PERCEIVED PROFESSIONAL DEVELOPMENT NEEDS AMONG PUBLIC SECONDARY SCHOOL SCIENCE TEACHERS

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ABSTRACT: *The study surveyed forty-eight science teachers in ten public secondary schools to know the graduate programs being pursued and the perceived needs for professional development in terms of training and seminars. The schools were clustered into high and low performing schools based on their performance in the National Career Assessment Examination (NCAE) with focus on the scientific ability component. Data shows that a greater number of science teachers opted for non-science programs at the graduate level. Science teachers from high performing school expressed the need for training in teaching new instructional materials, teaching skills and assessment approaches as the most urgent. On the other hand, teachers from low performing schools considered teaching new instructional materials, working with underachieving students and how students learn as the most urgent. There is a need for a paradigm shift in the kind of graduate programs science teachers should pursue. It is recommended that professional development is guided by a policy that is acceptable and understood by science teachers. If possible, training should be tailored according to needs.*

Keywords- professional development, science achievement, in-service training

1. INTRODUCTION

The country is facing a shortage of scientist and technologist that may result in our inability to compete globally in commerce and trade. It may seem that there is a need to encourage students to take up science and science-related courses in order to ensure sufficient workforce in technical and scientific fields. The primary and secondary schools are crucial stages wherein the love of the students for science and science-related careers can be developed by the teachers. Since not all students would find their interest in the field of science, the teacher is expected to develop among the majority of the students some sort of scientific literacy necessary for day to day decision making. Scientific literacy must be promoted for it is a driver for changes [1]. This requirement necessitates the total involvement of teachers in professional development through training and seminars. Teachers who are involved in professional development tend to improve their students' achievement [2]. It was also noted that the Department of Education spent so much for training and seminars in order to equip science teachers and improve classroom instruction. This is because education is a lifelong process that involves both teachers and students.

Students would often look up to their teacher for correct science instruction and guidance in learning complex science concepts. Regular and effective in-service education of teachers is therefore necessary not only to keep them updated in terms of content enrichment and proficiency but also with regard to changes taking place in social, scientific, environmental and technological fields. The role that science teachers play in the development of scientific literacy among our youth is substantial. When science teachers do not participate in training and seminars, they would positively put a limit on how much their students can potentially achieve from good science instruction. All teachers should be involved in professional development opportunities in order to enable their students to achieve high academic standards [3]. Bayar [4] identified the main components of an effective professional development activity that include a match to existing teacher and school needs, teacher involvement in the design/planning of professional development activities, active engagement opportunities, continuing engagement, and high-quality instructors.

The study sought to determine the present status of science teachers' professional development and school learning environment in selected public secondary high schools.

3. OBJECTIVES OF THE STUDY

The main objective of the study is to determine the graduate studies being pursued by science teachers including their opportunities for training and seminars. The study also determines the training needs as perceived by the teachers. The learning environment and the science learning opportunities available to students in terms of attendance to the science fair, conduct of science experiments, availability of science materials and facilities and intervention program to improve performance in high stake examinations are determined through an interview with focal persons such as science teachers and school heads during questionnaire distribution.

Professional development in this study refers to the training and seminars given to in-service science teachers as well as the graduate studies being pursued by the teacher. It is assumed that the teachers who engage in professional development would be updated with the latest strategies and methodology for effective classroom instruction. The researchers also assumed that science teachers are models of lifelong learning and hence they would seek to improve professionally in the field of science education.

In order to deliver the best science education, teachers need to be trained to provide an excellent education to students [5]. The training that both pre-service and in-service teachers undergo should be geared towards the development of science content knowledge and effective teaching strategies. Furthermore, Owens [5] also stipulated that teachers should be provided with more opportunities to observe modelling of effective science techniques, given increased pedagogical content knowledge and educated on how students learn. All of these will enhance their teaching methods and may eventually result in greater science literacy among students.

National Science Teachers Association (NSTA) issued a position statement on professional development in science

education. NSTA stipulated that in order to achieve the goal of providing professional development for science educators throughout their careers, professional development programs should incorporate the following guiding principles:

• Professional development programs should be based on student learning needs and should help science educators address difficulties students have with subject-matter knowledge and skills.

• Professional development programs should be based on the needs of science educators—of both individuals and members of collaborative groups—who are involved in the program. Ongoing professional development initiatives should be assessed and refined to meet teachers' changing needs.

• To best serve all students as they learn science, professional development should engage science educators in transformative learning experiences that confront deeply held beliefs, knowledge, and habits of practice.

• Professional development should be integrated and coordinated with other initiatives in schools and embedded in the curriculum, instruction, and assessment practices.

• Professional development programs should maintain a sustained focus over time, providing an opportunity for continuous improvement.

• Professional development should actively involve teachers in observing, analyzing, and applying feedback to teaching practices.

