper works, reports to accomplish, they may have insufficient time or may lack the expertise, experience or skills to accomplish such demand. For most teachers, paper works that come in abundance with the teaching job is very annoying. According to Kelly (2020), documenting students' progress, taking attendance and computing grades are meant to be housekeeping and recording tasks which are known as necessary evils in the teaching profession.

Schweitzer (2020) asserted that the learner-centered approach or stage in curriculum design is meant to empower the learners and are given the choice to shape their education at their own style of learning. Multiple Intelligences, as the educational theory advocated by Howard Gardner cleaves on the aspect of learning where the lessons are prepared and designed to include techniques, strategies and approaches aligned to students' learning style Jagodowski (2020).

Problem 3. What is the level of teachers' misconception based on the following areas, Earth Science (Earthquake and Faults), Biology (Mendelian Genetics), Chemistry (Periodic Table and Particle Nature of Matter) and Physics (Forces and Motion, Heat and Temperature and Electricity)?

Table 9
Descriptive Statistics on the Level of Misconception on Earth Science and Biology

Equivalent Rating for Incorrect Answers	Description	Earth Science		Biology	
		Frequency	Percent	Frequency	Percent
9-10	Very high	40	14.81	20	7.41
8-7	high	210	77.78	30	11.11
7-6	Low	15	5.56	180	66.67
5 and below	Very Low	5	1.85	40	14.81
Total		**270**	**100**	**270**	**100**
Overall Mean		**7.86**		**6.23**	
Standard Deviation		**5.83**		**7.23**	
Description		**High**		**Low**	

Table 9 shows the descriptive statistics on the teachers' misconception level in Earth Science and Biology. It reveals that the teachers have an overall mean of 7.86 (SD = 5.83) in Earth Science which has a description of **"High".** This implies that teachers teaching Science got high misconception in Earth Science. This implied that there were many competencies in Earth science which were not mastered. On the other hand, in Biology it is implied that the teacher respondents got 6.23 (SD = 7.23) and has a description of **"Low"**. This implied further that the teachers had low misconceptions on the area of Biology.

Among the four learning areas, the results revealed that Biology has the lowest level of misconception, with an overall mean of 6.23 (SD=7.23). This implied that teacher respondents have competencies mastered. Considering that most teachers are biology majors, with 90 (33.33%) respondents out of 270, most respondents has low misconceptions on Biology. These indicators are clearly related to resources, teachers professional competencies and the learning environment (Houston and Maikw, 2020) Lee Shulman (2020) pursued identifying subject knowledge as the missing link in teacher education. He campaigned for professional recognition of teaching, teachers possess a specialist knowledge based.

Furthermore, the study revealed some problematic issues concerning the teaching of biological evolution in Oklahoma's public high school introductory biology course. Multiple factors contribute in varying degrees the acquisition and retention of teachers' misconceptions on biological evolution. However, based on the study, teachers serve as sources of biological evolution-related misconceptions or propagators of existing misconceptions.

At level 6, students can draw on range of interrelated scientific ideas and concepts from the physical, life and earth and space sciences and use content, procedural and epistemic knowledge in order to offer explanatory hypotheses

of novel scientific phenomena, events and processes or to make predictions. In interpreting data and evidence, they are able to discriminate between relevant and irrelevant information and can draw on knowledge external to the normal school curriculum. They can distinguish between arguments that are based on scientific evidence and theory and those based on other considerations. Level 6 students can evaluate competing designs and complex experiments, field studies or simulations and justify their choices.

At level 5, students can use abstract scientific ideas or concepts to explain unfamiliar and more complex phenomena, events and process involving multiple causal links. They are able to apply more sophisticated epistemic knowledge to evaluate alternative experimental designs and justify their choices and the use theoretical knowledge to interpret information to make predictions. Level 5 students can evaluate ways of exploring a given questions scientifically and identify limitations in interpretations of the data sets including sources and the effects of uncertainty in scientific data.

