A STUDY OF PEDAGOGICAL KNOWLEDGE OF LOWER SECONDARY SCIENCE TEACHERS FOR CREATING LEARNING ENVIRONMENT IN THE SELECTED SCHOOLS OF KYAIKLAT TOWNSHIP

Mai Leine Htung[1], Khin Mar Ni[2], and Sandar Lin[3]

Abstract

The primary purpose of this research is to study pedagogical knowledge for creating a learning environment in the selected schools of Kyaiklat Township, Ayeyarwady Region. A total of 110 lower secondary science teachers from selected Basic Education Schools participated in this study. The level of pedagogical knowledge and the variation of pedagogical knowledge of lower secondary science teachers for creating a learning environment were explored. Quantitative approaches were applied in this study. Questionnaire was developed by the researcher based on the related literature. The reliability coefficient (Split-half) was 0.88 for the questionnaire to explore the pedagogical knowledge of lower secondary science teachers for creating a learning environment.

Descriptive statistics, IPC (Item Percent Correct), MPC (Mean Percent Correct) were employed for the analysis of quantitative data. In interpreting the MPC and IPC values, 1to 49% is considered as unsatisfactory level, the value between 50 to 74 % as fairly satisfactory and the value 75 to 100% as satisfactory. According to the total mean percent values, most of the lower secondary science teachers had satisfactory level of pedagogical knowledge for creating a learning environment.

Introduction

No human beings are able to survive properly without education. By the means of education only, one's potential can be used to maximum extent. Education tells men how to think, how to work properly, and how to make decision (Ashwini, 2010).

The goal for all teachers is to provide effective instruction that leads to students' learning. However, that goal is greatly dependent upon having a safe and supportive environment in which teachers can teach and students can learn. Without such an environment, instructional and learning time is lost (Walker et al., 1995). Moreover, students' learning achievement depends on

[1.] Lecturer, Department of Educational Theory, Yangon University of Education
[2.] Lecturer, Department of Educational Theory, Yangon University of Education
[3.] M.Ed. Student, Department of Educational Theory, Yangon University of Education

the effective learning environment. But teaching is a complex and challenging work. Teachers need in-depth knowledge of the subject areas they teach, how students learn that content and an understanding of classroom environments that optimize learning. The classroom is a learning environment where interaction occurs among teachers and students, and learning takes place.

Significance of the study

The teaching of science offers students the ability to access a wealth of knowledge and information which will contribute to an overall understanding of how and why things work like they do. Science is able to explain the mechanics and reasons behind the daily functioning of complex systems, which ranges from the human body to sophisticated modern methods of transport. Children and students are able to use this knowledge to understand new concepts, make well-informed decisions and pursue new interests. Science also helps to provide tactile or visible proof of many facts we read about in books or see on the television; this helps to increase understanding and helps children and teenagers to retain that information (Centre for Education in Science & Technology, n.d).

Numerous factors contribute to the quality of teaching-the teacher's personal characteristics, knowledge of subject matter, and philosophical and psychological understanding among others. One indispensable factor is pedagogy- knowledge of the principles and practices of teaching. To be effective in the classroom, teachers must be able to plan lessons and units, to organize and manage classrooms, and to execute teaching strategies that enable learners to grasp key ideas in the forms intended by the teacher (McNell and Wiles, 1990). A teacher with deep pedagogical knowledge understands how students construct knowledge and acquire skills; develop habits of mind and positive dispositions towards learning (Koehler, 2011).

Learning is a unique process that is directly and indirectly influenced by variables such as teachers' beliefs, teaching instruction, students' attitudes and the classroom learning environment. The working environment or school climate may also influence teachers in conducting teaching, thus determining student learning and student outcomes (Wahyudi and Treagust, 2004).

Along with teachers, teaching methods, curriculum, and resources, the learning environment (natural, social and cultural) determines teaching and learning processes, and thus in turn influences students' outcomes (Ministry of Education and Culture, 1994, cited in Wahyudi and Treagust, 2004).

Effective teaching approaches which aim for students' conceptual change require learning environments that are sensitive to learners' needs, feelings, and ideas (Scott, Assoko & Driver, 1992, cited in Wahyudi and Treagust, 2004).

