



TPACK IN
PHILIPPINE
STEAM
EDUCATION

DEVELOPING THE LESSON EXEMPLARS

Dr. Racidon P. Bernarte

Research Collaborator

Polytechnic University of the Philippines



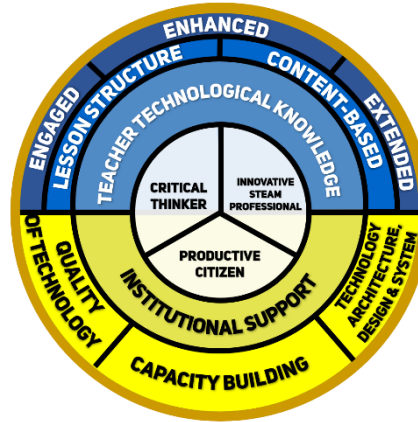
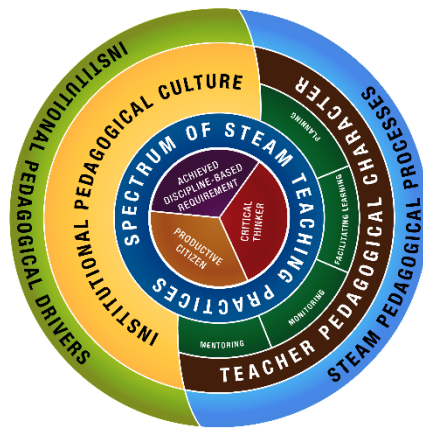
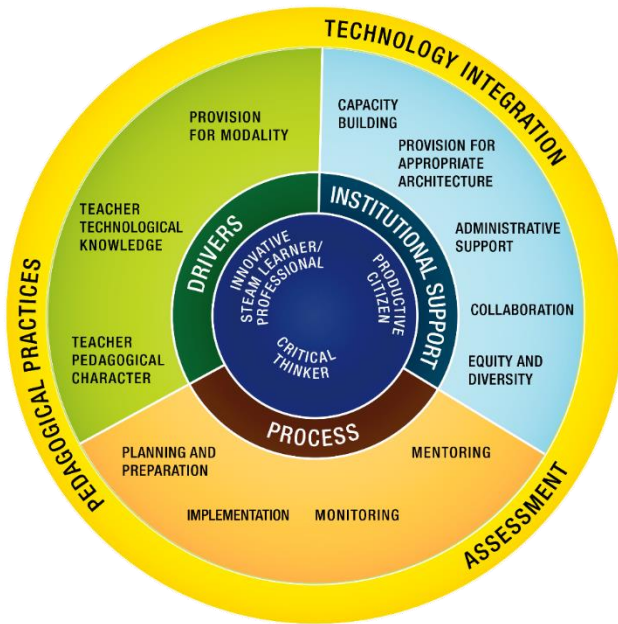
DESCRIPTION OF THE LESSON EXEMPLAR

The **Lesson Exemplar** is a compilation of Lesson Guides that can be utilized by STEAM Educators in teaching STEAM lessons in any STEAM discipline.

Inquiry-based investigations that provide STEAM teachers and Administrators with a way of teaching and assessing STEAM skills. They include performance tasks that can be tested in the classroom and used for assessment, instruction and professional development (Lumbag, 2017 May 21).

INSTRUCTIONAL DESIGN

Drawn from the PSE Models and TPACK Framework for Philippine STEAM Education Model.



ORIGINAL LESSON EXEMPLAR TEMPLATE

TPACK LESSON PLAN TEMPLATE

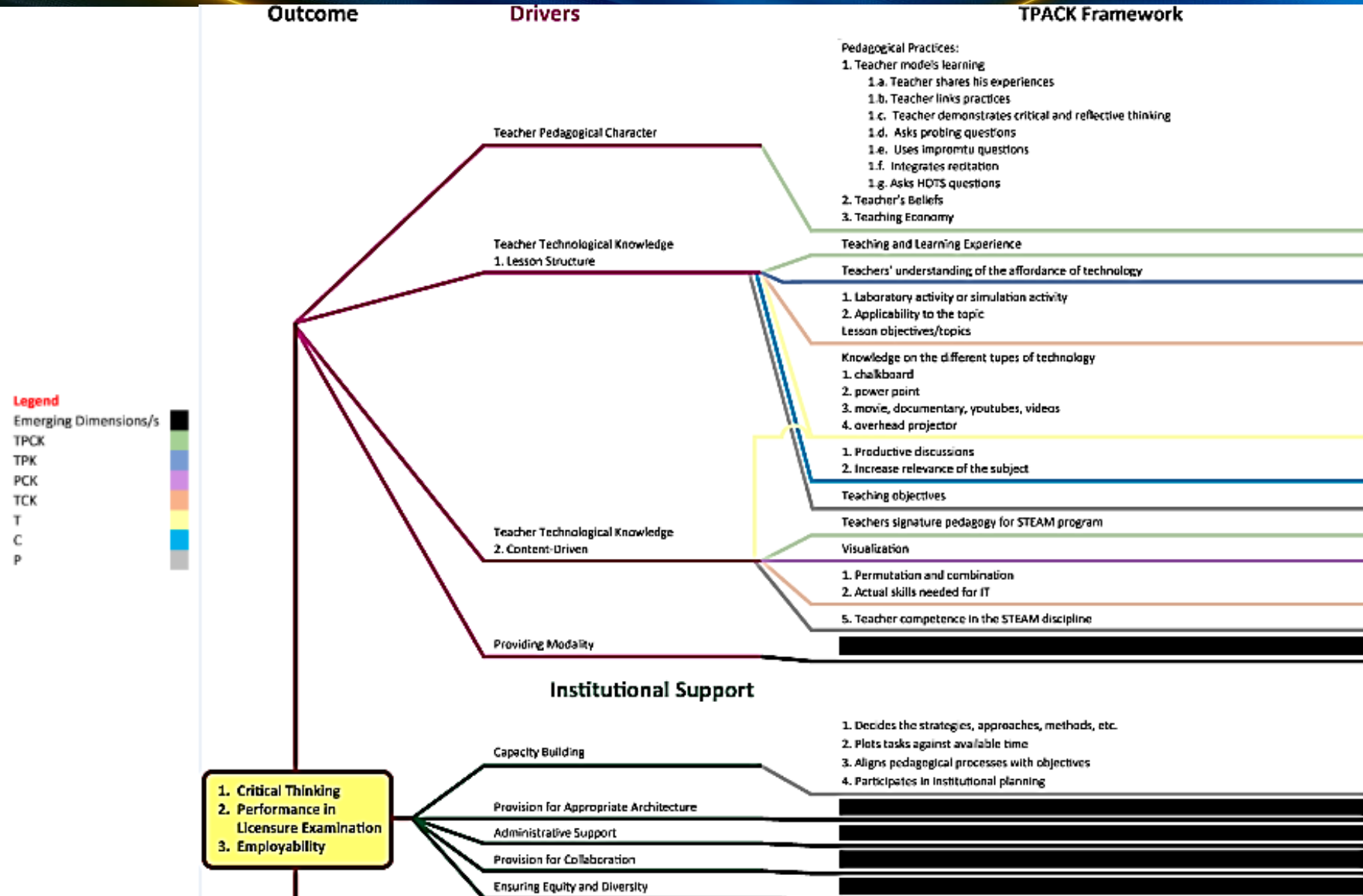
Your Name: _____ **Program:** _____
Subject/Course: _____
Topic: _____
Lesson Title: _____
Level: _____ **Lesson Duration:** _____

