Patterns of Teachers' Activity in Biology Classrooms

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Abstract

The study attempts to describe practices of biology teachers by determining the patterns of teachers' activities in the biology classroom, particularly, the teachers' pedagogy, time management, motivational skills, and assessing skills. Likewise, it is hoped to determine if the teachers utilize critical and higher order thinking skills.

Qualitative and quantitative data were utilized to describe the patterns of teachers' activities inside the biology classes which occur between the biology teacher and students in the five topics of biology, namely: photosynthesis, cellular respiration, human reproduction and genetics (Mendelian and non-Mendelian).

The results identified some recognized patterns; subsequent implications and recommendation are formulated.

Keywords: Best Practices, Higher Order Thinking Skills, Motivational Skills, Pedagogy, Time management, Representations

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Introduction

The instructional ability of teachers inside the classroom plays a significant role in the teaching-learning process. The main concern of teachers is to provide their students with the most useful and most powerful representations that are comprehensible to their students (Stofflet and Thorley, 1996).

Studying the patterns of the teachers' activities inside classroom is interesting in the field of science education because it will provide insightful experiences that could be the basis for in-service training and showing of best practices. This study attempts to describe the pattern of biology teachers' activities in the classroom, particularly, teachers' time management, pedagogy, motivational skills, and assessing skills.

Methodology

The subjects of the study were the second year secondary teachers and students in Iligan City and Lanao Del Norte. The secondary schools involved were: (1) Science Curriculum High Schoos (e.g., DepEd-supervised Science High Schools, State University Laboratory Science High School and private Science High School) and (2) SEDP Curriculum High Schools (e.g., DepED-SEDP Nationalized High Schools and Private SEDP Secondary High Schools).

School selection was done on the basis of the two types of high school curricula. Random sampling was employed among the schools in the area. A total of 21 classes were chosen but 6 classes were utilized for qualitative analysis.

Qualitative and quantitative data were utilized to describe patterns of teacher's activity inside the classroom. These are determined by identifying and describing the pattern of classroom discourses of biology classes which occur between the biology teacher and students in five topics of biology, namely: 1) Photosynthesis, 2) Cellular Respiration, 3) Human Reproductive System, 4) Mendelian Genetics, and 5) Non-Mendelian Genetics. Observed patterns are on time management, pedagogy, motivational skills and assessing skills of the teachers.

Results and Discussions

Time Management

A lesson is the highest unit of classroom discourse. This study recorded a total of five lessons of six teachers, making a total of thirty classroom discourses.

Each biology lesson lasts for 80 minutes in the SEDP Curriculum, while that of the biology class in the Science Curriculum lasts for 60 minutes.

Table 1 presents the time allotment for instructional and non-instructional activities of the teachers. Instructional activities are those content knowledge representations of the teachers, while non-instructional activities refer to those activities that are not related to content knowledge presentation. Note in Table 1 that the class time of the SEDP Curriculum is 80 minutes while that of the Science Curriculum is 60 minutes.

Table 1 shows that, in the Science Curriculum, the mean time allotted to instructional activities is 47.7 minutes (or 47.7/60 = 79.5%) and to non-instructional activities, 12.3 minutes (or 13/3/60 = 20.5%). In the SEDP Curriculum, the time allotted to instructional activities is 75 minutes (or 75/80 = 93.75%) and to non-instructional activities, 5 minutes (or 6.25%). Thus, it can be said that the biology teachers in the Science Curriculum utilize relatively more time for non-instructional activities than the SEDP Curriculum teachers. This is probably due to the early time schedule (*i.e.*, 7:30 to 8:30 a.m.) of the Science Curriculum; the teachers use part of the biology time for non-instructional activities like cleaning the room, singing the national anthem, prayer and roll call.

Table 1. Time Allotment for Instructional and non-Instructional Activities of a Biology Class (SEDP curr.: 80 min.; Science curr.: 60 min.)

