Knowledge, Practice, and Attributes of Junior High School Professional Science Teachers

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Abstract
Science teachers play an important role in upgrading the standards of teaching-learning process in the 21st century. Since the students are expected to possess learning outcomes and skills of the 21st century, professional science teachers should also have also the 21st skills so that they can give their best to ensure that the framework of science education is properly observed and become evident inside and outside the classroom. Hence, science teachers should possess the professional knowledge, apply professional practice, and exhibits professional attributes to become effective and efficient in educating the students on the importance of science concepts in their lives. This study used the cross-sectional survey and correlation designs in data collection and analysis of the knowledge, practice, and attributes of 37 Grade 10 science teachers. An adapted instrument, with a Cronbach's alpha coefficient of 0.92 was used. The participants labeled the knowledge (X=3.5397; SD=0.3928), practice (X=3.5422; SD=0.4291), and attributes (X=3.4839; SD=0.4520) as *"Strongly Agree (SA)"*. This study revealed that; (a) there is no significant difference between the male and female science teachers' knowledge, practice, and attributes; and (b) there is no significant difference between single and married science teachers' knowledge, practice, and attributes. However, there are components of science teachers' professional practice which are significantly related to educational attainment. This study would be replicated considering perspectives of junior high school science teachers in other grade levels and also include other variables that may also affect or influence their professional qualities.

Keywords: *Knowledge; Practice; Attributes; Professional Science Teachers; Demographic Variables; Professional Development Program*

1. Introduction

Science teachers play the pivotal role in establishing students' interest in learning science. Teachers are the direct implementers of the science curriculum in the classroom. Teachers engage students in different learning experiences to develop students' understanding about the nature and concept of science. By means of varied pedagogical approaches of teachers, students have the opportunity to be exposed to the real world of science exploration. New technological advances are also available for teachers to have an easy access of those materials needed in the prescribed learning competencies. The use of Information and Communication Technologies (ICT) into education can motivate teachers to gain necessary knowledge and skills in using ICT in their instruction (Cavas, Cavas, Karaoglan, & Kisla, 2009). Teachers nowadays are more open to relevant changes in the educational system specifically in the delivery of instruction in science. Science teachers adapt to changes in the approach of making students learn better in terms of contents in science. The active involvement of students and a focus on lifelong learning for both students and teachers can motivate against quality of schooling (Peng et al., 2014). Through this, science teachers become more resourceful in planning, designing and finding appropriate learning resources suitable for the needs and interests of the students. In other words, motivating students to learn is the reflection of the presence of teachers inside a science classroom. These teachers inspire the students to think critically and creatively. Science teachers really shape the society so that science could aid not just by its role in developing the society but sustainable development in particular.

Professional knowledge along with professional practice and professional attributes are the science teachers' weapon to become effective in educating the students. As time goes by, these professional qualities may be developed or reduced depending on the affecting factors. There should have a constant self-assessment on what particular area that teachers have difficulties so that they can find ways on how to address these difficulties. Furthermore, education authorities can also provide various programs for science teachers in the junior high school level in conformity with the demands of maintaining and or somehow improving the quality of teaching-learning process in science area. The current science education reform movement emphasizes the significance of professional development as a means of improving students' achievement in science (Supovitz & Turner, 2000). Science teachers should be updated of the innovations in teaching science concepts. It is the need of every science teacher to have professional development to ensure that they can deliver effective and quality science education to their students.

The framework of science curriculum in the Philippines requires learning outcomes which are expected in each student in the 21st century. Students in the 21st century are 'digital learners'. Some science teachers find it difficult to involve learners due to many issues concerning the delivery of science instruction. Science

teachers should equip with the fundamental characteristics to have full potential traits in their performance and being professionals. These qualities are having general knowledge of the content, significant teaching practice, and important positive attributes towards science teaching. Science teachers cannot deny the fact that society changes drastically. They are more challenged when it comes to imploring teaching-learning process effectively inside their classrooms. The core qualities of an effective teacher are absolutely necessary due to teachers' absolute role in the classroom to make the maximum effect on students' learning (Sahin & Adiguzel, 2014).

