Instructional Unit Design for Grade 7
English Program
Rittiyawannalai School
Bangkok, Thailand

Instructional Unit Overview
Designed by Mr. Michael Jhudz Jarin
Unit Focus: Chapter 3 Plants
Grade Level: 7 (Mattayomsuksa 1)
Duration of Unit: 30 hours

Learners and Contexts Assessment	
Description of Learners	Mattayomsuksa 1, or Grade 7 equivalent in K-12, students are Thai and are considered second language learners.
Entry Knowledge or Skills	In the previous unit lesson about cells, students learned the steps of scientific investigation and conducted an experiment. In this plant unit, the laboratory skill will be put to use to conduct more experiments.
Prior Knowledge of Specific Domain	Before instruction, grade 8 students will take a pre-test to determine their prior knowledge of the plant unit. The performance of laboratory skills will also be evaluated.
Attitudes Toward Content	Students anticipate performing laboratory experiments in groups and gaining hands-on experience in the science laboratory using Google Translate and online learning resources.
Academic Motivation	This group of second language learners is highly motivated to achieve high marks in everything they do in class. They will ensure that they understand how many points are allocated to the specific activity specified by the teacher.
Educational and Ability levels	The poor comprehension, communication, and laboratory skills of students will have an impact on instructional delivery.
Learning Preferences	Second language learners work best in groups and are most engaged when performing laboratory experiments.
Group Characteristics	Students can expect to work in groups with at least one leader who can express themselves in both English and Thai. These students are a diverse group. There are students who attended the English program during their primary school years, and there are students who did not.

Context Analysis – Analysis of Performance Setting	
Social Aspects	Students must exhibit desirable characteristics such as self-discipline, honesty and integrity, eagerness to learn, and dedication and commitment to work.
Physical Aspects	The lesson will be taught in the classroom, and the experiments will be carried out in the school science laboratory. The learning unit will be delivered face to face while using an e-learning platform called Moodle.
Relevance	This unit's lessons can be applied at home as they care for their own plants.
Adaptability and Accessibility	Students will be exposed to inquiry-based teaching instruction in the classroom using the 5-E learning model with corresponding assessment techniques in each part of the learning model.

Goals and Standards	
Essential Questions	1) How do plants change as they grow? 2) How do plants provide for their basic needs? 3) How do plants undergo photosynthesis? 4) What are the functions of each plant part? 5) How do plants reproduce? 6) How and why do plants adapt to their surroundings? 7) How do seeds move from one place to another? 8) Why does traveling help seeds to grow? 9) What is the role of modern technology in plants?
Goals	1) Understand photosynthesis. 2) Experiment to find and explain the essential factors for photosynthesis of plants. 3) Explain the importance of photosynthesis on living things and the environment. 4) Analyze the transport system in plants. 5) Experiment and explain groups of cells involved in transportation of water and nutrients in plants. 6) Analyze the sexual and asexual reproductive systems of flowering plants. 7) Explain sexual reproduction processes of angiosperms and plant asexual reproduction processes. 8) Understand the structures of a flower and their functions. 9) Experiment and explain floral structures involved in plant reproduction. 10) Analyze pollination. 11) Understand the development of fruits and seeds in plants.

<table>
<tr><td></td><td colspan="2">12) Understand the dispersal of seeds and fruits in plants.
13) Synthesis the concept of germination of seeds
14) Realize the importance of nutrients that affect plant's life and its growth.
15) Understand plant propagation and its application.
16) Understand vegetative reproduction methods and its application.
17) Realize the importance of plant tissue culture technology and its application.</td></tr>
<tr><td>Alignment with Standards/Frameworks</td><td>Learning Standards</td><td>Content Area</td></tr>
<tr><td rowspan="4"></td><td>M.1/6 Indicate the essential factors of photosynthesis and the outcomes of photosynthesis based on empirical evidence.
M.1/7 Explain the importance of photosynthesis of plants that affects living things and environment.
M.1/8 Realize the values of plants that impact on living things and environment by planting, watering, and looking after plants in your school and community.</td><td>➢ Photosynthesis</td></tr>
<tr><td>M.1/9 Describe the features and functions of xylem and phloem.
M.1/10 Draw a diagram describing the direction of transportation in xylem and phloem of plants.</td><td>➢ Transport System in Plants</td></tr>
<tr><td>M.1/11 Explain sexual and asexual reproduction in flowering plants.</td><td>➢ Sexual reproductive system of flowering plants</td></tr>
<tr><td>M.1/12 Explain the structure of flowers involving pollination and describe fertilization in flowering plants, formation of fruits and seeds, seed dispersal and germination of seeds. M.1/13 Realize the importance of animal pollination of flowering plants by not killing them.</td><td>➢ Pollination
➢ Development of fruits and seeds in plants
➢ Dispersal of seeds and fruits
➢ Germination of seeds</td></tr>
<tr><td></td><td>M.1/14 Explain the importance of some nutrients that affect plant's life and its growth. M.1/15 Appropriately choose the right fertilizer and right amount to plants in the given situations.</td><td>➢ Mineral requirements in plants</td></tr>
</table>