Type of Curricula/ Teacher	Time Allotment for Instructional Activities (in minutes)						Time Allotment for Non-Instructional Activities (in minutes)					
Science Curriculum	*P	*CR	*HRS	*MG	*NMG	**Mean**	*P	*CR	*HRS	*MG	*NMG	Mean
Teacher JTB	42	39	52	57	60	50	18	21	8	3	0	10
Teacher CTR	45	31	45	45	45	42.2	15	29	15	15	15	17.8
Teacher FTC	34	58	50	55	57	50.8	26	2	10	5	3	9.2
Mean	40.3	42.7	49	52.3	54	**47.7**	19.7	17.3	11	7.7	6	12.3
SEDP Curriculum												
Teacher JTM	78	80	80	80	76	78.8	2	0	0	0	4	1.2
Teacher CTC	75	70	74	80	78	70.8	20	20	2	0	4	4.5
Teacher RTL	60	60	76	80	78	70.8	20	20	2	0	4	9.2
Mean	71	70	76.7	80	77.3	**75**	9	10	2.7	0	3.3	5

*P= Photosynthesis; CR= Cellular Respiration; HRS= Human Reproductive system; G= Mendelian Genetics;
NMG= Non-Mendelian Genetics

Table 1 also shows that biology teachers spend more time in Genetics topics (Mendelian and Non-Mendelian Genetics) as compared to the other topics (*i.e.*, Photosynthesis, Cellular Respiration and Human Reproductive System). This must be due to the nature of the topic, which requires more time for analysis because of the mathematical component of the lesson. It can then be inferred that difficult topics require more time to discuss than less complicated ones. Likewise, the SEDP Curriculum teachers have more time to discuss the topics as compared to those Science Curriculum teachers. In general, however, representations of content knowledge (Instructional Activities) are utilized by about 80% to 94% in a given period of all the biology teachers in both curricula.

Tables 2A and 2B show the length of time devoted to instructional and non-instructional activities in a typical biology class. The class period is divided into four quarters. Table 2A represents an SEDP class, while Table 2B, a Science Curriculum class.

In both curricula, teachers' non-instructional activities include routine matters such as greetings, singing and other icebreaker activities.

To illustrate the situation, consider these events (Teacher CTR, 01.29.00,7:30-8:30, Human Reproductive System, Science Curriculum):

(Note: T stands for the biology teacher and S refers to the students)

S: Prayer
S: National Anthem
S: Ako Ay Pilipino, Ang Panunumpa...
S: Alma Matter song
T: Good morning everybody!
S: Good morning Mrs. CTR... Mabuhay!
T: Okay, pass all the assignment...(Teacher collects assignment) No more assignment?
S: (no answer).
T: Okay. Can you recall cell division? What happen when cell divides?

In general, during the first and second quarters of the class period, the following activities are carried out in this order:

1. Class prayer
2. For classes that start at 7:30 a.m., flag ceremony is done at the classroom; for some, however, it is done before 7:30 at the school playground. Still others, those after the seven-thirty class, no flag ceremony is done.
3. Teacher-student greetings, this is usually the first activity in the other schools.
4. Checking of students' attendance, with variants like checking through asking the monitor who are absent for the day, individually calling each student, asking the table leaders who are absent in their group, and by collecting students' assignments.
5. Reviewing the previous lesson by asking the important concepts and principles to be internalized and relating or connecting them to the present topic.
6. Asking and answering students' questions and problems regarding the previous day's lesson.

In some scenarios, it is either the teacher who greets the class first or the students themselves.

Table 2A Matrix Distribution Of Instructional And Non-Instructional Activities In A Biology Class (SEDP Curriculum)

Classroom Activities	Average Time Use (in minutes)			
	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Non-Instructional Activities				
• Cleaning the room and surrounding	0			
• Making announcements	0.6			
• Returning checked papers/reports	1.3			
• Collecting projects/assignments	1.1			
• Checking attendance/roll call	1.7			
• Praying	0.3			
• Flag raising	0			
• Singing School hymn	0			
Instructional Activities				
• Reviewing previous lessons	4.5			
• Motivating the students	4.2			
• Giving directions/instructions	3			
• Content knowledge representations	6	18	17	7.5
• Recapitulating/Summarizing the lesson		2	3	2.5
• Evaluating the activities/projects				8.5
• Giving assignment/ home works				2.75
Total time allotted: 80 minutes	20	20	20	20

Moreover, Tables 2A and 2B show how the instructional and non-instructional activities are spread out throughout the class period. For instance, the knowledge representation in B starts at the first quarter and extends to the fourth quarter of the class period.