Science teachers believe that science education has to be continuously improved to become more responsive when it comes to the needs of the society. They serve as role models not only for the students but also for the society they are living in (Liakopoulou, 2011). Teachers can make a better society (Ansari & Malik, 2013). Therefore, science teachers ensure that students will be more prepared to align their skills and abilities according to the society that they are dwelling with.

1.1 Primary Qualities of an Effective Teacher

Many researchers have been studying and describing the primary qualities of an effective teacher. Many people differ when it comes to their views and perspectives of an effective teacher. Ansari & Malik (2013) describe effective teacher who has a full command over a particular subject, has an ability to transmit the subject to the students, can stimulate rapport to the students, keeps her updated with new emerging technologies in education, should be result-oriented enabling the students to learn how to learn and should care about the well-being of the students. Teachers should possess several qualifications related to their areas of expertise so that they can deliver good and quality instruction to their students. Since teachers are expected and tasked to provide quality education such as in science education, knowing their primary qualities is very important so that they can assess and evaluate their needs most especially in updating their knowledge, practice, and beliefs in the emergence of new generations of the 21st century. Teachers are in position to evaluate their needs in terms of the qualifications that can facilitate their work to ensure that they are effective in their teaching (Liakopoulou, 2011).

1.2 Professional Knowledge of Teachers

Given the condition that teachers should possess the needed qualifications, it is required that they have enough professional knowledge (Liakopoulou, 2011). Teachers' initial education or professional development is on student learning (OECD, 2009). According to (Ansari & Malik, 2013), teachers have professional knowledge if they are aware of their commitment to students and if they portray a deep impact on the students. Teachers commonly use their professional knowledge appropriately and have mastery over the subject to enhance students' learning and to improve their personality (Ansari & Malik, 2013). Professional knowledge of teachers is linked to teachers' competencies in general and standards for teacher education in particular. This describes the quality of instruction (Fischer, Borowski, & Tepner, 2012). Professional knowledge of teachers is required for the successful performance of teachers (Liakopoulou, 2011). Skills can be developed and enhanced if the teachers have the in-depth knowledge of the subject that they teach and this is one of the important and essential qualifications. In the 21st century teaching, teachers should be aware on how they could update themselves in terms of having in-depth knowledge about the contents of the subject particularly in considering online learning resources aside from books or based on teaching experience. Dealing with the new generation requires professional knowledge on how communicate information to the learners by having different types of knowledge. The qualities that can ensure a teacher's effectiveness are not the sum of his knowledge, but rather the link between the different types of knowledge he possesses. (Liakopoulou, 2011). In this reason, teachers should continue to look for new and innovative ways on how they can use their professional knowledge which are applicable to the needs and interests of the 21st century students especially in science elementary students because foundation of knowledge of the students are very important to develop skills in them.

1.3 Professional Practice of Teachers

Having knowledge or the mastery of the subject matter is not enough in the chosen field of every teacher. A teacher is considered as a reservoir of knowledge that can be transmitted or passed to every generation of students at any time. The transmission of knowledge with the aid of various applications of pedagogical approaches is gained from actual experience of teachers (Liakopoulou, 2011). Inside the science classroom, teachers have the opportunities and privilege to showcase their best practice to convey the concepts of science to the learners. The teachers should practice the necessary skills to be acquired by the students and developed in them. In this manner, teachers can practice their science teaching effectively in class if they employ their skills, acquired 21st century skills, to their students (Ansari & Malik, 2013). Teachers must have varied teaching and learning strategies to be integrated inside their science classes. They have the ability to teach the subject well because of their long experiences over their techniques and capable of teaching the lessons with a variety of methodologies as well, and that is instructional effectiveness by professional practice (Ansari & Malik, 2013). Common practices of some teachers are being dependent on the prescribed teaching

materials and develop customized tasks for their students. They become self-sufficient in efficiently and effectively controlling and handling time to time changing situations (Ansari & Malik, 2013). Since generations of students are changing, there is a need for the teachers to execute suitable practices in the modern times to motivate and encourage the students to participate. This could indicate that the real learning can take place in an environment where students' attention is grabbed. (Sahin & Adiguzel, 2014). Students' attention is easily caught by technological advances. They have multiple of sources online. In this manner, teachers must constantly update their technological competence regardless of their area of expertise to accommodate the ever-changing technological environment and to assimilate the needs of having the practice of knowing the importance and significance of technology in education. The ability to adjust and update skills according to changing times; keeping them updated with the modern technology is the need of time. (Ansari & Malik, 2013).

