A Matrix of Strategies in Teaching Biology: An Input to Pre-Service Teachers

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Abstract:  
A large percentage of pre-service teachers are facing problems during their practicum since they do not have sufficient knowledge about teaching strategies and when it should be integrated into instruction. This study is a descriptive research employing a survey method using a survey questionnaire and interview in the collection of data. It aims to identify the common and not commonly used strategies by in-service Biology teachers in teaching Biology in terms of content and skill. It is anchored on the K to 12 Basic Education Curriculum substantiated by Outcome-Based Teaching and Learning Theory. The participants were selected through random sampling including 72 in-service public Junior High School Biology teachers in which 29 were teaching Grade 7, 27 in Grade 8, 27 in Grade 9, and 25 in Grade 10. Data were tabulated using frequency count and were analyzed using percentage analysis. Results showed that lecture-discussion is the commonly used strategy in teaching the content yet considered to be the most ineffective strategy based on the interview, while cooperative learning is the commonly used strategy in teaching in terms of skills. Not commonly used strategies in teaching the content include jingle, music creation, poster-making, word puzzle, and think-pair-share while word puzzle for the skills. The result of the study pointed out the need for more training and seminars regarding the use of innovative science teaching strategies which will help improve students’ performance in Biology both in content and skills.

Keywords: Biology education, teaching strategies, in-service teachers, pre-service teachers

1. Introduction  
Teachers are traditionally known to impart knowledge solely, but in today's context, it is not enough for a teacher who is already in-service to teach in a vacuum, confirming on what is conventional. Instead, teachers now look for possible ways on how to deliver their instruction effectively by keeping students motivated and engaged. The teacher as implementer has to choose the right strategies to render effective teaching and instruction to learners (Pambid 2015; Boiser 2000) aside from the fact that there are numerous learning and teaching strategies freely available. Teaching strategies alongside the teacher's knowledge about the curriculum and mastery of the subject matter are one of the determinants in the effectiveness of the curriculum (Kamamia 2014; Duze 2012). It can be deduced that the fundamental importance of teaching strategies is to make teaching instruction efficient and effective by implementing a variety of teaching methods and techniques; hence, having a repertoire of a variety of teaching strategies will help students take more responsibility and enhance their learning as well as to improve the process of teaching for learning. However, large percentage of the pre-service teachers who are expected to be in-service teachers in the future are facing problems in integrating teaching strategies for their instruction during their practicum since they lack the exposure to these strategies (Mangila, 2018).

For an easy integration of strategies to instruction, this research undertaking specifically aimed to: (a) find out the commonly and not commonly used strategies used by selected in-service Public Junior High School Biology teachers in teaching Biology (Living Things and Their Environment) in terms of content and skills and (b) to develop a matrix that will serve as a guide in choosing the strategies in teaching Biology contents and skills.

2. Theoretical Framework  
The study is anchored on the K to 12 Basic Education Curriculum, also known as Enhanced Basic Education Curriculum that offers a decongested 12-year program. As the current curriculum used in the Philippine educational system gives students sufficient time to master skills and absorb necessary competencies to provide teaching approaches that could improve the teaching and learning process. In line with this theory is the Outcomes-Based Teaching and
Learning which focuses on student-centered approaches rather than teacher-centered approaches in the delivery of educational programs (Garrett, 2008; Llanes, 2010). As cited in the paper of Magtolis (2013) and Livingstone (2014), it has its roots from the idea of Biggs and Tang (2011) who further called OBTL as constructive alignment because students can construct meaning out of the relevant activities they are exposed. Moreover, Piaget’s constructivism is affixed to the curriculum because of the integration of the spiral progression approach where current in-service teachers have a choice on what teaching strategies to use to come up with a meaningful learning experience (Bada, 2015).

Catering diverse intelligences of the students which enables a teacher to choose appropriate methods and strategies to use in instruction is the primary concern of Gardner’s multiple intelligences theory. It emphasizes what the learner can bring inside the classroom by providing cues to what strategies the teacher can employ while considering individual characteristics (Bordei, 2016). According to Lewis (2012) as mentioned in the paper of Gorontalo (2018), allowing students to perform specific tasks together as divided into small groups develops critical thinking skills and cooperative learning because they are part of the discussion. Contemporary teaching can be best implemented through learning by design and project-based learning as it contends that building knowledge occurs best through making things that are tangible and sharable (Ralph 2015; Ackerman et al. 2009). It is supported by Wurdinger and Carlson (2010) who stated that students’ learning must be facilitated by the instructor for them to apply their knowledge and conceptual understanding of real-world problems or authentic situations. This thought highlights experiential learning where teachers must employ a strategy to help bring about learning by trying to emphasize issues relevant to the learners and the context, they are in.

Indeed, upholding to these theories and approaches helped to assimilate the realization of the core learning area standard that develops scientific, technological and environmental literacy among learners as prescribed by the K to 12 Science curriculum. By integrating them across science topics and other disciplines with the aid of the spiral progression approach result to a meaningful understanding of concepts and direct application to real-life situations.

2.1. Conceptual Framework

The study is directed to answer the identified problems with the use of the schematic diagram shown below.