	M.1/16 Choose an appropriate reproduction process that suit to human wants by applying the knowledge of plant propagation. M.1/17 Explain the importance of plant tissue culture technology and the application of its usefulness in various fields. M.1/18 Realize the benefits of plant propagation by applying the knowledge in daily life.	➢ Asexual reproduction of plants

Performance Objectives (Skill, Condition, Criteria)
Students are expected to create a "Miniature garden" (*condition*) in which they will demonstrate their understanding of how plants undergo photosynthesis and adapt to their environment using their scientific investigation skills (*skill*). This activity takes four to five hours and must be completed entirely within the classroom. The activity will be graded based on the appropriateness of the materials used in the construction of the miniature garden, the thoroughness of their responses to the questions, and their overall presentation in front of the class (*criteria*). After the lesson, this activity is part of the end – product activity. However, instructions will be provided prior to the lesson to identify group members, prepare materials to be used, and plan every after class.

Instructional Activities and Assessment Methods
In this learning unit, students will be active participants in the learning process, with the teacher serving only as a facilitator. The teaching strategy to be used is inquiry-based instruction, in which students will be exposed to a series of questions to practice their critical and analytical skills. Once these skills have been developed, they will conduct experiments in the laboratory to apply scientific investigations, and most importantly, they will be able to create a laboratory report for each experiment they have conducted. Each activity will include an assessment technique to ensure that they can demonstrate the necessary skills. The assessment techniques are background knowledge probe (*assessing prior knowledge, recall, and understanding*), concept maps (*assessing skill in synthesis and creative thinking*), documented problem solutions (*assessing skill in problem solving*), student-generated test questions (*assessing skill in application and performance*), course-related self-confidence surveys (*assessing learner attitudes, values, and self-awareness*), interest/knowledge/skills checklists (*assessing students' self-awareness as learners*),

electronic survey feedback through google forms (*assessing learner reaction to instruction*), and lastly is group work evaluation (*assessing learner reactions to class activities*).

Second learners work best in groups, and instruction should be introduced earlier to avoid consuming too much time during the activity itself. Cooperative learning, hands-on activities, presentation, and performance are the overall instructional strategies.

Introduction/Pre-instruction:

This learning unit will be introduced to my students by setting expectations. I will provide the unit objectives so that they are aware of what they will accomplish during and after the lesson. I'll ask them to establish their expectations of me as their teacher. I will carefully discuss the details of each activity, such as scientific investigation rules, question making, groupings, laboratory performance, and, most importantly, their honest response to each strategy I will employ.

Instructional Activities and Sequence:

Learning Goals	Content Area	Teaching Hours	Activity	Instruction	Assessment Technique
1) Understand photosynthesis. 2) Experiment to find and explain the essential factors for photosynthesis of plants. 3) Explain the importance of photosynthesis on living things and the environment.	Photosynthesis	7 hours	Testing for the presence of starch in leaves (lab experiment) Investigating the factors required for photosynthesis (The presence of carbon dioxide, the presence of sunlight, and the presence of chlorophyll-lab experiment)	Students will be group into 6 with 5 members each group. Follow the guidelines given for the investigation process. Create a laboratory report about of the second experiment. Present the highlights in front of the class.	Documented problem solutions (*students track in a written format the steps they take to solve problems as if for a "show & tell")* Laboratory report category (*Experienced, Competent, Intermediate, Transition, Beginning, and Unacceptable level*)see rubric
4) Analyze the transport system in plants. 5) Experiment and explain groups of cells involved in transportation of water and nutrients in plants.	Transport Systems in Plants	7 hours	Perform a laboratory experiment. 1. Studying the pathway of water in a plant 2. Studying the transport of synthesized food	Students will be group into 6 with 5 members each group. Follow the guidelines given for the investigation process.	Documented problem solutions *(students track in a written format the steps they take to solve problems as if for a "show & tell")*