1.4 Professional Attributes of Teachers

The concern of science teachers to their students comprises their attributes. These involve reflections on how the students perform in their classes or if their practices inside the classroom as to application of teaching and learning strategies are effective or there is a need for an improvement. These situations normally pose common problems to some teachers. The challenge to them is there should have the needs and attributes of the 21st century and the skills that are essential for them to work effectively in the class (Ansari & Malik, 2013). Another thing that is being done by teachers is being aware of their strengths and weaknesses so that they can use them in improving their teaching practice and styles. As far as the achievement of students is concerned in every teaching-learning process, regardless of their attributes, teachers did their job properly to implement teaching and maintained similar levels of student achievement in their classes when the curriculum was the same for all. (Cakir, et al., 2016). Aside from being the direct implementer of the curriculum inside the classroom, teachers also work together and as a team to look and find for ways on how to improve and enhance learning of students effectively and efficiently. Interpersonal relations are one of the important professional attributes every teacher has to know. Several courses for teacher candidates and focusing on educating better teachers who are equipped with appropriate formations such as interpersonal relations. (Sahin & Adiguzel, 2014).

1.5 Professional Development Program for Teachers

Teachers are also active learners. They learn from their students most especially in the changing society as well as the changing behaviors of the students. Teachers are themselves learning throughout their teaching career. Good teachers are always in search of the activities that help them in their professional development (Ansari & Malik, 2013). Teachers seek for new innovations and updates in their area of expertise because the knowledge with which they graduated to become a teacher before has become insufficient now. They need to keep them updated (Ansari & Malik, 2013). Teacher effectiveness is an important theme in professional development programs due to teachers' inevitable role in students' learning (Sahin & Adiguzel, 2014). That is the reason why the basic qualification of teachers, related to their views on their role, responsibilities, training and qualifications, rights and professional development, working conditions, values, and philosophy, etc. is mainly connected to their professional development (Liakopoulou, 2011). Due to diversity of learners in the 21st century, teachers must equip with the diversified set of skills too. Teachers need to have broad and wide horizons to cope up with tremendous changes in the field of science and technology (Ansari & Malik, 2013). Such skills may be the focus of a professional development program in the form of education and training to keep the teachers abreast with the advancement and growth of scientific skills towards competence of teachers to impart these skills to the students. Professional development programs must be continuous and not just by presenting the new ideas in the field of science but also the importance of follow up is necessary to evaluate new learned skills. However, we cannot deny the reality that after the program, teachers still revert to their old habits of traditional learning style when such program ends (Dori, Tal, & Peled, 2003). New and innovative way of designing and implementing a professional development program will do so that teachers will be more encouraged and intrinsically motivated in their teaching profession. Teachers may attend In- Service Teachers Training Programs and Continuous professional Development programs. They may realize that it is an essential component of their professional career (Ansari & Malik, 2013). The need to empower the teachers by exposing them in such programs and not to compromise their personal concerns is indispensable so that they will have a high degree of showing commitment and passion to teaching.

It is timely that teachers need to upgrade their profession by means of Continuing Professional Development (CPD) program. It is a useful hook to initially engage teachers in the innovation and motivate them to use in their own classrooms (Girvan, Conneely, & Tangney, 2016). Its very basis is the R.A. 10912, otherwise known as the CPD Law of 2016, which is an act mandating and strengthening the Continuing Professional Development (CPD) program for all regulated profession including professional teachers. This program refers to a set of learning activities to be provided by organizations or agencies accredited by the CPD council which equip the professionals with advanced knowledge, skills, and values in specialized or in an inter-

multidisciplinary field of study, self-directed research and/or lifelong learning. Some examples of such programs include: seminars, workshops, technical features, subject matter meetings, non-degree training lectures and scientific meetings, and modules. Apparently, Professional Teachers are required to present earned 45 credit CPD units before the renewal of Professional Identification Cards. They shall complete the required units every three years.