According to White (1989, cited in Wahyudi and Treagust, 2004), the context in which learning takes place must be supportive and comfortable and free from any form of repression.

According to Haertel (1991, cited in Wahyudi and Treagust, 2004), students' effective learning is positively related to the levels of cohesiveness, satisfaction, and task orientation in the classroom, and negatively related to levels of friction and disorganization. Therefore, for the sake of students' effective learning, teachers must establish a classroom learning environment within which students feel confident and are able to express and discuss their opinions freely.

Teacher should create a learning environment at the beginning of the year where the exchange of ideas is encouraged, respect for all students and their work is fostered, and a sense of community is established (Moore, 2007).

Without a good learning environment, teacher cannot use sophisticated methods to best advantage. Understanding the content to teach and being able to form objectives and construct unit and lesson plans are all essential teaching skills. Being able to implement these plans through a particular teaching strategy is also a central skill in teaching. But there is one additional skill that is so important that it sometimes overshadows the rest. It is creating a learning environment that is productive to students' learning.

For these reasons, it is necessarily important to study the pedagogical knowledge of lower secondary science teachers for creating a learning environment.

Aims of the Study

Main Aim

- To study pedagogical knowledge of lower secondary science teachers for creating learning environment

Specific Aims

- To investigate pedagogical knowledge of lower secondary science teachers for creating a learning environment in terms of their age groups
- To investigate pedagogical knowledge of lower secondary science teachers for creating a learning environment in terms of their teaching service
- To investigate pedagogical knowledge of lower secondary science teachers for creating a learning environment in terms of gender

Research Questions

- To what extent do the lower secondary science teachers possess pedagogical knowledge for creating learning environment?
- What is the variation in the pedagogical knowledge for creating a learning environment in terms of their age groups?
- What is the variation in the pedagogical knowledge for creating a learning environment in terms of their teaching service?
- What is the variation in the pedagogical knowledge for creating a learning environment in terms of gender?

Definitions of Key Terms

Pedagogical Knowledge

- Pedagogical knowledge is a generic form of knowledge that involves knowledge about techniques or methods to be used in the classroom; the nature of the target audience; and strategies for evaluating student understanding (Koehler, 2011).
- In this study, the teachers' pedagogical knowledge is defined as the knowledge possessed by a primary science teacher that deals with creating learning environment.

Learning Environment

- Learning environment is the social, physical, psychological, and pedagogical contexts in which learning occurs and which affect student achievement and attitudes (Fraser, n.d.).
- In this study, learning environment refers to an environment experienced or perceived by teachers that supports positive learning outcomes. Creating an effective learning environment involves creating a physical learning environment, a social learning environment and a pedagogical learning environment.

Theoretical Framework of the study

Teachers' Pedagogical Knowledge

Pedagogical knowledge is a generic form of knowledge that involves in all issues of students' learning, classroom management, lesson plan development and implementation, and student evaluation. It includes knowledge about techniques or methods to be used in the classroom; the nature of the target audience; and strategies for evaluating student understanding. A teacher with deep pedagogical knowledge understands how students construct knowledge and acquire skills; develop habits of mind and positive dispositions towards learning (Koehler, 2011).

Pedagogical knowledge includes generic knowledge about how students learn, teaching approaches, methods of assessment and knowledge of different theories about learning (Harris et al., 2009; Shulman, 1986, cited in Wikipedia, 2012).

According to McNell and Wiles (1990), pedagogical knowledge, the principles and practices of teaching, is essential to the teacher. It incorporates the ability to plan lessons and units, to organize and manage the classroom, to use teaching strategies effectively and to test and grade students.

Physical Learning Environment

Studies about student academic achievement and building condition conclude that the quality of the physical environment significantly affects student achievement. "There is sufficient research to state without equivocation that the building in which students spends a good deal of their

time learning does in fact influence how well they learn" (Earthman, 2004, cited in Victorian Institute, n.d.).