Learning Outcome(s) (Content Standards and Performance Standards)	
Target Audience	
Knowing the Learner	
<i>Based on your survey data from earlier in the course, describe the target audience for this lesson; what types of learning styles will you need to be mindful of?</i>	
Pedagogies (Remembering to consider relevance and career/workforce readiness skills around what is being taught)	
Pedagogies	
<i>(How are technology, content, and pedagogical knowledge working together in this lesson?)</i>	
Technology Being Used by Students	Technology Being Used by Teacher

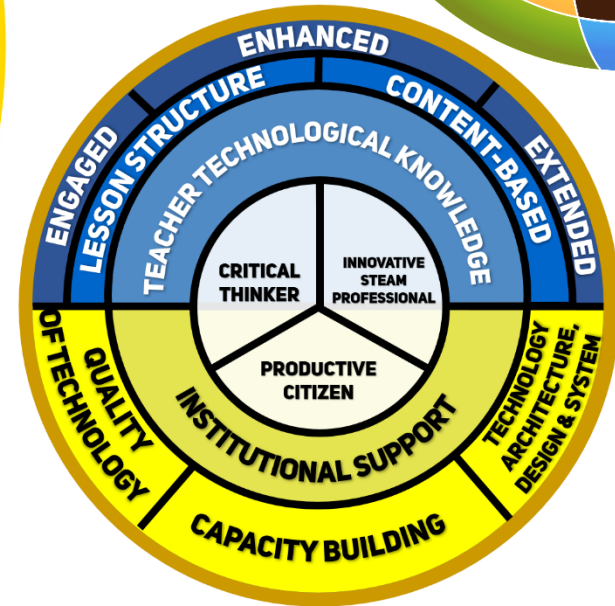
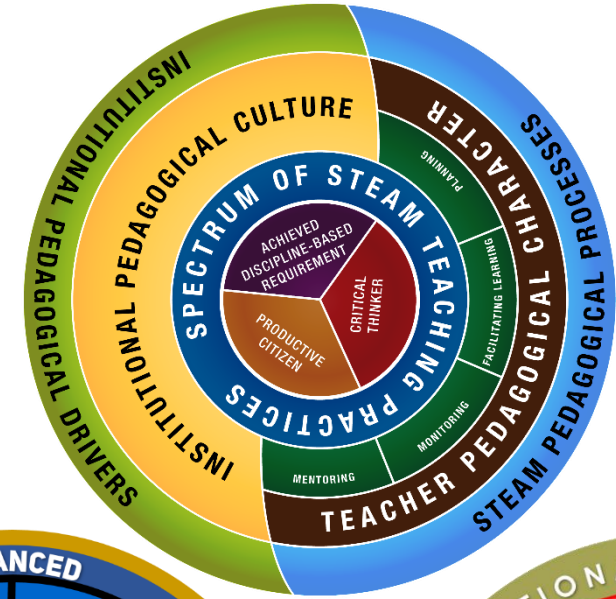
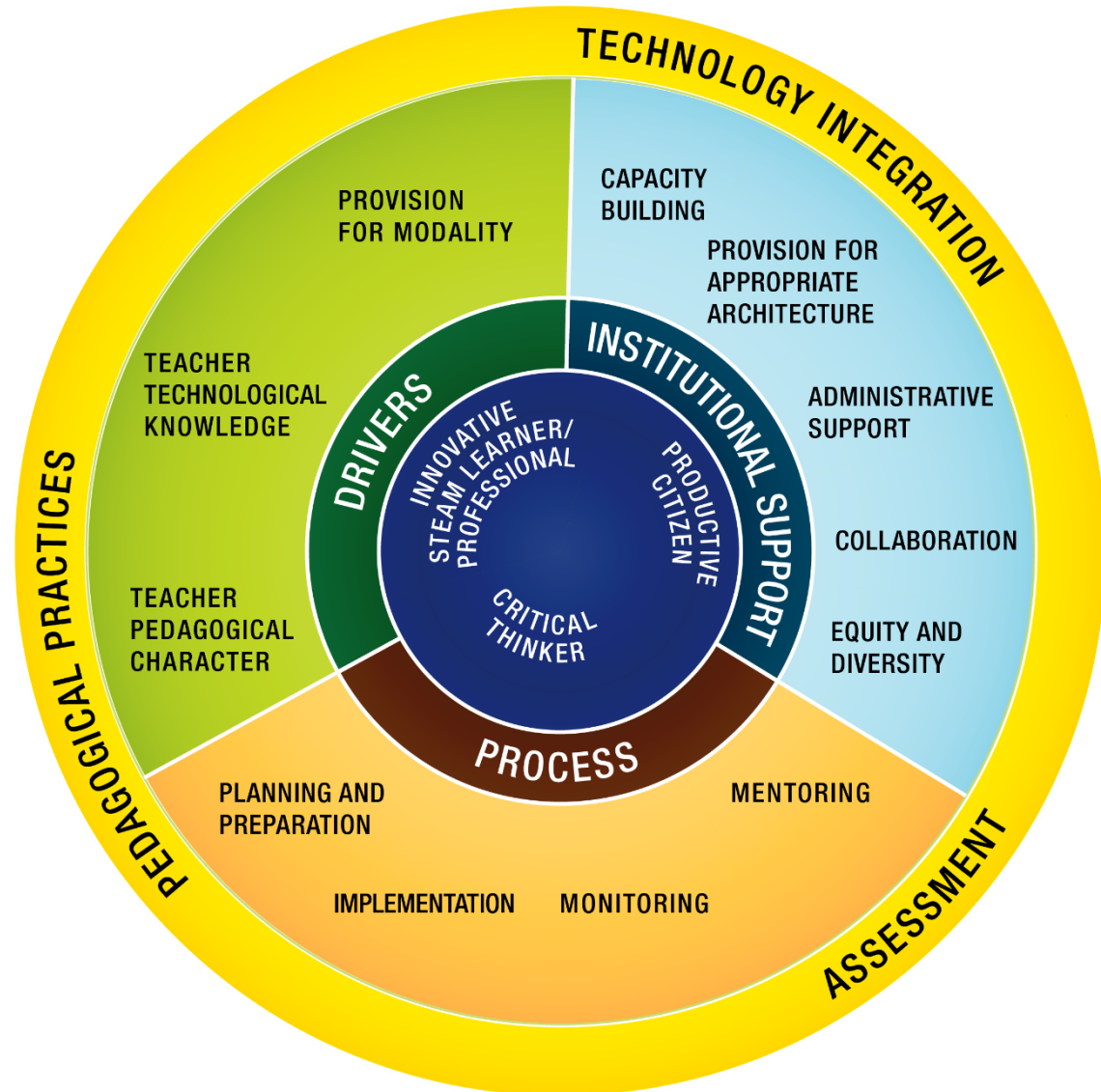
Lesson Strategy and Required Materials	
Assessment for Learning	
Assessment Strategy	Feedback Strategy
Assessment of Learning (How do you know students met the learning objectives and targets?)	
Reflection	
Modifications/Enrichments (imbedded in this lesson or ideas for future lesson delivery based on insights in peer review)	

THEORETICAL FRAMEWORK

TPACK FRAMEWORK



PHILIPPINE STEAM EDUCATION MODELS



METHODS

RESEARCH DESIGN

Design and Development Research

PARTICIPANTS

Sourced from two-tier sampling procedure

TIER 1	TIER 2
10% of 2299 Philippine HEIs (cluster sampling per region basis) and convenience sampling of schools (26) within the cluster (region)	Complete enumeration of STEAM educator (113) in the chosen school per cluster

INSTRUMENTS

1. Lesson Exemplar Instructional Design and Template (revised)
2. Rubric for Lesson Exemplar
3. Peer Review Form

INSTRUMENTS

ENHANCED TPACK LESSON PLAN TEMPLATE

Your Name: _____ Program: _____
 Subject/Course: _____
 Topic: _____
 Lesson Title: _____
 Level: _____ Lesson Duration: _____