2. Purpose of the Study

The purpose of this study was to examine the professional qualities which include the knowledge, practice, and attributes in the context of basic education in the public school system particularly in the Grade 10 level. Furthermore, this study wanted to determine the relationship of these indicators to some demographic variables such as gender, civil status, service record (years of service), age, educational attainment, and teaching position. Specifically, this study wanted to determine: (a) the general extent of the knowledge, practice, and attributes of the participants; (b) if there is a difference between male and female science teachers' knowledge, practice, and attributes (c) if there is a difference between single and married science teachers' knowledge, practice, and attributes; and (d) if knowledge, practice, and attributes of science teachers are related to their demographic variables.

3. Methods

This study adopted the cross-sectional survey and correlation designs. Cross-sectional design is commonly used by researcher to collect data at one point in time and it is advantageous in terms of measuring current attitudes, beliefs, opinions or practices (Creswell, 2012). Correlation design is used by a researcher to determine possibility for two or more variables to vary consistently. This design is used to see if two or more variables are related or if they influence each other (Creswell, 2012). There are instances that survey design is similar to correlational in a manner that the former focuses on learning about the samples and less focus on relating variables than what the latter is commonly do.

In this study, cross-sectional survey design was used to assess the perceptions or beliefs of Grade 10 science teachers when it comes to their professional knowledge, professional practices, and professional attributes. The correlation design was also used to determine if these professional indicators are related to some demographic variables.

3.1 Participants

Purposive sampling determined the total number of Grade 10 science teachers, who participated willingly in this study was 37 from 6 public secondary high schools in Quezon City. There were 23 (62.16%) female teachers and 14 (37.84%) male teachers. The participants' mean age was 38 *(SD=8.04)* with a range of 26 – 58 years. The participants' mean service record or number of years in service was 9.19 (SD=7.00), with a range of 1 – 30 years, though majority of the teachers have 1 – 10 years (72.97%) of teaching in the public school system. Out of 37 participants, 8 (21.62%) of them are still single while 29 (78.39%) are married. In terms of educational attainment, 18 (48.65%) participants earned units in graduate school (MA science program), 10 (27.03%) participants earned units in graduate school (MA non-science program in which of them got units in Special Education and 8 in Educational Management/Administration and Supervision), 1 (0.027%) participant graduated in MA science program, and lastly 1 (0.027%) earned units in graduate school (PhD in science education program). For the teaching position, majority of the participants are Teacher I (27 or 72.97%) while other participants 5 or 13.51%, 1 or 0.027%, and 4 or 10.81% are Teacher II, TIII, and Master Teacher I respectively.

3.2 Research Instrument

This study used an adapted instrument, survey questionnaires, in collecting the data necessary to answer the specific research questions. A questionnaire in a survey design is used wherein participants choose answers to questions and complete basic information then return to the researcher (Creswell, 2012). This study ensured the reliability (using Cronbach's alpha coefficient) of the instruments used. The alpha coefficient of 0.92 suggests that the instrument is reliable and therefore valid. The instrument involves several items or indicators in assessing qualities of effective science teachers pertaining to professional knowledge, professional practice, and professional attributes. These are included in the Framework for Philippine Science Teacher Education produced by Science Education Institute, Department of Science and Technology (SEI-DOST) and the University of the Philippines National Institute for Science and Mathematics Education Development (UP NISMED). The professional knowledge, professional practice, and professional attributes of teachers will be assessed using an 80-item instrument (SEI-DOST & UP NISMED, 2011). The adapted instrument involves four (4) sub-variables for the professional knowledge which are the knowledge of science content, knowledge of general pedagogy, pedagogical content knowledge, and knowledge of the curriculum structure and materials. Six (6) practices are included in the instrument for the professional practice of teachers and these are: (a)

Designs sound science teaching and learning experiences suitable for the needs and interests of varied learners; (b) Creates and maintains a learner-centered, emotionally supportive, and physically safe learning environment; (c) Engages students in scientific investigations to be able to generate, construct, and test knowledge and evaluate evidence; (d) Finds and implements ways to extend students' understanding of the ideas and concepts being learned; (e) Builds students' confidence and capacity to use scientific knowledge and processes to make informed decisions; and (f) Uses a wide variety of strategies consistent with learning goals to monitor and assess students' learning and to provide effective feedback. Lastly, two (2) important components are also involved under the professional attributes of teachers and these are: (a) Analyzes, evaluates, and refines teaching practices to improve student learning of science; and (b) Works with other teachers within the school and joins professional teachers and/or community organizations to improve the quality and effectiveness of science education. This instrument involves a 4-point rating scale based on degree of agreement or disagreement (*4-Strongly Agree; 3-Agree; 2-Disagree; 1-Strongly Disagree*).

