

METHOD, STRATEGIES, AND TECHNIQUES USED BY STUDENT TEACHERS IN TEACHING SCIENCE

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ABSTRACT

The study described the methods, strategies and techniques used by the student teachers in teaching Science. It focused on the materials, innovative methods, strategies and techniques and the patterns of Science teaching used by the student teachers as described in their plans. The quantitative and qualitative methods were used in the study. The books, teacher hand-outs and classroom lectures were the sources of methods, strategies and techniques. The chalkboard and self-made drawing were often used materials. Conventional method like lecture, discussion and demonstration were commonly employed. The strategies included group discussion and use of motivating questions and stories to arouse interest of students. Direct-eye contact, body expressions, jokes and news/trivia were frequent techniques. Values integration in the lesson becomes less as the year level increases. The pattern of teaching drawn followed the formal style: I. Objectives, II. Subject matter, III. Learning Tasks, IV. Synthesis of the lesson, V. Assessment and VI. Enrichment. It is then advised that students in the college of teacher education should try other teaching methods which can develop higher order thinking skills among pupils.

Keywords: Teaching, methods, strategies, techniques

Introduction

Quality learning among students needs quality teaching and quality teaching produces quality learning that can only be had at a quality method of handling classes. The quality of teaching refers to the appropriateness of the method selected to achieve the identified objectives for a certain subject matter. Murgatroud as cited by Duque (2003) suggested that quality teaching could be viewed in terms of standards of meeting specific requirements.

There are strategies suggested as effective modalities in teaching Science such as Initial gaming, Personalized System of Introduction, Cooperative Learning, Mastery Learning, Laboratory Approach, Concept Mapping Approach, Science-Tech-Society Approach (STS), Audio-Visual-Tutorial Approach (AVT), Demonstration Method, Expository Method, Morrison Technique in Unit Method, Discovery-Inductive Strategy, Discovery-Deductive Strategy, Directed-Inductive Strategy, Directed-Deductive Strategy, Discovery-Trans-directive Strategy, Directed –Trans-directive Strategy, Experiments, Fields Trips, Demonstrations and Role Playing (Silberman, 1991).

These suggested effective modalities in teaching Science involve the classroom teacher as one of the key person in the educational enterprise. He is directly involved in the instructional process in the classroom setting. John Dewey as cited by Cioco (2003) states that students learn by doing and learning is enhanced when the frequency with which the students actively respond during instructions increased. There are many pedagogical approaches published and teachers work alone when planning instructional activities. Planning the context and execution of the lesson is both done by the teacher. Thus, the teacher pre-service education is very particular with lesson planning and method of teaching.

The findings of this study on pedagogy can help student teachers realize the common pattern of orderly procedures from planning, implementing and evaluating practices in order to produce the desired results/output skills acquired in practice teaching. The pedagogical content knowledge in science does not only include science subject matter, but variety of teaching methods, strategies and techniques which may not be available in books since they are creations of the teachers. The teacher will not find an exact method, unique innovation in delivering knowledge to the

students. These methods, strategies and techniques could be applied in the classroom depending on the teachers' understanding and availability of materials. Unknowingly student teachers maybe applying these methods but it may not be properly described and discriminated.

It is this thought that the researcher investigated the methods, strategies and techniques (MST) of student teachers (STs) in teaching Science (General Science, Biological Science, Chemistry and Physics) at the Pangasinan State University-Laboratory High School (PSU-LHS). The process or the methods used in teaching maybe unique, a revival, or a creation out of the imagination of the students, or common method of teaching Science.

Statement of the Problem

The study described the methods, strategies and techniques used by STs in teaching at PSU Laboratory High School during the 1st semester of the school year 2009-2010. Particularly, this study described the following: (1) the sources/references of the methods, strategies and techniques used by student teachers in teaching Science (2) the instructional materials used, (3) innovative methods, strategies and techniques as described in their actual teaching if there is any and draw the flow/pattern of teaching science as observed in their lesson plan.