Learning Outcome(s)		
Learning Outcomes	Objectives	Tasks (What task/s should I give my students to ensure realization of the objectives?)
Performance Standards (What should the students be able to do?) 1. 2.	1.a 1.b 2.a 2.b	
Content Standards (What should the students know to be able to do?) 1. 2.	1.a 1.b 2.a 2.b	

Target Audience

Knowing the Learner

Based on your survey data from earlier in the course, describe the target audience for this lesson; what types of learning styles will you need to be mindful of?

Year Level: _____ Ethnicity: _____
 Course/Discipline: _____ Language: _____
 General Attribute (characteristics of the class): _____

Pedagogies (Remembering to consider relevance and career/workforce readiness skills around what is being taught)

1. Walkthrough of the lesson (how will you deliver the lesson/topic (from engaging the student to ensuring achievement of learning objectives?)
2. How will the lesson delivery manifest efficient classroom management?
3. What student misconceptions did you consider in designing this lesson?
4. How will I integrate technology in the lesson delivery?

Summary: How are technology, content, and pedagogical knowledge working together in this lesson?

Technology Being Used by Students	Technology Being Used by Teacher
<ul style="list-style-type: none"> • What technology will my students use in this lesson? • What were your reasons for choosing the technology for the students to use? • What are the limitations and potential problems in utilizing the technology? 	<ul style="list-style-type: none"> • What technology will I use in this lesson? • What were my reasons for choosing the technology? • What are the limitations and potential problems in utilizing the technology?