• Professional development should concentrate on specific issues of science content and pedagogy that are derived from research and exemplary practice. Programs should connect issues of instruction and student learning of knowledge and skills to the actual context of classrooms.

• Professional development should promote collaboration among teachers in the same school, grade, or subject.

A study on the status and quality of teaching and learning of science in Australian schools by Goodrum et al. [6] identified nine themes that best describe the ideal picture of quality in science teaching and learning. Two of these themes echo the importance of professional development for teachers. These are:

1. Teachers are life-long learners who are supported, nurtured and resourced to build the understandings and competencies required of contemporary best practice.
2. Teachers of science have a recognized career path based on sound professional standards endorsed by the profession.

Professional knowledge and instruction-related beliefs in particular are likely to play a mediating role for learning and hence for impacts or for the success of teacher training programs.

Instructional practices may greatly impact students' achievement in science. Hence, there is a greater need to consider the improvement of professional knowledge that is a result of teacher training, both pre-service and in-service for this has great influence on the instructional practice of the teacher.

What is effective professional development? Effective professional development enables educators to develop the knowledge and skills they need to address students' learning challenges. To be effective, professional development requires thoughtful planning followed by a careful implementation with feedback to ensure it responds to educators' learning needs. Educators who participate in professional development then must put their new knowledge and skills to work.

4. MATERIAL AND METHODS

The study used descriptive research design with the survey as a method of data gathering. The study was conducted in selected public secondary schools in the Philippines. The schools were chosen based on their performance in the National Career Assessment Examination (NCAE) with focus on the scientific ability component only. Purposive sampling was employed. Therefore, all year level science teachers are the respondent of the study. A questionnaire was constructed based on literature review and is focused on three areas namely: content, teaching and assessment. The questionnaire used in the study was validated by four experts for content and its sufficiency in answering the research questions. One expert looked into each question for cultural suitability. After incorporating all the corrections and recommendations from these experts, the questionnaire was pilot tested to 16 science teachers from another public secondary high school to get the reliability, internal consistency, determine confusing items and remove ambiguity. Although all the 16 sets of questionnaires were successfully retrieved, only 14 sets of questionnaires were considered for their completeness and correctness in response. The data collected were analyzed using SPSS 18 and Cronbach's alpha was used to establish consistency and reliability. Cronbach's alpha coefficient for self-assessment of needs for professional development was found to be 0.709. After acquiring permission from the Division Office for the conduct of research, visits to the respondent schools were made and an initial interview with the respective principals or head teachers were conducted. The interview focused on the science achievement of the school, science activities and programs actively pursued by the school and on the mechanism used in sending teachers to professional development activities. Moreover, the views of the principal or the focal person on the science teaching and learning goals and the problems encountered by the school of science were among the central themes of the interview. The researcher sought information on the existence of laboratory facility and equipment, availability of funds for science activities and other science-related activities such as science fair, science quiz bee, and the conduct of investigatory projects. Research instruments were distributed by the head teacher to the respondent teachers. After a week or two, a follow-up visit was made to each school for the questionnaire retrieval. Questionnaire retrieval rate was 83%.

5. RESULTS AND DISCUSSIONS

Data indicates that the youngest science teacher in the study is 25 years old while the oldest is 58 years old. The median age is 35. Data also shows that the science teachers in the high performing and low performing schools, when clustered as below and above the median age, are almost equal in population. In terms of the length of service, the median year is 8. The longest teaching experience is 31 years while the shortest is 7 months. Most of the science teachers are not new to the job. The low performing schools have more science

teachers that have rendered more than eight years teaching service.

The survey also revealed that a higher percentage of the science teachers in the low performing schools are non-science specialists. Across the group, you can find teachers whose specialization is English but are teaching either biology or chemistry. Engineering graduates and mathematics majors are teaching physics while a number of majors in physical sciences are teaching either physics or chemistry.

Although 71 percent of the science teachers in the high performing school has indicated that they have earned a Master's degree or have units in a graduate program, there are teachers who opted to pursue a graduate program in educational planning or school management rather than obtain a degree in the field of science or science teaching. This career path may have something to do with the desire to function as a school administrator such as principal or school head. For the low performing school, 59 percent of the science teachers have also earned units or degree in a graduate program. The same phenomenon is observed here, meaning, there are science teachers who chose to have a graduate program in educational planning and other non-science specialization. Some of the science teachers who pursued non-science programs were not graduates of science education programs at the undergraduate level. The low performing schools have 75 percent of their science teachers preferring non-science programs at the graduate level.

Table 1 shows that science teachers from low performing schools express higher sufficiency in their knowledge of content areas, teaching skills and assessment approaches. This means that these teachers may believe that their need for the identified areas is less when compared to the science teachers from high performing schools.