Table 2b. Matrix Distribution of Instructional and Non-instructional Activities in a Biology Class (Science Curriculum)

Classroom Activities	Average Time Use (in minutes)			
	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Non-Instructional Activities				
• Cleaning the room and surrounding	4.1			
• Making announcements	0.7			
• Returning checked papers/reports	1.5			
• Collecting projects/assignments	1.4			
• Checking attendance/roll call	1.9			
• Praying	0.4			
• Flag raising	1.2			
• Singing School hymn	1.1			
Instructional Activities				
• Reviewing previous lessons	0.3	3.9		
• Motivating the students	0.4	4.1		
• Giving directions/instructions	0.3	2.8		
• Content knowledge representations	1.7	4.2	15	4.1
• Recapitulating/Summarizing the lesson				2.4
• Evaluating the activities/projects				6.1
• Giving assignment/ home works				2.4
Total time allotted: 60 minutes	15	15	15	15

One observation is that some instructional activities in the Science Curriculum (Table 2B) are done in the first two quarters, specifically, reviewing previous lessons, motivating students, and giving directions or instructions. Meanwhile, the same activities are accomplished within the first quarter only of the SEDP Curriculum. This is probably because of the longer and continuous flow of activities in the latter.

The teachers also recap the lessons after important concepts have been discussed. For example, SEDP Curriculum (Table 2A) teachers allow 2 to 3 minutes summarizing the concepts after important major concepts have been discussed during the second and third quarters; the overall summary is done at the last quarter of the allotted time. These teachers are able to do such activities because they have available time to do so. However, the teachers in the Science Curriculum (Table 2B) have a

limited time such that recapitulation is done only at the last quarter of the time allotment. Meanwhile, teachers of both curricula show the same pattern in evaluating student activities and giving of homework and assignment. They usually implement these activities at the fourth quarter of the allotted time utilizing around 6 minutes for the Science and 8.5 minutes for the SEDP Curriculum, respectively. This might mean that there is a need to increase time allotment for the Science Curriculum classes.

Biology Teachers' Pedagogy

The pedagogy of teachers inside the classroom is determined with the use of an observation checklist and classroom discourses. For instance, teachers' pedagogy was determined using a five-point scale checklist where 1 is the lowest and 5 is the highest as illustrated below:

Table 2C. Description of Pedagogy Used by Biology Teachers in Classroom Discourses

Scale	Descriptions*
1	**Pure one-way pedagogy** (The teacher makes no attempt to monitor students' learning through oral questioning.)
2	**Predominantly one-way pedagogy** (The teacher accepts choral answer to questions.)
3	**Initial step towards two-way pedagogy** (The teacher directs some questions to individual students, but does not use their responses formatively in the discussion.)
4	**Incomplete two-way pedagogy** (The teacher directs many or most questions to individual students, occasionally uses those responses formatively.)
5	**Full two-way pedagogy** (There is effective dialogue between teacher and students in the construction of knowledge and concepts.)

* Ravina (2001)

Table 3 presents the patterns of teacher's type of pedagogy used inside the classroom. Of the 30 classroom discourses, 16 (53%) use **incomplete two-way pedagogy**, meaning, the teacher directs many or most questions to individual students but occasionally uses those responses formatively. On the other hand, 13 (43%) have **initial steps towards a two-**

way pedagogy (*i.e.*, biology teachers direct some questions to students but **do not** use students' responses formatively in the discussion). While only one or 4% utilize a **full two-way pedagogy**. Thus, it is apparent in the table that most of the teachers both in SEDP and Science Curriculum employ **incomplete two-way pedagogy**. This implies that biology teachers lack an effective dialogue between them and their students in the construction of knowledge and concepts.