Table 10
Descriptive Statistics on the Level of Misconception on Chemistry

Equivalent Rating for Incorrect Answers	Description	Chemistry	
		Frequency	Percent
17-20	Very high	20	7.40
14-16	High	220	81.50
11-13	Low	20	7.40
10 and below	Very Low	10	3.70
Total		**270**	**100**
Overall Mean		**14.86**	
Standard Deviation		**3.82**	
Description		**High**	

Table 10 shows the descriptive statistics on the level of misconceptions on Chemistry. The results show that Chemistry has an overall mean of 14.86 (SD=3.82). This means that there were competencies in Chemistry which were not mastered. Chemistry is a very conceptual subject, and many of its concepts are rather abstract. So whereas some chemical terms refer to materials students can see and manipulate (solution, sulfur, so - dium) or at least processes they can observe directly (combustion, distillation, mixing), many refer to ideas that are not so easily demonstrated.

Misconceptions have been identified in most topics learnt in chemistry. Interestingly, many of these misconceptions relate to the abstract entities used in chemical explanations at the level of atoms and molecules. A great deal of the explanatory framework of modern chemistry depends upon models of the structure of matter at sub-microscopic levels (in terms of atoms and molecule and electrons and bonds). Of course it is not possible to show students these entities, as they are much too small to be seen.

At level 4, students can use more complex or more abstract content knowledge, which is either provided or recalled, to construct explanations of more complex or less familiar events and processes. They can conduct experiments involving two or more independent variables in a constrained context. They are able to justify an experimental design, drawing on elements of procedural and epistemic knowledge. Level 4, students can interpret data drawn from a moderately complex data set or less familiar context, draw appropriate conclusions that go beyond the data and provide justifications for their choices.

At level 3, students can draw upon moderately complex content knowledge to identify or construct explanations of familiar phenomena. In less familiar or complex situations, they can construct explanations with relevant cueing or support. They can draw elements of procedural or epistemic knowledge to carry out a simple experiment in a constrained context. Level 3 students are able to distinguish between scientific and non-scientific issues and identify the evidence supporting a scientific claim.

At level 2, students are able to draw on everyday content knowledge and basic procedural knowledge to identify an appropriate scientific explanation, interpret data, and identify the question being addressed in a simple experimental design. They can use basic or everyday scientific knowledge to identify a valid conclusion from a simple data set.

For students that lean most toward facts, structures, and "memory" aspects of things, physics is harder than chemistry. Chemistry works "from the clouds, downward", starting with stuff that took years for historical chemists to understand, working their ---_depends on the learner. High school chemistry has basic stoichiometry, chemical reactions and names of various chemicals and compounds. High school physics has Newton's laws, gravitational theory and other topics. So it's totally dependent on the learner. Physics does require you to think outside the box and it sometimes labelled as hard because there is not a set

pattern on how to approach a physics problem. Misconceptions about chemistry topics are also common among secondary science teachers. Kruse and Roehrig (2021) report reliance on macroscopic language rather than particle terminology to describe behaviour particles.

Table 11
Descriptive Statistics on the Level of Misconception on Physics

Equivalent Rating for Incorrect Answers	Description	Physics	
		Frequency	Percent
26-30	Very high	70	25.93
21-25	High	165	61.11
16-20	Low	25	9.26
15 and below	Very Low	10	3.70
Total		**270**	**100**
Overall Mean		**23.45**	
Standard Deviation		**7.11**	
Description		**High**	

Table 11 shows the statistics on the level of misconceptions on Physics. The table revealed that the level of misconception on Physics had the overall mean of 23.45 (SD=7.11) and obtained a description as **"HIGH".** The standard deviation indicates that there were competencies in Physics which were not mastered. At this level teachers seemed to have abled to use basic or everyday content and procedural knowledge to recognize aspects of simple scientific phenomenon. They were able to identify simple patterns in data, recognize basic scientific terms and follow explicit instructions to carry out scientific procedure. Respondents demonstrated basic cognitive knowledge by being able to identify questions that can be investigated scientifically. Undeniably, Physics for most teachers is most difficult than other subjects. Physics is a new way of thinking and it has a very steep learning curve compared to the other sciences. In Physics, there are half a dozen basic equations that everything follows from and most of the time spent learning the mathematics and standard tricks of how to unpack those equations and apply them to specific problems.