![Figure 1: Conceptual Framework of the Study](image)

The figure shows how the study looked into the teaching of Biology (Living Things and Their Environment) contents and skills in the field concerning to the contemporary methods and strategies used by in-service Public Junior High School to bring about the commonly used strategies and develop a matrix containing the possible strategies that can be used in choosing teaching strategies. Collectively, the findings and results will serve as an input to other in-service teachers and to pre-service teachers in becoming an effective teacher by equipping and immersing themselves into a variety of strategies and when to use them. The impact on them would be an additional input to the various educational-related individuals and authorities regarding what to retain, improve, and remove during instruction.

2.2. Review of Related Literature

Science, engineering, and technology has been widespread in every feature of modern life and used as an instrument to conquer humanity’s most pressing challenges. The journey to seek an answer to a problem by exhibiting methods and principles in Science is to acquaint with the ever-flourishing technology advancements and to know and understand the challenges faced by the environment. These are the most critical components of the learning process in the 21st century Science teaching which the Committee on Conceptual Framework for New K to 12 Science Education Standards designed the framework comprising the broad set of expectations for students in Science. In the Philippines, this can be reflected in the K to 12 Science curriculum which envisions the development of scientifically, technologically, and environmentally literate and productive members of society who are critical problem solvers, responsible stewards of nature, innovative and creative citizens, informed decision makers, and effective communicators.

Teachers, as one of the determinants of the success of a curriculum, bombarded with vast strategies can use them in today’s teaching instruction. It is crucial to remember that not every strategy can or should be applied in every teaching situation. Instructional strategies serve as tools in designing and implementing instruction; hence, these can be used synchronously provided that it serves its purpose which is to support and nurture student learning. Based from the report of Schroeder et al. (2002), the Center for Mathematics and Science Education Project of Texas in A&M University presented descriptions of the identified effective research-based strategies in teaching K to12 Science which includes enhanced context strategies, collaborative grouping strategies, questioning strategies, inquiry strategies, manipulation strategies, assessment strategies, instructional strategies, and enhanced material strategies.

Effective science teachers are those who recognize suitable methods for teaching specific concepts or skills in different situations that provide appropriate instruction and those who have a vast array of instructional strategies and methods available to produce successful learning. Pre-service teachers as future educators play a vital role in the component and integral part of the curriculum (Alsubaie 2016; Mavrogiorgos 2014; Avgitidis 2007). It is claimed that
many pre-service teachers have considered their pre-service teaching or practicum to be the most significant influence upon learning how to teach (Adoniou 2013; Hastings 2010). However, it was observed that the pre-service teachers do not have sufficient knowledge about teaching strategies, methods, and techniques and that they cannot even distinguish between these concepts (Pambid 2015; Gunes et al. 2011).

In today’s setting, if the teacher intends to create more interactive learning environments, he or she has to integrate technology and use innovative strategies applicable into the learning experience because students are more likely interested and abreast. The world today is changing and advancing so teachers especially the pre-service teachers who are to be in-service teachers in the future need to be flexible, innovative and technology savvy. Thus, this calls for the identification of the strategies used by the present in-service teachers and the development of a repertoire of strategies for the immersion of the pre-service teachers to this variety of strategies. So as to create meaningful learning in the process of teaching and learning that requires contextualization by bridging the students’ real-life experiences into the content and deliverance.

3. Methodology

3.1. Research Design

The study utilized a descriptive research design employing a survey method in the collection of data where the respondents answer questions administered through survey questionnaires where quantifiable information was used for statistical inference. The data gathered were validated through conducting interviews to further elaborate their answers and to strengthen the reliability of the results.

3.2. Research Locale

The information presented in this study is geographically based in the Tacloban City Division where the participants are currently affiliated. Tacloban City as the regional center of the region of Eastern Visayas and despite being autonomous from the province of Leyte, still many educationally-motivated individuals in nearby municipalities and provinces seek to enroll because of the various public and private institutions that provide an excellent training ground for productive individuals in the future.

3.3. Sampling Procedure

The sampling technique utilized was random sampling wherein the researchers selected the respondents randomly for the pilot testing and during the actual data gathering by getting the list of all schools under the Division of Tacloban City and each school provided the number of teachers teaching Biology. Out of the 88 teachers, 13 teachers were chosen as the participants for pilot testing to achieve feasibility and 72 teachers for the actual data gathering with 95% confidence level and 5% margin of error for the results to establish reliability.

3.4. Data Instrument and Collection

Researchers have sought permission to each of the chosen schools where the study was conducted. The use of a survey questionnaire as an instrument was then distributed to the research respondents where they have to provide their demographic profile and placed a checkmark before the name of the strategy or strategies, they are utilizing in teaching Biology contents and skills. A follow-up interview consisted by eight open-ended questions was conducted to support their answers on the survey questionnaire and holistically develop the matrix for the possible instructional strategies that can be used in teaching Biology (Living Things and Their Environment). The gathered data were tabulated, analyzed and interpreted by using frequency count and percentage analysis as statistical tools. The different strategies used by the respondents in teaching the contents and skills in Biology in each grade level were tallied to derive the frequency of each strategy as well as to determine the value percentage. These enable to identify the common and not commonly used strategies in teaching Biology contents and skills and the matrix to be developed.

3.5. Data Analysis

The gathered data during the pilot testing and actual data collection were coded and tallied for commonalities. Frequency count and percentage analysis were used to analyze the data provided by the respondents to give accurate interpretations and conclusions of the results gathered during the survey conducted. In the form of a table, all the strategies used in teaching Biology contents and skills were summarized to develop the matrix.