Methodology

The Research Design

The research design used in this study was descriptive and the data were treated quantitatively and qualitatively. The quantitative approach was used to determine the sources of the methods, strategies and techniques used by student teachers and the materials used in teaching science. The qualitative approach was used to describe and analyze the innovative methods, strategies and techniques used by student teachers in their actual teaching.

The Respondents of the Study

The subjects of this study were the 28 student teachers of General Science, Biological Science, Chemistry and Physics majors who took-up on-campus

student teaching during 1st semester of the school year 2009-2010. There were 3 males and 7 females General Science, 4 males and 7 females Biological Science, 2 males and 2 females Chemistry and 2 males and 1 female of Physics majors thus, comprising the total number of 28 respondents.

The Research Instrument

The instruments used were classified according to the type of the data needed. These consisted of questionnaire-checklist and interview guide. The questionnaire used was divided into three parts: (1) the student teachers' sources/references of the methods; (2) materials used in teaching; and (3) description of their innovative methods, strategies and techniques in teaching science. The instrument was validated by three Science Professors of PSU and was pilot tested among STs with other majors.

The researchers conducted an interview with the 28 student teachers and three supervising instructors to find out their descriptions on the innovative methods, strategies and techniques used in their actual teaching. The interview guide was composed of an open-ended question to describe the respondents' innovative methods, strategies and techniques in teaching science, sources of the ideas that led to their innovations, motives for making the innovations and problem encountered during the process. Probing questions were given for every item that needs clarification. Triangulation was also used to justify answers in the checklists through actual classroom observations. The researchers also gathered 32 lesson plans from STs to determine the pattern of Science teaching methods.

The Data Gathering Procedure

The researcher administered the questionnaire and conducted the interview. During the administration of the questionnaire, the researcher explained to the students the objectives of the study and guided them to accomplish the questionnaire. Interview of the respondents followed immediately after observing their class. Informal talk with them was used, to verify their answers on the questionnaire. An interview of their three supervising instructors and some of their students was also used for triangulation. Much needed information for triangulation was needed because the weakness of the checklist was strengthened by other sources of data. The 32 lesson plans

of the respondents were analyzed to extract the pattern of teaching Science subjects. Coding of the parts of the lesson plan was used to determine the pattern of teaching style of the student teachers.

Results and Discussions

The data consisted of responses from STs of the PSU-LHS regarding the sources/references of the MSTs, the materials used in teaching and the common flow of teaching if any. The data are presented into six heading namely: 1.) Sources/references; 2.) Materials used; 3.) Methods; 4.) strategies; 5.) techniques; and 6.) Pattern or common flow of teaching.

Sources/references of Methods, Strategies and Techniques

For teaching to be effective, a teacher should have all the faculties to teach. He should not only depend on his prior knowledge to carry out the teaching learning process but extract from the different resources available in his environment. These materials help the student decide on what methods, strategies and techniques he will be using that would fit his subject matter. The following table shows the sources of MSTs used by student teachers.

TABLE 1: Sources of Methods, Strategies and Techniques (MSTs) Used by Student Teachers in Teaching Science

Sources	Frequency	Percentage
Books	27	96
Teacher Handouts	21	75
Classroom Lectures	21	75
Internet	20	71
Methods recommended by friends	17	61
Methods recommended by experienced teachers and mentors	13	46
Prototype Lesson Plans	13	46
Science Magazines	12	43
Science education journals	12	43
Pamphlets	11	39
Teachers prepared study guides	11	39
Science Journals	9	32
Newspapers	8	29
Lecture from seminar workshop	6	21
Television	6	21
Radio	2	7

The table shows that books are the common source of MSTs with 96 % (27) of the respondents have chosen it, this is followed by teachers' handouts 75 % (21), Internet 71 % (20), and methods from experienced teachers 61 % (17). Other sources of methods includes methods recommended by friends 46 % (13), prototype lesson plans 46 % (13), Science magazines 43 % (12), pamphlets 39 % (11), teacher's prepared study guides 39 % (11), Science journals 32 % (9), Newspapers 28 % (8), lecture from seminar workshop 21 % (6) and Television 21 % (6). Very few chose radio as the source of ideas for methods of teaching.