Physics is usually by far the most quantitative. Physics is not even a bit about memorizing. Anything that can be learned by memorization or qualitative understanding, that doesn't translate well to physics, where the math tends to hit earlier and harder. Physics needs more creativity and out of the box thinking to find ways to work out different questions. It is a bit like geometry. Physics is hard because Mathematics is hard. In most cases, the physics involved is very simple, but the process of representing the problem in some mathematical form is hard. How to convert graphical problem into mathematical equation, one has to be a good mathematician. That's why most of the physicists are very good in Math. It can be noted that mostly it would depend on how good you are in Math and science. If one is good in math then physics is a bit easier but if struggling with Math it makes Physics harder. This will bring into understanding Man's philosophy in life is that "Man by nature evolved only to survive". The main purpose of evolution is not for understanding the universe, but to survive on Earth. The things which will help us to survive in this world are pretty much intuitive to us, for example, we don't need to understand the physics of predicting the motion of an object. Physical laws, in general, are easy but the process of converting those laws into perfect mathematical sense is hard. And that's why physics seems hard to most of the people. And teachers are of no exemption.

Teachers' physics content knowledge has been studied more extensively than biology and chemistry. This may be because most science teachers are not physicists, creating a non-specialist investigations. Also, many physics concepts are abstract, so are prone to misunderstandings. Faulty ideas remain unchanged and unchallenged from childhood, resulting in recycling between generations of teachers and students. A consistent findings is that teachers are observable, macroscopic phenomena oriented rather than particle ideas. Ball and McDiarmid (2019) suggest that teachers' Science content knowledge is grounded in everyday and school education experiences rather than being developed through teacher education.

Barrass (2019) wrote "mistakes", "misconceptions" or misleading ideas, and "misunderstandings" or misinterpretations of facts are perpetuated by teachers and textbook authors. His study revealed that students typically

exit the Science classroom more confident in their biological evolution knowledge but holding greater numbers of misconceptions than they initially possessed upon entering the course. Significant relationships between teachers' acquisition of misconceptions and their bachelor's degree field, terminal degree, and hours dedicated to evolution instruction were also revealed. In addition, the probabilities that specific biological evolution-related misconceptions were being transmitted from teachers to their students were also identified. Teachers were found to hold misconceptions about many science topics. Large scale projects across sciences simultaneously revealing international commonalities in misconceptions and understanding. In a cross-cultural study, Ameh and Gunstone (2021) found that irrespective of nationality, teachers held the same misconceptions about life and physical world concepts. Research evidence suggests that maturity and additional education reduce teachers' misconceptions relative to their students, but eliminating these are nonetheless important in planning teacher education. Teachers' physics content knowledge has been studied more extensively than their biology and chemistry. This may be because most science teachers are not physicists, creating a non-specialist investigations. Also, many physics concepts are abstract, so are prone to misunderstandings. Faulty ideas remain unchanged and unchallenged from childhood, resulting in recycling between generations of teachers and students. Teachers' understandings about science ideas, notably particles have been investigated. A consistent findings is that teachers are observable, macroscopic phenomena oriented rather than particle ideas. Ball and McDiarmid (2019) suggest that teachers' science content knowledge is grounded in everyday and school education experiences rather than being developed through teacher education.

Problem 4. How do the respondents compare in the areas of misconceptions when grouped according to age, sex, position, teaching experience, field of specialization, highest educational attainment and attitude towards science teaching?

Table 12
Correlation Matrix between Respondents' Level of Misconception and Personal Profile

	Level of Misconception							
	Earth Science		Biology		Chemistry		Physics	
Profile	**r**	**P**	**R**	**P**	**r**	**P**	**r**	**P**
Age	0.643	0.00* **S**	0.323	0.01* **S**	0.233	0.00* **S**	0.129	0.01* **S**
Sex	0.683	0.00* **S**	0.063	0.010* **S**	0.083	0.01* **S**	0.073	0.02* **S**
Position	0.556	0.00* **S**	0.416	0.00 **S**	0.306	0.01* **S**	0.756	0.01* **S**
Teaching Experience	0.763	0.01* **S**	0.563	0.01* **S**	0.233	0.01* **S**	0.854	0.02* **S**
Field of Specialization	0.786	0.01* **S**	0.785	0.01* **S**	0.783	0.01* **S**	0.412	0.00* **S**
Highest educational qualification	0.698	0.00* **S**	0.698	0.01 **S**	0.745	0.01* **S**	0.365	0.00* **S**
Attitude towards Science	0.365	0.00* **S**	0.521	0.01* **S**	0.354	0.00* **S**	0.231	0.01* **S**