4. Results and Discussion

This chapter presented the results of the research study drawn out from the answers of the respondents in the survey questionnaires and interviews with the corresponding interpretation and analysis. They are presented in a manner that they sequentially answer the research questions.
The respondents of the study included seventy-two (72) teachers who are composed mainly of females belonging to the age group between 21-30 years old with Biological Sciences as their major field of specialization and Bachelor's degree for their highest educational degree attained. Most of the teachers have taught Biology in the span of 1 to 5 years due to the ever-changing system of giving loads and preparation to the teachers. However, in terms of their nature of appointment of their service, mostly are Teacher 3 which implies that they are engaged in continued professional development. It is important to take note that the total number respondents reflected in Table 1 may exceed the total number of respondents of the study because some of the teachers teach Biology in other grade levels.

### Table 1: Profile of the Respondents of the Study

| A. Age and Sex | B. Specialization or Major Field | C. Highest Educational Degree | D. Length of Time Spent in Teaching Biology | E. Nature of Appointment |
|----------------|---------------------------------|-------------------------------|------------------------------------------|-------------------------|
| Age            | Specialization                  | Highest Educational Degree   | Length of Time Spent in Teaching Biology | Nature of Appointment   |
|                | (Male)                          | (Female)                      | (No. of Years)                          |                         |
|                | G7 G8 G9 G10                   | G7 G8 G9 G10                  | G7 G8 G9 G10                            |                         |
|                | T                               | T                             | T                                       |                         |
| 21-30          | 1                              | 2                             | 2                                       | 2                       |
| 31-40          | 2                              | 3                             | 3                                       | 3                       |
| 41-50          | 3                              | 4                             | 4                                       | 4                       |
| 51-60          | 4                              | 5                             | 5                                       | 5                       |
| DNS            | -                              | -                             | -                                       | -                       |
| Total          | 10                             | 30                            | 93                                      | 100                     |
| Percentage     | 11%                            | 57%                           | 32%                                     | 100%                    |

### Table 2: Strategies Used Across All Grade Levels in Teaching Biology in Terms of the Content

| Strategy                  | f | % |
|---------------------------|---|---|
| Lecture-Discussion         | 46 | 28.13 |
| Multimedia Instruction    | 42 | 20.58 |
| Brainstorming             | 88 | 53.86 |
| Cooperative Learning      | 17 | 10.07 |
| Role Playing              | 48 | 28.8 |
| Picture Analysis          | 43 | 24.42 |
| Cues and Questioning      | 41 | 24.49 |
| In-School Field Experiment| 38 | 22.62 |
| Research Review           | 37 | 22.26 |
| Concept Mapping           | 32 | 18.95 |
| Reporting                 | 32 | 18.95 |
| Laboratory Activity       | 31 | 18.85 |
| Model Making              | 30 | 18.33 |
| Inquiry                   | 23 | 14.06 |
| Show and Tell             | 21 | 12.80 |
| Graphic Organizer         | 20 | 12.02 |
| Film Showing              | 19 | 11.58 |
| Continence Mapping        | 10 | 6.06 |
| P.O.E.                    | 10 | 6.06 |
| Venn Diagram              | 10 | 6.06 |
| TOTAL                     | 108 | 100 |

The results revealed that 39 strategies were utilized by the selected Biology teachers across all grade levels in teaching Biology in terms of the content. Relative to this, lecture-discussion was the commonly used strategy while jingle, music creation, poster making, think-pair-share, and word puzzle were the strategies which are not commonly used. Lecture-discussion is the best teaching method that can be applied in many circumstances and for many students especially for communicating conceptual knowledge (Charlton, 2006) like in teaching the contents in Biology. In 2014, the Center for Instructional Development and Distance Education argued that despite its disadvantages such as providing students with individual feedback, difficult to adapt to learning differences and failure to promote independent learning can be addressed by incorporating into the lecture with other teaching strategies like questioning and problem-solving activities will surely support active learning.
Cooperative Learning

1. Multimedia Instruction 314 10.88 27 Targeted Feedback 15 0.52
2. Laboratory Activity 305 10.56 25 Tracking One’s Meal 15 0.52
3. Brainstorming 217 7.52 18 Trivia Question 15 0.52
4. Picture Analysis 166 5.75 20 4 Pics 1 Word 14 0.48
5. Boardwork 123 4.26 13 Music Creation 14 0.48
6. Role Playing 86 2.88 14 Planning A Healthy Diet 14 0.48
7. P.O.E. 84 2.91 29 Name Game 13 0.45
8. Model Making 77 2.67 12 Debate 12 0.42
9. Comic Strip Making 72 2.49 30 Gallery Walk 12 0.42
10. Graphic Organizer 68 2.36 12 Modelling 12 0.42
11. In-School Field Experience 68 2.36 12 Peer Teaching 12 0.42
12. Venn Diagram 64 2.22 11 3-Day Menu 11 0.38
13. Lecture-Discussion 59 2.04 11 Making Illustrations 11 0.38
14. Simulation 55 1.91 10 Word Wall 11 0.38
15. Lecture-Demonstration 50 1.73 12 Film Showing 10 0.35
16. Concept Mapping 49 1.70 12 Instructional Analysis 10 0.35
17. Situational Analysis 46 1.59 33 Memory Game 9 0.31
18. Direct Instruction 39 1.35 34 Journal Making 8 0.29
19. Concept Mapping 38 1.32 10 Think-Pair-Share 8 0.28
20. Reporting 38 1.32 35 Integration With Other Content 7 0.24
21. Research Review 27 0.94 36 Survey Activity 6 0.21
22. Collaborative Learning 26 0.90 7 Reaction Papers 5 0.17
23. Picture Puzzle 26 0.90 7 Reaction Papers 5 0.17
24. Classifying Organisms 24 0.83 10 Realitas 5 0.17
25. Reciprocal Teaching 22 0.76 38 Focus Group Discussion 4 0.14
26. Advertising 19 0.66 14 Video Making 4 0.14
27. Cues and Questioning 18 0.62 39 Poem Making 3 0.10
28. Story Making 18 0.62 38 R.E.P.R. 3 0.10
29. Jigsaw 16 0.55 40 Poster Making 2 0.07
30. Playing A Board Game 16 0.55 31 Word Puzzle 2 0.07
31. Project-Based Task 16 0.55 63 TOTAL 2600 100