Table 1 Self-assessment for Professional Needs

	High Performing Schools	Low Performing Schools
Areas	Mean	Mean
Content	2.71	2.75
Teaching Skills	2.60	2.77
Assessment	2.71	3.0

Table 2 shows science teachers from high performing school expressing the need for training in teaching new instructional materials, teaching skills and assessment approaches as the most urgent. Science teachers from low performing schools consider teaching new instructional materials, working with underachieving students and how students learn as the most urgent. Surprisingly the same teachers considered training for content understanding as the less urgent. This could mean that these science teachers believe that their knowledge of the content area is sufficient and they need more help on how to work effectively with underachieving students and this requires knowing very well how students learn.

A number of researchers recommended that science teachers must show the connections between the concept and students' everyday lives to capture the interest of low performing students [7] and integrate reading and writing in science classes for meaningful learning [8]. There is also a suggestion for teachers to develop "habits of mind" in order to help them to create a classroom climate that supports students' engagement and learning [9].

Table 2 Self-Assessment for Training Needs

	High Performing Schools	Low Performing Schools
Areas	Rank	Rank
Content understanding	4	7
Teaching skills	2	6
Teaching new instructional materials	1	1
How students learn	5	3
Assessment approaches	3	4
Interdisciplinary teaching and learning	7	5
Working with underachieving students	6	2

Table 3 shows the perceived professional needs of the science teachers. It is evident that teachers need help whenever new instructional materials are available. This is also true when the new curriculum is introduced. There is also a need to train teachers on how to deal with students who are not doing well academically. In an informal interview, science teachers commented that some training and seminar do not adequately meet their most urgent needs. The teachers encountered problems in the classroom implementation of what has been learned in seminars and training because of inadequate materials and equipment. The science teachers disclosed that there is no monitoring nor evaluation of the effectiveness of whatever is learned. Maybe there is a need for monitoring and evaluation as well as proper motivation in terms of rewards and recognition for teachers who are successful in the implementation of new strategies for instance.

Table 3 Over-all Rank for Training Needs

Areas	Rank
Teaching new instructional materials	1
Teaching skills	2
Working with underachieving students	3
Assessment approaches	4
How students learn	5
Content understanding	6
Interdisciplinary teaching and learning	7

DeMonte [10] affirms that there are no sets of teaching practices that have been recognized as important for all teachers to know, understand, and master. In addition, DeMonte [10] recommends the formulation of a strong evaluation system that identifies strengths and weaknesses in teaching practice. This can be made possible through the collaborative efforts of the teachers to improve their practice [11] and attendance to relevant training and seminars. Evaluation and monitoring may be used to ensure that the benefits derived from such training and seminars are sustained.

Interview Results

The interview was conducted during the questionnaire distribution. It covers questions on the following concerns:

1. Science achievement as a result of science activities and participation in a science contest

2. Availability of science laboratories and facilities
3. Intervention programs to improve science achievement
4. Faculty development and attendance at training and seminars

Science activities and participation to a science contest

All schools regularly participate in science contest and activities sponsored by the Department of Education (DepEd) and by other government and private agencies. The participation of these schools is dependent on the budget of the school and the financial capability of the students. The science teachers acting as coach for the students will usually shoulder the fare of the students participating in contests. This may even include expenditure for the food and materials required for the contest, especially in investigatory projects. If the contest is already in the regional or national level and when contests are outside of the city, the school will usually solicit funds from parents, Parents-Teachers Association or from politicians to be able to send students to these contests.

One top performing school is an agricultural school. Some of its science activities are the creation of mini forest and herbal garden for biology subject. Students regularly attend the contest at the division level such as science quiz, and Physics Olympics. They also have an existing science club.

Two of the top performing schools are using science curriculum. This means that they have more mathematics and science subjects. Chemistry and Physics at one school are taken during the third and fourth year in high school. The students of this science and technology school have research subjects during their third and fourth year in high school. In their third year, the students are required to submit a research proposal as a final requirement of the subject. In their fourth year, students will conduct the research study. Most of the researchers conducted are usually production of outputs in terms of alternative raw material for certain processes like baking and crafts making. The other science curriculum user school requires all their students to conduct investigatory projects. Eight of the sampled schools made use of the regular Basic Education Curriculum. The other schools conduct investigatory projects for purpose of competition and not as part of the regular activities for all students. It means that it is a selective process wherein only few and perhaps the best students are able to participate. One science teacher stated that in the following school year, DepEd will require all secondary school students to conduct the investigatory project as part of their school activities and have it as a competition during the science month which is every September.

Availability of science laboratories and facilities

Majority of the schools used the classroom as laboratory room. Equipment and materials for science activities are stored in the faculty room, housed under the stair or placed inside cabinets in the classroom. One top-performing school has identified laboratory rooms for physics, chemistry, biology and zoology that also double as lecture rooms for these science subjects only.

