Teachers' Strategies For Developing Metacognitive Behaviors And Ability To Facilitate Learning In Relation To Students' Level of Cognition In Biology

Nisnisan, Bienvenida
Lala National High School
nis_bien@yahoo.com

Abstract: Identification of teachers' strategies for developing metacognitive behaviors and ability to facilitate learning in relation to the students' level of cognition in Biology was conducted. Descriptive method of research was employed with the questionnaires for teachers and department heads and test for the students in cognition as data gathering tools. Results revealed that the teachers were effective in developing students' metacognitive behaviors in terms of identifying what students know; talking about thinking; planning and self-regulations; debriefing the thinking process; and self-evaluation. Statistical analysis using t-test revealed that a significant difference exists between the perceptions of the department heads and teachers on the effectiveness of teachers' in developing students' metacognitive behaviors in terms of identifying what students know; talking about thinking; planning and self-regulation; debriefing the thinking process and self-evaluation. Most of the teachers have satisfactory level of abilities in facilitating learning in terms of setting up the learning environment; activating prior learning; reinforcing the learning using a variety of approaches and engaging learners in a dialogue. It was also found out that majority of the students have fair level of knowledge, comprehension, application, analysis, synthesis and evaluation indicating that the students fairly achieved the knowledge competencies in Biology. A significant relationship exists between the teachers strategies in developing metacognitive behaviors of the students in terms of (a) identifying what students know and students' comprehension, application, analysis, synthesis and evaluation cognition levels; (b) talking about thinking and students' knowledge, comprehension, analysis, and synthesis cognition levels; (c) planning and self-regulation and students' application cognition level; (d) debriefing about thinking process and self-evaluation and students' knowledge, comprehension, application, analysis and synthesis cognition levels. The results indicate that the teachers' reinforcing of the students' learning affects the students' cognitive levels in Biology.

Key Words: strategies, metacognitive behaviours, facilitate learning, level of cognition in Biology

1. INTRODUCTION

1.1 Background of the Study

Science teachers often reflect on the content they are going to teach, and to what extent do science teachers think reflectively about the pedagogy they use to teach specific scientific concepts and skills.

1

To teach science successfully, teachers can use their metacognitive or high level thinking about what, why and how they teach in order to manage and regulate their teaching so that it meets the needs of their students.

In addition, to help students learn science effectively, teachers can develop their students' use of metacognition as they gain awareness and control over themselves as learners.

According to Livingston (1997), metacognition is one of the latest buzz words in educational psychology. The length and abstract nature of the word makes it sound intimidating, yet it is not as daunting a concept as it might seem. Every individual engages in metacognitive activities every day. Metacognition enables an individual to be successful learners. It refers to highest order thinking which involves active control over the cognitive processes engaged in learning.

Activities such as planning how to approach a given learning task, monitoring comprehension, and evaluating progress toward the completion of a task are metacognitive in nature. Because metacognitive plays a critical role in successful learning, it is important to study metacognitive activity and development to determine how students can be taught to better apply their cognitive resources through metacognitive control.

According to Roberts, (1993), metacognition involves overseeing whether a cognitive goal has been met. This is the defining criterion for determining what is metacognitive. Cognitive strategies are used to help an individual achieve a particular goal. (e.g., understanding a text) while metacgnitive strategies are used to ensure that the goal has been reached (e.g., quizzing oneself to evaluate one's understanding of that text). Metacognitive experiences usually precede or follow a cognitive activity. They often occur when cognitions fail, such as the recognition that one did not understand what one just read. Such an impasse is believed to activate metacognitive processes as the learner attempts to rectify the situation.

Metacognition enables students to benefit from instruction (Carr, Kurtz, Schneider, Turner & Borkowski, 1989; Van Zile-Tamsen, 1996) and influences the use and maintenance of cognitive strategies. While there are several approaches on metacognitive instruction, the most effective involve providing the learner with both knowledge of cognitive processes and strategies (to be used as metacognitive knowledge), and experience or practice in using both cognitive and metacognitive strategies and evaluating the outcomes of their efforts (develops metacognitive regulation). Simply providing knowledge without experience or vice versa does not seem to be sufficient for the development of metacognitive control (Livingston, 1996).

Huitt (2004) presented revisions of the Bloom's taxonomy of cognitive domain of learning which consists of six aspects, namely: knowledge, comprehension, application, analysis, synthesis and evaluation.

In teaching Biology, teachers have experiences relating to metacognition in teaching and students' learning science. It is the direction of the present r4esearcher to study about metacognition in teaching Biology and students' learning in the subject.

The level of teachers' ability to facilitate learning was assessed in terms of setting the learning environment, activating prior knowledge, reinforcing the learning using a variety of approaches, and engaging learners in a dialogue.

The students' level of cognition was determined in terms of knowledge, comprehension, application, analysis, synthesis and evaluation.

This study focused on determining the teachers' strategies for developing metacognitive behaviors; ability to facilitate learning among the students and the students' level of cognition among second year students in Biology in the Division of Lanao del Norte. The level of effectiveness of teachers in their strategies for developing metacognitive behaviors of the students was measured in terms of identifying what the students know; talking about thinking; planning and self-regulation; debriefing the thinking process and self-evaluation.

2. METHODOLOGY

2.1 Research Design

The descriptive method of research was utilized in this study The questionnaires served as data gathering tools. Data gathered were treated with frequency, percentage, weighted means and t-test and chi-square tools for statistical problems.

2.2 Respondents of the Study

The respondents of the study were the department heads, second year teachers and second year students in Biology.