Assessment for Learning (Formative Assessment)

1. Assessment Strategy	1. Feedback Strategy
2. Technology which will be integrated in the Assessment	2. Technology which will be integrated in the Feedback System

Assessment of Learning (Summative Assessment)

1. How do you know students met the learning objectives and targets?
2. What technology will you use to facilitate assessment of learning?

Reflection

Modifications/Enrichments (imbedded in this lesson or ideas for future lesson delivery based on insights in peer review)

INSTRUMENTS

RUBRIC FOR LESSON EXEMPLAR

Your Name: _____ **Program:** _____

Subject/Course: _____

Topic: _____

Lesson Title: _____

Level: _____ **Lesson Duration:** _____

	1- Below Proficient	2- Proficient	3- Above Proficient	Score/Level
<i>Connection among content, pedagogical approach and technology</i>	There is no apparent connection among content, pedagogy and technology.	Content, instructional strategies and technology are somewhat connected.	Content, instructional strategies and technology are strongly connected AND the lesson plan includes a description of the connections.	
<i>Rationale for Instructional strategy/ies</i>	The rationale for selecting the instructional strategy/ies is insufficient OR there is no rationale for the instructional activities in the lesson plan.	The rationale for selecting the instructional strategy/ies used is sound.	The rationale for selecting the instructional strategy/ies is sound AND is tied to a learning theory.	
<i>Appropriateness of technology for instructor use</i>	The rationale for selecting the technology for instructor uses is insufficient OR there is no rationale for the instructor use of technology in the lesson plan.	The rationale for selecting the technology for instructor use is sound.	The rationale for selecting the technology for instructor use is sound AND includes reasons why other technologies were not selected.	

<i>Alignment to state standards for content and computer skills</i>	Lesson plan is not clearly aligned to state standards for content and/or computer skills.	Lesson plan is clearly aligned to state standards for both content and computer skills at the appropriate grade level.	Lesson plan is clearly aligned to state standards for both content and computer skills at the appropriate grade level AND is also aligned to one or more other discipline standards (interdisciplinary).	
<i>Completeness</i>	Lesson plan is incomplete. One or more key elements are missing or are insufficient.	Lesson plan is complete. It contains all of the required elements.	Lesson plan is complete AND includes at least one of the following: -addresses higher-order thinking as per Bloom's Taxonomy -integrates with other content areas -includes accommodations for students with special needs. -includes accommodations for students with special needs.	
<i>Language and Mechanics</i>	Lesson plan contains multiple errors in grammar, spelling, punctuation and/or grammar OR word choice is inappropriate	Lesson plan contains no more than two grammar, spelling, and/or punctuation errors. Errors do not affect the meaning of the writing. Word choice is appropriate for the lesson.	Lesson plan is error-free. Writing demonstrates superior understanding of grammar, spelling and punctuation.	

Comments/Suggestions:

INSTRUMENTS

PEER-REVIEW FORM

Your Name: _____ **Program:** _____
Subject/Course: _____
Topic: _____
Lesson Title: _____
Level: _____ **Lesson Duration:** _____

TPACK Dimension	Attributes	5	4	3	2	1	Remarks/Suggestions
		Exceeds standard	Meets standard	Nearly meets standard	Does not meet standard	No Evidence	
Content	Provides Clear Lesson Objectives.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Exhibits sufficient knowledge of the subject topic/content.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Pedagogy	Assessments match instructional method.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Lesson appears to help organize and manage student behavior—Explains sequence of events and procedures for students.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Technology	Lesson plan incorporates at least 1 technology.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Discusses possible limitations to technology or potential problems, as well as solutions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Provides clear rationale for technology choice.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Demonstrates understanding of technology as teacher tool or student tool.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Pedagogical Content Knowledge	Selects effective teaching strategies appropriate to subject domain to guide student thinking and learning.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Demonstrates awareness of possible student misconceptions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Presents appropriate strategies for developing understanding of the subject content.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

INSTRUMENTS

Technological Pedagogical Knowledge	Chooses technologies enhancing approaches (teacher-centered approaches) –Uses technology to present material.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
	Chooses technologies enhancing student learning (student-centered approaches) – Students use technology to explore content and achieve learning goals.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
	Provides clear rationale for technology choice to deliver instruction.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
Technological Content Knowledge	Chooses appropriate technologies for subject domain (mathematics, science).	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
	Link between technology and content is obvious or explicit	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
Technological Pedagogical Content Knowledge	Appropriately uses content, pedagogy, and technology strategies.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
	Technology enhances content objectives and instructional strategies.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
General Comments/Suggestions:			

DATA COLLECTION: Training and Orientation

Presentation of Validated Philippine STEAM Education Model(s)



DATA COLLECTION: Training and Orientation


Orientation on Lesson Exemplar



DATA COLLECTION: Training and Orientation

Presentation of Guidelines on:

1. Lesson Exemplar Development
2. Peer Review
3. Revisions from Peer Review

 PHILIPPINE NORMAL UNIVERSITY *Nurturing Innovative Teachers*®

GUIDELINES ON THE PRESENTATION OF LESSON EXEMPLAR

- This session is an open presentation.
- Each presenter is given at most 15 minutes for the presentation of the Lesson Exemplar.
- Highlight in the presentation how the group weaved the components reflect the TPACK framework.
- Question and answer proceed after the lesson presentation. This will run for about 15 minutes.
- We request that at most 5 members from the cluster accompany the presenter in the question and answer part of the presentation.
- We will also accommodate question per cluster. For the others from the cluster who intend to provide suggestions may ask for strips of paper from their respective facilitators. Please write your School Affiliation on the strips of paper. They can also submit their suggestion to their facilitator.