***LEGEND*: * = SIGNIFICANT**

Table 12 shows the correlation between respondents' level of misconception and personal profile. Data reveal that the teachers' demographic profile showed no bearing on teachers' level of misconceptions among the four learning areas in Science. After recognizing that the conceptual mistakes of teachers that do not correspond with the scientific information, lead to problems in science teaching, a research initiative in the select topics of the four learning areas and what to do for eliminating these problems. Under the light of all this information, it can be clearly seen that the detection of conceptual mistakes, including their prior knowledge are of importance for preventing these mistakes (Mahdi, 2019; Yavuz Mumcu and Yıldız, 2020). This implies that teachers are not having the ability correlate the subjects with their daily lives, the Latin and foreign terms used in the general content of the four learning areas in Science, including the complicated relations between these subjects, lead these subjects not being learned properly (Ozkan and Bal, 2019).

For minimizing these mistakes of respondents-teachers and to accomplish the respective objective in teaching, it is essential for the teachers to pick the materials tailored for the respective subjects, to use them correctly and to have a satisfactory level of knowledge on the respective subjects. Therefore, they must receive a first-class education during undergraduate study period, as well as having good knowledge and skills on the respective areas.

Güneş and Güneş (2021) stated in their studies that there is a possibility for the teachers to bring their conceptual mistakes to the next level. It was stated that the teachers that are not well-informed in the respective area, providing inconsistent information, cannot properly relay information to the students, thus leading the students to be negatively affected. As a matter of fact, Alkan et al. (2019) and Özdemir, Şimşek and Ecevit (2020) pointed out that the majority of teachers fall into conceptual errors in Science. In another study carried out on active teachers and teacher candidates, it was confirmed that the teachers did not control the information on the textbooks while teaching, and led the students to face with learning problems while simplifying the subjects without even realizing it.

Considering all these matters, it can be seen that the domain knowledge of the teacher candidates and actively working teachers are to be reviewed and researched with regards to the subjects they have difficulty in understanding. Therefore, it was determined to carry out a study that set forth the reasons for being unable to learn the four learning areas in Science and concepts.

However, this is just one of the common effects of teachers' misconceptions in some cases, on one hand, it goes contrary with data presented in this study. Also, teachers with least mastered and misconceptions has negative effects on colleagues. According to Fisher (2021), teachers' lack of mastery about other negative effects, such as increased absenteeism, decline in classroom performance, and poor interpersonal relationships with colleagues and students. Moreover, teachers of this state mentioned above are usually less committed to their jobs. They develop lower tolerance for classroom disruptions, are less prepared for class, and are generally less productive. As a result, these teachers can have a negative influence on the morale of new teachers. These teachers are more narrow-minded about their practices, and resistant to changes in those practices. Misconceptions creates conceptual crisis that impacts not only teachers but students as well.. The problem will not go away on its own.

Teacher instability affects student motivation and enthusiasm for learning that is why it is important to identify and develop programs that will help teachers learn to cope inefficiency and incompetency before it morphs into a larger problem. Reducing teacher inefficiency promotes a constructive approach to building a stronger community that fosters life-long learners and benefits students, teachers and society (Jacobson, 2020).

These findings enhance the understanding of the teacher factors issues that influence student outcomes. Research data revealed from Dworkin, (2019) that teachers with least mastered topics and misconceptions adversely affect students' performance except for high-achieving learners. It is very evident that the educators will look after on what is best for their students, and giving quality education.

In a report published by Hake (2000, 2020), Hestenes (1995, 2019), and Halloun (1998, 2019), found out that pre-service teachers have large amount of misconceptions in a particular topic in Science where they attributed it to factors such as naïve belief and ineffective traditional methods of teaching the subject. Teachers who believe that their misunderstanding on forces is correct will lead to a domino effect to their students who will be carrying the same misconception which is incompatible to complex concepts of Science.

As published *The Physics Teacher* in 2019, the Force Concept Inventory (FCI) authored by Hestenes, Wells, David and Swackhamer, the multiple-choice test designed to assess understanding of the most basic concepts and to trace conceptions that normally cannot be measured using traditional methods of assessment in Physics (Halloun et al, 2019).