2.3 Research Instrument

The researcher-constructed questionnaires were used as data gathering instruments. The questionnaire for the department heads and teachers is composed of two parts. Part I addresses their perceptions on the effectiveness of teachers' strategies in developing metacognitive behaviors of the students; and Part II deals with the teachers' ability to facilitate learning while the questionnaire for the students is the summative test in biology which evaluated their cognitive aspects in terms of knowledge, comprehension, application, analysis, synthesis and evaluation. The perceptions of the department heads and teachers on the effectiveness of teachers' strategies for developing metacognitive behaviors of students were analyzed and interpreted using the following continuum:

Continuum	Responses	Interpretation
4.50 – 5.00	Always	Very Effective
3.50 – 4.49	Often	Effective
2.50 – 3.49	Sometimes	Fairly Effective
1.50 – 2>49	Rarely	Less Effective
1.00 – 1.49	never	Not Effective

The perceptions of the department heads and teachers on the teachers' ability to facilitate learning were analyzed and interpreted using the following continuum:

Continuum	Interpretation
4.50 – 5.00	Very Satisfactory
3.50 – 4.49	Satisfactory
2.50 – 3.49	Fair
1.50 – 2.49	Poor
1.00 – 1.49	Very Poor

The cognitive learning of the students in terms of knowledge, comprehension and application was analyzed and interpreted using the following continuum:

Scores	Interpretation
13 – 15	Very Satisfactory
10 – 12	Satisfactory
7 - 9	Fair
4 - 6	Poor
1 - 3	Very Poor

The cognitive learning of the students in terms of analysis, synthesis and evaluation was analyzed and interpreted using the following continuum:

Scores	Interpretation
9 – 10	Very Satisfactory
7 – 8	Satisfactory
5 - 6	Fair
3 - 4	Poor
1 - 2	Very Poor

2.4 Validation of the Instruments

In coming up with the items and indicators of the questionnaires, the researcher gathered suggestions from the department heads as to the aspects of metacognitive behaviors and facilitating learning of the students especially in science instruction.

In improving the questionnaire, instrument validation was employed. The questionnaire was tried out to selected department heads and teachers who were not respondents of the study in selected district of Lanao del Norte Division. Opinions were again considered in finalizing the questionnaire. In determining the performance of the students in Biology, the summative test was based on the six taxonomy of learning objectives by Bloom and Learning Competencies of the Secondary curriculum. The test items were selected from the test papers of the past two years and collected from the teachers handling the Biology subject.

2.5 Data Gathering Procedure

Before gathering the data needed in this study, permission was sought from authorities. When the permit was issued to her, she approached each school head regarding her intent, that she be assisted in the distribution and retrieval of the questionnaire. When all permits are sought and granted to her, the researcher did the actual data-gathering process.

When accomplished questionnaire sets were all collected, tallying of responses was made. After tabulating the data, analysis and interpretation followed.

2.6 Statistical Treatment

The following statistical tools were used to analyze and interpret the data:

Percentage was used to determine the proportion of each category or variable used.

Average weighted mean was computed to describe the perceptions of the department heads and teachers on the effectiveness of teachers' strategies for developing metacognitive behaviors of students and teachers' ability to facilitate learning.

The t-test tool was utilized to test the significance of the difference between the perceptions of the department heads and teachers on the effectiveness of the teachers' strategies for developing metacognitive behaviors of students and teachers' ability to facilitate learning.

Chi-square tool was used to test the significant relationship between the variables.

3. RESULTS AND DISCUSSION

3.1 Effectiveness of teachers in Developing Students' Metacognitive Behaviors as Perceived by the Department Heads and Teachers

Identifying What the Students Know. Generally, the department heads gave a rating of 4.13 weighted mean which signifies that they described their teachers as effective in identifying what their students' knowledge in science and technology II (Table 1) The same level of perceptions was noted by most of the teachers when the weighted mean of their responses is 4.26, indicating that they described themselves as effective in this aspect of metacognitive processes.

Determining the knowledge base of the students is imperative if the teachers would like to predetermine what are the needs and strengths of the students. This will serve as their diagnostic to students' level of capability.

Table 1. Effectiveness of Teachers in Developing Students' Metacognitive Behaviors in Terms of Identifying What Students Know

Statements	Dept.Heads		Teachers	
	AWV	I	AWV	I
1. Ask students what they know about a research topic.	3.93	E	4.06	E
2. Identify what the students want to learn about	4.13	E	4.47	E
3. Teach students how to verify /clarify information or data	4.13	E	4.29	E
4. Teach students how to expand topic by giving guide questions	4.27	E	4.29	E
5. Ask students to replace or given data & reliable information or data.	4.20	E	4.18	E
Weighted Means	**4.13**	**E**	**4.26**	**E**

With the learning of how far the students have accomplished and achieved their educational goals in the previous instruction will give the teachers ideas and insights on how to address the difficulties and weaknesses of their students. Instructional strategies and approaches can be curved and fitted into the learning capabilities of the students.

Talking about Thinking. The perceptions of the department heads resulted to a weighted mean of 4.36 which is interpreted as "effective." This is in consonance with the perceptions of the teachers which is interpreted as "effective." The teachers were effective in talking about thinking as a means of developing their students' metacognitive behaviors.

The teachers were effective in giving a summary or points of clarification of the discussion and likewise guiding the students on giving their own summary of the discussion.

Table 2. Effectiveness of Teachers in Developing Students' Metacognitive Behaviors in Terms of Talking about Thinking

Statements	Dept.Heads		Teachers	
	AWV	I	AWV	I
1. Clarify & summarize the materials given for discussion	4.27	E	4.29	E
2. See to it that students follow demonstrated thinking process	4.27	E	4.18	E
3. Unlocks terms & improve' vocabulary on the topic discussed	4.67	VE	4.41	E
4. Establish small groups of students whereby giving each an opportunity to take roles as teacher& students	4.20	E	4.35	E
5. In established small groups encourage, the students to ask questions.	4.40	E	4.41	E
Weighted Means	**4.36**	**E**	**4.33**	**E**

Planning and Self-Regulation. The data show that both department heads and teachers are effective in developing metacognitive behaviors of their students in terms of planning and self-regulation (Table 3).

The data show that the school heads and the teachers were effective in developing students' metacognitive behaviors in terms of planning and self-regulation.

Table 3. Effectiveness of Teachers in Developing Students' Metacognitive Behaviors in Terms of Planning and Self-Regulation

Statements	Dept.Heads		Teachers	
	AWV	I	AWV	I
1. Teach students to plan for learning activities.	4.27	E	4.29	E
2. Teach students how to make estimate time requirements for each activity to be to be undertaken.	4.00	E	4.06	E
3. Teach students how to organize materials that are needed to undertake their activities	4.33	E	4.29	E
4. Illustrate how to schedule procedures and processes necessary to complete the activity to be carried out.	4.27	E	4.18	E
5. Develop criteria for evaluation of the activities with the students to develop their ability to think critically.	4.27	E	4.41	E
Weighted Means	**4.23**	**E**	**4.25**	**E**

Debriefing the Thinking Process. The data pointed out that the department heads and teachers described the teachers as effective which indicates that the teachers were effective in directing the students to analyze the data of an activity, in assisting them in the data collection on thinking process in an experiment. As students in science classes, they should be guided on how to develop their critical thinking processes.