DATA COLLECTION: Lesson Exemplar Development

Four (4) Identified Clusters



Technology
and
Engineering



Science
(Physics &
Chemistry)



Mathematics



(Biology
And
Agri-Fisheries)

DATA COLLECTION: Content Validation

Two-rounds of Peer Review



DATA COLLECTION: Content Validation

Panel Presentation and Critiquing



DATA ANALYSIS: Consolidation of Comments & Suggestions

The groups per cluster consolidated all comments based on peer reviews and panel critiquing for the revisions.

DATA COLLECTION: Pilot Study/Testing

The core team asked each of the chosen best Lesson Exemplar to test the plan in their respective classes.

The core team requested documentation as well

DATA ANALYSIS

**Transcriptions of video and audio records
of lesson delivery**

RESULTS AND DISCUSSION

RESULTS & DISCUSSION

Lesson Exemplars (L.E.) with specific features of PSE Model

First Set of Results	Four (4) Best Lesson Exemplars
a) Physical Science [5 L.E.]	a) Physical Science -Group 3
b) Biological Science & Agri-Fisheries [7 L.E.]	b) Biological Science and Agri-Fisheries -Group 2
c) Technology and Engineering [4 L.E.]	c) Technology and Engineering -Group 2
d) Mathematics [6 L.E.]	d) Mathematics -Group 3

PHYSICAL SCIENCE



1

Year/Grade	PHYSICAL SCIENCE GROUP	Program	PHS - Science
Subject/Content	Thermodynamics: 1st & 2nd Law		
Topic	Thermodynamics		
Lesson Title	The Laws of Thermodynamics		
Level	11 th Year - 12 th Semester	Lesson Duration	1 hour

LOs	LOs (Knowledge/ Skills)
01	The EQUILIBRIUM Principle
02	The ENERGY Principle
03	The ENTROPY Principle
04	The TEMPERATURE Principle

2

Learning Outcomes

At the end of an interactive metadisciplinary lesson, the learners are expected to attain the following:

- state the laws of thermodynamics operationally;
- apply the laws to analyze different thermodynamic processes; and
- relate the laws of thermodynamics to the different societal issues (thermal pollution, global warming and energy resources).

3

★

Target Audience

The target audience for this lesson are 3rd Year BSE – Science Majors of Maharaja State University during the 2nd semester of SY 2019 -2020, who are digital 21st Century learners mainly manipulative, visual, tech savvy, interactive, creative, reflective, diverse, innovative and confident to understand the value of collaboration and the relationship of effort to results, and the need to continually grow.

4

★

Target Audience

A few of the class members are academically resilient due to problems in developing their problem solving skills and their use of mathematical skills. There are three students in the class who have learning challenges (1 nearsighted, 1 dyslexia and 1 dyscalculia).

5

★

Pedagogies

This lesson shall be presented using constructionism and neurocognitive – based teaching model wherein the students will be the one to develop their own understanding of the concepts.

6

★

Pedagogies

In the motivation part and in the cognitive assessment, an interactive online presentation will be used. In the lesson development, powerpoint presentation, video, and an interactive online laboratory (virtual reality using PhysLets) using problem – based learning and inquiry approach will be utilized.

7

★

Pedagogies

The exposure to the different technologies allow the students to boost attention, gather information, understanding of concepts, organization of thoughts, idea clarification or looking for something new and students' re – engineering of concepts learned.

8

★

Technology

Technology Being Used by Students	Technology Being Used by Teacher
Smartphones, Tablets, Digital Presentation, Online Applications, Websites, QR Codes, QR Code Readers, AR/VR Headsets, Smartboards, Interactive Whiteboards, Projectors, Document Cameras, etc.	PowerPoint, Lesson Plans, Computer Simulations, Online Applications, Projectors, Interactive Whiteboards, etc.

9

Lesson Strategy and Required Materials

In the motivation part, we will use the mesentimeter, an open interactive presentation to elicit students' understanding of terms related to thermodynamics forming a word cloud. Each student, using their smartphones will give a word associated to "Thermodynamics" in this online link: <https://www.mesentimeter.com/s/893da57b41f2995bf4976de8f27c30b00191e0594276>.

10

Lesson Strategy and Required Materials

Students will be grouped into 5 with 5 members each. Then, allow the students to deduce laws of thermodynamics in the following systems using a 3 – minute video clips presented by the teacher.

- Heat engine (car engine)
- Heat pump (air condition refrigerator)
- Human being as thermodynamic system
- A rock falling on the ground
- Earth as a thermodynamic system
- Perfect crystals

11

Lesson Strategy and Required Materials

Students will answer the guide questions that would elicit their conclusion about the laws of thermodynamics. Further, the students will answer the following questions, based on the assignment given: Prior to the viewing, the questions will be projected on screen.

12

Lesson Strategy and Required Materials

The teacher process the students' understanding on thermal equilibrium, the first law in terms of conservation of energy, irreversibility of natural processes and entropy. Then students will write the deduced statements of the laws of thermodynamics.

13

Lesson Strategy and Required Materials

Students will give practical activities or daily activities, which are considered as thermodynamic involving the laws of thermodynamics. The teacher demonstrate also to the class using PheT simulations and allow the students to analyze the situation what law of thermodynamics is applicable to the situation.

14

Lesson Strategy and Required Materials

The students will collaborate in a laboratory activity on the *statistical interpretation of entropy*.