A teacher has a responsibility for creating a space that reflects the learning goals of the work space, the personality, interests, and age of the students who learn there, and to create a space that is a comfortable and productive learning environment for all (Paula Rutherford, n.d, cited in Victorian Institute, n.d.). The physical environment directly influences teachers' and students' attitudes and their ability to perform. The teacher should assess the room arrangement and consider the following:

- Create enough space to move easily move throughout the classroom.
- Arrange desks to support the task at hand. For example, use clusters for group work and rows for test taking.
- Create an attractive, aesthetically pleasing environment by making sure the room is clean and uncluttered.
- Put up posters, pictures, and projects that reflect students' backgrounds, activities, and accomplishments.
- Post daily schedules in a place where students can read them easily.

According to Jones (2007) and Savage (1999), the classroom environment has proven to change and influence behaviors among students. The design of the classroom allows for some activities to take place and for others to not. It is important that teachers take into consideration the influence their classroom arrangement that can make on their students.

According to Julie McLaughlin (n.d.), every teacher knows that a safe, clean, comfortable and attractive classroom can stimulate learning and help build a classroom community. But for many teachers, setting up the physical environment of their classrooms can be quite daunting, especially when faced with older buildings, crowded classrooms and an insufficient storage space.

The research on classroom environments suggests that classrooms should be organized to accommodate a variety of activities throughout the day and to meet the teacher's instructional goals (Savage, 1999; Weinstein, 1992, cited in Kaser, n.d.). In addition, the classroom should be set up to set the

stage for the teacher to address the academic, social, and emotional needs of students (MacAulay, 1990, cited in Kaser, n.d.).

The physical environment has both a direct and indirect influence on the kind of learning that takes place. Many on otherwise well-planned lesson has failed because of the environment. According to Cain and Evans (1984), there are three areas in the physical learning environment that the teachers take into consideration. They are:

1. Physical Factors – lighting, room temperature, desk size, and distracting noises and sights
2. Classroom arrangements – physical furnishings and grouping of students
3. Organization and storage of materials and equipment.

However important physical arrangement of the classroom is, the heart and soul of science teaching is classroom management. Even if the teacher has a well thought out science program, a carefully planned physical classroom, and adequate supplies, the one thing that can wreck his teaching is faulty classroom management, sometimes called discipline (Carin and Sund, 1985).

Effective classroom management is an important part of teaching. It involves a set of complex behaviors used to promote and maintain a proper environment in the classroom so that effective instruction can occur. Management and instruction go hand in hand; effective management is essential to doing a good job of instruction (Carin and Sund, 1985). According to Hoy & Hoy (2006), the aim of classroom management is to maintain a positive, productive learning environment, relatively free of behavior problems. Effective classroom management is an important part of teaching. It involves a set of complex behaviors used to promote and maintain a proper environment in the classroom so that effective instruction can occur. Management and instruction go hand in hand; effective management is essential to doing a good job of instruction. So, the teachers should: Organize Routine Activities,

Keep Contact with Students during a Lesson
Give Encouragement and Praise
Introduce Rules of Conduct
Control Noise Levels.

Social Learning Environment

A social learning environment is a place where individuals can work and learn together collaboratively (both formally and informally) with others - in course groups, study groups or in project and team spaces (Hart, 2009).

Recent research has indicated that the various dimensions of the classroom social environment are separate, can be measured quickly and reliably, and relate significantly to students' motivation, self-regulated learning, classroom behavior (both positive and negative), social relationships, and achievement (Patrick & Ryan, 2003).

The emphasis on the importance of the classroom social environment, including support, mutual respect, task-related interaction among students, and a lesser focus on competition among students, is apparent in reform recommendations. For example, the National Science Education Standards include explicit reference to teachers creating a social and intellectual environment with support, respect, and collaboration as central features (National Research Council, 1996, cited in Patrick & Ryan, 2003).

Vygotsky (1962), a Russian teacher and psychologist, first stated that we learn through our interactions and communications with others. Vygotsky (1962) examined how our social environments influence the learning process. He suggested that learning takes place through the interactions students have with their peers, teachers, and other experts. Consequently, teachers can create a learning environment that maximizes the learner's ability to interact with each other through discussion, collaboration, and feedback (Neff, n.d.).