Table 4. Effectiveness of Teachers in Developing Students' Metacognitive Behaviors in Terms of Debriefing the Thinking Process

Statements	Dept.Heads		Teachers	
	AWV	I	AWV	I
1. Guide students to review the activity.	4.40	E	4.41	E
2. Facilitate in the gathering of data on thinking processes & feelings.	4.07	E	4.41	E
3. Lead the students to classify related ideas,& identify thinking Strategies used.	4.13	E	4.41	E
4. Guide students in evaluating				

	success.	4.27	E	4.29	E
5. Facilitate in discarding inappropriate strategies, identifying valuable strategies for future use & seeking alternative approaches.		4.20	E	4.29	E
Weighted Means		**4.21**	**E**	**4.36**	**E**

Self-Evaluation. It can be noted that the teachers were effective in initiating guided self-evaluation activities. In science classes, the teachers have recognized the need to apply their learning in new situations and experiences, hence, giving them activities to relate their learning to new situations and applications.

Table 5. Effectiveness of Teachers in Developing Students' Metacognitive Behaviors in Terms of Self-Evaluation

Statements	Dept.Heads		Teachers	
	AWV	I	AWV	I
1. Introduce guided self-evaluation experiences.	4.13	E	4.41	E
2. Discuss the importance of individual conferences.	4.00	E	4.18	E
3. Discuss the use of checklist f ocusing on thinking processes as self-evaluation methods.	4 .13	E	4.18	E
4. Lead students to recognize that Learning activities in different discipline are similar.	4.13	E	4.41	E
5. Give activities to students applying learning strategies to new situations.	4.13	E	4.41	E
Weighted Means	**4.10**	**E**	**4.32**	**E**

3.2 Significant Difference between the Perceptions of the Department Heads and Teachers on the Teachers' Effectiveness in Developing Students' Metacognitive Behaviors

As shown (Table 6), there is no significant difference between the perceptions of the department heads and teachers on the effectiveness of teachers in

5

developing students' metacognitive behaviors in terms of identifying what students know. It can be deduced from the findings that the department heads have recognized the teachers' effectiveness in identifying the level of understanding of the students before presentation or discussion of the new lessons by soliciting the students' knowledge of the topic at hand.

Table 6. Difference Between the Perceptions of the Department Heads on the Teachers' Effectiveness in Developing Students' Metacognitive Behaviors in Terms of Identifying What Students Know

Statements	AMV	
	Dept. Heads	Teachers
1. Ask students what they know about a research topic.	3.93	4.06
2. Identify what the students want to learn about.	4.13	4.47
3. Teach students how to verify/ clarify information or data	4.13	4.29
4. Teach students how to expand topic by giving guide questions	4.27	4.29
5. Ask students to replace given information or data with more accurate & reliable information or data.	4.20	4.18
Weighted Means	**4.13**	**4.26**

It can be deduced from the findings that the department heads have recognized the teachers' effectiveness in identifying the level of understanding of the students before presentation of the new lessons by soliciting the students' knowledge of the topic at hand.

Table 7. Difference Between the Perceptions of the Department Heads on the Teachers' Effectiveness in Developing Students' Metacognitive Behaviors in Terms of Talking about Thinking

Statements	AMV	
	Dept. Heads	Teachers
1. Clarify & summarize the materials given for discussion.	4.27	4.29
2. See to it that students follow demonstrated thinking process	4.27	4.18
3. Unlocks terms & improve students' vocabulary on the topic discussed	4.67	4.41
4. Establish small groups of students whereby giving each an opportunity to take roles as teacher & students	4.20	4.41
5. In established small groups, encourage the students to ask question	4.40	4.41
Weighted Means	**4.36**	**4.33**

Ho: There is no significant difference between the perceptions of the department heads and teachers on the teachers' effectiveness in developing students' metacognitive behaviors in terms of talking about thinking.

Significance Test: t = .323   df = 8
                     cv = 1.860   p = .05

There is no significant difference between the perceptions of the department heads and teachers on the effectiveness of teachers in developing students' metacognitive behaviors in terms of talking about thinking (Table 7). The findings imply that the department heads were in consonance with the teachers' perceptions, that the latter were effective in utilizing small groups to encourage students to take roles as teachers and students within their group.

It can be seen in Table 8 that no significant difference exists between the perceptions of the department heads and teachers on the effectiveness of the latter in developing students' metacognitive behaviors in terms of planning and self-regulation.

Table 8. Difference Between the Perceptions of the Department Heads on the Teachers' Effectiveness in Developing Students' Metacognitive Behaviors in Terms of Planning and Self-Regulation

Statements	AMV	
	Dept. Heads	Teachers
1. Teach students to plan for learning activities.	4.27	4.29
2. Teach students how to make estimate time requirements for each activity to be to be undertaken.	4.00	4.06
3. Teach students how to organize materials that are needed to undertake their activities.	4.33	4.29

6

4. Illustrate how to schedule procedures
   and processes necessary to complete
   the activity to be carried out.   4.27   4.18

5. Develop criteria for evaluation of th
   e activities with the students to develop
   their ability to think critically   4.27   4.41

Weighted Means	4.23	4.25

Ho: There is no significant difference between the
perceptions of the department heads and teachers on the
teachers'   effectiveness   in   developing   students'
metacognitive behaviors in terms of planning and self-
regulation.
Significance Test: t = .194   df = 8
                           cv = 1.860   p = .05
          The data show that there is a significant
difference between the perceptions of the department
heads and teachers on the effectiveness of teachers in
developing students' metacognitive behaviors in terms of
debriefing the thinking process. The department heads
and teachers have differed in their perceptions on how
the teachers exert efforts in facilitating the students in
data gathering as well as in leading the students to
classify, organize related ideas and determine thinking
processes involved.