Furthermore, the types of classroom interaction inside the biology classroom are shown in Table 4. Once again, teacher-student interaction is based on classroom discourse cross-validated by an observation checklist. Student-teacher classroom interaction is determined and classified based on the ratio of student and teacher activities/talk inside the classroom. Results reveal that 97% of the discourses are teacher-dominated. There are more teacher talks or activities rather than student activities.

Table 3. Patterns of Biology Teachers' Classroom Pedagogy (n = 30)

Type of Curriculum/ Teacher	Type of Teacher's Pedagogy						
Science Curriculum	P	CR	HRS	MG	NMG	Mean	Qualitative Description
JTB	3	3	3	3	3	3.0	Initial step towards two-way pedagogy
CTR	4	4	4	4	4	4.0	Incomplete two-way pedagogy
FTC	3	4	4	4	4	3.8	Incomplete two-way pedagogy
	3.3	3.7	3.7	3.7	3.7	3.6	Incomplete two-way pedagogy
SEDP Curriculum							
JTM	5	4	4	4	4	4.2	Incomplete two-way pedagogy
CTC	3	3	3	3	3	3.0	Initial step towards two-way pedagogy
RTL	4	4	4	4	4	4.0	Incomplete two-way pedagogy
Mean	4.0	3.7	3.7	3.7	3.7	3.67	Incomplete two-way pedagogy

*P= Photosynthesis; CR= Cellular Respiration; HRS= Human Reproductive system;
G= Mendelian Genetics;
NMG= Non-Mendelian Genetics

This result suggests that biology teachers' type of pedagogy reflects the interaction inside biology classrooms. The incomplete two-way pedagogy does not promote good interaction between students and teacher. Teachers tend to dominate the activities, which does not facilitate good dialogue between listener and speaker and, as a consequence, does not develop and promote higher-order thinking skills.

The patterns of biology teacher's pedagogy can be generally stated as teacher-dominated and incomplete two-way pedagogy.

Table 4. Patterns of Students-Teacher Interaction inside Biology classroom

Type of Teacher-Students Interaction	Frequency	Percentage (%)	Qualitative Description
Teacher-dominated	29	97	Mostly teacher talks/activities
Student- dominated	0	0	Mostly student talks/activities
Teacher-Student Dialogue	1	3	Equal proportion of teacher and student talks/activities
Total	30	100	

Biology Teachers' Motivational Activities

Teachers' motivational activities can be done any time within the class period. Based on the data gathered, all the teachers provide initial motivation to students prior to the introduction of the topical conception.

Table 5 summarizes the opening motivational activities and skills to the five topics observed from the six teachers. It can be said that the teachers use various methods of initial motivational activities to stimulate students' interest about the topic. For example, an opening motivational activity used by teacher FTC in discussing the topic photosynthesis started with the history and philosophy of science to interest the students on the development of a scientific invention. On the other hand, the use of visual illustrations and asking questions about the topic to stimulate students' visual activity (to stimulate/ignite thinking

skills through analytical thinking about the diagram) are among the initial motivational strategies used by other biology teachers. Such strategies were used by Teachers RTL, JTB and JTM, while others used previous knowledge as springboard for introducing a new topic.

Moreover, Table 6 presents the motivational skills and strategies utilized by the biology teachers during the opening of the class discussions. Teacher JTM, for instance, conducts a laboratory activity to facilitate the discussion of photosynthesis. Science teachers are, in fact, expected to be knowledgeable about this technique as well as the content knowledge to be able to discuss the results of the laboratory activity and connect the idea to the main topic.

Biology teachers use different strategies depending on the topic and the appropriateness of the strategy.