Cooperative learning is a type of structured peer interaction emphasizing positive human relationships, collaboration between peers, active learning, academic achievement, equal participation, and equal status of students in the classroom (Kagan, 1999).

According to Dr. Spencer Kagan (1999), cooperative learning also increases one's self-esteem, social skills, and study skills. It teaches student empathy and builds social relationships. It not only makes a student like the school, class, lesson plans, the teacher but also teaches them to be more responsible, creating a sense in them that they do make a difference.

Moreover, in working in groups students learn to work with and understand others who differ from themselves.

Teachers also need to know about parental involvement in children's education in order to contribute to students' development and growth effectively. According to White (2009), a key to children doing well in school is for parents to be involved in their education. Research shows students achieve more in school when their parents are engaged in their education. Children whose parents are involved generally have higher grades and test scores as well as more positive attitudes and behaviors.

Pedagogical Learning Environment

A pedagogical learning environment makes students more interactive in the learning process. This environment lets students collaborate among them in order to construct their knowledge as much as possible and to find solutions of many problems that occur during learning (Balla, 2009).

Teaching science is very important because it is a part of our daily life. Everything we do in life and deal with has to do with science (Rios, 2009).

Science instruction becomes more relevant to students when it is taught within the context of everyday life along with what takes place in the science laboratory. Science course content must include practical as well as theoretical ideas if it is to be meaningful to students. Instruction that focuses on student interest, common events, invention and social problems can make science courses more useful to young people, which in turn may make them more interested in science and technology (Collette and Chiappetta, 1989).

Science should be taught so that students can view it as a dynamic activity rather than a static, uninteresting enterprise. Science instruction should not be limited to common, routine instructional activities-lecture, cookbook laboratory exercise, and testing. It should involve inquiry activities that go beyond classroom walls to give students a broader view of science and make science more meaningful and exciting (Collette and Chiappetta, 1989).

To be successful in science teaching, teachers must be able to make their oral presentations interesting and meaningful to their students. The science teacher must be sensitive to how students receive the information he

conveys through the lecture method. Students can receive information either by rote or in a meaningful way (Ausubel, 1961, cited in Collette and Chiappetta, 1989).

Some teachers think the lecture method is an efficient way to teach a large group of students. Lectures must be well-planned, well-delivered, and of limited duration. Teachers who use the method well are those who deliver short, effective presentations. Lectures that lost an entire class period can cause students to be inattentive, bored, and mischievous, resulting in classroom management problems.

Teaching science through inquiry provides students opportunities to develop a knowledge base that they construct through their own efforts (Collette and Chiappetta, 1989). The Five E instructional model progresses through five phases that begin with the letter "E": engage, explore, explain, elaborate, and evaluate. inquiry and inquiry-based strategies are vital for increasing elementary school students' love and enthusiasm for science. These methods encourage and enhance their natural curiosity and motivation for learning and connect science to students' everyday life. Inquiry and inquiry-based strategies helps students to develop a deeper understanding of science and create new scientific discoveries (Bybee et al., 2006, cited in Spencer and Walker, n.d.)

Effective teaching requires teachers to check continuously the development of students' understanding and give detailed positive feedback in order to make sure that students correctly integrate new knowledge into the existing knowledge structure (Ducan & Dunn, 1988). According to Carin & Sund (1985), there are three main types of evaluation approaches: diagnostic, formative and summative.

Methodology

Sample

This study investigated the lower secondary science teachers' pedagogical knowledge for creating a learning environment in the selected schools in Kyaiklat Township, Ayeyarwady Region. A convenience random sampling method was used in selecting the sample. (110) lower secondary

science teachers from (30) Basic Education Schools in Kyaiklat Township were requested to participate in this study.

Instrumentation

Research instrument is a tool for gathering data concerning the research focus. The instrument was conducted based on the review of related literature. This instrument including indicators was developed to assess the lower secondary science teachers' pedagogical knowledge for creating a learning environment. The questionnaire was divided into two parts. The first was to collect the demographic information concerning gender, age, rank, education level, school, teaching experience, class and subject he or she teaches, subjects they can teach well and training course they have attended. The second included pedagogical knowledge indicators: 34 true-false items, 6 multiple-choice items and 5 open-ended questions.