Table   9. Difference Between the Perceptions of the
Department Heads on the Teachers' Effectiveness in
Developing Students' Metacognitive Behaviors in Terms
of Debriefing the Thinking Process

Statements	AMV	
	Dept. Heads	Teachers
1. Guide students to review the activity	4.40	4.41.
2. Facilitate in the gathering of data on thinking processes& feelings.	4.07	4.41
3. Lead the students to classify related ideas & identify thinking strategies used .	4.13	4.41
4. Guide students in evaluating success.	4.27	4.29
5. Facilitate in discarding inappropriate strategies, identifying valuable strategies for future use & seeking alternative approaches	4.20	4.29

Weighted Means	4.21	4.36

Ho: There is no significant difference between the
perceptions of the department heads and teachers on the
teachers'   effectiveness   in   developing   students'
metacognitive behaviors in terms of debriefing the
thinking process..
Significance Test: t = 2.055   df = 8
                           cv = 1.860   p = .05
          There is a significant difference between the
perceptions of the department heads and teachers on the
effectiveness of teachers in developing students'
metacognitive behaviors in terms of self-evaluation. The
difference could be attributed to the fact that the
department heads have responses that yielded lower
average weighted values compared to the teachers
especially in the aspects of leading the students to
recognize that learning in different disciplines are
similar and giving activities to students applying
learning strategies to new situations.

Table   10. Difference Between the Perceptions of the
Department Heads on the Teachers' Effectiveness in
Developing Students' Metacognitive Behaviors in Terms
of Self-Evaluation

Statements	AMV	
	Dept. Heads	Teachers
1. Introduce guided self-evaluation experiences.	4.13	4.41
2. Discuss the importance of individual conferences.	4.00	4.18
3. Discuss the use of checklist focusing on thinking processes as self-evaluation methods.	4.13	4.18
4. Lead students to recognize that learning activities in different discipline are similar.	4.13	4.41
5. Give activities to students applying learning strategies to new situations.	4.13	4.41

Weighted Means	4.10	4.32

Ho: There is no significant difference between the
perceptions of the department heads and teachers on the
teachers'   effectiveness   in   developing   students'
metacognitive behaviors in terms of self-evaluation.
Significance Test: t = 2.314   df = 8

7

cv = 1.860   p = .05

It can be seen in Table 10 that there exists a significance difference between the perceptions of the department heads and teachers on the teachers' effectiveness in developing the students' metacognitive behaviors in terms of self-evaluation. The difference could be attributed to the fact that the department heads have responses that yielded lower average weighted values compared to the teachers especially in the aspect of learning the students to recognize that learning activities in different disciplines are similar and giving activities to students applying learning strategies to new situations.

Level of Teachers' Ability to Facilitate Learning As Perceived by the Department Heads and Teachers

Tables 11 to 15 present the perceptions of the department heads and the teachers.

Setting Up the Learning Environment> It is revealed in Table 11 that the teachers were trying their best to provide satisfactory level of learning environment. The teachers were cognizant of the relevance of positive and effective learning environment to the better achievement of the students.

In providing a conducive learning environment, the teachers must understand that students have the basic and moral rights for a safe, predictable and orderly learning environment.

Table 11. Teachers' Ability to Facilitate Learning Among Students in Terms of Setting Up the Learning Environment

Statement	Dept.Heads		Teachers	
	AWV	I	AWV	I
1. Make students fully aware of & Understand the set of rules.	4.53	VS	4.41	S
2. Show that he/she follows rules & regulation of school as a sign of respect& social responsibility	4.67	VS	4.35	S
3. Give proper guidance & short reminders to develop orderliness, patience & perseverance while performing the learning activity.	4.53	VS	4.47	S
4. Control the volume of sound from loud conversations & careless handling of breakable materials/equipment.	4.27	S	4.53	VS
5. Attend immediately with misbehaviours & recurring mistakes.	4.20	S	4.35	S
6. Use simple of cues as warning devices as the need arises.	4.53	VS	4.00	S
Weighted Means	**4.46**	**S**	**4.35**	**S**

Activating Prior Learning. The teachers have exemplified the value of taking into account past experiences, past lessons in the introduction of new learning experiences. From the students, the teachers were effective in considering similarities and differences of concepts, ideas and discussions.

Table 12. Teachers' Ability to Facilitate Learning Among Students in Terms of Activating Prior Knowledge

Statement	Dept.Heads		Teachers	
	AWV	I	AWV	I
1. Identify common experiences, environment, aspirations & gals of the students.	4.40	S	4.35	S
2. Present a review of the past discussions or lessons.	4.53	VS	4.71	VS
3. Give contrasting concepts or ideas.	4.00	S	4.47	S
4. Ask students to make comparison of previous & new lessons.	4.27	S	4.53	VS
5. Check regularly prior Knowledge.	4.53	VS	4.18	S
6. Structure the learning to bring Misconceptions to attention.	4.13	S	4.41	S
Weighted Means	**4.31**	**S**	**4.44**	**S**

The teachers also dealt with misconceptions in order to make clarifications and consequently bring better understanding of concepts.

Reinforcing the Learning. In reinforcing learning among the students, the teachers make constant follow-up and assessment of the learning process, either in the form of test, orally or written or through actual observation of the acquired skills and competencies of the students.

8

The teachers have satisfactory level of ability in using results of assessment as baseline data for instructional modifications and improvements.

Table 13. Teachers' Ability to Facilitate Learning Among Students in Terms of Reinforcing the Learning

Statement	Dept.Heads		Teachers	
	AWV	I	AWV	I
1. Monitor students' learning, both formally & informally.	4.27	S	4.29	S
2. Require students to be accountable fr their academic work.	4.20	S	4.53	VS
3. Undertake routine assessment procedures b checking student progress easier.	4.00	S	4.29	S
4. Use assessment results to evaluate students & o diagnose instruction to find out if teaching methods are working	3.87	S	4.35	S
5. Give consistent rewards to students for academic achievement & excellent behaviour.	4.20	S	4.18	S
6. Communicate with parents about student successes & request them to help their children keep working for excellence.	4.27	S	4.29	S
Weighted Means	**4.31**	**S**	**4.44**	**S**

Using a Variety of Approaches. It can be noted from the responses that the department heads and teachers have satisfactory level of ability in the utilization of variety of approaches especially in science instruction (Table 12). This is made possible because the teachers attended seminars and workshops in enhancing their skills in instructional materials formulation and utilization.

Table 14. Teachers' Ability to Facilitate Learning Among Students in Terms of Using a Variety of Approaches.