STs of Science at PSU-LHS used various resources from where they have based their chosen MSTs. Majority of the respondents still selected books and teacher's handouts as their sources of ideas in teaching, with regards to the use of textbooks and teachers handouts, ST 4 said:

"Considering the availability of books, we considered books as partners and sources of specific MSTs to be used in teaching".

Books such as Methods and Principles of Teaching, Focus in Teaching and others were used by them to enrich their knowledge, gain more insights, and enlighten their minds regarding MSTs of teaching. According to some of the respondents, they considered teacher handouts and classroom lecture as their next source of MSTs. Through teacher handouts they can easily understand the simplified methods, strategies and techniques. Through classroom lectures, student teachers can easily select what methods, strategies and techniques to be used because the explanations made by the teachers are simple. Furthermore, ST 10 mentioned,

"The Internet also gives me modern ideas on what methods, strategies and techniques I will utilize."

STs have an access to the Internet to search for some innovative MSTs that could be used in teaching. This implies that science student teachers used several sources of their ideas on MSTs. Journals in science education can be an informative source of modern or trendy style of MSTs however seldom used.

Materials Used in Teaching Science Subjects

Knowledge transfer is a vague job for teachers without the use of materials. These materials can make teaching complexities become simple. Audio-visual aids are the general types of materials being used as a tool or equipment in teaching. The use of these materials in the process of teaching can be effective in motivating the students' interest on the subject matter. To upgrade the professional growth and quality of teaching-learning effectiveness, instructional materials are one factor in attaining such objectives (Acero, 2000). Through teaching aids, students will be most benefited because such materials or devices widen the knowledge and understanding of the lesson to the learners (Wright, 1977). The learners easily grasp the meaning of the lessons presented when all their senses are used. Table 2 presents the materials used by STs in teaching Science subjects.

TABLE 2: Materials/Instructional aids Used in Teaching Science subjects

Materials	Gen. Sci.		Bio. Sci.		Chemistry		Physics	
	F	%	F	%	F	%	F	%
Radio with recorder	1	10	1	9	1	25	0	0
Chalkboards	10	100	11	100	4	100	2	67
Cut-outs or still pictures	8	80	11	100	3	75	3	100
Graphs	5	50	10	90	0	0	2	67
Charts	8	80	0	0	3	75	1	33
Maps and globes	4	40	0	0	0	0	0	0
Posters	9	90	5	45	2	50	2	67
Exhibits	1	10	2	18	1	25	2	67
Flannel and magnetic board	1	10	0	0	0	0	1	33
Live specimen	8	80	7	64	2	25	1	33
Models	6	60	4	36	2	25	2	67
Self-made drawings	10	100	11	100	4	100	3	100
Movies, TV	1	10	0	0	0	0	1	33
OHP, projector	1	10	2	18	1	25	1	33
Video recorder	0	0	1	9	2	50	0	0
Multi-media/computer	0	0	0	0	0	0	1	33
Laboratory equipment	8	80	6	55	3	75	1	100
Laboratory Chemicals/ specimen	5	50	6	55	3	75	1	33

The table reveals that 100% of the General Science STs use chalkboards and self-made drawings as instructional materials in teaching, followed by

cut-outs or still pictures however; video tape, recorder, and multimedia/computer are not used. Hundred percent of the Biology STs utilized the chalkboard, and cut out or still pictures and self-made drawings as instructional materials followed by the use of graphs. However, maps, globes, charts, movies, flannel/magnetic board multimedia/computer are not used during teaching. For the Chemistry STs 100% use chalkboards and self-made drawings and cut-outs or still pictures while charts, map, globe, flannel board or magnetic board, movies and multimedia are not used. All Physics STs use cut-out pictures, laboratory apparatus and self-made drawings in teaching while none of them use recorder and video recorder.

It can be noted from the table that electronic devices like radio, tape recorders, video- recorder and computer/multimedia are not utilized materials in teaching. According to ST 8:

"I used chalkboard, self-made drawing and cut out or still pictures for their availability, high accessibility and convenience in teaching; chart for its easy handling and time-saving ability; and self-made drawings for its economy and my talent-exposing characteristics".