			substances via the phloem 3. Identifying the locations of xylem and phloem	Discuss the documented solution in front of the class.	
6) Analyze the sexual and asexual reproductive systems of flowering plants. 7) Explain sexual reproduction processes of angiosperms and plant asexual reproduction processes. 8) Understand the structures of a flower and their functions. 9) Experiment and explain floral structures involved in plant reproduction.	Sexual reproductive system of flowering plants	1 hour	Venn diagram analysis of sexual and asexual reproductive systems of flowering plants Perform the laboratory activity and create a table to show the parts of a flower and their functions.	Create a Venn diagram to compare sexual and asexual reproductive systems of flowering plants (individual activity) Do the laboratory experiment and show the parts and functions of a flower. The correct answer will be flashed on the projector to check the answers of each group.	Diagnostic learning logs *(Students write to learn by identifying, diagnosing, and prescribing solutions to their own learning problems)* Venn diagram will be evaluated using the rubric indicated in the appendix part.
10) Analyze pollination. 11) Understand the development of fruits and seeds in plants. 12) Understand the dispersal of seeds and fruits in plants. 13) Synthesis the concept of germination of seeds	Pollination Development of fruits and seeds in plants Dispersal of seeds and fruits Germination of seeds	9 hours	Venn diagram analysis self-pollination and cross pollination Laboratory experiment observing the development of pollen tubes in different percentages of sugar solutions. Lab activity in determining	Group activity written in an A4 paper showing the similarities and differences of self and cross pollination. Summarize the concept of germination of seeds in two sentences.	Application cards (*students generate examples of real-work applications for important principles, generalizations, theories, or procedures*)

			the conditions necessary for the germination of green bean		
14) Realize the importance of nutrients that affect plant's life and its growth.	Mineral Requirements in Plants	1 hour	Video Lesson in e-learning.	Watch the video posted in e-learning and answer the guide questions provided	Yes/No survey to collect data of students about the instructional material
15) Understand plant propagation and its application. 16) Understand vegetative reproduction methods and its application. 17) Realize the importance of plant tissue culture technology and its application.	Asexual reproduction in plants	3 hours	Lab activity: Asexual propagation.	Conduct the experiment about leaf cutting and leaf bud cutting and then make a laboratory report.	Course related self-confidence survey (*Students complete an anonymous survey indicating their level of confidence in mastering the course material*) Group work evaluation (*Students complete a brief survey about how their group is functioning and make suggestions for improving the group process*)

Assessable End Product/Activity:

The end result is a STEM activity involving the creation of a miniature garden. Students will be surprised at how little water plants require in a closed system after participating in this activity. It gives them the impression that these plants can exist entirely on recycled air, water, and nutrients. This encourages them to investigate how plants recycle air, water, and nutrients when they are cut off from their surroundings.

Overall Assessment Method Overview
Learners' understanding of key concepts and skills will be assessed through their performance in each activity and their final requirement, which is to create a miniature garden and present it in front of the class. Feedback will be provided in every subsequent session of the class and will be discussed in front of the class before we proceed to our next activity and lesson, with the guidance of my rubrics intended for every experiment and project making as well. Short activities such as Venn diagrams, questioning, and video learning resources will receive immediate feedback. As for me, I have included assessment techniques in the instructional activities to determine whether the strategy used will be repeated or needs to be revised. Formative and summative assessments will be used to ensure that students understand the key concepts of the lesson, these are short quizzes (short-answer questions, concept mapping and so on) and project portfolio and performance task.
The Value of Technology
Because of the recent pandemic, our school has provided us with an e-learning platform called Moodle. This platform has a significant impact on the ease with which lessons are delivered. Because students can easily access the system using their log in information, and teachers can creatively upload learning resources to be used in the teaching and learning process. The e-learning platform will be used as supplemental resources in this unit to deliver advanced instruction and another related instructional video. Indeed, technology assists both students and teachers in making the learning environment more understandable and reliable.
Implementing the Unit
This learning unit will be implemented in the upcoming semester, which marks the beginning of our new school year in Thailand. This plant-related topic is one of the first chapters covered in the first term of the school year. The laboratory and handouts are readily available as learning resources. The learning unit must be completed by the end of July, before the midterm examination.
Implementation Reflection Tool
(this will be accomplished upon completion of the learning unit)