Statement	Dept.Heads		Teachers	
	AWV	I	AWV	I
1. Structure learning into manageable groups.	4.33	S	4.53	VS
2. Use variety of instructions brainstorming, describing, explaining, questioning through direct instruction.	4.07	S	4.47	S
3. Allow time for students to be actively informed in their learning	4.40	S	4.41	S
4. Allow time for students to experience excitement of finding out for themselves.	4.40	S	4.29	S
5. Allow students to have time to reflect on what they have learned	4.00	S	4.53	VS
6. Encourage students to have opportunities to apply their learning of new knowledge.	4.27	S	4.53	VS
7. Make herself available to interact with students as they undertake tasks.	4.20	S	4.53	VS
Weighted Means	**4.31**	**S**	**4.44**	**S**

Engaging Learners in a Dialogue. The data show that the department heads and teachers have expressed almost similar descriptions as to the teachers' ability to facilitate learning in terms of engaging learners in a dialogue as revealed in their responses which are interpreted as satisfactory.

Table 15. Teachers' Ability to Facilitate Learning Among Students in Terms of Engaging Learners in a Dialogue

Statement	Dept.Heads		Teachers	
	AWV	I	AWV	I
1. Ask students to list down their own perceptions or ideas about what they think or feel about the topic discussed.	4.13	S	4.29	S
2. Ask students to develop their own portfolio to write down what they are learning.	4.07	S	4.06	S
3. Ask students to write down what role their acquired knowledge plays in their life.	4.00	S	4.06	S
4. Create a small group discussion on a certain topic.	4.40	S	4.47	S

5. Find creative ways to involve students
in a dialogue situation with people
other than students
in class or outside of class.   4.20 S 4.00 S

6. Encourage students to observe
demonstration by the teachers, or
observe phenomena being studied. 3.87   S 4.12   S

Weighted Means	4.11	S	4.17	S

Significant Differences Between the Perceptions of the Department Heads and Teachers on the Level of Teachers' Ability to Facilitate Learning

The results of the test using t-test are shown in Tables 16 to 20.

It is revealed in the data that the null hypothesis is not rejected (Table 16).

Table 16. Teachers' Ability to Facilitate Learning Among Students in Terms of Setting Up the Learning Environment

Statements	AMV	
	Dept. Heads	Teachers
1. Make students fully aware of and understand the set of rules.	4.53	4.41
2. Show that he/she follows rules and regulation of school as a sign of respect and social responsibility.	4.67	4.35
3. Give proper guidance and short reminders to develop orderliness, patience and perseverance while performing the learning activity	4.53	4.47
4. Control the volume of sound loud conversations and careless handling of breakable materials/ equipment.	4.27	4.,53
5. Attend immediately with calmness misbehaviours and recurring mistakes .	4.20	4.35
6. Use signals or cues as warning devices as the need arises.	4.53	4.00
Weighted Means	**4.46**	**4.35**

Ho: There is no significant difference between the perceptions of the department heads and teachers on the teachers' ability to facilitate learning among students in terms of setting up the learning environment.
Significance Test: $t = .892$ $df = 10$
    $cv = 1.812$ $p = .05$

The data pointed out that providing an effective learning environment in a concern shared by the department heads and teachers to make learning and learning events successful.

Table 17. Teachers' Ability to Facilitate Learning Among Students in Terms of Activating Prior Learning

Statements	AMV	
	Dept. Heads	Teachers
1. Identify common experiences, environment, aspirations and goals of the students.	4.40	4.35
2. Present a review of the past discussion or lessons.	4.53	4.71
3. Give contrasting concepts or ideas.	4.00	4.47
4. Ask students to make comparison of previous and new lessons	4.27	4.53
5. Check regularly prior knowledge	4.53	4.18
6. Structure the learning to bring misconceptions to attention.	4.13	4.41
Weighted Means	**4.31**	**4.44**

Ho: There is no significant difference between the perceptions of the department heads and teachers" ability to facilitate learning among students in terms of activating prior learning.
Significance Test: $t = 4.05$ $df = 10$
    $cv = 1.812$ $p = .05$

It can be deduced from the findings that the department heads and teachers are concerned with the learning process of the students which emphasized that teachers should look back and relate past experiences before bringing the attention and focus of the students to the new lesson and objectives to be carried out.

Table 18. Teachers' Ability to Facilitate Learning Among Students in Terms of Reinforcing the Learning

Statements	AMV	
	Dept. Heads	Teachers

1. Monitor students learning,
   both formally and informally.   4.27   4.29

2. Require students to be accountable
   academic   for their work   4.20   4.29

3. Undertake routine assessment procedures
   by checking student progress easier   4.00   4.29
   .
4. Use assessment results to evaluate students
   and to diagnose instruction to find out
   if teaching methods are working.   3.87   4.35

5. Give consistent rewards to students
   for academic achievement and
   excellent behaviour.   4.20   4.18

6. Communicate with parents about
   Student successes and request and
   request them to help their children.   4.27   4.29

Weighted Means   **4.14** **4.32**

Ho: There is no significant difference between the
perceptions of the department heads and teachers on the
teachers' ability to facilitate learning among students in
terms of reinforcing the learning.
Significance Test: t = 2.084   df = 10
                          cv = 1.812   p = .05
        The difference in the responses of the teachers
and department heads can be attributed to the fact that
the teachers described themselves to have very
satisfactory level of ability in requiring students to be
accountable for their academic work while the
department heads rated them as satisfactory.

Table 19. Teachers' Ability to Facilitate Learning Among
Students in Terms of Using a Variety of Resources

Statements	AMV	
	Dept. Heads	Teachers
1. Structure learning into manageable groups.	4.33	4.53
2. Use a variety of instructions such as brainstorming,, describing, explaining questioning into direct instruction.	4.07	4.47
3. Allow students to be actively Informed in their learning.	4.40	4.41
4. Allow time for students to experience the excitement of finding out for themselves.	4.40	4.29

5. Allow students to have time to
   reflect on what they have   learned.   4.00   4.53

6. Encourage students to have opportunities to
   apply their learning of new knowledge   4.27   4.53
.
7. Make herself available to interact with
   students as they undertake tasks.   4.20   4.53

Weighted Means   **4.24**   **4.47**

Ho: There is no significant difference between the
perceptions of the department heads and teachers on the
teachers' ability to facilitate learning among students in
terms of using a variety of resources.
Significance Test: t = 3.115   df = 12
                          cv = 1.782   p = .05
        The differences on the perceptions of the
department heads and teachers can be attributed to the
fact that the department heads rated their teachers as
having satisfactory level of skills in structuring learning
into manageable groups, allowing the students to
experience the excitement of finding out for themselves,
encouraging students to have opportunities to apply
their learning of new knowledge and making the
teachers available for interacting with the students.
        The teachers rated themselves very satisfactory
on the abilities. This is so because they are ones who
have the best of knowledge of their own practices and
abilities in relating with their students.