One respondent said, drawings and cut out materials can also maximize his efficiency and effectiveness as a student teacher. Majority of the respondent said that they never used radio, magnetic board, movies and computers because they are not fixed in the classrooms and considered to be costly.

The table implies that General Science, Biological Science, Chemistry and Physics STs rely on chalkboards, cut-out pictures and self-made drawings as common materials used while multimedia/computers and map/globes were not used. It can be noted that electronic devices such as computer, TV, recorders, projector, radio and laboratory apparatus/equipment were sparingly used because these equipment are not fixed in every room. These equipment are kept in the audio visual room for common use. The class asks for schedule for the use of the audio visual room if needed and if available.

Methods Used in Teaching Science Subjects

One reason why teaching runs smoothly is with the use of certain

procedures. Although a teacher has all the materials, he could not carry out his task without utilizing certain methods of teaching. Educators obtain a delicate position in molding individuals; a mistake creates multiple chain reactions. Knowing the fact that a teacher is knowledgeable in the class, he should use ways to deliver information. Thus, lack of methodology in teaching would speak to the declining level of knowledge-input to students (Lardizabal, 1977).

The new methods placed more emphasis on thinking and less upon memorizing, more on understanding and less on merely accumulating facts and more genuine interest and less learning through coercion. The activities are governed by the democratic principles and idea, group planning and selected materials, freedom from rigid regulation and control authority and friendly attitude between teacher and pupil. The new methods are child-centered since they aim principally to the total growth and development of the child.

During the interview majority of the STs said that they used discussion and lecture method in their on-campus teaching due to their neophyte behavior in the field of teaching; they feel inadequate to use the new methods. Majority of the STs said that they are afraid to try out new methods because they are not comfortable with it and they might not deliver their topic well thus they will get low grades in Practicum or Practice Teaching.

Demonstration was also used by most Physics STs. According to ST 21, "Using demonstration as a method of teaching is very suitable especially for me as a Science student teacher. Demonstration and lecture method gives me confidence to deliver my subject matter effectively to the whole class so that the students can see the actual process of the experiment first.

Table 3 below presents the methods used by STs in teaching Science subjects. Community based instruction, student theme project, directive references and other new methods were least used because STs were not fully aware of these methods.

TABLE 3: Methods Used by Student Teachers in Teaching Science subjects

Methods	Gen. Sci. f %		Bio. Sci. f %		Chemistry f %		Physics f %	
Culture back/community based	1	10	0	0	0	0	0	0
Demonstration	9	90	7	55	3	75	3	100
Lecture and discussion	10	100	11	100	4	100	3	100
Multimedia representation with discussion	0	0	0	0	0	0	1	33
Student theme project	1	10	0	0	0	0	2	67
Role play with discussion	6	60	8	72	0	0	0	0
Individualized instruction	2	20	1	9	0	0	2	67
Student-directed activity	6	60	5	45	0	0	2	67
Teacher-directed activity	3	30	3	27	0	0	1	33
Concept-approach/mapping	2	20	4	36	0	0	2	67
Deductive method	2	20	0	0	1	25	2	67
Inductive method	3	30	1	9	0	0	2	67
Fieldtrip/community visit	1	10	2	18	1	25	1	33
Practical work approach	3	30	2	18	0	0	2	67
Concept-mapping	6	60	8	73	0	0	2	67
Problem-solving approach	6	60	4	36	2	50	1	33
Project evaluation	1	10	2	18	2	50	2	67
Open Laboratory method	2	20	3	27	1	25	2	67
Structured laboratory method	2	20	3	27	3	75	3	100
Discovery-directed method	3	30	0	0	0	0	2	67
Cooperative learning	2	20	2	18	1	25	2	67
Inquiry approach	2	20	1	9	0	0	1	33
Investigatory project approach	2	20	1	9	1	25	1	33
Discovery method	6	60	2	18	1	25	2	67
Outdoor lecture	3	30	9	82	2	25	2	67

However, it can be noted that STs concentrated to few methods of teaching, where they are familiar and confident to deliver information to their students. Methods such as inquiry (Staver, 2007), problem solving (Abell and Lederman, 2007), investigatory and discovery methods (Abell and Lederman, 2007) were seldom utilized. This method according to Staver (2007) inquiry promotes deep scientific understanding (Abell and Lederman, 2007) reiterated that problem solving is the first step of scientific inquiry which should be a part of scientific knowledge.