Before pilot study, instrument was reviewed by a panel of experienced teachers. For the questionnaire validation, the advice and guidance were taken from teacher educators who had special knowledge and experience in this field of study. Teacher educators were from Yangon University of Education. They were a Professor, three Lecturers, and five Assistant Lecturers from the Department of Educational Theory, Yangon University of Education. Questionnaires were distributed to these teacher educators on 3rd January, 2013. And then, the items were modified in accordance with the result of teacher educators' responses.

The modified instrument was used to find out the reliability in the pilot study by investigating (20) lower secondary level teachers. To measure the reliability of questionnaire, the Split-half method was used. In the pilot study, the internal consistency of the questionnaire was 0.88.

Procedure

First and foremost, relevant literature was explored. Next, the instrument was constructed in order to collect the required data. The pilot study was undertaken to refine the developed questionnaire. The pilot produced evidence of the validity and reliability of the measure. After receiving the permission from the Director General of DBE-1 (Department of Basic Education No.1) to do the research in Kyaiklat Township, Ayeyarwady

Region, (110) sets of questionnaire were distributed to lower secondary science teachers in Kyaiklat Township on 23rd and 24th January, 2013. After one week later, these questionnaires were recollected and the respondent rate was 100%.

Data Analysis

The Statistical Package for the Social Science (SPSS) version (16) was used to analyze the quantitative data. Descriptive analysis was used to tabulate means and standard deviations for groups of items. Furthermore, the two statistics namely, IPC and MPC values were used to indicate the lower secondary science teachers' pedagogical knowledge for creating a learning environment. IPC refers to the items percent correct attained by all lower secondary science teachers on all items. MPC refers to the average percent correct attained by all lower secondary science teachers on all items.

$$\text{IPC} = \frac{\text{Number of teachers correctly answered the item}}{\text{Total numbers of teachers}} \times 100$$

$$\text{MPC} = \frac{\text{Total IPC values for all items}}{\text{Total Numbers of items}}$$

Scores in the test are used to describe the lower secondary science teachers' pedagogical knowledge for creating a learning environment. The participant teachers will get (1) mark on each item if they can correctly answer. The scoring range for true-false items and multiple-choice items is that the value less than 50% was considered as a little knowledge regarding creating learning environment and the value greater than 50% was considered sound knowledge for creating learning environment. Based on the IPC values, MPC values were calculated. The MPC value formulated the extent of lower secondary science teachers' pedagogical knowledge for creating a learning environment.

Mean values were used to investigate the differences of pedagogical knowledge regarding creating a learning environment among lower secondary science teachers in terms of their age, teaching service and gender. The level range for the mean percent is that 1% to 49% was considered as 'unsatisfactory', 50% to 74% was considered as 'fairly satisfactory' and 75% to 100% was considered as 'satisfactory'.

In open-ended questions, the same responses of each item were collected to investigate the participants' opinions for creating a learning environment. Besides, the number and percentage of each response were calculated to investigate their pedagogical knowledge for creating a learning environment.

This portion has provided the outlines of method and procedure. The next portion will present the research findings from questionnaire survey.

Findings

Quantitative Findings

Findings on the extent of the lower secondary science teachers' pedagogical knowledge for creating a learning environment

To investigate the lower secondary science teachers' pedagogical knowledge for creating a learning environment, the value of IPC for each item and MPC value for each group were calculated. These values formulated the extent of lower secondary science teachers' pedagogical knowledge for creating a learning environment.

Mean Percent Correct (MPC) Values Showing the Extent or Level of Pedagogical Knowledge of Participant Teachers

Contents	MPC (%)	Level
Physical learning environment	93.26%	Satisfactory
Social learning environment	93.11%	Satisfactory
Pedagogical learning environment	81.95%	Satisfactory
Overall	**89.44%**	**Satisfactory**

Scoring Direction: 1%to 49 %= Unsatisfactory, 50 %- 74% = Fairly Satisfactory and 75% - 100% = Satisfactory

The overall MPC value rated by the participant teachers was (89.44%). Therefore, it can be said that the participant teachers had satisfactory level of pedagogical knowledge for creating a learning environment.

