Developing the Garbage Problem in Iligan City STEM Education Lesson Through Team Teaching

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Abstract. The paper will clarify the learning activities which provide through Sutaphan nad Yuenyong [11] context based STEM education learning approach. This approach consists of 7 stages including (1) Identification of social issues, (2) Identification of potential solution, (3) Need for knowledge, (4) Decision-making, (5) Development of prototype or product, (6) Test and evaluation of the solution, and (7) Socialization and completion decision stage. This will be implemented using team teaching approach by the Earth Science, Physics, Chemistry, and Biology teachers. Identification of social issues, the earth science teacher raises the social issue about the garbage problem affecting the residents of Brgys. Bonbonon and Digkilaan, Iligan City, Philippines. Students may answer that the probable source could be the leachate from the sanitary landfill and from there the teacher will put the problem causes problem to the people in the locality where the landfill is located and to the City’s tourism as well. Identification of potential solution, the Earth Science teacher facilitates the class discussion about thinking of possible solutions to help solve the problem on garbage in Iligan City. The need for knowledge stage, the input of the scientific knowledge necessary for the learners’ decision in designing their prototype or product in solving the problem on garbage in Iligan City will be done separately in Physics, Chemistry, and Biology class. Physics teacher may provide scientific inquiry about force and compression to help the students design a prototype of a garbage/trash compactor. Chemistry teacher may provide learning activities about classification of mixtures according to particle size helps the students think of a design for a water treatment process. Biology teacher may provide learning activities about classification of mixtures according to particle size helps the students think of a design for a water treatment process. Biology teacher may provide learning activities related to macroinvertebrates and a bioindicator of the water quality of the streams/rivers. The decision making stage, lets the students decide on how they are going to make the required prototype for Physics, Chemistry and Biology aspect as possible solutions to the problem. The development of prototype or product stage, students are given enough time to create the compactor, water treatment process and the poster-infographic about macroinvertebrates. Test and evaluation of the solution stage, students will apply their knowledge related to their prototype or product for test and evaluation of the solution. The socialization and completion decision stage, the students’ will have an exhibit of their output. The paper will discuss how to provide students chance to applying STEM knowledge through these activities.

1. Introduction
The Philippines had just implemented the K to 12 Basic Education Program. It aims to create a functional basic education system that will produce productive and responsible citizens equipped with
the essential competencies and skills for both life-long learning and employment. Today, the education system tries to impose on students the attitude of lifelong learning. Life-long learning (LLL) as viewed involves all strategies that are put in place to create opportunities for people to learn throughout life by providing both the individual needs and that of the relevant community [1]. Lifelong learning can be associated to the following notions: (1) individuals take ownership of the need for and the content of learning, (2) learning focuses on how students think rather than on what to think about, (3) teachers become role models and mentors for lifelong learning rather than distributors of information, (4) evaluation encourages students for self-development and becomes a facilitator in the process rather than classifying them according to a norm, and (5) learning is considered as an enjoyable and essential part of the individual [2]. Methods such as problem-based learning, conscious learning, mutual teaching and cognitive apprenticeship, and such naturally motivating activities and similar teaching strategies as cooperation, reflection and student autonomy are employed by individuals in order to remain updated in today’s world [5]. It is also important to note that problem solving, critical thinking, and reasoning skills are essential to lifelong learning for these skills allow learners to acquire the knowledge, skills and attitudes necessary not only for academic success but also for their overall well-being [7]. In order to help students become lifelong learners, the schools should be organized in such a way that the students will have the opportunities to develop these skills.

The science curriculum framework for basic education in the Philippines has three primary themes: maintaining good health and living safely; utilizing energy and coping with changes; and conserving and protecting the environment which are used in various real life contexts across grade levels. The framework embeds science concepts in the context of students’ daily life to help them develop a more clear understanding of the concept or process they are learning. Connecting learning to events and activities in students’ lives enables them to develop understandings that will last a lifetime. In order for learners to apply science into context, teaching science should not be compartmentalized so that they will have opportunities to make connections for a deeper understanding of the importance and application of science and technology in everyday life. As the interaction among science, technology and society are learned, students begin to appreciate that technological design and problem solving involves many factors besides science. Teachers then need to communicate that science alone cannot solve human problems or meet human needs but it has to be integrated with other disciplines [9].