Table 20. Teachers' Ability to Facilitate Learning Among
Students in Terms of Engaging Learners' in a Dialogue.

Statements	AMV	
	Dept. Heads	Teachers
1. Ask students to list down their own perceptions or ideas about what they think or feel about the topic discussed.	4.13	4.29
2. Ask students to develop their own portfolio to write down what they are learning .	4.07	4.06
3. Ask students to write down what role their acquired knowledge plays in their life.	4.00	4.06
4. Create a small group discussion on a certain topic.	4.40	4.47
5. Find creative ways to involve students in a dialogue situation with people other than		

students in class or outside of class	4.20	4.00

.

6. Encourage students to observe
   demonstrations by the teachers, or
   observe a phenomena being studied. 3.87   4.12

Weighted Means	**4.11**	**4.17**

Ho: There is no significant difference between the perceptions of the department heads and teachers on the teachers' ability to facilitate learning among students in terms of engaging learners in a dialogue.

Significance Test: t = .483   df = 10
                      cv = 1.812   p = .05

It can be deduced from the findings that the department heads and teachers have almost similar level of perceptions on describing the teachers as having satisfactory level of engaging the learners in a dialogue.

Students' Level of Cognition

The students' level of cognition was measured in terms of knowledge, comprehension, application, analysis, synthesis and evaluation levels. Tables 21 to 24 present the distribution of the students according to their cognition level of learning.

Knowledge. The majority of the students have fair level of knowledge as a cognitive level of learning which implies that they fairly achieved the knowledge competencies of the biology subject. This could also mean that most of them fairly achieved the skills of identifying specific facts such as giving ways and means of dealing with specifics.

The teachers need to provide enrichment activities such as drill and exercise that will enable the students to improve their skills on the basic level of cognitive learning.

Table 21. Students' Level of Cognition in Terms of Knowledge

Comprehension	Frequency	Percentage
Very High	3	0.54
High	46	8.30
Fair	240	43.32
Low	230	41.52
Very Low	35	6.32

Comprehension. The data manifest that most of the students have fair level of comprehension which indicates that most of them have difficulty in acquiring mastery of skills in comprehension. In this case, the teachers have to give students

exercises and learning experiences that will further develop their skills in understanding meanings of information.

Table 22. Students' Level of Cognition in Terms of Comprehension

Comprehension	Frequency	Percentage
Very High	1	0.18
High	118	21.30
Fair	334	60.29
Low	81	14.62
Very Low	20	3.61
Total	**554**	**100.00**

Application. The data signify that most of the students have fairly achieved the competencies which require their application level of cognition. This means that the students fairly developed the skills in use of previously understood and learned concepts and acquired skills in new and concrete situations especially in solving problems with single or best answer.

Table 23. Students' Level of Cognition in Terms of Application

Comprehension	Frequency	Percentage
Very High	-	-
High	63	11.37
Fair	334	60.29
Low	135	24.37
Very Low	22	3.97
Total	**554**	**100.00**

Analysis. The findings suggest that the students have difficulty in examining and trying to understand the organizational structure of information to develop divergent conclusions.

Table 24. Students' Level of Cognition in Terms of Analysis

Comprehension	Frequency	Percentage
Very High	1	0.18
High	70	12.64
Fair	195	35.20
Low	161	23.06
Very Low	127	22.92
Total	**554**	**100.00**

Synthesis. Based n the data (Table 25), results showed that the students have achieved fair level of

skills in creatively or divergently applying prior knowledge and skills to produce a new and original whole. They need t develop further and enhance their abilities to anticipate, collaborate, combine, compare, substitute and validate.

Table 25. Students' Level of Cognition in Terms of Synthesis

Comprehension	Frequency	Percentage
Very High	3	0.54
High	133	24.01
Fair	266	48.01
Low	121	21.84
Very Low	31	5.60
Total	**554**	**100.00**

Evaluation. Generally, the students have fair level of evaluation skills, They have fair level of cognition in appraising, comparing and contrasting, concluding, criticizing, critiquing, deciding, defending, interpreting and supporting.

Table 26. Students' Level of Cognition in Terms of Evaluation

Comprehension	Frequency	Percentage
Very High	-	-
High	72	13.00
Fair	297	53.61
Low	178	32.13
Very Low	7	1.26
Total	**554**	**100.00**

Significant Relationship Between the Teachers' Effectiveness in Developing the Students' Metacognitive Behaviors and the Students' Level of Cognition

The results of the tests are reflected in Tables 27 to 31.

Table 27. Relationship Between the Teachers' Strategies in Developing Metacognitive Behaviors in Terms of Identifying What the Students Know and the Students' Cognitive Level

Variables	Chi-Square Values	df	Critical Value at α =.05	Decision
Developing Students' Metacognitive Behaviors In Terms of Identifying What the Students Know And Cognitive Level of Students in terms of:				
Knowledge	1.84	2	5.99	Do not reject Ho
Comprehension	10.84	2	5.99	Reject Ho
Application	6.18	2	5.99	Reject Ho
Analysis	10.54	2	5.99	Reject Ho
Synthesis	13.76	2	5.99	Reject Ho.
Evaluation	6.15	2	5.99	Reject Ho.

Ho: There is no significant relationship between the teachers' strategies in developing students' metacognitive behaviors in terms of identifying what the students know and cognitive level of students.

There is a significant relationship between the teachers' ability to facilitate learning in terms of using a variety of approaches and the students' knowledge, comprehension, application and analysis levels of cognition.

However, no significant relationship can be seen between the teachers' ability to facilitate learning in terms of using a variety of approaches and the students' synthesis and evaluation levels of cognition.

Table 28. Relationship Between the Teachers' Strategies in Developing Metacognitive Behaviors in Terms of Talking About Thinking and the Students' Cognitive Level

Variables	Chi-Square Values	df	Critical Value at α =.05	Decision
Developing Students' Metacognitive Behaviors in Terms of Talking About Thinking and Cognitive Level of Students in terms of:				
Knowledge	9.60	2	5.99	Reject Ho.
Comprehension	8.30	2	5.99	Reject Ho.
Application	3.21`	2	5.99	Do not reject Ho.
Analysis	20.83	2	5.99	Reject Ho.
Synthesis	13.07	2	5.99	Reject Ho.
Evaluation	1.79	2	5.99	Do not reject Ho.