Generally, biology teachers utilize different opening motivational strategies. To summarize, these strategies are: (1) reviewing the previous lesson and relating it to present topic (40%); (2) starting with a definition and elaborating it (14%); (3) using an actual example (14%); (4) using an illustration (10%); (5) using a passage in the textbook related to the topic (6%); (6) using laboratory activities and relating them to the present topic (3%); and (7) using PROBEX (predict-observe-explain) technique to ignite students' interest (3%).

Meanwhile, about 50% of the teachers use the following motivational strategies in their classroom: planning more activities that cater to students' interests and requiring students to relate the previous topic with new topic.

About 30% utilize the following motivational activities: providing encouragement to students with low performance, offering rewards as incentives for performing well; structuring appropriate and healthy competition, giving more opportunities for students to participate, applying novel and interactive instructional method, asking questions related to the assignment, and reviewing the previous lesson and relating it to the new lesson.

About 16% use history and philosophy of science in stimulating student interest on the topic.

In general, the clinical interviews, lesson plan, classroom discourse transcripts and observations show that the teachers follow a logical sequence in putting motivation strategies in their lessons. The motivational strategies start even before the lesson implementation. For

instance, Teacher JTM, FTC and CTC identify the objectives for the lesson and provide meaningful learning activities based on the identified objectives. From there, they select the appropriate opening stimulating activities relevant to the lesson. Considering the learning objectives and the importance of the topic to everyday life, they prepare instructional materials so that the lesson (especially if it involves abstract concepts) becomes concrete to the students. The motivational strategies used by all the teachers are as follows:

1) Identifying meaningful learning objectives for the topic.
2) Starting stimulating activities relevant to the lesson.
3) Pointing out the importance of the lesson in daily activities.
4) Providing students with concrete instructional support.
5) Presenting abstract concepts concretely in a more personal and familiar manner.

Meanwhile, other motivational activities used by some teachers are: planning more activities that cater to students' interests and requiring students to relate the previous topic with the new topic, providing encouragement to low performers, offering rewards as incentives for performing well, encouraging appropriate and healthy competition, giving more opportunities for students to participate, applying novel and interactive instructional methods, asking questions related to the assignment, reviewing the previous lesson and relating it to the new lesson, and using history and philosophy of science in stimulating student interest on the topic.

Biology Teachers' Assessment

Teachers' assessment of students' learning can be in the form of questions evaluating students' understanding. This can be done after the class discussion or during the learning process itself. In this study, questions of teacher while developing conception were counted, evaluated, and classified based on the type and quality of questions.

There were 628 assessment questions identified from thirty classroom discourses. Assessment questions were classified according to whether the question requires higher-order thinking or simple recalling. Results in Table 7 show that about 50% of the questions qualify as higher order thinking questions. These are distributed into critical thinking

questions which analyzes arguments (23%), problem solving which analyze alternative solutions (16.90%), decision-making questions which pertain to making a choice from a number of options (12%) and creative thinking questions (0.48%). However, it is apparent in the data of the five types of questions, that majority are simple recall (48%).

Table 5.6 further classifies questions as to whether these are divergent or convergent. A convergent question is one that requires one exact answer, while a divergent question requires varied answers. Of the 628 questions asked by the teachers in the process of teaching, there were 367 (58.4%) convergent questions, and 261 (41.6%) divergent questions.

Table 7. Distribution and Classification of Assessment Questions Generated by Biology Teachers during Classroom Discourses in five topics

Type of Assessment Questions	TOPIC					TOTAL	
	P	CR	HRS	MG	NMG	f	%
Problem Solving	0	12	0	44	50	106	16.90
Creative Thinking	0	3	0	0	0	3	00.48
Analytical Thinking	24	7	16	20	6	73	11.62
Critical Thinking	25	40	35	13	31	144	22.92
Simple Recall	76	72	67	46	41	302	48.08
Total	125	134	118	123	128	628	100.00

In addition, Table 8 provides the data on the teachers' manner of questioning. As revealed in the table, sixty percent are specific questions to a particular concept discussed in class. In 53% of the questions, the teachers gave time for student to think before responding. The wait-time ranged from 2 to 40 seconds depending on the kind of questions. Generally, however, the average is about 12 seconds. A 12-second wait-time is necessary to allow students especially a slow learner, to organize his/her thoughts. In most cases, whenever a student cannot answer the question, the teacher usually repeats it or rewords it or asks leading questions. This implies that the teachers provide enough chance for the students to answer correctly. However, this is not done as often as

desired: the frequency of phrasing or rephrasing questions clearly in Table 8 is only 53%.