3.3 Data Collection

Before the data collection, the researcher obtained the required permission from the Schools Division Office of Quezon City. The researcher then administered the research instrument and secured an informed consent to the participants particularly about the purpose of this study. The research instrument was handed to the Science coordinator with the approval of the school principal. The survey questionnaires were collected once the participants are done in answering the survey. The researcher followed up the remaining survey questionnaires if the participants are not yet done answering the survey after the first collection. The data was collected during the month of December of S.Y. 2017-2018.

3.4 Data Analysis

The analyses for answering the research questions and for testing the hypothesis was performed using statistical package SPSS version 20.0 for Windows and MS Excel 2010 version. Descriptive statistics such as the Mean and standard deviation were used to determine the level of agreement and disagreement of teachers about their professional qualities (knowledge, practice, and attributes. Independent samples t-Test was also used to determine the difference in the knowledge, practice, and attributes of male and female. Pearson r was used to determine if the professional qualities of science teachers are related to their demographic variables.

3.5 Ethical Consideration

The participants in this study were fully informed of the purposes and procedures of the study, which their participation were voluntary and they can withdraw anytime or of their ability to decline participation from the study. The participants were provided an informed consent form which is printed and have signed that they are fully aware of the purpose of the research as well as their role in the conduct of the study. They were given the right to remain anonymous to be protected especially the use of their names. The information gathered and collected from them was kept in strict confidentiality and being used solely in achieving the purpose of this study. The participants were also informed about the possibility of publishing this study and they have the right to know first the results of the study.

4. Results and Discussion

Table 1
Weighted Mean of Science Teachers' Professional Knowledge, Practice, and Attributes

Professional Qualities	Mean	SD	Description
Professional Knowledge	**3.5397**	**0.3928**	**SA**
Knowledge of Science Content (KSC)	3.6032	0.3359	SA
Knowledge of General Pedagogy (KGP)	3.5297	0.3896	SA
Pedagogical Content Knowledge (PCK)	3.5068	0.4130	SA
Knowledge of Curriculum Structure and Materials (KCSM)	3.5189	0.4197	SA
Professional Practice	**3.5422**	**0.4291**	SA
Practice 1: Designs sound science teaching and learning experiences suitable for the needs and interests of varied learners	3.4532	0.4244	SA
Practice 2: Creates and maintains a learner-centered, emotionally supportive, and physically safe learning environment	3.5865	0.4021	SA
Practice 3: Engages students in scientific investigations to be able to generate, construct, and test knowledge and evaluate evidence	3.5757	0.4272	SA
Practice 4: Finds and implements ways to extend students' understanding of the ideas	3.51189	0.4439	SA

Practice 5: Builds students' confidence and capacity to use scientific knowledge and processes to make informed decisions	3.5446	0.4005	SA
Practice 6: Uses a wide variety of strategies consistent with learning goals to monitor and assess students' learning and to provide effective feedback	3.5811	0.4579	SA
Professional Attributes	**3.4839**	**0.4520**	
Attribute 1: Analyzes, evaluates, and refines teaching practices to improve student learning of science	3.5316	0.4363	SA
Attribute 2: Works with other teachers within the school and joins professional teachers and/or community organizations to improve the quality and effectiveness of science education	3.4362	0.4622	SA