Studies have noted that science process skills are effective on teaching and learning about Science [3]. Teaching strategies such as inquiry teaching, problem solving, problem based learning and project based learning relies heavily on the effective use of the science process skills by students to complete in an investigation [4]. Problem solving is considered as the most important constructivist learning method [6]. Constructivist course goals should provide realistic problems that elicit social cognition, facilitate student application of external knowledge sources, and encourage students to utilize scientific reasoning. Students are more likely to persist in pursuit of problem solutions if they feel efficacious, that is, if they judge themselves as capable of solving the problem [10]. Self-efficacy can be promoted by encouragement, but is best promoted by actual problem solving success. Students, as well, can apply their scientific knowledge when trying to find a solution about the problem found in the society.

2. Developing STEM Education Learning Activities
The developed Lesson Plan is a collaboration among Physics, Chemistry & Biology teachers to address the issue on the garbage problem in Iligan City. All of the concepts were based from the Grade 12 Curriculum Guide of the three specified subjects. The concept on Pressure and Compression, Separating Mixtures, and Macroinvertebrates all aims that students learn the subject on the relation between concepts in science, technology, engineering and mathematics. The lesson plan was developed on concept of Context-based STEM education learning approach which the STEM
education learning activities should provide not only the ways of investigation and solving problem but also a real world problem solving. Regarding on Sutaphan and Yuenyong [11], the context-based STEM education learning approach included (1) Identification of social issues, (2) Identification of potential solution, (3) Need for knowledge, (4) Decision-making, (5) Development of prototype or product, (6) Test and evaluation of the solution, and (7) Socialization and completion decision stage.

Regarding on the 7 stages of context based STEM education teaching approach, the activities could be started from social issues and/or human needs such as disasters, pollutions, environmental issues, biotechnology, health, cosmetics, ecosystem, energy, market, commerce, and designing some technological products. The 7 stages will allow students using applying scientific and other knowledge for designing the solutions, and provided the context of instruction requires solving a real-world problem or task through teamwork. And, students will have also chance to apply their scientific and other knowledge for problem solving in context of engineers, technology, or entrepreneurship [11].

2.1 Purposes of the Lesson Plan
1. Explain the scientific principles about Pressure & Compression, Separating Mixtures, and Macroinvertebrates.
2. Explain the factors affecting the compression of objects.
3. Investigate ways of separating dissolved solids from a mixture classification.
4. Identify the macroinvertebrates which could be present in streams/rivers and explain what it tells about the quality of the river/stream.
5. To design a manual garbage/waste compactor (Physics), an infographics about macroinvertebrates (Biology), and a water treatment process (Chemistry).
6. Select suitable materials for creating the model.
7. Explain the process of creating the prototype/product.

2.2 The activities of Garbage Problem in Iligan City STEM Education Lesson
The garbage problem in Iligan City STEM Education was developed through team teaching as provided in the table 1.

Table 1. Lesson Plan on Garbage Problem in Iligan City adapting the Context-based STEM education learning approach

| Stage | Activity |
|-------|----------|
| 1. Identification of Social Issue | 1. Ask students to discuss hazards of improper waste segregation and disposal.  
2. Teacher raises the issues, “How can students minimize the size of the garbage sent to sanitary landfills?” “What pollutants are present in the landfill and how can it affect humans and the local ecosystem?” “What methods can be used to treat waste water or leachate?”  
3. The teacher raises the social issue about the garbage problem affecting the residents of Brgys. Bonbonon and Digkilaan, Iligan City. Due to improper waste management and design of the Compost Material Recovery Facility (CMRF), the sanitary landfill in the area is being filled fast and the leachate contaminates the river where the local people source their livelihood. Also, the Dodiongan Falls is located downstream and is also affected which could affect the local tourism. |
| 2. Identification of Potential Solution | 1. Students and teachers discuss about  
a. the design of a simple garbage/waste compactor considering the use of materials that are easy to find, its cost & functionality. [Physics]  
b. the sequence of processes that can be used to clean waste water. [Chemistry]  
c. the design of an poster-infographics showing the different macroinvertebrates. [Biology] |
### Table 1. (Cont’)