15

Lesson Strategy and Required Materials

The teacher will present the different societal issues (thermal pollution, global warming and energy resources) case study, which has been previously distributed. A class argumentation activity or SSI (Socioscientific Issues) within 15 minutes will be conducted.

16

Assessment

Assessment for Learning	Assessment for Learning	Assessment for Learning
Assessment for Learning	Assessment for Learning	Assessment for Learning
In the motivation part, the students construct their own understanding of thermodynamics.	The teacher will analyze the word cloud generated from the online activity.	The teacher will provide the answers provided by the students in the guide questions.

17

Assessment

Assessment of Learning (Students can make use of these resources on open)
<p>Summative</p> <ol style="list-style-type: none"> Write the 1st Law of Thermodynamics in terms of macroscopic or stated resources. Give an illustration of thermodynamic processes and state what law of thermodynamics is applied in particular situation. <p>The students' answers to the guide questions in the laboratory activity.</p> <p>Students' responses from the case studies. Students will be used to gauge student's participation in the class (not supplemented in this).</p>

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BIOLOGICAL SCIENCE & AGRI-FISHERIES

LESSON EXEMPLAR
SCIENCE CLUSTER
BIOLOGICAL SCIENCES GROUP

1

YOUR NAME : SCIENCE CLUSTER (BIOLOGICAL SCIENCES GROUP)
PROGRAM : B.S. BIODIY MAJOR IN ANIMAL BIOLOGY
SUBJECT /COURSE : ANIMAL PHYSIOLOGY
TOPIC : MOVEMENT
LESSON TITLE : DIFFERENT MUSCLE TYPES
LEVEL : THIRD YEAR
LESSON DURATION : 1 1/2 HOURS LECTURE AND 3 HOURS LABORATORY

2

Learning Outcome(s)
(Common Standards and Performance Standards)

1. Identify the different muscle types.
2. Relate the physical characteristics of the different types of muscles and their location in the body to their functions.
3. Perform basic laboratory techniques designed to study the different muscle types.
4. Appreciate the uniqueness of the physical characteristics of each muscle type and its implication to human movement.

3

Target Audience

Knowing the Learner:
Based on your survey data from earlier in the course, describe the target audience for the lesson; what types of learning styles will you need to be mindful of?

The target audience are the third year Biology students composed of regular students, second semester students, and transferees from other colleges/university or from the same university but from different programs.

4

Pedagogy
(Remembering to consider activities and career/workforce readiness skills around what is being taught)

Pedagogy:
(How are technology, content, and pedagogical knowledge working together in this lesson?)

- Video presentation will be used to introduce the three types of muscles and their functions (motivation part)
- The different muscle types and functions will be presented using laptop and LCD through powerpoint presentation in connection to the video presented. (lecture method)

5

- The use of the 2 Models (Human Body and Mr. Muscle) will enable the learners to relate the physical characteristics of the different muscle types to their location in the body to their functions.
- The binocular microscope and prepared slides will be used to present the physical characteristics of the different muscle types (group laboratory activity and individual laboratory practical exam)
- Laboratory manuals and equipments for the basic laboratory techniques in studying the three types of muscles and their functions.

6

Technology Being Used by Students	Technology Being Used by Teacher
Mr. Muscle model for the identification of the structure and location of the skeletal muscles	Video clip presentation for the motivation
Human model for the identification of the structure and location of the skeletal muscles and muscle fibers	Video for the presentation (presentation and video observation) of the 3 types of muscles and location of muscles for motivation and lecture method
Binocular microscope for the observation and identification of the three types of muscle fibers and their location	LCD and prepared slides for the presentation of the physical characteristics of the different types of muscles, practical exam and equipment
	Laboratory manual for the experimentation on the three types of muscles

7

Technology Being Used by Teacher

- Video presentation for the motivation and location of the skeletal muscles
- Human Body model to present the location and functions of the skeletal muscles and muscle fibers
- Binocular microscope and prepared slides for the presentation of the physical characteristics of the different types of muscles, practical exam and equipment
- Laboratory manual for the experimentation on the three types of muscles

8

Possible Limitations to Technology - Potential Problems and Solutions: Students	Possible Limitations to Technology - Potential Problems and Solutions: Teacher
Student Limitation 1. Technology not managed properly Solution: Orientation on the use of laboratory equipments by the laboratory instructor 2. Not used at time management Solution: Proper time allocation on the laboratory session Teacher Problem 1. Poor management Solution: Proper coordination with the maintenance personnel	Teacher Limitation 1. Technology not managed properly Solution: Orientation on the use of laboratory equipments by the laboratory instructor 2. Not used at time management Solution: Proper time allocation on the laboratory session Teacher Problem 1. Poor management Solution: Proper coordination with the maintenance personnel

9

Possible Limitations to Technology - Potential Problems and Solutions: Teacher

1. Inadequate number of models and microscopes in proportion to the number of the students

Solution:
1. Proper allocation of available technology (models and microscopes) through round robin strategy.

10

Lesson Strategy and Required Materials

Venue: Science Lecture Room
A. Motivation:
• Video presentation to introduce the three types of muscles and their functions in the body to produce movement. [The required materials are laptop, LCD, and speakers]

11

Lesson Strategy and Required Materials

Lesson Proper:

- Powerpoint presentation of the different types of muscles and their functions in relation to the video presented. (Lecture Method)
- Presentation of the skeletal muscles, their location, and functions using Mr. Muscle Model
- Presentation of the cardiac muscle and visceral muscles their locations and functions using the Model of the Human Body

12

Venue: Biology Laboratory

Laboratory Equipment:

- Conduct of experiment using the laboratory sheet in the laboratory manual, microscope and prepared slides on the three types of muscles, their location and function.
- Identification of the different skeletal muscles, their location and functions using the Mr. Muscle Model by group
- Identification of the cardiac muscle and visceral muscle in relation to location and functions using the Model of Human Body by group/practical evaluation
- Answer the reflective question "What will happen to you if you don't have muscles?"