SA-Strongly Agree

It can be gleaned in Table 1, the participants perceived and labeled their knowledge, practice, and attributes as "strongly agree". Science teachers possess these qualities to respond in the demand of science education in the 21st century. Teachers' professional practice is more evident (X=3.5422; SD=0.4291) than their professional knowledge (X=3.5397; SD=0.3928) and professional attributes (X=3.4839; SD=0.4520). It can be observed that among the indicators of professional knowledge, knowledge of science content is more evident (M=3.6032; SD=0.3359). Science teachers are very much particular about the mastery of the content and of the subject matter. They want to make sure that they can deliver lessons because they are equipped with the knowledge and cognitive aspects with regards to science lessons. Science teachers who know their subject matter and possess detailed information about instructional processes and the way students learn and develop (Ajaja & Eravwoke, 2013). As a professional practice, teachers want to create and maintain a learner-centered, emotionally supportive, and physically safe learning environment for the students (M=3.5865; SD=0.4021). Aside from ensuring that the classroom is conducive to learning, science teachers also ensure that this is free from any form of distraction which can affect the personal aspect of the students. Teachers in this manner are caring and serve as parent surrogate of the students. Involving students in their learning can help them develop confidence and positive learning environment (Saravanan & Al Wadi, 2014). Effective feedback from the students is also important. Hence, as a teaching practice, science teachers use wide variety of strategies consistent with learning goals to monitor and assess students' learning to provide feedback. Havnes, Smith, Dysthe, & Ludvigsen (2012) revealed in their study that there is significant difference by which teachers perceive their own way of giving feedbacks. They found out there are four classroom situations that are rich in feedback opportunities: (1) the teacher works through a test or assignment when returning these to the students after corrections, (2) student presentations of projects, (3) group-work and (4) discussions between the teacher and the students. Furthermore, they revealed that teachers find feedback useful to students. Therefore, they recommended that teachers need to be more explicit when giving feedback, explaining how the assessment is formed, be clear about what is required of the students, and suggest alternatives for improvement and future work. In order for the science teachers to improve student learning in science, they analyze, evaluate, and refine their teaching practices (M=3.5316; SD=0.4363) as part of their professional attributes. They are sensitive and reflect on students learning outcomes in order for them to identify areas of their teaching that need improvement from time to time. They considered students outputs and study them to have some modifications on their teaching practice. In this manner, science teachers are open for some new or additional information from professional development activities and/or even suggestions from their colleagues just to improve first their teaching and finally the student learning. Science teachers are open when it comes to new teaching/learning/assessment activities for classroom use and also liaises and works with other science teachers (Sweeney, Bula, & Cornett, 2001).

Table 2
Comparing Weighted Mean, t-Test, and p-value of Male and Female Science Teachers' Professional Knowledge, Practice, and Attributes

Professional Qualities	Gender	Mean	SD	Mean Difference	t-Statistics	p-value
Professional Knowledge						
Knowledge of Science Content (KSC)	Male	3.5357	0.3344	-.1086	-.939	0.35
	Female	3.6443	0.3451			
Knowledge of General Pedagogy (KGP)	Male	3.5143	0.3739	-.0248	-.183	0.86
	Female	3.5391	0.4153			
Pedagogical Content Knowledge (PCK)	Male	3.4464	.4181	-.0971	-.679	0.51
	Female	3.5435	.4241			

Knowledge of Curriculum Structure and Materials (KCSM)	Male Female	3.4571 3.5565	0.3631 0.4630	-.0994	-.684	0.50
Professional Practice						
Practice 1: Designs sound science teaching and learning experiences…	Male Female	3.4114 3.4787	0.4007 0.4542	-.0673	-.456	0.65
Practice 2: Creates and maintains a learner-centered…	Male Female	3.4714 3.6565	0.3730 0.4198	-.1851	-1.355	0.18
Practice 3: Engages students in scientific investigations…	Male Female	3.4293 3.6648	0.3925 0.4404	-.2355	-1.641	0.11
Practice 4: Finds and implements ways …	Male Female	3.3771 3.5939	0.3726 0.4804	-.2168	-1.442	0.16
Practice 5: Builds students' confidence and capacity …	Male Female	3.4114 3.6257	0.4080 0.3915	-.2142	-1.589	0.12
Practice 6: Uses a wide variety of strategies …	Male Female	3.4286 3.6739	0.4746 0.4423	-.2453	-1.592	0.12
Professional Attributes						
Attribute 1: Analyzes, evaluates, and refines teaching practices …	Male Female	3.3571 3.6378	0.4076 0.4368	-.2807	-1.943	0.06
Attribute 2: Works with other teachers …	Male Female	3.3571 3.4843	0.4855 0.4782	-.1272	-.797	0.43

Generally, both groups (male and female science teachers) labeled their professional characteristics as "strongly agree". It can be gleaned in table 2 that there are slight differences in terms of mean scores of male and female groups as to their professional characteristics (knowledge, practice, and attitudes). This indicates no significant difference at .05 level of significance (p>.05). It seems that these professional characteristics are possessed by science teachers regardless of their gender. On the other hand, it can be observed that female teachers perceived high knowledge, practice, and attributes (M=3.5709; M=3.6156; M=3.5611) than male teachers (M=3.4884; M=3.4215; M=3.3571). It is evident that there were more female teachers than male teachers participated in the study. There were more female teachers inside the classroom teaching the grade 10 junior high school level.