| Stage       | Activity                                                                                           |
|-------------|----------------------------------------------------------------------------------------------------|
| 3. Need for Knowledge | The topics will be discussed separately to grade 10 learners in their Earth Science Class as a requisite discussion about Surface and Groundwater. Each of the lesson will be conducted for an hour and the class will be divided into 4 groups with 8 members each. |
|             | **PHYSICS (1 hour)**                                                                                 |
|             | 1. The related knowledge that will be raised includes Pressure & Compression.                        |
|             | 2. Students may do some activities about pressure to explain that solids are hard to compress because the molecules are closely packed together – they have high density, thus it requires greater pressure in order to reduce its size/volume. |
|             | 3. Do Activity 1 Pressure                                                                           |
|             | 3.1 Give the students push pins. Let them think of these two situations.                            |
|             | 4.1.a. Pushing a drawing pin into the table with pointy ends towards the table.                    |
|             | 4.1.b. Pushing a drawing pin into the table with pointy ends towards your thumb.                    |
|             | 3.2 What result did they get? Students will write down their answer on a paper.                     |
|             | 3.3 The teacher and students discuss the reason for the difference in pressure according to the activity. Assuming that the same force is applied, each case would have a different pressure acting on the thumb. In the first situation, the thumb pushes on a large area so the force is spread out and the pressure is low. In the 2nd situation, the force is concentrated on a small area so the pressure is much higher. Given the relationship \[ P = \frac{F}{A} \], it can be deduced that Pressure is directly proportional to the Force applied and inversely proportional to the surface area. |
|             | **CHEMISTRY (1 hour)**                                                                               |
|             | 1. Students will review their previous knowledge on classification of mixtures according to particle size (solution, colloid, suspension). |
|             | 2. Students will think of ways to separate the dissolved solids from each mixture classification.     |
|             | 3. Do Activity 2 separation of mixtures                                                              |
|             | 3.1 Group the class into 5 members. Give each group 3 containers each with milk, salt solution, and muddy water. |
|             | 3.2 The students will be tasked to answer pertinent questions on their worksheets. Questions to be answered will be as follows: (1) how will you classify the three mixtures presented? (2) What are the properties of each classification (solution, colloid, suspension)? (3) What possible methods can be used to separate the water from the other component(s)? (4) Is there a process that can be used to separate mixtures regardless whether it’s a solution, colloid or suspension? Why or why not? |
Table 1. (Cont’)

| Stage | Activity |
|-------|----------|
| 3.3   | Provide each group with filter paper, layer of rocks and sand in a container. Let the students use the above-mentioned materials to separate the 3 mixtures previously given to them. Students write down their conclusion on worksheets. |
| 3.4   | Teacher and students discuss their answers and have an open discussion on why particle size of the dissolved or suspended component matters in determining the separation method to be used. |
| 3.5   | Teacher will explain that solutions have suspensions contain solids that are big enough to be affected by gravity. The suspended solids in this type of mixture can be separated from the liquid component by simply allowing it to stand for a certain amount of time. Filtration can also be employed to separate the components of a suspension. Colloids, on the other hand, have dispersed particles that are much smaller than suspensions and hence, do not settle out. The colloidal particles can be removed from the mixture by adding coagulants or flocculants, i.e. alum, which help the particles to form aggregates that precipitate out of the mixture. |
| 3.6   | Among the three, solutions have the smallest particle size. Components of a solution mixture are usually separated through distillation. |

**BIOLOGY (1 hour)**

1. The students will review their previous knowledge about macro invertebrates present in the river
2. Students will use the Biotic Index of Water Quality and will familiarize which group or level these macroinvertebrates belong.