Continue to the next column.

Table 3: Strategies Used Across All Grade Levels In Teaching Biology In Terms Of The Skills

On the other hand, the commonly used strategy by selected Biology teachers in teaching Biology in terms of the skills was cooperative learning and word puzzle as the not commonly used strategy. Cooperative learning is employed by teachers to increase student understanding of content, to build particular transferable skills, or some combination of the two from small group work to capitalize on the impacts of peer-to-peer interaction and discussion (Brake and Biel 2015; Johnson et al. 2008). Promoting students in working together maximize their own and each other’s learning is the primary instructional use of small groups. Johnson and Johnson (2015) stressed that cooperative learning has characterized by positive interdependence, where students perceive that better performance by individuals produces better performance by the entire group. They also added that it is one of the most effective teaching approaches to be used to analyze the results of the activities performed.

| Strategy | f | % | Strategy | f | % |
|----------|---|---|----------|---|---|
| Multimedia Instruction | 735 | 16.60 | Story Making | 18 | 0.41 |
| Lecture-Discussion | 620 | 14.74 | Playing A Board Game | 16 | 0.36 |
| Cooperative Learning | 431 | 9.73 | Project-Based Task | 16 | 0.36 |
| Laboratory Activity | 336 | 7.99 | Magic Creation | 15 | 0.34 |
| Brainstorming | 315 | 7.11 | Targeted Feedback | 15 | 0.34 |
| Picture Analysis | 209 | 4.72 | Tracking One’s Meal | 15 | 0.34 |
| Boardwork | 136 | 3.07 | Memory Game | 14 | 0.32 |
| Role Playing | 134 | 3.03 | Planning A Healthy Diet | 14 | 0.32 |
| Model Making | 107 | 2.42 | Name Game | 13 | 0.29 |
| In-School Field Experience | 106 | 2.39 | Pick and Match | 13 | 0.29 |
| P.O.E. | 100 | 2.26 | Video Making | 13 | 0.29 |
| Graphic Organizer | 88 | 1.99 | Debate | 12 | 0.27 |
| Concept Mapping | 81 | 1.83 | Modelling | 12 | 0.27 |
| Venn Diagram | 80 | 1.81 | Peer Teaching | 12 | 0.27 |
| Comic Strip Making | 72 | 1.63 | D-Day Menu | 11 | 0.25 |
| Reporting | 70 | 1.58 | Making Illustrations | 11 | 0.25 |
| Research Review | 64 | 1.45 | Word Wall | 11 | 0.25 |
| Simulation | 63 | 1.42 | Instructional Analysis | 10 | 0.23 |
| Concept Mapping | 54 | 1.22 | Poem Making | 10 | 0.23 |
| Direct Instruction | 51 | 1.19 | Realitas | 9 | 0.20 |
| Lecture-Demonstration | 50 | 1.13 | Think-Pair-Share | 9 | 0.20 |
| Jigsaw | 38 | 0.86 | Journal Making | 8 | 0.18 |
| Show and Tell | 37 | 0.84 | Integration With Other Content | 7 | 0.16 |
| Film Showing | 25 | 0.56 | R.W.H.L | 7 | 0.16 |
| Collaborative Learning | 26 | 0.59 | Survey Activity | 6 | 0.14 |
| Picture Puzzle | 26 | 0.59 | Checklist | 5 | 0.11 |
| Classifying Organisms | 24 | 0.54 | Cumulating Activity | 5 | 0.11 |
| 4 Pics 1 Word | 23 | 0.52 | Reaction Papers | 5 | 0.11 |
| Role Playing | 22 | 0.50 | Group Discussion | 4 | 0.09 |
| Trivia Question | 20 | 0.45 | Poster Making | 3 | 0.07 |
| Advertisement Making | 19 | 0.43 | R.E.P.R. | 3 | 0.07 |
| Gallery Walk | 19 | 0.43 | Word Puzzle | 2 | 0.05 |
| Cues and Questioning | 18 | 0.41 | Jingle | 1 | 0.02 |

Continue to the next column.

Table 4: Summary of All Teaching Strategies Used by Selected in-Service Public Junior

High School Biology Teachers in Teaching Biology Content and Skills across All Grade Levels

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Moreover, out of 66 teaching strategies used by in-service Public Junior High School Biology teachers across all grade levels in teaching both the contents and skills in Biology, multimedia instruction is the commonly used strategy while jingle is the not widely used strategy.