Table 3
Comparing Weighted Mean, t-Test, and p-value of Single and Married Science Teachers' Professional Knowledge, Practice, and Attributes

Professional Qualities	Gender	Mean	SD	Mean Difference	t-Statistics	p-value
Professional Knowledge						
Knowledge of Science Content (KSC)	Single Married	3.6675 3.5855	0.2806 0.3577	.0820	.597	0.55
Knowledge of General Pedagogy (KGP)	Single Married	3.7000 3.4828	0.2619 0.4158	.2172	1.395	0.17
Pedagogical Content Knowledge (PCK)	Single Married	3.5625 3.4914	0.4173 0.4251	.0711	.420	0.68
Knowledge of Curriculum Structure and Materials (KCSM)	Single Married	3.6000 3.4966	0.3024 0.4555	.1035	.603	0.55
Professional Practice						
Practice 1: Designs sound science teaching and learning experiences…	Single Married	3.4700 3.4486	0.3900 0.4471	.0214	.123	0.90
Practice 2: Creates and maintains a learner-centered…	Single Married	3.5125 3.6069	0.4156 0.4105	-.0944	-.574	0.57
Practice 3: Engages students in scientific investigations…	Single Married	3.5012 3.5962	0.3897 0.4485	-.0950	-.544	0.60
Practice 4: Finds and implements ways …	Single Married	3.4237 3.5362	0.3887 0.4690	-.1125	-.620	0.54
Practice 5: Builds students' confidence and capacity …	Single Married	3.5012 3.5566	0.4160 0.4099	-.0553	-.337	0.74
Practice 6: Uses a wide variety of strategies …	Single Married	3.5625 3.5862	0.4955 0.4642	-.0237	-.126	0.90

Professional Attributes						
Attribute 1: Analyzes, evaluates, and refines teaching practices …	Single Married	3.4588 3.5517	0.4059 0.4565	-.0930	-.521	0.61
Attribute 2: Works with other teachers …	Single Married	3.5363 3.4086	0.4025 0.4800	.1276	.677	0.50

Generally, both groups (single and married science teachers) labeled their professional characteristics as "strongly agree". There are slight differences in the mean scores of single and married science teachers as to their professional characteristics (knowledge, practice, and attributes). It can be gleaned in table 3 that these groups of teachers vary. In professional knowledge area, single teachers perceived high mean (M=3.6325) than married teachers (M=3.5141). In the area of professional practice, married teachers perceived high mean (M=3.5551) than single teachers (M=3.4912). In the area of professional practice, single teachers perceived high mean (M=3.4976) than married teachers (3.4802). Though there are differences in the mean scores of the groups, these differences are not significant at .05 level of significance (p>.05). Science teachers perceived the same professional characteristics regardless of their civil status.

Table 4
Science Teachers' Professional Knowledge, Practice, and Attributes correlated to demographic variables

Professional Characteristics	Gender	Civil Status	Years of Service	Age	Educational Attainment	Teaching Position
Professional Knowledge						
Knowledge of Science Content (KSC)	.157	-.078	.079	.050	.249	.115
Knowledge of General Pedagogy (KGP)	.031	-.178	-.026	.006	.115	.035
Pedagogical Content Knowledge (PCK)	.114	-.056	.046	.051	.055	.122
Knowledge of Curriculum Structure and Materials (KCSM)	.115	-.78	.012	.028	.160	.090
Professional Practice						
Practice 1: Designs sound science teaching and learning experiences…	.077	-.016	-.149	-.018	.288	-.129
Practice 2: Creates and maintains a learner-centered…	.223	.076	.095	.005	.277	.266
Practice 3: Engages students in scientific investigations…	.267	.072	.124	.013	.433**	.180
Practice 4: Finds and implements ways …	.237	.081	-.160	-.277	.300	-.041
Practice 5: Builds students' confidence and capacity …	.259	.045	-.019	-.030	.426**	.003
Practice 6: Uses a wide variety of strategies …	.260	.017	.020	.047	.371*	-.028
Professional Attributes						
Attribute 1: Analyzes, evaluates, and refines teaching practices …	.312	.069	-.096	-.137	.324	-.048
Attribute 2: Works with other teachers …	.134	-.089	-.059	-.104	.266	-.094