Strategies Used in Teaching Science subjects

Teaching to be effective requires a lot of time, talent and effort from anyone who wants to pursue this inspiring and very fulfilling task. Effective

teaching is only possible if teachers would consider the understanding of the complexity of classroom and learn to develop strategies that will continually evaluate and improve teaching-learning effectiveness. Strategies are plans or ways to meet or address certain situation, by knowing his students, his job as a teacher and what teacher are supposed to develop in themselves to be better service to learners (Boiser, 2000).

Clearly, teaching is both a science and an art of employing strategies and schemes in achieving a goal. Strategies to be useful, requires intelligence, maturity and devotion of teachers. Furthermore, the successful teacher should have the knowledge and the sense of purpose that allows them to rise above casual and conventional approaches and to do things others cannot (Boiser, 2000). Strategies then are described as practices that STs usually do during the act of teaching.

The following table presents the strategies used by STs in teaching Science.

TABLE 4: Strategies Used by Student Teachers in Teaching Science subjects

Strategies	Gen. Sci.		Biology		Chemistry		Physics	
	F	%	F	%	F	%	F	%
Feedback Learning	3	30	4	36	1	25	1	33
Use of motivating questions/stories/trivia	9	90	10	91	1	25	3	100
Prepare wholesome atmosphere in the class	3	30	5	45	4	100	1	33
Use of live specimen	4	40	11	100	2	50	1	33
Use of attractive, models & pictures	9	90	6	55	4	100	3	100
Storytelling	2	20	2	18	1	25	2	67
News reporting	2	20	1	9	1	25	1	33
Graded discussion	5	50	1	9	1	25	2	67
Conceptualization	2	20	5	45	0	0	2	67
Generalization	3	30	7	64	3	75	1	33
Simulation, role play, games	9	90	8	73	0	0	2	67
Values or other subjects /topics integration	9	90	10	91	2	50	1	33
Multi-media effects	0	0	0	0	0	0	1	33
Topic reporting	3	30	3	27	0	0	0	0
Group discussion/work	10	100	11	100	3	75	3	100

The table shows that of 90% General Science and 91% Biology, 100% Physics STs use motivating questions, stories or trivia at the beginning of discussion as their strategy. The Biology majors use live specimen as strategy to catch the attention of their students. Group discussion/activity is

the majority strategy of the science teaching. Values and other subjects integration to the lesson is often a strategy among General science and Biology but are seldom used strategy in Chemistry and Physics. It can be noted in the table that the use of multi-media was only employed by only one Physics ST.

One ST stressed that:

“Class discussion is considered to be easy when I utilize it. Multi-media or PowerPoint presentation is time consuming, so I do not use it. Furthermore, the Department does not have multi-media equipment fixed in the classrooms.” (ST 6)

Another respondent also said that:

“By using motivation and stories I could catch the attention of my students to listen and learn eagerly and enthusiastically”. (ST 5)

The use of attractive pictures is believed to be an effective strategy in teaching Physics and Chemistry. Group discussion or group work is a popular strategy among science STs, while use of live specimen is very popular among Biology majors. However, multi-media, was not used because they are not fixed in every classroom. The findings of this study on the use of storytelling among Physics STs is in consonance with the findings of Wandersee as cited by McIntyre (1996) that storytelling provides information about the nature of science.

Techniques Used in Teaching Science Subjects

A technique is a method or a way of doing things. A good technique is skillful and rapid; it gets the task at hand done according to plan specifications, or objectives associated with it. A technique maybe simple or complicated practice. Techniques are necessary and important; in fact, nothing could be evolved in any field without knowledge on how to do things. The technique used must be carefully selected and planned to fit the subject, the students and the objectives (Cioco, 2003).