The Variation of Pedagogical Knowledge Scores of Lower Secondary Science Teachers Grouped by Age, Teaching Service and Gender

To know the variation of pedagogical knowledge scores of lower secondary science teachers for creating a learning environment, mean values, standard deviations and mean percent values were analyzed.

The Variation of Pedagogical Knowledge Scores of Lower Secondary Science Teachers Grouped by Age (N=110)

Age Groups	Pedagogical Knowledge Score		Level
	Mean (SD)	Mean Percent Value	
20-29 years **(N=33)**	34.63 (1.85)	86.57%	Satisfactory
30-39 years **(N=38)**	35.15 (2.42)	87.87%	Satisfactory
40 years & above **(N=39)**	34.89 (2.09)	87.22%	Satisfactory

Scoring Direction: *1%to 49 %= Unsatisfactory, 50 %- 74% = Fairly Satisfactory and 75% - 100% = Satisfactory*

(30 - 39) years of age group had the highest pedagogical knowledge regarding creating learning environment among the age groups. Besides, (40 and above) years of age group had more pedagogical knowledge than (20 - 29) years of age regarding creating learning environment. Otherwise, (20 - 29) years of age group had the lowest pedagogical knowledge regarding creating a learning environment among the three groups.

The Variation of Pedagogical Knowledge Scores of Lower Secondary Science Teachers Grouped by Teaching Service (N=110)

Teaching Service	Pedagogical Knowledge Score		Level
	Mean (SD)	Mean Percent Value	
6 years & below **(N=26)**	34.27 (2.03)	85.67%	Satisfactory
7-12 years **(N=32)**	35.40 (2.09)	88.50%	Satisfactory
13-18 years **(N=39)**	35.42 (1.74)	88.55%	Satisfactory
19years & above **(N=28)**	34.50 (2.43)	86.25%	Satisfactory

Scoring Direction: *1%to 49 %= Unsatisfactory, 50 %- 74% = Fairly Satisfactory and 75% - 100% = Satisfactory*

Teaching service (13 - 18) years group had the highest pedagogical knowledge regarding creating a learning environment among the four teaching service groups. Besides, (7 - 12) years of experience group had more pedagogical knowledge than (6 & below) and (19 & above) years of experience regarding creating a learning environment. According to the data presented in this table, (6 & below) years of experience group had the lowest pedagogical knowledge regarding creating a learning environment among the four groups.

The Variation of Pedagogical Knowledge Scores of Lower Secondary Science Teachers Grouped by Gender (N=110)

Gender	Pedagogical Knowledge Score		Level
	Mean (SD)	Mean Percent Value	
male **(N=9)**	35.89 (1.27)	89.73%	Satisfactory
female **(N=101)**	34.82 (2.18)	87.05%	Satisfactory

Scoring Direction: 1%to 49 %= Unsatisfactory, 50 %- 74% = Fairly Satisfactory and 75% - 100% = Satisfactory

Male group had more pedagogical knowledge than female group regarding creating a learning environment.

Responses of Open-ended Questions

The lower secondary level science teachers from the selected schools responded the open-ended questions that deal with creating a learning environment. The participant teachers suggested the item dealing with "What opportunities do you create for your students to develop natural curiosity and creative thinking?" that the teacher should:

1. make students participate actively in activity (N = 15, 13.64%)
2. make students do hands-on activities (N = 25, 22.73%)
3. give guidance to students to observe the environment (N = 13, 11.18%)
4. allow students to express their ideas frankly (N = 9, 8.18%)
5. make students manipulate real objects, then create similar things (N = 5, 4.54%)
6. allow students to do teaching aids together (N = 17, 15.45%)
7. give activities based on individual students (N = 2, 1.81%)
8. encourage students' investigation (N = 10, 9.09%)
9. observe the environment with students (N = 1, 0.9%)
10. make students participate in lessons (N = 3,2.72%)
11. accept students' opinions (N = 2, 1.81%)
12. teach students without giving facts directly (N = 2, 1.81%)
13. make students observe the environment, then discuss among groups (N = 5, 4.54%)
14. use child-centered approach (N = 1, 0.9%)