Work Cited/References:

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Fathullah, A. (2012, October). Design and development of physics module based on learning style and appropriate technology by employing isman instructional design model. Retrieved April 21, 2021, from https://www.academia.edu/16572839/DESIGN_AND_DEVELOPMENT_OF_PHYSICS_MODULE_BASED_ON_LEARNING_STYLE_AND_APPROPRIATE_TECHNOLOGY_BY_EMPLOYING_ISMAN_INSTRUCTIONAL_DESIGN_MODEL

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Isman, A. (2011, January). Instructional design in education: New model. Retrieved April 21, 2021, from https://files.eric.ed.gov/fulltext/EJ926562.pdf

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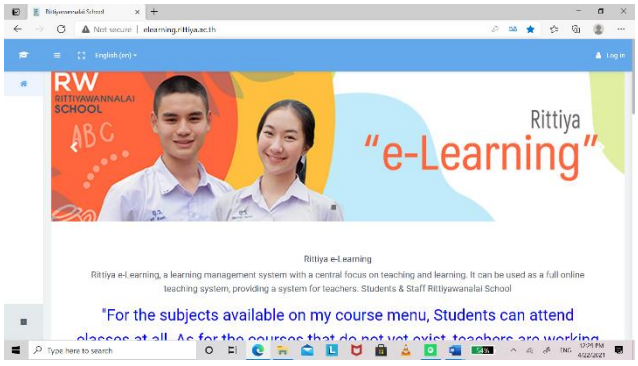
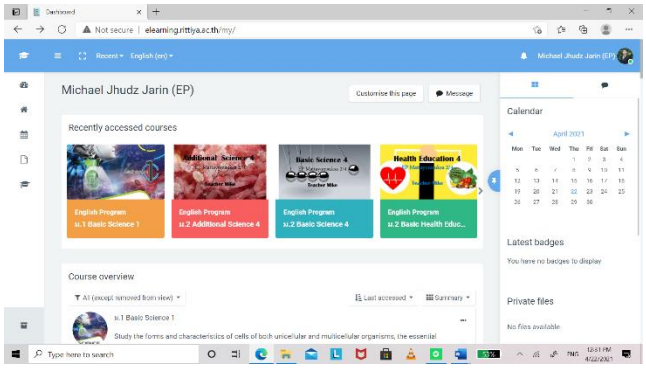
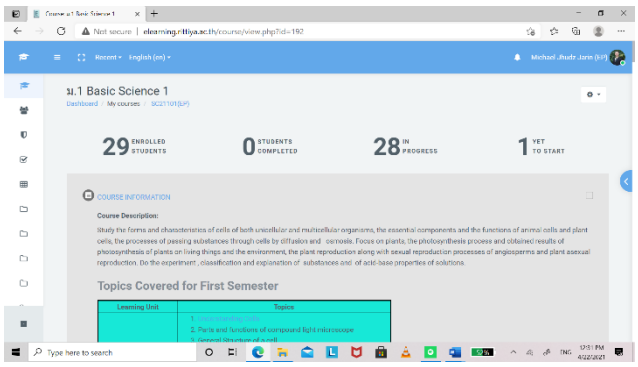
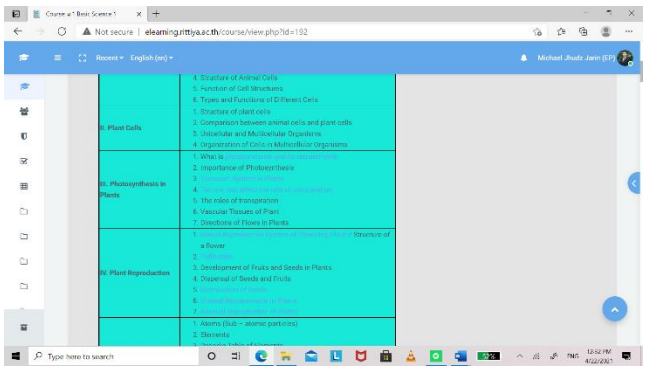
Appendix:

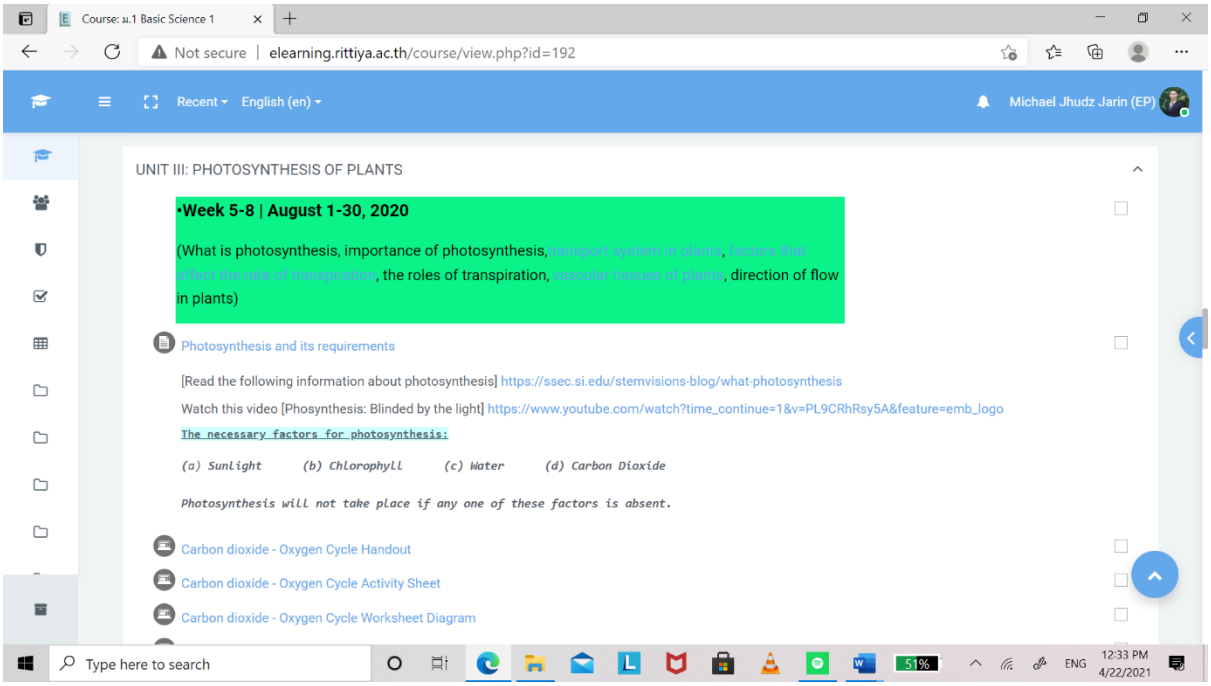
The e-learning resources included in the instructional design are depicted in the screenshots below.