Ho: There is no significant relationship between the teachers' strategies in developing students' metacognitive behaviors in terms of talking about thinking and cognitive level of students.

In talking about thinking, the students were helped with the thinking vocabulary facilitated or discussed by the teachers.During planning and problem solving situations, the students were guided in following demonstrated thinking

process. The teachers' modelling and discussion help the students develop their vocabulary for thinking and talking about their own thinking as well as for recognition and thinking skills.

Table 29. Relationship Between the Teachers' Strategies in Developing Metacognitive Behaviors in Terms of Planning and Self-Regulation and the Students' Cognitive Level

Variables	Chi-Square Values	df	Critical Value at α =.05	Decision
Developing Students' Metacognitive Behaviors in Terms of Planning and Self-Regulationand Cognitive Level of Students in terms of:				
Knowledge	6.42	4	9.49	Do not reject Ho.
Comprehension	5.43	4	9.49	Do not reject Ho.
Application	14.95	4	9.49	Reject Ho.
Analysis	8.94	4	9.49	Do not reject Ho.
Synthesis	6.52	4	9.499	Do not reject Ho.
Evaluation	8.56	4	9.49	Do not reject Ho.

Ho: There is no significant relationship between the teachers' strategies in developing students' metacognitive behaviors in terms of planning and self-regulation and cognitive level of students.

If the teachers help the students figure out how to do a particular task and make sure that the tasks are carried out correctly, then the students are facilitated in promoting their intellectual development.

Table 30. Relationship Between the Teachers' Strategies in Developing Metacognitive Behaviors in Terms of Debriefing the Thinking Process and the Students' Cognitive Level

Variables	Chi-Square Values	df	Critical Value at α =.05	Decision
Developing Students' Metacognitive Behaviors in Terms of Debriefing the Thinking Process and Cognitive Level of Students in terms of:				
Knowledge	10.57	2	5.99	Reject Ho.
Comprehension	6.06	2	5.99	Reject Ho.
Application	6.98`	2	5.99	Reject Ho.
Analysis	8.87	2	5.99	Reject Ho.
Synthesis	9.74	2	5.99	Reject Ho.
Evaluation	1.04	2	5.99	Do not reject Ho.

Ho: There is no significant relationship between the teachers' strategies in developing students' metacognitive behaviors in terms of debriefing the thinking process and cognitive level of students.

The teachers apply closure activities that focus on thinking processes that aim to develop awareness of strategies. They facilitate in the students' identification of useful strategies, discriminate alternative approaches.

Table 31. Relationship Between the Teachers' Strategies in Developing Metacognitive Behaviors in Terms of Self-Evaluation and the Students' Cognitive Level

Variables	Chi-Square Values	df	Critical Value at α =.05	Decision
Developing Students' Metacognitive Behaviors In Terms of Self-Evaluation and Cognitive Level of Students In terms of:				
Knowledge	10.12	2	5.99	Reject Ho.
Comprehension	8.11	2	5.99	Reject Ho.
Application	8.70`	2	5.99	Reject Ho.
Analysis	8.56	2	5.99	Reject Ho.
Synthesis	8.30	2	5.99	Reject Ho.
Evaluation	0.58	2	5.99	Do not Reject Ho.

Ho: There is no significant relationship between the teachers' strategies in developing students' metacognitive behaviors in terms of self-evaluation and cognitive level of students.

The teachers use assessment results not only to evaluate students but also for instructional diagnosis and to find out if teaching methods are working. Systems are set up in the classroom for frequent and consistent rewards to students for academic achievement and excellent behaviour.

Metacognition involves higher level og thinking which involves active control over the process of thinking that is involved in learning situations. These include planning the way to approach a given learning task, monitoring comprehension, and evaluating the process towards the completion of a task.

LLI-II-017

Significant Relationship Between the Level of Teachers' Ability to Facilitate Learning and the Students' Level of Cognition

Table 32. Relationship Between the Teachers' Ability to Facilitate Learning in Terms of Setting Up the Learning Environment and the Students' Cognitive Level

Variables	Chi-Square Values	df	Critical Value at α =.05	Decision
Teachers' Ability to Facilitate Learning in Terms of Setting Up the Learning Environment and Cognitive Level of Students In terms of:				
Knowledge	10.21	2	5.99	Reject Ho.
Comprehension	10.08	2	5.99	Reject Ho.
Application	9.83`	2	5.99	Reject Ho.
Analysis		2	5.99	Reject Ho.
Synthesis		2	5.99	Reject Ho.
Evaluation		2	5.99	Do not Reject Ho.

Ho: There is no significant relationship between the teachers' ability to facilitate learning in terms of setting up the learning environment and cognitive level of students.

Results showed that there is a significant relationship between the teachers' ability to facilitate learning in terms of setting up the learning environment and the students' knowledge, comprehension, application, synthesis and analysis levels of cognition.

However, no significant relationship can be seen between the teachers' ability to facilitate learning in terms of setting up the learning environment and the students' evaluation level of cognition.

The teacher should provide effective learning environment to make teaching and learning events successful.

Table 33. Relationship Between the Teachers' Ability to Facilitate Learning in Terms of Activating Prior Learning and the Students' Cognitive Level

Variables	Chi-Square Values	df	Critical Value at α =.05	Decision
Teachers' Ability to Facilitate Learning in Terms of Activating Prior Learning and Cognitive Level of Students In terms of:				

Knowledge	11.46	2	5.99	Reject Ho.
Comprehension	2.16	2	5.99	Do not reject Ho.
Application	6.01`	2	5.99	Reject Ho.
Analysis	6.31	2	5.99	Do not reject Ho.
Synthesis	6.46	2	5.99	Do not reject
Evaluation	0.80	2	5.99	Do not reject Ho.

Ho: There is no significant relationship between the teachers' ability to facilitate learning in terms of activating prior learning and cognitive level of students.

Data show that there is a significant relationship between the teachers' ability to facilitate learning in terms of activating prior learning and the students' knowledge and application levels of cognition.

However, no significant relationship can be seen between the teachers' ability to facilitate learning in terms of activating prior learning and the students' comprehension, analysis, synthesis and evaluation levels of cognition.