***Correlation is significant at the 0.01 level (2- tailed)*
**Correlation is significant at the 0.05 level (2- tailed)*

It can be gleaned in table 4 that there is no significant correlation between professional characteristics (knowledge, practice, and attributes) of science teachers and gender, civil status, years of service, age, and teaching position in general. On the other hand, sub-components under professional practice revealed a positive significant correlation to their educational attainment. Educational attainment of science teachers has something to do with how they engage their students in scientific investigations to be able to generate, construct, and test knowledge and evaluate evidence (t-value=.433, p-value=.01). It can be inferred that science teachers who have skills obtained in the graduate school program have more chance to integrate scientific skills to their students through hands-on learning. In the study of Wurdinger & Rudolph (2009), they pointed problem-based learning as one of the integral approaches that promotes experiential learning for the students. Here, students are using their hands to design and construct things. This approach teaches students on how to create and produce

projects. When projects are completed students often present them to their peers with an explanation of how they created the project and what they learned from the experience. Educational attainment of science teachers is also related as to how they build students confidence and capacity to use scientific knowledge and processes to make informed decisions (t-value=.426, p-value=.01). It can be inferred that science teachers who have earned skills from the graduate school program can able to help students in using the scientific knowledge in problem solving. Hence, decision-making is being developed in them. In return, students are noted to have increase in confidence and developed a more positive attitude towards learning (Girvan, Conneely, & Tangney, 2016). Educational attainment of teachers shows significant relationship as to how to how science teachers use a wide variety of strategies consistent with learning goals to monitor and assess students' learning and to provide feedback (t-value=.371, p-value=.05). It can be inferred that science teachers are constant in providing feedback after the given assessments of the teacher and to ensure monitoring of students development. It is more helpful for the students that science teachers point out what kinds of errors they are making, and what they need to do to improve (William, 2011).

5. Conclusions and Recommendations

The study underscores some findings which could serve as additional information despite of the many researches done pertaining to the professional characteristics of science teachers specifically in the junior high school level. It sounds critical for grade 10 teachers to be fully informed about their skills in the 21st century for the purpose that after them, students will enter the new chapter of their basic education which requires the fundamental knowledge and skills needed to complete the subjects of their chosen tracks. Hence, grade 10 teachers should be aware of the benefits and negative effects of their impacts to students' achievement. It is nice to read that all science teachers participated in this study perceived and labeled their knowledge, practice, and attributes as "strongly agree". This clearly shows that though there are some changes in the curriculum, they are still find ways on how to align themselves against the demands of the present educational system. Demographic variables such as gender, age, civil status, years of teaching, educational attainment, and teaching profession adheres to the normal of the professional qualities. Though majority of these demographic variables do not significantly related to their professional characteristics, they cannot deny the fact that educational attainment by continuing professional education such as getting into a graduate school program will help them to ensure the quality of services (education) to the students. It is timely that the government, with the help of Professional Regulation Commission and Department of Education, implement ways on how to upgrade science teachers' professional development and one of the necessary and required earned units must come from continuing professional studies in a graduate school program. Through this, science teachers could gain updated information with regards to correcting misconceptions in science concepts. Furthermore, new skills and techniques in using varied and effective pedagogical approaches could be also got by science teachers through continuing professional studies. Science teachers who wish to pursue this; they should consider the school which can give the necessary competencies so that they can transfer these to their students in correct way. Future researchers can consider other grade levels of science teachers to compare their results from the present study. Various trainings for professional development programs could be given to teachers to address some issues concerning teaching-learning process and students' achievement. Other variables could also be done to have a wide scope of findings with regards to the important role of science teachers towards appreciation of students and to apply whatever they learned as part of their life in the changing society.

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