Meanwhile, some of the teachers asked questions that encourage participation of students (3.18%). This can be gleaned from the excerpts of classroom discourses below.

Teacher JTB: *When you talk of genetics, what idea comes into your mind?*
(CDT: JTB 2/28/01, Mendelian Genetics)
Teacher FTC: *Here is a diagram of the male reproductive system: can you identify the parts of the system? Who wants to begin?*
(CDT: FTC 1/177/01,Human Reproductive System)
Teacher CTR: *I have here a Punnett square. Okay, who will start to fill the box on the board?*
(CDT: CTR 01/23/01, Mendelian Genetics)
Teacher JTM: *What are the characteristics that are transfered from parents to offspring? Can you name some characteristics?*
(CDT: JTM 3/8/01, Mendelian Genetics)
Teacher CTC: *Look here and try to think what we are going to discuss this morning. Observe. (The teacher lighted a candle) what idea can you deduce from her? Anybody in the class?*
(CDT: CTC10/9/00, Cellular Respiration)
Teacher RTL: *This is a diagram showing the relationship of photosynthesis and cellular respiration. What ideas do you get from this diagram?*
(CDT: RTL 12/6/01, Cellular Respiration)

Figure 1. Excerpts of Classroom Discourses in Biology Classess

Table 8. Manner of Questioning of Biology Teachers during Classroom Discourses in the five topics

Manner of Questioning	Frequency	Percentage (%)
1. Phrases and rephrases the question clearly	335	53.3
2. Asks specific questions	377	60.0
3. Gives the students time to think before responding Average wait time: 11.8 seconds (Range: 2-40 sec)	334	53.1
4. Asks questions that encourage students' participation. (N=628)	20	3.18
5. Encourages students to ask question and answer them. (N=108)	17	15.7
6. Asks convergent questions. (N=628)	367	58.4
7. Asks divergent questions. (N=628)	261	41.6

As shown in the sample questions, the teachers try to encourage the students to participate in the classroom discussions. However, it is sad to note that only about 17 out of 108 (15.7%) teachers encourage students to ask questions and answer them. This low percentage means that the teachers did not sufficiently encourage a two-way communication during classroom discussion.

Table 9. Assessment Tool used by Biology Teachers

Tool Used	Frequency	Percentage (%)	Rank
Pencil-and-paper testing	14	47	1
Rating students' class participation	0	0	
Giving of homework/Assignment	0	0	
Student-teacher conference	0	0	
Asking a questions during class discussion as a sort of evaluation	8	27	2
Oral testing after the lesson has been presented	3	10	4
Essay writing	5	16	3

Table 9 gives the ranking of assessment tools based on frequency of use by biology teachers. As shown, forty-seven percent use traditional

pencil-and-paper testing, which ranked first. This result suggests that the teachers still rely on the traditional method of assessment. Thus, they need to attend in-service training to learn more modern techniques in students' evaluation and assessment such as portfolio assessment, concept mapping and others.