The teachers activate the students on what they already have knowledge with and guided them to apply new knowledge to what they already have known. Such actions enable the students to make new information easy to absorb.

Table 34. Relationship Between the Teachers' Ability to Facilitate Learning in Terms of Reinforcing the Learning and the Students' Cognitive Level

Variables	Chi-Square Values	df	Critical Value at α =.05	Decision
Teachers' Ability to Facilitate Learning in Terms of Reinforcing the Learning and Cognitive Level of Students In terms of:				
Knowledge	8.23	2	5.99	Reject Ho
Comprehension	1.47	2	5.99	Do not reject Ho.
Application	2.10`	2	5.99	Do not reject Ho.
Analysis	7.54	2	5.99	Reject Ho.
Synthesis	7.70	2	5.99	Reject Ho.
Evaluation	0.52	2	5.99	Do not reject Ho.

Ho: There is no significant relationship between the teachers' ability to facilitate learning in terms of

reinforcing the learning and cognitive level of students.

Chi-square vales signify that there is a significant relationship between the teachers'

There is a significant relationship between the teachers' ability to facilitate learning in terms of reinforcing the learning and the students' knowledge, analysis and synthesis levels of cognition.

However, no significant relationship can be seen between the teachers' ability to facilitate learning in terms of reinforcing the learning and the students' comprehension, application and evaluation levels of cognition.

In monitoring the learning process, the teachers frequently monitor student learning both formally and informally and require that students be accountable for their academic work.

Table 35. Relationship Between the Teachers' Ability to Facilitate Learning in Terms of Using a Variety of Approaches and the Students' Cognitive Level

Variables	Chi-Square Values	df	Critical Value at α =.05	Decision
Teachers' Ability to Facilitate Learning in Terms of Using a Variety of and Cognitive Level of Students In terms of:				
Knowledge	14.21	4	9.49	Reject Ho.
Comprehension	12.07	4	9.49	Reject Ho.
Application	16.57	4	9.49	Reject Ho.
Analysis	9.98	4	9.49	Reject Ho.
Synthesis	6.69	4	9.49	Do not reject Ho.
Evaluation	7.10	4	9.49	Do not Reject Ho.

Ho: There is no significant relationship between the teachers' ability to facilitate learning in terms of using a variety of approaches and cognitive level of students.

It can be gleaned that there is a significant relationship between the teachers' ability to facilitate learning in terms of using a variety of approaches and the students' knowledge, comprehension, application and analysis levels of cognition.

However, no significant relationship between the teachers' ability facilitate learning in terms of using a variety of approaches and the students' synthesis and evaluation levels of cognition.

Using a variety of approaches can be effective especially in developing and enhancing the students' lower level of cognition thinking such as knowledge, comprehension, application and analysis levels of cognition.

This means that the teachers' ability to use a variety of instructional methods such as informing, describing, explaining, questioning and direct instruction can bring forth better acquisition of the knowledge of facts about biology and botany.

Table 36. Relationship Between the Teachers' Ability to Facilitate Learning in Terms of Engaging Learners in a Dialogue and the Students' Cognitive Level

Variables	Chi-Square Values	df	Critical Value at α =.05	Decision
Teachers' Ability to Facilitate Learning in Terms of Engaging Learners in a Dialogue and Cognitive Level of Students In terms of:				
Knowledge	8.45	2	5.99	Reject Ho.
Comprehension	10.83	2	5.99	Reject Ho.
Application	5.25	2	5.99	Do not reject Ho.
Analysis	7.86	2	5.99	Reject Ho.
Synthesis	0.67	2	5.99	Do not reject Ho.
Evaluation	0.17	2	5.99	Do not Reject Ho.

Ho: There is no significant relationship between the teachers' ability to facilitate learning in terms of engaging learners in a dialogue and cognitive level of students.

As shown (Table 36), there is a significant relationship between the teachers' ability to facilitate learning in terms of engaging learners in a dialogue and the students' knowledge, comprehension and analysis levels of cognition.

However, there is no significant relationship between the teachers' ability to facilitate learning in terms of engaging learners in a dialogue and the students' application, synthesis and evaluation levels of cognition.

The teacher developed activities that help the students reinforce what they have learned, tie things together and project into the future.

4. CONCLUSIONS

Based on the findings, the following conclusions are drawn:

LLI-II-017

1. The teachers were effective in the aspects of asking or inquiring what the students have known and what are their ideas about research topics in science and technology II.

2. The department heads and the teachers differed on their perceptions on the effectiveness of the teachers in developing students' metacognitive behaviors in terms of debriefing the thinking process and self-evaluation.

3. The teachers have satisfactory ability in planning and implementing strategies that provide conducive and favourable learning environment, setting the mode of discussion by consolidating first prior learning experiences, environment, aspirations and goals of the students. The have satisfactory level of abilities in the use of evaluative assessments and making use of these results in diagnosing instruction and modification.

4. The majority of the students have fair level of knowledge as a cognitive level of learning. This implies that the students fairly achieved the knowledge competencies of the Biology subject in the second year level curriculum.

5. The students are facilitated by the teachers during planning and problem solving situations with the guidance in demonstrated thinking process, modelling and developing vocabulary facility.

6. The teachers' reinforcing of the students' learning affects the students' cognitive level as to knowledge, comprehension levels but not with the application, analysis, synthesis and evaluation levels.

7. The teachers' use of assessment and evaluation to diagnose if the instruction has significantly helped the students in their learning has facilitated the students' development of the knowledge and comprehension levels of cognition.

5. ACKNOWLEDGMENTS

6. REFERENCES

Carr, M., Kurtz, B. E.,Schneider, W., Turner, L. A., & Borkowski, J. G. (1989). Strategy acquisition and transfer among German and American children: Environmental influences on metacognitive development. Developmental Psychology, 25, 765-771

Huitt, W. (2004). Bloom et al.'s taxonomy of the cognitive domain. *Educational Psychology Interactive*. Valdosta, GA: Valdosta State University

Livingston, J. A. (1996). Effects of metacognitive instruction on strategy use of college students. Unpublished manuscript, State University of New York at Buffalo.

Lucangeli, D. & Cornoldi, C. (1997). Mathematics and metacognition: What is the nature of relationship?Mathematical Cognition, 3, 121-139.

Roberts, M. J., & Erdos, G. (1993). Strategy selection and metacognition. Educational Psychology, 13, 259-266.

.

LLI-II-017