**PHYSICS**

1. The students design a manual garbage/waste compactor. They should apply scientific principle, force, pressure and other knowledge for presentation to the class.
2. Let them draw the draft of their design on a paper and indicate the materials that they are going to use and the reason behind using those.

**CHEMISTRY**

1. So as to simplify the problem, the students will only be tasked to design a water treatment process. Students will apply scientific knowledge in classifications of matter and separation techniques.
2. Students will work on a draft of the waste water treatment process on paper. They would also indicate the materials that they will be using and justify why they will use those materials.

**BIOLOGY**

1. The teacher will group the students with 5 members each. They will design a Digital Infographics about Macroinvertebrates as Bioindicators of Water Pollution in streams/rivers and will post it to their social media account (e.g. Facebook, Instagram, etc.) to maximize the spread of information about the importance of these macroinvertebrates.
Table 1. (Cont’)

| Stage | Activity |
|-------|----------|
| 2. The students will apply all their knowledge about Macroinvertebrates present in the streams/rivers as well as the classifications of these organisms (Pollution-Sensitive, Moderately Pollution-Sensitive, Pollution- Tolerant) |
| 3. Students will think of their design and content of their Digital Infographics in a piece of paper. |

| 5. Development and prototype or product |
|----------------------------------------|
| PHYSICS | The students will create a simple waste compactor using the materials that they have proposed. |
| CHEMISTRY | Students will design a water treatment process. They will be given freedom to choose their materials. |
| BIOLOGY | The students will create a Poste-Infographic that will present the information about the Macroinvertebrates as a Bioindicator of Water Quality in the streams/rivers. The students must use the following: Laptop with Adobe Photoshop/Microsoft Office and Internet connection. |

| 6. Test & Evaluation of the solution. |
|--------------------------------------|
| PHYSICS | Let the students develop ideas of how their compactor will work. They need to test the following issues: 1. What maximum volume/size of waste material can the compactor compress or reduce in size? 2. By what factor does the volume of the trash/waste reduced (compaction ratio)? |
| CHEMISTRY | The teacher will test their prototype by letting them treat provided muddy water. The students will be asked to conduct turbidity and BOD tests of their influent and effluent streams. They need to test for the following issues: 1. Does the water quality of the effluent pass the minimum requirement required by the Department of Environmental and Natural Resources (DENR)? 2. If the prototype is implemented in real life, how much would it cost? |
| BIOLOGY | The teacher will rate/ critique the Infographics done by the students based on the rubrics provided. |

| 7. Socialization and completion decision stage |
|-----------------------------------------------|
| 1. The class will exhibit their final prototype – the compactor, a water treatment process and poster-infographic. |
| 2. Present how to test and evaluate the solution. |
| 3. Present how the prototype can be explained as the real one. |
| 4. Share what they learn from the comment and what they will revise for the completion solutions. |

This lesson is designed for 10th graders who are taking up Earth Science. The Earth Science class is conducted for one (1) hour daily. This will be implemented using team teaching approach by the Earth Science, Physics, Chemistry and Biology teachers. The Earth Science and students discusses first about Ground and Surface Water. The Earth Science teacher raises the issue on the garbage problem in Iligan City which could affect surface and Ground Water. With the help of the Physics, Biology &
Chemistry teachers, the students identify possible solutions to the problem using scientific concepts. This will be implemented to two (2) Earth Science classes comprising of 33 students per class.

The table below shows the class schedule and activities per day during the implementation period. Each class will be divided into 4 groups and each group will be tasking themselves in the development of the product/prototype for the solution in the Physics, Chemistry & Biology aspect. It is also expected that the students will make a write-up about the results of the testing & evaluation of their prototype.