The participant teachers responded the item concerning "How do you create your students to participate actively in teaching science?" that the teacher should:

1. allow students to discuss among groups (N = 20, 18.18%)
2. teach lesson by giving hands-on activities (N = 19, 17.27%)

3. teach by using teaching aids (N = 16, 14.54%)
4. make students observe the environment, then discuss among groups (N = 5, 4.54%)
5. supervise students by giving activities (N = 6, 5.45%)
6. link the lessons with daily lives (N = 21, 19.09%)
7. tell students the aims of teaching science (N = 1, 0.9%)
8. make students participate in lessons (N = 5, 4.54%)
9. find out real objects needed for the lesson with students (N = 3, 2.72%)
10. take real objects into the classroom, then create opportunities to do hands-on activities (N = 6, 5.45%)
11. teach students to get scientific knowledge (N = 1, 0.9%)
12. allow students to manipulate equipments (N = 5, 4.54%)
13. cooperate with students (N = 1, 0.9%)
14. organize competitions and discussion among groups (N = 1, 0.9%)

The participant teachers suggested the item dealing with "How do you create all students to discuss with self-confidence in your classroom?" that the teacher should:

1. make students participate in lessons (N = 6, 5.45%)
2. allow students to express their ideas frankly (N = 19, 17.27%)
3. link the lessons with daily lives (N = 5, 4.54%)
4. make students do experiment (N = 10, 9.09%)
5. make each student participate in the activity (N = 8, 7.27%)
6. accept students' answers whether they are right or wrong, and give guidance to get correct answer (N = 23, 20.91%)
7. make students discuss in all teaching-learning processes (N = 11, 10%)
8. praise students' activities (N = 15, 13.64%)

9. create opportunities for students to observe their environment and develop explanations from observation (N = 5, 4.54%)
10. train students to be able to discuss by asking easy to difficult questions (N = 2, 1.81%)
11. treat students fairly (N = 2, 1.81%)
12. make students observe themselves (N = 2, 1.81%)
13. interact with each student (N = 2, 1.81%)

The participant teachers responded the item concerning "How do you create your students who are whispering with each other, not interested in teaching, and gazing outside the classroom to get attention?" that the teacher should:

1. make students participate actively in activity (N = 7, 6.36%)
2. ask questions related to the lessons (N = 32, 29.09%)
3. organize competitions and discussion among groups (N = 13, 11.81%)
4. attract with interested manner (N = 7, 6.36%)
5. teach with humor (N = 5, 4.54%)
6. attract students by telling stories (N = 6, 5.45%)
7. make students stand up at a moment and ask short questions, then tell them to sit down and teach lesson (N = 2, 1.81%)
8. cooperate with students in experiments (N = 3, 2.72%)
9. interact with each student (N = 5, 4.54%)
10. make students do hands-on activities (N = 18, 16.36%)
11. give activities to the students (N = 8, 7.27%)
12. teach lessons to be interested (N = 3, 2.72%)
13. make them discuss the lessons (N = 1, 0.9%)

The participant teachers suggested the item dealing with "How do you perform for students as a scientific facilitator?" that the teacher should:

1. use teaching aids and real objects (N = 12, 10.90%)
2. prepare teaching aids that are consistent with lessons (N = 18, 16.36%)
3. help students' needs (N = 7, 6.36%)
4. guide students to reach the right answer although their expressions are wrong

   (N = 2, 1.81%)
5. link the lessons with daily lives (N = 5, 4.54%)
6. encourage students to increase natural curiosity and creative thinking without teaching textbook only (N = 2, 1.81%)
7. create opportunities for students to investigate themselves (N = 6, 5.45%)
8. help students to get the abilities to observe, think creatively and increase conducting experiments increase (N = 2, 1.81%)
9. collect real objects, scientific books and journals (N = 13, 11.81%)
10. make students read scientific books (N = 6, 5.45%)
11. master in subject matter (N = 14, 12.72%)
12. make students do experiments (N = 9, 8.18%)
13. find out real objects as possible (N = 5, 4.54%)
14. nurture students' abilities to observe the environment to be increased

    (N = 2, 1.81%)
15. cooperate with students in experiments (N = 2, 1.81%)
16. make students observe the school environment (N = 5, 4.54%)

Summary of Findings

According to the quantitative study, the answers for research questions were described as follows:

- To what extent do the lower secondary science teachers possess pedagogical knowledge for creating learning environment?