The table below indicates that majority of the respondents employed the use of thought provoking questions, jokes, news, rewards

during graded recitation, direct eye contact and body expressions as their technique in motivating students. The results of this study suggests similarities with Cioco (2003) that a teacher is an actor/actress who delivers powerful tools like presence of eye contact and facial, hand and voice expression. The teacher yields effective results through direct eye contact with body, hand and voice expressions with their students.

TABLE 5: Techniques Used by Student Teacher in Teaching Science Subjects

Techniques	Gen. Sci.		Bio. Sci.		Chemistry		Physics	
	f	%	f	%	f	%	F	%
Use of thought provoking questions	10	100	10	91	3	75	3	100
Use direct eye contact and body expressions to elicit recitation	10	100	10	91	4	100	2	67
Use of rewards such as graded r recitation	10	100	11	100	4	100	2	67
Use of jokes and news to arouse discussion	7	70	9	73	4	100	3	100
Use of open textbook during discussion	5	50	3	27	1	25	1	33
Use of flashcards	5	50	4	36	0	0	0	0
Use of stick in teaching	3	30	1	9	1	25	0	0
Define objectives before the lesson	2	20	1	9	0	0	1	33
Use of hand-outs as supplement	5	50	4	36	2	50	1	33
Use of worksheets	1	10	3	27	2	50	2	67

The use of stick in teaching in Physics is never used, 30% in General Science, 9% in Biological Science and 25% in Chemistry; and defining objectives before the lesson with 20% in General Science, 33% in Physics and 9% in Biological Science are the least utilized techniques in teaching science subjects.

ST 14 said that:

"With the use of direct eye-contact, I could anticipate my student's behavior and catch their attention during class discussion".

Furthermore, according to the Biological Science respondents, the use of body expressions and jokes or trivia helps them add color and interest to the

subject matter.

ST 13 revealed that:

“The use of stick in teaching is very traditional and is not already applicable for the high school students while defining objectives before the lesson could create anticipation of discussion on the part of the students and only focus on the objectives defined at the start of the lesson”.

The table also reveals variety of teaching techniques have been used by science STs depending on the suitability of the technique to their subject. The findings of this study on defining objectives before the lessons is least preferred by the student teachers, however, this result is in contrast with the study of Calachan (1998), that the performance of the students in Science III is enhanced when exposed to the technique of defining objectives at the start of the lesson.

Pattern of Teaching as Described in their Lesson Plans

The 28 student teachers' lesson plans have noticeable similarities in their pattern of teaching. Common steps were identified and were drawn into pattern.

The 11 General Science lesson plans analyzed illustrated this trend of teaching pattern: I. Objectives, II. Subject Matter, III. Activities, IV. Wrap-up, V. Evaluation, VI. Assignment. The part III or the activities was further divided into presentation of the lesson under which A.) Recall, B.) Motivation, and C.) Development of the lesson. Further divisions are parts of development of the lessons, which are Vocabulary, problem solving and open-class discussion. The identified pattern of teaching General Science among 10 student teachers suggest a flow that activity is the longest part of the lesson because it has several sub-parts. Observations manifested that integration of values were often taken up as a motivation or sometimes in the wrap-up.

The 19 Biology lesson plans analyzed have the same trend of pattern in teaching. Their pattern involves three major parts namely; I. Objectives, II. Subject Matter, and III. Learning Tasks. The learning tasks is further subdivided into (A) Pre-Developmental Activity, (B) Lesson Proper, (C) Wrap-up/Synthesis, (D) Evaluation and (E) Assignment and

Enrichment. The Pre-developmental Activity is often divided into two parts namely (1) recall and (2) Motivation which is often a game, role play or an activity. The learning task is the longest part of their lesson plan. The Biology classes showed that values integration or trivia were usually found as part of the lesson under wrap-up or learning task particularly where they discussed about nature and environment.