The advantages such timeliness and effectiveness are one of the reasons why multimedia instruction is the most commonly used strategy among others because it altered the landscape in the educational arena by providing the students an opportunity to manage cognitive load which increases motivation (Mayer, 2014) and retention (Conrad and Bliemel, 2016) by developing inquisitiveness makes learning experiences purposeful (Ketsman 2014; Allen 2003). It also allows learners to be creative in a way that it will enable them to become active producers of knowledge by reducing the need for memorization through changing "how” by “why” in the classrooms according to Neary and Winn (2009). As revealed during the interview, excerpts are in the text below:

**Figure 1**

INTVW, Exc. 1
Teacher 11: Multimedia for me is the commonly used strategy especially that the students, the millennials nowadays are much more on multimedia rather than visual aids like

**Figure 2**

INTVW, Exc. 2
Teacher 10: The most effective teaching strategy is the multimedia presentation by downloading different kinds of video presentation which are related to my topic. It was indeed effective, most effective because students are learning a lot of things rather than chalk talk, like I talk while writing something on the

**Figure 3**

INTVW, Exc. 3
Teacher 4: As for the technical glitches, I made sure to set up my multimedia equipment ahead of time so as to avoid delay and wastage of time, especially if the laboratory activities and learner’s materials are unavailable.

**Figure 4**

INTVW, Exc. 4
Teacher 10: If there are problems, I encountered in the multimedia, I actually give my PowerPoint presentation through an application for the students to have a copy.

The result indicated that lecture-discussion was the second common strategy and it is not surprising since its widespread use is well documented (Goffe and Kauper 2014; Smith and Valentine, 2012). According to Carnegie Mellon University (2019), it is an excellent strategy for enhancing student motivation, fostering intellectual agility, and provides avenues for exploration and discovery. However, numerous studies have demonstrated that traditional lectures relying on passive learning is not as effective as active, student-centered learning strategies (Lom 2012; Tanner 2009). It noted that lecture-discussion was pointed out by the respondents as least effective during the interview. The responses of the teachers attest this point of view written in the following text.

**Figure 5**

INTVW, Exc. 5
Teacher 3: The least effective strategy is the lecture-discussion because some of the students are not listening, some were talking to their seatmates and some were not able to understand what the teacher was talking about.

**Figure 6**

INTVW, Exc. 6
Teacher 11: Spoon feeding the students is not the trend any more for students tend to be bored most of the time. If the teacher does the talking and the ideas and information are being spoon-fed by the teacher. It should be then the students, student-centered activities should be catered wherein the teacher will just serve as the facilitator in class.
However, considering this critical claim of the respondents is the answer to why there are contrasting results between the result of the survey and their responses in the interview as stipulated in the statement below:

**INTVW, Exc. 7**
Teacher 13: … teachers can use it anytime as long as you have the mastery of the lesson. As you can notice, teachers nowadays are not only tasked to teach, we also accomplish reports if you are aware of that. We are told to do so many things and we even play roles that are beyond the teaching profession. Sometimes it’s painful to think that we cannot prepare that much for our lessons due to these additional roles we play in the school premises. So, when these situations occur, lecture-discussion would be a good alternative to use.

Figure 7

This claim implies that teachers resorted to using lecture-discussion despite its ineffectiveness considering it as suitable in all situations or an answer to any school’s urges with their intention of not wasting time or establishing gaps between their lessons. It may be an excuse but the mere fact, it happens in the real scenario. Even the Guyana Ministry of Education (2017) also perceived the same claim that the traditional lecture method of teaching is the only way to be applied in all circumstances.

Upon gathering the necessary data, development of matrix completed the process which comprises all the strategies used by every grade level in-service Public Junior High School Biology teacher in the Division of Tacloban City in teaching Biology contents and skills. As the expected outcome of the study, it primarily intends to provide an input to pre-service teachers in practicing the field of teaching. As shown in the succeeding tables is the developed matrix of the study.

| Table 5 |
|---|

**Table 5**

| Content | Learning Competencies | Strategies | Activities | Strategies |
|---|---|---|---|---|
| 1. Parts and Functions | | | | |
| 1. identify parts of the microscope and their functions | | | | |
| 2. Microscopy | | | | |
| 1. identify parts of the microscope and their functions | | | | |
| 2. focus specimens using the compound microscope | | | | |
| 2. Levels of Biological Organization | | | | |
| 1. describe the different levels of biological organization from cell to organism | | | | |
| 3. Animal and Plant Cells | | | | |
| 4. differentiate plant and animal cells according to presence or absence of certain cell types | | | | |
| 5. explain why the cell is considered the basic structure and functional unit of all organisms | | | | |
| 4. Fungi, Protists, and Bacteria | | | | |
| 5. identify beneficial and harmful microorganisms | | | | |

**Summary of All Strategies Used in Terms of the Content and Skill**

- **Content:**
  - Plant Cells
  - Animal Cells
  - Microscopy
  - Levels of Biological Organization
  - Fungi, Protists, and Bacteria

- **Learning Competencies:**
  - Knowledge and Understanding
  - Skill and Proficiency
  - Attitude and Values

- **Strategies:**
  - Lecture
  - Discussion
  - In-School Field Trip
  - Collaborative Learning
  - Laboratory Activity

- **Activities:**
  - Identifying plant and animal cells
  - Differentiating plant and animal cells
  - Describing plant cells
  - Investigating plant cells
  - Comparing plant and animal cells
  - What other things grow in the school grounds?
  - What do these things look like under the microscope?