Rubrics for Laboratory Skills and Performance

Category	Criteria
Experienced Level (100 points)	✓ Throughout the lab procedure, excellent technique was used. ✓ Procedures were well-planned and carried out. ✓ Data and observations were accurately, descriptively, and completely recorded, with no major errors. ✓ Calculations and data analyses were carried out in a clear, concise, and accurate manner, using the correct units. ✓ Graphs were drawn accurately and neatly and were clearly labeled if necessary. ✓ Recognized the connections between observations and related concepts; expressed understanding clearly and completely. ✓ The answers to the questions were complete and written correctly and precisely.
Competent Level (90 points)	✓ During the lab procedure, no errors in technique were observed; procedures were well-planned and carried out in an organized manner. ✓ With only minor errors, data and observations were recorded accurately, descriptively, and completely. ✓ The calculations and data analyses were done correctly, with the correct units and calculations, but the work may have been slightly unclear or disorganized. ✓ Graphs were drawn accurately and neatly as needed. ✓ Recognition of the connections between observations and related concepts was effectively expressed. ✓ Answers to questions were written correctly and accurately, but minor misunderstandings may have occurred.
Intermediate Level (80 points)	✓ During the lab procedure, only minor technique errors were observed. ✓ The procedures were followed correctly, but they may have been a little disorganized. ✓ The data and observations were accurately recorded, with only minor errors or omissions. ✓ The calculations and data analysis were done correctly, but there were a few minor errors, either in the calculations or in the application of the correct units. ✓ Graphs were drawn accurately and neatly as needed. ✓ Recognition of the connections between observations and related concepts was expressed satisfactorily. ✓ The report's reasoning was occasionally weak, but only in a few places. ✓ Answers to most questions were correct, but there are some misunderstandings or minor errors.
Transition Level (70 points)	✓ During the lab procedure, only a few technique errors were observed, but they could have been significant. ✓ Procedures may not have been well-planned or may have been carried out in an unorganized manner. ✓ Data and observations were adequately recorded, with only minor errors or omissions. ✓ The calculations and data analysis were done correctly, but there were a few minor errors in the calculations and in applying the correct units. ✓ If graphs were required, they were drawn properly. ✓ Was able to recognize connections between their observations and related concepts, but this understanding was expressed in a very weak way. ✓ Throughout the report, the reasoning was generally poor. ✓ Some answers to questions were incorrect due to misunderstandings, minor errors, or insufficient data.
Beginning Level (60 point)	✓ Several serious technique errors were observed during the lab procedure. ✓ Procedures were not well-planned and were carried out in an ad hoc manner. ✓ Most data and observations were adequately recorded, but with several significant errors or omissions. ✓ Calculations and data analysis were done incorrectly, but the correct units were used most of the time. ✓ If graphs were required, they were drawn properly. Was unable to recognize connections between their observations and the related concepts; there was no expression of understanding in the report.

	✓ The report may have contained logical errors, and it may have been disorganized and unclear. ✓ Some of the responses to questions were incorrect or poorly written.
Unacceptable Level (0point/Repeat)	✓ All the work was deplorable. ✓ There were no responses that were relevant to the lab, and major components of the lab were missing.

Modified from (Holt, Rinehart, & Winston, Scoring Rubric for Skills Practice in Lab)

Assessment Rubric for Venn Diagram

Category	4 Points	3 Points	2 Points	1 Point
Similarities	Student includes four or more facts that are similar.	Student includes three facts that are similar.	Student includes two comparable facts	One similar fact is included by the student.
Differences	Student includes four or more distinct facts for each topic.	Student includes three distinct facts for each topic.	Student includes two distinct facts for each topic.	Student includes one or no distinct facts for each topic.

Grading Breakdown

8 points (100%)
7 points (95%)
6 points (90%)
5 points (85%)
4 points (80%)
3 points (75%)
2 points (70%)
1 point (65%)
0 point (60%)

Rubrics for Student Generated Test Questions:

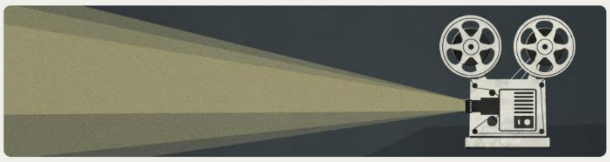
Category	Great (5 points)	Fair (3 points)	Poor (1 point)
Number of questions	Student has 10 questions	Student has 6 questions	Student has an inadequate number of questions
Test questions	All questions are clear & relate to all parts of lesson discussed. Each part of activity and discussion is covered.	Most questions are well written and have a clear relation to activities and discussion.	Questions do not relate to the activities and discussion
Level of questions	Students must think to answer all questions, are higher order thinking questions.	Some variety in thinking levels and several higher levels of thinking.	Question on test do not provide a variety of thinking levels, and most are lower levels of thinking or too easy for your lesson.
Spelling, grammar, and clarity	No misspellings or grammar errors. Students know exactly what they are supposed to do to answer the question.	Some misspelled questions, 1-2 grammatical errors, questions mostly clear.	Misspelled questions, grammatical errors, and/or unclear questions. Students do not know what they are expected to do from the question.