13

Post Lab Discussion

- Item analysis of the practical exam results.

14

Assessment Strategy	Feedback Strategy
Short quiz	Inform students about the results of the quiz, practical exam and laboratory report
Practical exam (individual)	Result of group evaluation using Mr. Muscle and Human Body Model
Laboratory report (individual)	Opportunity to conduct microscopies
Group evaluation (peer review)	

15

Assessment of Learning
(How do you know students met the learning objectives and targets?)

Results of the following:

Quiz
Practical exam
Laboratory report
Group evaluation

16

Reflection

1. Analyze students difficulties in:
 - the use of Mr. Muscle and Human Body models in identifying the types and functions of the 3 types of muscles
 - conducted quiz, practical report
2. The teacher can evaluate the need to re-teach the lesson or move on to the next.

17

TECHNOLOGY & ENGINEERING

**TPACK LESSON EXEMPLAR
IN BINARY NUMBER
SYSTEM CONVERSIONS**

1 ★

LEARNING OUTCOMES

- Identify the base and usage of each number system.
- Determine the validity of given numbers with respect to their bases.
- Convert binary numbers to decimal, octal and hexadecimal numbers.
- Apply binary number systems in encoding and decoding messages.

2 ★

TARGET AUDIENCE

The target audience are the first-year engineering and technology students with weak learning styles. In this lesson, the extractor should be mindful of the following factors.

- Industry learning activities will be highly logical, communicative and collaborative in nature.
- Non-logical learners (visual) - supplementary learning materials should be given to them. Academic counseling can also be utilized for these types of learners.
- Verbal/auditory/psychomotor - mechanics, including the point system should be made very clear to avoid unnecessary issues while group activities are going on.

3 ★

PEDAGOGIES

- The Binary Number System can be best taught using direct instruction. This strategy can be implemented using flashcards, worksheets, and board work. The extractor can also assign individual and group activities to reach the knowledge of students on Binary Numbers. Follow up activities can be given through an online learning platform (the learning management system) for students to better understand the lesson while maintaining attention and interest in it.

4 ★

TECHNOLOGIES USED BY STUDENTS	TECHNOLOGIES USED BY TEACHER
<ul style="list-style-type: none"> Board and Marker/Chalk Pen and Paper Flash Cards Learning Management System Mobile Device Internet Connectivity 	<ul style="list-style-type: none"> Laptop PowerPoint Presentation LED Projector/TV Board and Marker/Chalk Flash Cards Learning Management System Mobile Device Internet Connectivity

5 ★

LESSON STRATEGY AND REQUIRED MATERIALS

Introduction

Estimated Duration:
30-45 Minutes

Materials Required:
Laptop, LED Projector/TV, PowerPoint Presentation on the introduction to Number Systems. Board from the lecture, students will be asked to explain how the computer understands the user.

Description:

- The group leader points their cards to the number word and to binary through hand signals (punch for 0 and index finger for 1).
- Each member relays the signal to another member next to binary.
- The last member will act as the decoder and message to the instructor.
- The instructor validates the message.

6 ★

Lesson

Estimated Duration:
10-15 Minutes

Materials Required:
Laptop, LED Projector/TV, PowerPoint Presentation on the introduction to Number Systems. Board from the lecture, students will be asked to explain how the computer understands the user.

Description:

The extractor introduces the number systems, their bases, ranges and significance through PowerPoint presentation.

7 ★

Activity 1: Flash Cards

Estimated Duration:
10-15 Minutes

Materials Required:
Laptop, LED Projector/TV, PowerPoint Presentation on the introduction to Number Systems.

Description:

- Students will be grouped by four.
- Each group will be provided with two flash cards. Each flash card is labeled with WULD and RWULD.
- Values with given bases will be flashed on screen.
- The group will determine whether each flashed value is WULD or RWULD.

8 ★

Activity 2: Discussion

Estimated Duration:
20-30 Minutes

Materials Required:
Laptop, LED Projector/TV, PowerPoint Presentation on the conversion of binary number systems to other number systems.

Description:

- The extractor discusses the Power of 2 then the class proceeds to the discussion of the following conversions.
 - Binary Number System to Octal Number System
 - Binary Number System to Decimal Number System
 - Binary Number System to Hexadecimal Number System
- Needed questions will be provided for the class after the discussion.

9 ★

Activity 3: Quiz

Estimated Duration:
10 Minutes

Materials Required:
LMS, Internet Connectivity, Laptop, LED Projector/TV, Mobile Device.

Description:

Before teaching the lesson, the extractor should have prepared 10 quiz items on the Learning Management System. Students should have already been grouped in the Learning Management System. Each group should have 1 internet connected mobile device. Using their device, they will be answering the quiz items provided. A real-time bar chart generated by the LMS is flashed on screen to keep track of the progress of each group in the quiz item.

10 ★

Assessment and Reflection

The extractor prepares Quiz like items on a PowerPoint presentation and students write their answers on date. The extractor can also write their answers in the board in case of power interruption.

11 ★

ASSESSMENT FOR LEARNING

ASSESSMENT STRATEGY	FEEDBACK STRATEGY
<ul style="list-style-type: none"> Small Group Activity: Rate your Card Odd (Student Feedback) 10/10 Give five 	<ul style="list-style-type: none"> Peer Feedback Quick Survey: The instructor will ask the class about the challenges that they have encountered during the learning process.