**Grid 1**

- **Content:**
  - 1. Parts and Functions
  - 2. Microscopy
  - 3. Levels of Biological Organization
  - 4. Animal and Plant Cells
  - 5. Fungi, Protists, and Bacteria

- **Learning Competencies:**
  - Knowledge and Understanding
  - Skill and Proficiency
  - Attitude and Values

- **Strategies:**
  - Lecture
  - Discussion
  - In-School Field Trip
  - Collaborative Learning
  - Laboratory Activity

- **Activities:**
  - Identifying plant and animal cells
  - Differentiating plant and animal cells
  - Describing plant cells
  - Investigating plant cells
  - Comparing plant and animal cells
  - What other things grow in the school grounds?
  - What do these things look like under the microscope?
### Table 6

| Content                                                                 | Learning Competencies | Strategies                                      | Activities                                      | Strategies                           |
|------------------------------------------------------------------------|-----------------------|-------------------------------------------------|-------------------------------------------------|--------------------------------------|
| 2. Density, Inheritance and Variation                                  |                       |                                                 |                                                 |                                      |
| 1. Austral Introduction                                                |                       |                                                 |                                                 |                                      |
| 2. Sexual reproduction                                                 |                       |                                                 |                                                 |                                      |
| 3. describe the process of fertilization                              |                       |                                                 |                                                 |                                      |
| 6. Ecosystems                                                          |                       |                                                 |                                                 |                                      |
| 7. describe the biotic components of an ecosystem                     |                       |                                                 |                                                 |                                      |
| 10. describe the different ecological relationships found in an ecosystem |                       |                                                 |                                                 |                                      |
| 11. predict the effect of changes in one population on other populations in the ecosystem |                       |                                                 |                                                 |                                      |
| 12. predict the effect of changes in abiotic factors of the ecosystem  |                       |                                                 |                                                 |                                      |

**Table 7**

| Content                                                                 | Learning Competencies | Strategies                                      | Activities                                      | Strategies                           |
|------------------------------------------------------------------------|-----------------------|-------------------------------------------------|-------------------------------------------------|--------------------------------------|
| 1. Stomach and Functions: Focus on the Digestive System                |                       |                                                 |                                                 |                                      |
| 1. The stomach, digestion, and absorption                              |                       |                                                 |                                                 |                                      |
| 5. Organs of the digestive system and their connection with organs of the body's immunity, and accessory systems   |                       |                                                 |                                                 |                                      |
| 6. Changes in food as transductions of physical and chemical digestion |                       |                                                 |                                                 |                                      |
| 7. Diseases resulting from deficient digestion and ingestion of harmful substances |                       |                                                 |                                                 |                                      |
| 8. Prevention, detection, and treatment of diseases of the digestive system |                       |                                                 |                                                 |                                      |
| 3. classify the diseases that affect the digestive system              |                       |                                                 |                                                 |                                      |

**Table 6**

| Content                                                                 | Learning Competencies | Strategies                                      | Activities                                      | Strategies                           |
|------------------------------------------------------------------------|-----------------------|-------------------------------------------------|-------------------------------------------------|--------------------------------------|
| 2. Density, Inheritance and Variation                                  |                       |                                                 |                                                 |                                      |
| 1. Austral Introduction                                                |                       |                                                 |                                                 |                                      |
| 2. Sexual reproduction                                                 |                       |                                                 |                                                 |                                      |
| 3. describe the process of fertilization                              |                       |                                                 |                                                 |                                      |
| 6. Ecosystems                                                          |                       |                                                 |                                                 |                                      |
| 7. describe the biotic components of an ecosystem                     |                       |                                                 |                                                 |                                      |
| 10. describe the different ecological relationships found in an ecosystem |                       |                                                 |                                                 |                                      |
| 11. predict the effect of changes in one population on other populations in the ecosystem |                       |                                                 |                                                 |                                      |
| 12. predict the effect of changes in abiotic factors of the ecosystem  |                       |                                                 |                                                 |                                      |

**Table 7**
## Grade 8
### Summary of All Strategies Used in Terms of the Content and Skill

| Content | Learning Competencies | Strategies | Activity/Use | Strategies |
|---------|-----------------------|------------|--------------|------------|
|          |                       |            |              |            |

**Table 8**

## Grade 9
### Summary of All Strategies Used in Terms of the Content and Skill

| Content | Learning Competencies | Strategies | Activity/Use | Strategies |
|---------|-----------------------|------------|--------------|------------|
|          |                       |            |              |            |

**Table 9**
### Table 10

| Content                          | Learning Competencies | Strategies | Activities | Strategies |
|----------------------------------|-----------------------|------------|------------|------------|
| 1. Respiratory and Digestory Systems Working with the Other Organ Systems |                       |            |            |            |
| 1. Explain the respiratory and digestive systems work together through nutrients, gases, and other molecules from the different parts of the body. | Question, Discussion   |            |            |            |
| 2. Describe how the respiratory system affects the functioning of the respiratory and digestive systems. | Question, Discussion   |            |            |            |
| 3. What is the role?             | Multi-Instruction      | Research   |            |            |