The observations suggest that the pre-developmental activity, which includes Motivation, is usually in the form of activity or experiment after which, classroom discussion followed. Open classroom discussion is usually their strategy to evaluate an activity and teach theories in Biology. To the Biology STs, the games or an activity motivates the learners to participate well in the discussion. This pattern implies that Biology STs use inquiry method to begin the class.

The 16 evaluated Chemistry lesson plans involved I. Objectives; II. Subject Matter; III. Learning Tasks, which is subdivided into (A) Recall, (B) Motivation and (C) Discussion; IV. Generalization; V. Valuing; VI. Evaluation and VII. Assignment. The common method of teaching Chemistry is class discussion and analysis of problems and equations. However, there is an emerging trend of teaching Chemistry. The STs use generalization or application of theories instead of synthesizing the whole lesson, after which application of lesson to daily life is included in valuing. Values integration is a part of application of theories in the lesson plan however, in the actual observations it was noticed that only two cases of class observations were observed to have integrated values in the lesson. This may be that the lesson in that time was balancing equation.

The physics STs have a common pattern of teaching, too which includes: I. Objectives, II. Subject Matter, III. Learning Tasks; IV. Assessment and V. Assignment. The Learning Tasks have several parts, (A) Motivation, (B) Lesson Proper, whereby discussion and problem solving is used, (C) Generalization and (D) Application. A distinctive part of the lesson is noticeable for Physics teaching; the generalization is followed by applications to problem sets or problems and solutions. The teaching method usually used by Physics STs is also discussion and problem solving. It was noted in the lesson plan that values integration was a part but through observations there was never a chance that values was integrated in the actual discussion. The whole period of one hour was devoted to problem analysis where the students and the ST were all talking about numbers and

formulas. Almost all the STs considered quiz and long test as a measure of assessing the performance of the students such that after each topic or theory there should always be a long or short quiz. Other forms of assessment were never spotted during the class observations. When the STs were interviewed about evaluation, they said that they are aware of several types of assessment measures but they wanted to implement quiz because they could easily score the items. If the assessment is through a project, play or any tangible object they all agreed that they have difficulty of constructing rubrics for judging/ evaluating the project.

Conclusions and Recommendations

The PSU science student teachers commonly used books, teacher handout and classroom lectures while seldom used science education journals as reference materials for modern methods of teaching. They often used chalkboard, cut outs, pictures and self-made drawings as teaching materials however STs seldom used electronic devices as teaching aids.

The science STs collective method used in teaching were lecture with discussion and demonstration however, methods that develop scientific inquiry among high school students such as concept-mapping, problem-solving, discovery, open laboratory and inquiry were seldom used. The common strategies of teaching science were; the use of motivating questions, stories or trivia particularly at the beginning of the lesson. In particular the General Science, Chemistry and Physics STs used attractive pictures and models, for the Biology STs used live specimen and the Chemistry STs prepared a wholesome atmosphere. To facilitate learning and better class discussion the STs employed techniques such as; use of thought provoking questions, jokes, and news; direct eye contact and body expressions; and reward like graded recitation.

A general flow of Science teaching evolved as: I. Framing of Objectives, II. Stating the Subject Matter, III. Planning of the Learning Tasks, IV. Synthesis/Wrap-Up of the Lesson, V. Evaluation/Assessment and VI. Assignment/Enrichment. Use of activity or games before discussion is a motivation, generalization after the discussion, and additional valuing in the lesson is a pattern that evolved. It is also a mutual practice among STs to give written quiz or test after a lesson/chapter as an assessment tool.

The science pre-service training is rigid with less flexibility, innovations and creativity. The science teacher preparation has minimal

training on scientific inquiry, investigation and problem solving where the students think independently for life long applications of theories. It is then suggested that Teacher Education Institutes should challenge their students to (1) use modern instructional aids and equipment, (2) apply appropriate modern strategies and techniques proven to be good through research, and (3) should learn to apply research results in teaching in order to test theories, at the same time the meaning of science is created in the minds of pupils as a result of their sensory interaction with this world.

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