Table 2. Class activities during the lesson implementation period.

|                | Monday | Tuesday | Wednesday | Thursday | Friday            |
|----------------|--------|---------|-----------|----------|-------------------|
| Week 1         |        |         |           |          | Stage 5           |
| 7:30 – 8:30    |        |         |           |          | Development of    |
| 8:30 – 9:30    | Stage 1 & 2 Identification of the Social Issue & the Potential Solution | Physics Stage 3 & 4 (Need for Knowledge and Decision Making) | Chemistry Stage 3 & 4 (Need for Knowledge and Decision Making) | Biology Stage 3 & 4 (Need for Knowledge and Decision Making) | prototype or product. |
| Week 2         |        |         |           |          | Stage 6           |
| 7:30 – 8:30    | Stage 6 Test and evaluation of Prototype or Product | Stage 6 Test and evaluation of Prototype or Product | Stage 7 Exhibit of their prototype or product | | |
| 8:30 – 9:30    |        |         |           |          |                   |

**Stage 1. Identification of Social Issue**

It is assumed that the discussion of ground and surface water is already done the previous meetings. In this stage, the Earth Science teacher is going to ask first the students about the possible sources of contamination/pollution in the ground and surface water in general. The students may answer that the probable source could be the leachate from the sanitary landfill and from there the teacher will put the problem causes problem to the people in the locality where the landfill is located and to the City’s tourism as well. The teacher and students will discuss the big issue of the garbage problem of the city.

**The Problem**

The residents of Brgy. Bonbonon and Brgy. Digkilaan felt that their livelihood, food security and safety are threatened by the landfill leachate coming from the Central Materials Recovery Facility in Sitio Bangko, Bonbonon, Iligan City. This is because of the excessive amount of garbage that are collected from the whole vicinity of the city itself. Since then, residents started to see black and brown liquid being carried by the streams into the falls and nearby rivers which were approximately a couple of kilometers below the landfill. Residents complained that the contamination has caused skin diseases to some and it would contaminate their drinking water in the long run and they fear this would discourage tourists and affect their means of living because they rely primarily on springs and deep wells. The city government has yet to issue a statement on their long- and short-term solution to the leak, and the rehabilitation.
Upon identifying the social issue, questions such as “How can students minimize the size of the garbage sent to sanitary landfills?”, “What pollutants are present in the landfill and how can it affect humans and the local ecosystem?”, “What methods can be used to treat waste water or leachate?” will be asked which leads the students to think of possible solutions to the social issue identified.

Stage 2. Identification of Potential Solution

In this stage, the Earth Science teacher facilitates the class discussion about thinking of possible solutions to help solve the problem on garbage in Iligan City. The students may think of solutions in the personal level, in the households and as a community. The possible solutions that may arise could be that the garbage to be brought to the landfills be reduced in size using a compactor, the leachate from the landfill be treated before throwing to the river or let the people be aware that they can determine the quality of the water in the river or streams using macroinvertebrates and many others.

Stage 3. Need for Knowledge

The input of the scientific knowledge necessary for the learners’ decision in designing their prototype or product in solving the problem on garbage in Iligan City will be done separately according to the time allotment shown in Table 2.

Physics
The discussion on force & compression helps the students design a prototype of a garbage/trash compactor. It is assumed that the students already have learned the concept of force in the previous grade level. The discussion starts with Pressure which is produced by applying a force on a certain area. It is important to note also that the application of force will cause a deformation on the object – changes the size and form of the object. It must be emphasized that the compression is dependent on whether the object is solid, liquid or a gas. A simple activity (see Table 1) to enhance the understanding of the learners as well giving them the opportunity to think will be given. The activity lets the learners describe what they have observe when trying to push the drawing pin against the table with the pointy end on top or the other way around. The teacher leads the students to explaining that when a force is applied to a small area it results to a bigger pressure and when the same amount of force is applied to a bigger area it results to a smaller pressure. The bigger the pressure the greater the strain (deformation) and vice versa. These concepts help the students decide how to design the compactor and choose the cost-effective materials.
Chemistry
Discussion on classification of mixtures according to particle size helps the students think of a design for a water treatment process. It is assumed that the students have had prior knowledge of solutions, colloids and suspensions from their previous grade level. The discussion starts by reviewing the classification of matter before focusing on mixtures. It will be emphasized to the students that what sets mixtures apart from pure substances is that the components of the former can be separated through physical means.