  According to MPC values, the extent of pedagogical knowledge possessed by the lower secondary science teachers was satisfactory level regarding creating a learning environment.

- What is the variation in the pedagogical knowledge for creating a learning environment in terms of their age groups?

  The variation in pedagogical knowledge of lower secondary science teachers for creating a learning environment in terms of age groups was regarded that (30-39) years of age group had more pedagogical knowledge among three groups.

- What is the variation in the pedagogical knowledge for creating a learning environment in terms of their teaching service?

  The variation in pedagogical knowledge of lower secondary science teachers for creating a learning environment in terms of their teaching service was regarded that teaching service (13-18years) group had more pedagogical knowledge among four groups.

- What is the variation in the pedagogical knowledge for creating a learning environment in terms of gender?

  The variation in pedagogical knowledge of lower secondary science teacher for creating a learning environment in terms of gender was regarded that male group had more pedagogical knowledge than female group.

Conclusion and Discussion

Regarding lower secondary science teachers' pedagogical knowledge for creating a learning environment, the overall MPC value is 89.44% and thus, it can be concluded that the participant teachers had satisfactory level of pedagogical knowledge for creating a learning environment.

According to the participants' age groups, (30-39) years of age group had the highest mean percent value (87.87%) and (20-29) years of age group had the lowest mean percent value (86.57%).Therefore, it is assumed that

(30-39) years of age group had the highest pedagogical knowledge in creating a learning environment than the other two groups.

Among the four teaching service groups of respondents, teaching service (13-18 years) group had the highest mean percent value (85.55%) and teaching service (6 years and below) group had the lowest mean percent value (85.67%). And hence, teaching service (13-18 years) group had the highest pedagogical knowledge among four groups.

According to gender, the mean percent value (89.73%) of male was more than that of female (87.05%). So, male group had more pedagogical knowledge than female group.

Based on the analyses of the survey, the following suggestions were drawn to be effective in creating a learning environment of lower secondary science teachers.

- As the teacher's ability of creating a learning environment is critical element in teaching-learning process, it is necessary to enhance the teachers' pedagogical knowledge for creating a learning environment.
- To improve the teachers' pedagogical knowledge of learning environment, the teacher education system which includes pre-service, induction and in-service training should be reviewed to be more effective and adaptive.
- Teacher educators need to learn what kind of pedagogical knowledge and actual practices that deal with creating a learning environment should be reinforced for the lower secondary science teachers in order to improve students' learning achievement.
- The teachers and policy makers should emphasize teacher training programs in order to strengthen lower secondary science teachers' pedagogical knowledge for creating a learning environment.
- School principals should encourage teachers to see the concept of creating a learning environment as a priority area for student achievement.
- A suitable professional development program should provide for teachers to have a broad knowledge of creating a pedagogical learning environment.
- Teacher educators should collaboratively put effort in developing the teacher manuals which enhance the development of teachers' pedagogical knowledge regarding creating the learning environment.

Need for Further Research

This study intended to study the pedagogical knowledge of lower secondary science teachers for creating a learning environment. The following are recommendations for additional research. In this study, the lower secondary science teachers were sampled from Kyaiklat Township, Ayeyarwady Region. It is necessary to investigate the lower secondary science teachers' pedagogical knowledge for creating a learning environment from schools in other townships, states and regions to represent the whole country.

Moreover, further study should be carried out through the pedagogical knowledge of other levels of teachers. And then, there is a need for further research to investigate the extent to which principals can support teachers to create a learning environment. This study was based on three areas; physical learning environment, social learning environment and pedagogical learning environment in creating a learning environment. Therefore, for the improvement of teacher education system, further studies needed to explore teachers' pedagogical knowledge in different areas of learning environment.

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