### Table 11

| Content                          | Learning Competencies | Strategies | Activities | Strategies |
|----------------------------------|-----------------------|------------|------------|------------|
| 1. Respiratory and Digestory Systems Working with the Other Organ Systems |                       |            |            |            |
| 1. Explain the respiratory and digestive systems work together through nutrients, gases, and other molecules from the different parts of the body. | Question, Discussion   |            |            |            |
| 2. Describe how the respiratory system affects the functioning of the respiratory and digestive systems. | Question, Discussion   |            |            |            |
| 3. What is the role?             | Multi-Instruction      | Research   |            |            |

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**Note:** The tables and content have been reorganized to maintain readability and clarity. The original content has been paraphrased to ensure natural language presentation.
### Table 12

| Content                  | Learning Competency | Strategies                  | Activities                  | Strategies       |
|--------------------------|---------------------|-----------------------------|-----------------------------|------------------|
| 1. Biodiversity and Extinction |                     |                             | Activity 1: Index of Diversity | Cooperative Learning |
|                          |                     |                             |                             | In-School Field Trip |
|                          |                     |                             |                             | Brainstorming     |
|                          |                     |                             |                              | Peer Teaching     |
|                          | 5. relate species extinction to the failure of populations to adapt to abrupt changes in the environment |                         | Activity 2: Measuring Population Density | Cooperative Learning |
|                          |                     |                             |                             | In-School Field Trip |
|                          |                     |                             |                             | Brainstorming     |
|                          |                     |                             |                              | Collaborative Learning |
|                          |                     |                             |                              | Direct Instruction |
|                          |                     |                             |                              | Laboratory Activity |
|                          | 6. evaluate species extinction to the role of human activities in the event of extinction |                             | Activity 3: Enlarged Gut for Enzyme Activity | Cooperative Learning |
|                          |                     |                             |                             | Laboratory Activity |
|                          |                     |                             |                              | Brainstorming     |
|                          |                     |                             |                              | Direct Instruction |
|                          |                     |                             |                              | Multimedia Instruction |
|                          |                     |                             |                              | Recording         |
|                          |                     |                             |                              | Simulation        |
|                          | 7. Activity 5: Mating Predictions |                             |                             | Picture Analysis  |
|                          |                     |                             |                              | Brainstorming     |
|                          |                     |                             |                              | Laboratory Activity |
|                          |                     |                             |                              | Collaborative Learning |
|                          |                     |                             |                              | Lecture-Discussion |

### Table 13

| Content                          | Learning Competency | Strategies | Activities | Strategies |
|----------------------------------|---------------------|-------------|-------------|-------------|
| 4. Ecosystems                    |                     |             |             |             |
| 4.1 Flow of Energy and Matter in Ecosystems |             |             |             |             |
| 4.2 Biodiversity and Stability   |                     |             |             |             |
| 4.3 Population Growth and Carrying Capacity |             |             |             |             |
| 4.4 Plant Growth and Photosynthesis |             |             |             |             |
| Activity 1. What are the structures involved in the food making process in plants? |             |             |             |             |
| Activity 2. Investigating the Leaf Structures |             |             |             |             |
| Activity 3. Evidence of Photosynthesis |             |             |             |             |
| Activity 4. The Power House |             |             |             |             |
| Activity 5. Let Us Recharge |             |             |             |             |
| Activity 6. Comparing Photosynthesis and Respiration |             |             |             |             |
### Table 16

#### Summary of All Strategies Used Both in Content and Skills

| Content | Learning Competencies | Strategies | Activities | Strategies |
|---------|-----------------------|------------|------------|------------|
| 1. Biodiversity and Evolution |                         |             | Activity 1A. Where Do I Belong? | Classifying Organisms, Organism Analysis, Laboratory Activity, Cooperative Learning, Concept Mapping, Direct Instruction, Lecture-Discussion, Scientific Analysis |
|         |                       |             | Activity 1B. What’s My Angle? | Classifying Organisms, Organism Analysis, Laboratory Activity, Cooperative Learning, Concept Mapping, Direct Instruction, Lecture-Discussion, Scientific Analysis |
|         |                       |             | Activity 2. Analyzing Homologous Evidence for Evolution | Brainsstorming, Cooperative Learning, Laboratory Activity, Cooperative Learning, Concept Mapping, Direct Instruction, Lecture-Discussion, Scientific Analysis |
|         |                       |             | Activity 3. So, who is my Relative? | Brainsstorming, Cooperative Learning, Laboratory Activity, Cooperative Learning, Concept Mapping, Direct Instruction, Lecture-Discussion, Scientific Analysis |
|         |                       |             | Activity 4. Let’s Compare | Brainsstorming, Cooperative Learning, Laboratory Activity, Cooperative Learning, Concept Mapping, Direct Instruction, Lecture-Discussion, Scientific Analysis |
|         |                       |             | Activity 5. Follow the Track | Brainsstorming, Cooperative Learning, Laboratory Activity, Cooperative Learning, Concept Mapping, Direct Instruction, Lecture-Discussion, Scientific Analysis |
|         |                       |             | Activity 6. Behave | Brainsstorming, Cooperative Learning, Laboratory Activity, Cooperative Learning, Concept Mapping, Direct Instruction, Lecture-Discussion, Scientific Analysis |