Conclusions and Implications

On Time Management

- Both SEDP and Science Curriculum teachers utilize more time for instructional activities (about 80% and 94%, respectively), usually done from first to fourth quarter of the allotted time. On the other hand, they utilized about 20% (SEDP) and 6% (Science) of the period for non-instructional activities, usually done on the first or second quarter of the class period.
- The teachers spend more time in genetics (Mendelian and non-Mendelian) as compared to the other topics under study. This must be due to the nature of the topics, which requires more time for analysis because of the mathematical component.
- Some activities in the Science curriculum are done in the first two quarters of the periods. On the other hand, the same activities are accomplished only within the first quarter in the SEDP Curriculum. This is probably because of the longer and continuous flow of the activities in the latter (*i.e.*, 60 minutes in Science Curriculum and 80 minutes in SEDP Curriculum, both five days a week). This might imply a need to increase time allotment for the Science Curriculum.
- Both curricula have the same schedule for evaluating student activities and giving of homework and assignment. They usually implement these activities at the fourth quarter of the allotted time, about 6 minutes for the Science and 8.5 minutes for SEDP Curriculum, respectively.

On Teacher's Pedagogy

- Majority of the teachers in both SEDP and Science curricula employ **incomplete two-way** pedagogy (*i.e.*, the teachers direct many or most questions to individual students, only occasionally using their responses formatively). This implies that there is insufficient effective dialogue between them and students in the construction of knowledge and concepts. As a consequence, the students-teacher interaction is **teacher-dominated** (*i.e.*, teachers tend to do the talking most of the time), which in turn does not facilitate good dialogue between listener and speaker. Unfortunately this does not develop or promote higher-order thinking skills among students.

Motivational Activity

- All the teachers provide initial motivation to students prior to the introduction of the topical conception. The opening motivational strategies, according to percentage of use by the teachers, are as follows: (1) reviewing the previous lesson and relating it to the present topic (40%); (2) starting with a definition and elaborating on it (14%); (3) using an actual example (14%); (4) using an illustration (10%); (5) using a passage in the textbook related to the topic (6%); (6) using laboratory activities and relating them to the present topic (3%); and (7) using PROBEX (predict-observe-explain) technique to ignite students' interest (3%).
- As to the utilization of the kind of motivational strategies used by teachers, the findings indicate that:

  1) All the teachers use the following motivational strategies: starting with stimulating activities relevant to lessons; providing students with concrete instructional material support; having meaningful learning objectives; relating the lesson to daily activities; and presenting abstract concepts concretely in a more personal and familiar manner.
  2) Other teachers put additional motivational activities like (a) planning activities that cater to students' interests, (b) requiring students to relate the previous topic with a newly introduced topic,

(c) providing encouragement to low performers, (d) offering rewards as incentives for keeping up the good work, (e) structuring appropriate and healthy competition, (f) planning more opportunities for students to respond, (g) applying novel and interactive instructional methods, (h) asking questionsrelated to book assignment, and (i) reviewing the previous lesson and relating it to the new lesson, and (j) using history and philosophy of science in stimulating student interest on the topic.

On Teacher's Assessment

There were 628 assessment questions identified from thirty classroom discourses. Of the 628 assessment questions:

a. About 52% qualify for higher-order thinking, distributed into critical thinking questions that analyze arguments (23%), problem solving questions, which analyze alternative solutions (16.90%), decision-making questions which pertain to making a choice from a number of options (12%), and creative thinking questions (0.48%).
b. The other 48% were all simple recall questions.
c. As to whether the question is divergent or convergent, the findings show that there were 367 (58.4%) convergent questions, and 261 (41.6%) divergent questions.
d. As for the teachers' manner of questioning, the findings reveal that:

- About 60% of the questions are specific to a particular concept discussed in class.
- With 53% of the questions, the teachers give time for students to think before responding. The wait-time ranges from 2 to 40 seconds depending on the kind of questions. Generally, however, the average is about 12 seconds. This implies that the teachers provide enough chance for the students to answer correctly. However, this is not done as often as desired.
- In 53% of the questions, the teacher rephrases the questions so as to be understood by the students.

e. Some of the teachers asked questions that encourage participation of students (3.18%). However, it is sad to note that only about 17 questions out of of 108 (15.7%) encourage students to ask questions and answer them. These low percentages mean that the teachers do not sufficiently encourage a two-way communication during classroom discussion.

f. The teachers still rely mostly on traditional methods of assessment (*i.e.*, pencil-paper test, laboratory practical test, *etc.*)

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