GUIDE QUESTIONS:

- Which part of the lesson do you find most interesting?
- Which part of the lesson do you find most challenging?

The instructor references the gathered responses through a bar chart and more examples.

12 ★

ASSESSMENT OF LEARNING

- Achievement of Worksheets
- Number System Conversions with integrated questions and mathematical problems.

13 ★

REFLECTION

- Assuming that the LMS did not work well, alternative methods should be applied. Thus, it is recommended that the extractor should always prepare an alternative.
- If certain number of students did not pass the assessment, enrichment activities should be prepared by the instructor.

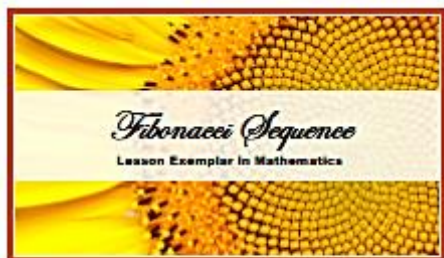
14 ★

MODIFICATION/ENRICHMENTS

- Improved learning outcomes.
- Reduced the pedagogies.
- Added technologies to be used by both students and instructors.
- Completed learning strategies in such a way that it conforms to, before, during and after.

15 ★

MATHEMATICS



1



Learning Outcome(s)

At the end of the lesson, students will

1. recognize Fibonacci sequence;
2. determine the n th term in the Fibonacci sequence;
3. identify Fibonacci sequence in nature;
4. express appreciation of Fibonacci sequence in nature.

2



Target Audience

- > Students with different learning styles will be catered.
- > First year students are coming from different backgrounds and different learning styles.
- > The topic will be able to respond to visual learners and auditory learners through the video that will be presented.

3



Target Audience

- > Kinesthetic learners will appreciate the examples in nature that illustrates Fibonacci number.
- > Students with numerical intelligences will be challenged in the activities.

4



Pedagogies

1. Students will be given a problem (The Rabbit Problem) shown through PPT presentation. Students will discuss among themselves the solution to the problem and will be asked to give their answers and how it was arrived at. Students can use their scientific calculators or cellphone calculators so they can work efficiently.
2. The teacher will provide the answer illustrating the pattern of numbers and will introduce the concept of Fibonacci number and formula.

5



Pedagogies

3. Students will have a problem exercise about finding the n th term in the Fibonacci sequence.
4. Objects in nature illustrating Fibonacci numbers will be shown through pictures and video clip.
5. Students will be asked to write a reflection paper about the video they watched.
6. Students will be given an assignment that targets multiple intelligences.

6



Technology Being Used

By students	By teachers
<ul style="list-style-type: none"> • computers/ laptops • cellphones • scientific calculators 	<ul style="list-style-type: none"> • computers/ laptops • cellphones • scientific calculators • LCD projector

7



Lesson Strategies

- In the Rabbit Problem, the students will be able to discuss among themselves possible solutions to the problem by scaffolding: think-pair-share or group work.
- The proper use of the calculator will be done by demonstration.

8



Required Materials

- The lesson will be delivered through PowerPoint presentation using computer/laptop and the LCD projector.
- To illustrate the solution, the board and marker will be utilized.

9



Required Materials

- The calculator will be used to provide alternative solution in finding the n th number in the Fibonacci sequence.
- The video clip (Nature by Numbers by Cristobal Vila) will be shown using the laptop, speaker and LCD projector.

10



Assessment for Learning

Assessment Strategy	Feedback Strategy
<ul style="list-style-type: none"> • Students will be asked randomly to fill in a series of numbers with the missing Fibonacci number. • Problem exercise in finding the nth term in the Fibonacci sequence. • Students will be randomly asked to give examples of things they see in the environment that exhibit Fibonacci numbers. • The students will be asked randomly and share their reflection on the class presentation about Fibonacci sequence. 	<ul style="list-style-type: none"> • Provide student misconceptions that their is difficult will be addressed by illustrating examples of math in nature. • Provide student affinity in the proper use of calculator for computation of the nth number in the Fibonacci sequence can be assessed by whole class discussion, peer mentoring, and guided inquiry.

11



Assessment of Learning

- Performance task given as an assignment specific to each of the multiple intelligences of the students (linguistic, naturalistic, spatial, and more).
- Students will be tasked to take pictures of objects found in nature that exhibit Fibonacci numbers. The work will be presented in class and will be grade using a rubric.
- Students will be required to bring a picture of their face which will be measured to illustrate the Golden Ratio. This will provide realization on the application of the Fibonacci number as a golden ratio in the human body.

12



Reflection

- Identify appropriate strategies suited to the needs of the 21st century learners.
- Be able to handle/overcome technical problem/s due to limitations in technology use.

Modifications/Enrichments

- Modify teaching strategies

13



14



CONCLUSION

STEAM LESSON EXEMPLARS AS PRODUCT VALIDATION OF PSE MODELS

TPACK LESSON PLAN TEMPLATE

Your Name: Biological Sciences Group 2

Program: B.S.Biology|Major in Animal Biology

Subject/Course: Animal Physiology

Topic: Movement

Lesson Title: Different Muscle Types

Level: Third Year

Lesson Duration: 1 ½ hours lecture
and 3 hours
laboratory

Learning Outcome(s) (Content Standards and Performance Standards)

1. Identify the different muscle types
2. Relate the physical characteristics of the different types of muscles and their location in the body to their functions .
3. Perform basic laboratory techniques designed to study the different muscle types.
4. Appreciate the uniqueness of the physical characteristics of each component/individual to reach the common goal such as movement

THANK YOU!