### Table 17

#### Summary of All Strategies Used Both in Content and Skills

| Content | Learning Competencies | Strategies | Activities | Strategies |
|---------|-----------------------|------------|------------|------------|
| 4. Ecosystems |                         |             | Activity 1. Describing the Value of Ecosystems | Cooperative Learning, Multimedia Instruction, In-School Field Trips, Laboratory Activity, Cooperative Learning, Concept Mapping, Brainsstorming, Lecture-Demonstration |
|         |                       |             | Activity 2. Dependent or Independent? | Brainsstorming, Cooperative Learning, Laboratory Activity, Cooperative Learning, Concept Mapping, In-School Field Trips |
|         |                       |             | Activity 3. Analyzing Environmental Issues | Brainsstorming, Cooperative Learning, Laboratory Activity, Cooperative Learning, Concept Mapping, In-School Field Trips |
|         |                       |             | Activity 4. Biodiversity Status in the Community | Brainsstorming, Cooperative Learning, Laboratory Activity, Cooperative Learning, Concept Mapping, In-School Field Trips |
|         |                       |             | Activity 5. Product Development | Brainsstorming, Cooperative Learning, Laboratory Activity, Cooperative Learning, Concept Mapping, In-School Field Trips |

### Table 16

#### Summary of All Strategies Used Both in Content and Skills

| Content | Learning Competencies | Strategies | Activities | Strategies |
|---------|-----------------------|------------|------------|------------|
| 4. Ecosystems |                         |             | Activity 1. Describing the Value of Ecosystems | Cooperative Learning, Multimedia Instruction, In-School Field Trips, Laboratory Activity, Cooperative Learning, Concept Mapping, Brainsstorming, Lecture-Demonstration |
|         |                       |             | Activity 2. Dependent or Independent? | Brainsstorming, Cooperative Learning, Laboratory Activity, Cooperative Learning, Concept Mapping, In-School Field Trips |
|         |                       |             | Activity 3. Analyzing Environmental Issues | Brainsstorming, Cooperative Learning, Laboratory Activity, Cooperative Learning, Concept Mapping, In-School Field Trips |
|         |                       |             | Activity 4. Biodiversity Status in the Community | Brainsstorming, Cooperative Learning, Laboratory Activity, Cooperative Learning, Concept Mapping, In-School Field Trips |
|         |                       |             | Activity 5. Product Development | Brainsstorming, Cooperative Learning, Laboratory Activity, Cooperative Learning, Concept Mapping, In-School Field Trips |

### Table 17

#### Summary of All Strategies Used Both in Content and Skills

| Content | Learning Competencies | Strategies | Activities | Strategies |
|---------|-----------------------|------------|------------|------------|
| 4. Ecosystems |                         |             | Activity 1. Describing the Value of Ecosystems | Cooperative Learning, Multimedia Instruction, In-School Field Trips, Laboratory Activity, Cooperative Learning, Concept Mapping, Brainsstorming, Lecture-Demonstration |
|         |                       |             | Activity 2. Dependent or Independent? | Brainsstorming, Cooperative Learning, Laboratory Activity, Cooperative Learning, Concept Mapping, In-School Field Trips |
|         |                       |             | Activity 3. Analyzing Environmental Issues | Brainsstorming, Cooperative Learning, Laboratory Activity, Cooperative Learning, Concept Mapping, In-School Field Trips |
|         |                       |             | Activity 4. Biodiversity Status in the Community | Brainsstorming, Cooperative Learning, Laboratory Activity, Cooperative Learning, Concept Mapping, In-School Field Trips |
|         |                       |             | Activity 5. Product Development | Brainsstorming, Cooperative Learning, Laboratory Activity, Cooperative Learning, Concept Mapping, In-School Field Trips |
5. Conclusions

There is a big gap between the common and not commonly used strategy both in content and skills in terms of its applicability and effectivity. This finding led to a revelation that teacher-respondents are still facing unceasing common problems such as unavailability of laboratory apparatuses and instructional materials which continuously hinders them at present to implement the strategies, they think are said to be effective. As a solution, they resorted to using what they call “traditional” way of teaching despite of knowing its ineffectiveness and impact on the students just for topic completion and convenience. Majority of them suggested adopting strategies that are hands-on and student-centered activities to fulfill the aim of the K to 12 curriculum which is learner-centered and inquiry-based. The matrix developed will be helpful to guide pre-service and in-service teachers in choosing appropriate strategies to be integrated into the instruction. The said matrix comprises the collection of teaching strategies that can be applied explicitly to every competency of the Biology curriculum across all grade levels. Therefore, the result of the study would be a wake-up call to pre-service teachers, in-service teachers, and administrators the need to practice various science teaching strategies as identified in the matrix to improve the performance of students both in Biology contents and skills.

6. Recommendations

Based on the findings and conclusion, the following are recommended: (a) the use of science innovative teaching strategies, technology-based materials and needs-based curriculum enabling teachers to build rapport between students and improve teaching and learning process (b) more trainings and seminars regarding the use of teaching strategies to immerse teachers into a variety of teaching strategies that can be used in teaching Biology (c) to conduct studies to thoroughly evaluate the effectiveness of the strategies as reflected in the matrix developed (d) constant monitoring to eradicate the unceasing problems of teachers which continuously affecting the teachers’ vision of rendering effective instruction.

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