The Learning Policy Institute Research Brief (2016) revealed that teachers do continue to improve in their effectiveness as they gain experience in the teaching profession (Kini and Podolsky, 2021). They found out that teaching experience is, on average, positively associated with student achievement gains throughout a teacher's career. Of course, variation in teacher effectiveness exists at every stage of the teaching career: not every inexperienced teacher is, on average, less effective, and not every experienced teacher is more effective. The researcher believes that basic process skills mastery and attitude towards science teaching may affect the level of teachers' misconception in Science. This study was conducted to prove the correlation of the aforementioned variables.

Problem 5. To what extent does the curriculum design contribute to teachers misconceptions in Science?

Table 13
Simple Linear Regression Analysis between the Levels of Clinical Supervision Process of the School Head and the Teachers' COT-Rating

Independent Variable	Regression Coefficient	T-Value	Probability	Interpretation
Curriculum Design	0.56	8.21	7.18×10^{-14}	Significant

Constant	: 23.81	F- value	:	65.46**
r	: 0.55	Significance Level	:	8.15×10^{-14}
r^2	: 0.35			

Regression analysis was used to find out the extent of effect of influence of an independent variable to a dependent variable. Table 13, exhibited the result of simple linear regression analysis taking teachers' evaluation of curriculum design as an independent variable to show the degree of the influence one affects the misconception in Science. The result showed that the two variables got highly significant positive effect (r=0.55) on each other. This denoted that the higher the level of curriculum design respondents have, the higher is the level of their misconceptions in Science. The coefficient of determination (r^2) =0.35 meant that only 35 percent of the difference on the level of Science misconception is being explained by the level of curriculum design learned and 70 percent can be explained by other factors. The regression model $\hat{y}=23.81 + 0.56x$ indicated that the coefficient of "a" or the y intercept is 23.81.

Problem 6: Based on the findings of the study, what Faculty Development Plan on misconception can be designed?

Areas of Concern	Specific Objectives	Strategies/ Activities Applied	Time Frame	Persons Involved	Budget	Expected Output
Class Program	Equipped with learning resource materials.	Specialized Science make-shift class program	June to March	Department Head Science Coordinator	1500 Php/ annum	Diverse learners in a diverse teaching experience
Teachers load	Demonstrate mastery of the subject matter in one learning area	Specialist spiral walk through in four grade levels	June to March	Specialized Science teachers	1500 Php/ annum	Mastery of the subject matter. Developed best practices in a particular learning area.
Learning Resourse Materials	Select resource materials that would best fit the teaching need of the teacher.	Science learning Resource materials Gallery walk	1st week of June	Master teachers Trainers Research enthusiasts	5000 php	Enriched with teaching pedagogy
Researches	Explore from the presentation of	Research Congress	October	Research	15000 php	Enriched of having

	innovative ideas, approaches, development and result of research projects.		and February	enthusiasts		explored the world of research.
Researches	Explore Science inventions and innovations on how Science works operationally.	Science Fair and Expo	October	DepED	15000 php	Adopted innovative learning resource materials
Information drive	Observe and participate a platform for dialogue, exchange of ideas and collaboration.	Symposium	October	Allied Agencies and Partners	1500 php	Being informed.
Computer literacy	Learn through Science like exploration on dynamic visual representations make the invisible visible.	Simulation or virtual laboratory	May	ICT coordinators	1000 Php/ annum	Information and computer technology development

Conclusions

Newly hired teachers aging 25 years and below at Teacher 1 position comprise the big number in the teaching force. Teachers in Science who had been teaching a specific area not his or her specialization still possess positive outlook in the teaching career. Science teachers were deficient in teaching Physics especially among the four areas of specialization in Science subject and Biology came out to be the easiest. Teachers' profile or characteristics do not directly affect or showed no bearing on teachers' level of misconceptions among the four learning areas in the teaching of Science subject. Problem-centered curriculum design utilized by Science teachers can enhance higher level of impact among the learners if given activities that fit to their age.

Recommendations:

1. There must be a regular assessment or monitoring for supervision and evaluation in order to obtain a comprehensive feedback on how the Science teachers perform, hence, measures and plans of actions could be designed to assist them in their teaching tasks.
2. Science teachers must be given teaching load according to one's area of specialization or else, their misconceptions and confusions would affect the students' learning.
3. The Department of Education has to attend to the needs of the Science teachers given a teaching load not his or her field of specialization.
4. Recent DOST scholars be hired and deployed in the field and receive remuneration at the level of Teacher 1 salary grade.

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