Modified from (TGIANFALA, Irubric: Student generated questions rubric 2021)

Rubrics for Group Activity

Skills	4 Advanced - Exceeds expectations	3 Competent - Meets expectations	2 Progressing - Does not fully meet expectations	1 Beginning - Does not meet expectations
Contributions, Attitude	*Always willing to help and do more. Routinely offered useful ideas. Always displays positive attitude.*	*Cooperative. Usually offered useful ideas. Generally, displays positive attitude.*	*Sometimes cooperative. Sometimes offered useful ideas. Rarely displays positive attitude.*	*Seldom cooperative. Rarely offers useful ideas. Is disruptive.*
Cooperation with Others	*Did more than others–highly productive. Works extremely well with others. Never argues.*	*Did their part of the work-cooperative, Works well with others, rarely argues*	*Could have done more of the work–has difficulty. Requires structure, directions, and leadership. Argues sometimes.*	*Did not do any work–does not contribute. Does not work well with others. Usually argues with teammates.*
Focus, Commitment	*Tries to keep people working together. Almost always focused on the task and what needs to be done. Is very self-directed.*	*Does not cause problems in the group. Focuses on the task and what needs to be done most of the time. Can count on this person.*	*Sometimes not a good team member. Sometimes focuses on the task and what needs to be done. Must be prodded and reminded to keep on task.*	*Often is not a good team member. Does not focus on the task and what needs to be done. Let others do the work.*
Team Role Fulfillment	*Participated in all group meetings. Assumed leadership role as necessary. Did the work that was assigned by the group.*	*Participated in most group meetings. Provided leadership when asked. Did most of the work assigned by the group.*	*Participated in some group meetings. Provided some leadership. Did some of the work assigned by the group.*	*Participated in few or no group meetings. Provided no leadership. Did little or no work assigned by the group.*
Ability to Communicate	*Always listens to, shares with, and supports the efforts of others. Provided effective feedback to other members. Relays a great deal of information–all relates to the topic.*	*Usually listens to, shares with, and supports the efforts of others. Sometimes talks too much. Provided some effective feedback to others. Relays some basic information–most relates to the topic.*	*Often listens to, shares with, and supports the efforts of others. Usually does most of the talking–rarely listens to others. Provided little feedback to others. Relays very little information–some relates to the topic.*	*Rarely listens to, shares with, or supports the efforts of others. Is always talking and never listens to others. Provided no feedback to others. Does not relay any information to teammates.*
Correctness	*Work is complete, well organized, has no errors and is done on time or early.*	*Work is generally complete, meets the requirements of the task, and is mostly done on time.*	*Work tends to be disorderly, incomplete, not accurate, and is usually late.*	*Work is generally sloppy and incomplete, has excessive errors and is mostly late or not at all.*
Total Score				

Yes or No Survey for Instructional Video Used



5-minute Yes/No Survey

This survey is designed to help you evaluate the video "Photosynthesis in plants |Biology basics for children" that was shown in class. Your honest feedback will assist the teacher in creating or finding a more effective and engaging instructional video for use in the classroom. Your responses are private and should be kept anonymous. This survey is divided into four (4) sections: content (how ideas are presented and their relevance to the class topic), pacing (the rate of speech or the speed at which the speaker talks in the instructional video), graphics and sound tools (how color and sound affect your learning), and a suggestion section (optional) if there are another things you want to add for the improvement of selecting the instructional video.

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Content

Read the following questions carefully. In these questions, there are only two options. Select only one option.

Is the instructional video relevant to the textbook topic? *

- [ ] Yes
- [ ] No

Is the instructional video clear about the goal and context? *

- [ ] Yes
- [ ] No

Are the concepts simple to grasp? *

- [ ] Yes
- [ ] No

Is the video at the appropriate level of comprehension for you? *

- [ ] Yes
- [ ] No

Is it easy to understand the vocabulary words used in the instructional video? *

- [ ] Yes
- [ ] No

Does the instructional video help you understand the information in the textbook? *

- [ ] Yes
- [ ] No

Does watching this instructional video make you feel more confident in explaining the concept on your own? *

- [ ] Yes
- [ ] No

Pacing

Read the following questions carefully. In these questions, there are only two options. Select only one option.

Is the speaker's speaking speed in the video understandable? *

- [ ] Yes
- [ ] No

Does the instructional video hold your interest? *

- [ ] Yes
- [ ] No

Is the speaker in the video speaking fast? *

- [ ] Yes
- [ ] No

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Full details at https://docs.google.com/forms/d/1F-NKrEIzKX5es0FBQ67jyXFwHuZIhvxaYB9eN1OnrXs/edit?usp=sharing