Science teachers professed that they have to use their own initiative to acquire basic glassware for science experiments. Most of the time, they forego the use of chemicals in experiments since the classroom is not designed for such activities and the chemicals are sometimes not available. Most of the time, the teacher will perform science demonstration rather than let students perform experiments in groups as a result of the congested classroom, lack of basic facilities and lack of materials.

Intervention programs to improve science achievement

All schools do not have a particular intervention program to improve science achievement. Science achievement for these schools is solely based on their performance in high stake tests such as National Achievement Test (NAT) and National Career Assessment Examination (NCAE). This is the reason that they conduct review sessions months before taking NAT or NCAE. The start of the review classes usually varies across schools and it was noted that the review classes are done after class hours and during Saturdays. Teachers who conducted review classes on Saturdays are given service credits. High School A often ask some of the students in the higher year to tutor the students for NAT and the better-performing students to tutor their peers for NCAE. High School B showed the researchers a collection of NCAE reviewers they have acquired. High School C also has a collection of reviewers that were provided by DepEd. When asked whether all of the students are allowed to take the examination, the school respondents affirmed that they require all their students to take NAT and NCAE. In the case of NCAE, DepEd requires students who missed the exam due to some reasons to take the exam on a special schedule.

Faculty development and attendance at training and seminars

Faculty development in terms of the pursuit of graduate studies is dependent on the science teachers' personal and professional goals. If a science teacher intends to pursue graduate studies, the usual factors that come into play are the marital status, financial status, and location of a school assignment. Some science teachers even consider the support or approval from the principal as crucial in their pursuit of masters and doctoral degrees. For neophyte science teachers, the reasons they gave for not pursuing yet a master's degree is that they are still adjustments to be made in the workplace. They need to learn the ropes, build up a collection of teaching repertoire, activities and establish a support system in terms of possible teacher mentor in school. Mentoring is not established as a culture in Philippine schools and this means that science teachers learn by themselves and if lucky enough may find some experienced science teacher willing to guide and teach the new teacher's survival techniques for their first year in teaching. Since new science teachers start at the lowest salary grade, they still need the income to support their parents or younger siblings if still unmarried and in the case of married teachers, to support their children's' education or the family if the husband is unemployed. Most of the science teachers consider the acquisition of a master's or doctoral degree as a means of getting a promotion. This is the reasons that a number of science teachers would rather have a degree in educational planning and management to be considered for the principal item. It would seem that a graduate degree in science /science teaching was not considered as a means of improving science instruction and thus improve science achievement of students. It was also noted that although DepEd has provided a program called Project RISE to help science teachers whose degree program

is not in science, the teachers when they pursue their master's degree will enrol in a graduate school program similar to their undergraduate program. For example, a math teacher who teaches physics or chemistry will pursue a master's degree in mathematics and not in science. This is despite the fact that project RISE is a credit program. The science subjects the teacher will successfully complete are credited. One teacher stated that promotion is sometimes not enough motivation for teachers to pursue graduate studies. This is because the size of the school and the number of teachers are considered in the number of slots for the master teacher.

The attendance to training and seminars lies solely on the discretion of the school head or principal. There are training and seminars that require all the teachers to attend and this is usually during the summer and semestral breaks. For seminars that require a selection process, the principal will consider participants who will most benefit from the attendance. Teachers are also sent on a rotation basis and in cases wherein registration fees are required, availability of funds or budget is considered. Some schools are more fortunate than the others because the size and type of school are factors in budget allocation. In the case of Annex schools, the mother school decides who is going to attend and it also depends on the budgetary allocation of the school.

6. CONCLUSION & RECOMMENDATIONS

Most of the public secondary schools have no intervention program that can effectively improve performance in high stake test such as NCAE. Science teachers are more realistic in what they can do in the classroom. The teachers gained confidence from the professional development they engaged in and from the experience obtained from science classes. Professional development that integrates content learning with analysis of student learning and teaching rather than advanced content or teacher metacognition alone is recommended [12]. Teachers' teaching skills need upgrading in the advent of new curriculum or new teaching materials. It can also be concluded that science teachers are not equipped to deal with academically challenged and disturbed students. This is because achievement is due to complex and myriad factors and teacher factors may not be the sole contributors to students' achievement.

It is recommended that professional development be guided by a policy that is acceptable and understood by science teachers. Training and seminars may be sustained with full support during implementation in terms of facilities and resources. If possible, training should be tailored according to needs. Science facilities and materials are essential for the cultivation of science culture among students. Hence, school buildings may have provisions for adequate science laboratory. Science experiments may be performed in such laboratories and not inside classrooms. Class size maybe reduced to a more manageable size that will allow the science teachers to interact more adequately and effectively with students. Successful reforms factor in teachers' existing knowledge, beliefs, and attitudes [13]

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