A simple activity (see Table 1) to enrich the understanding of the students and encourage critical thinking will be given. The activity lets the students observe the properties exhibited by each type of mixture and think of ways on how the separate the suspended or dissolved solids from the liquid component. For the learners to demonstrate the physical methods they suggested, additional materials will be provided.

The teacher leads the students to realize that suspended solids in a suspension, having the largest particle size, can be separated with the help of gravity by allowing it to stand for a certain amount of time or through filtration. Colloidal particles are much smaller than suspensions and can be removed from the mixture by adding coagulants or flocculants which help the particles to form aggregates that precipitate out of the mixture. Lastly, solutions have the smallest particle size and are usually separated through distillation or evaporation.

Biology
The previous knowledge of the students about Macroinvertebrates will serve as a guide for them in the identification process knowing that by definition, macroinvertebrates are organisms that are large enough to be seen with unaided having no backbone. Further discussions about macroinvertebrates will be about the qualities that made these aquatic organisms a bioindicator of the water quality of the streams/rivers, how will these aquatic organisms be collected in terms of their morphology and classified in terms of their tolerance level (pollution-sensitive, moderately pollution-sensitive, and pollution-tolerant).

The teacher will present the Macroinvertebrate Biotic Index chart and will lead the students to think and make conclusions about how the presence of a certain macroinvertebrate indicates the health of the stream/river.

The information about these macroinvertebrates as a bioindicator will not be caged in the four corners of the classroom and so is the reason why the students will be given an activity to make a poster infographic to further disseminate the information on how these macroinvertebrates function in the ecosystem aside from being a food source from other higher trophic organism such as fish. By having all of those ideas and information, the students will then think of an infographic design that is powerful enough to allow the people to easily understand and digest the information about Macroinvertebrates as a bioindicator of water quality with the proper use of color, words, attention-grabbing and persuasive graphics and images.

Stage 4. Decision-making
This stages lets the students decide on how they are going to make the required prototype for Physics, Chemistry and Biology aspect as possible solutions to the problem. The class is divided into 4 groups and the groups must have a clear tasking to ensure that each of the members has a part to perform.

Physics
To help the students design their prototype, the things to be considered must be presented. It is important to stress that the materials to be used must be readily available and at low cost, the design should be sturdy or with strong support and it should have a big compaction ratio (compressed volume/original volume). The learners must give the rationale of the design and the use of materials; or that it must be supported with scientific concepts. A draft of the design is to be presented first and will be approved by the Physics teacher.

**Chemistry**

The teacher will remind the students of the things to be considered in designing their prototype. It is necessary to emphasize that in choosing materials, those that are readily available is preferred. The students are also reminded to consider the cost and efficiency of each material. The effluent of the water that they will be treating must pass the minimum requirements of the DENR and DOH. The students must explain and justify their design and materials chosen through sound scientific reasoning.

**Biology**

To help the students design their poster infographic, they need to consider the materials needed for it to actualize the project. The students must first put everything into writing all the information they will present and how the design would look like. The students must give highlight to the scientific information about the Macroinvertebrate and not just merely focus on the design itself.

### Stage 5. Development of the Prototype or Product

The student are given enough time to create the compactor, water treatment process and the poster-infographic about macroinvertebrates. Each group should have a clear tasking of who is going to be in-charge of the development of each of the required prototype or product. They already have the design and it is now ready for development. It is understood that as scheduled (see Table 2), the students bring with them the materials needed for the task.

### Stage 6. Test and Evaluation of the Solution

In this stage, students will apply their knowledge related to their prototype or product for test and evaluation of the solution. This will help the students improve their prototype or product and make the necessary actions before it will be exhibited.

**Physics**

The garbage/trash compactor will be tested according to its functionality – its ability to compress. Its compaction ratio will be determined by dividing the new volume by the original volume of the compressed object. The maximum volume that the compactor can compress will also be determined. Each group’s compactor will be tested to similar materials like carton, sheets of paper, soft plastic containers, and trash available in the trash bins of the school premises. Based from the output of testing the compactor, necessary improvements will be made.

**Chemistry**

The students’ design of the water treatment process will be tested by determining if the effluent’s turbidity and BOD tests passed the Department of Health and Department of Environment and Natural Resources’ requirements.
Biology
The students’ poster-infographic will be evaluated using an adapted rubric. The poster-infographic will be posted on a certain location in school and comments from the evaluators will be solicited for the improvement of the product. Sample Rubric for the poster-infographic is shown in Table 3.

Table 3. Rubric for Evaluating the Poster-Infographic.

| Category          | 4 | 3 | 2 | 1 | 0 | Total |
|-------------------|---|---|---|---|---|-------|
| Content Accuracy  | At least four accurate facts about macroinvertebrates are displayed on the poster-infographic. | At least three accurate facts about macroinvertebrates are displayed on the poster-infographic. | At least two accurate facts about macroinvertebrates are displayed on the poster-infographic. | Less than two accurate facts about macroinvertebrates are displayed on the poster-infographic. | No accurate facts about macroinvertebrates are displayed on the poster-infographic. | No decision |
| Graphics          | All graphics are related to the topic and make it easier to understand. | All graphics are related to the topic but there are those that cannot be understood. | All graphics are related to the topic. | Some graphics are related to the topic. | No graphics are related to the topic. |
| Layout/Design     | Makes excellent use of font, color, graphics, effects, etc. to enhance the presentation. | Makes good use of font, color, graphics, effects, etc. to enhance the presentation. | Makes some use of font, color, graphics, effects, etc. to enhance the presentation. | Makes little use of font, color, graphics, effects, etc. to enhance the presentation. | Makes no use of font, color, graphics, effects, etc. to enhance the presentation. |
| Grammar           | No misspellings or grammatical errors. | Two or fewer misspellings and/or mechanical errors. | Three or more misspellings and/or grammatical errors. | Four or more spellings or grammatical errors. | Piece so filled with errors that meaning is undetectable. |
| Mechanics         | Capitalization/punctuation are current and consistent throughout the poster infographic. | Two or fewer capitalization/ punctuation errors exist in the poster infographic. | Three capitalization/ punctuation errors exist in the poster infographic. | Four capitalization/ punctuation errors exist in the poster infographic. | Piece so filled with errors that meaning is undetectable. |
| Required Elements | The poster infographic includes all required elements as well as additional information. | All required elements are included on the poster infographic. | Some required elements are included on the infographic. | Very few required elements are included on the infographic. | No required elements are included on the infographic. |
| **TOTAL**         |                              |                              |                              |                              |                              |

Stage 7. Socialization and Completion Decision Stage
The students’ will have an exhibit of their output. They will provide a poster stating the rationale of creating the prototype, a brief explanation of the process of designing the prototype and the results of the test and evaluation. They will also include how they incorporate the comments and suggestions based from the result of the test and evaluation of the prototype.

3. Conclusion
This paper showed how to provide STEM education through team teaching based on Sutaphan and Yuenyong [11] context based STEM education learning approach. The local issue of the problem on garbage in Iligan City, Mindanao, Philippines could be provided for the Philippines STEM classroom. In the identification of potential solution, it seems to enhance students to develop their possible ideas of designing something as solutions. And, physics, chemistry, and biology class will support students to find the possible designing solutions regarding on the physics, chemistry, or biology content. In physics class may allow students to design about a simple garbage/waste compactor which requires knowledge of force and pressure. In biology class will enhance students to develop the ideas of designing indicators of water quality from organisms in the water. In chemistry class, teacher will enhance students to develop their designing for clean waste water which require knowledge of chemical treatment waste water. Then, classroom will move to the need for knowledge stage where
students will investigate scientific knowledge related to their possible designing solutions. After students learn some more scientific knowledge, they could develop their prototypes or products which concurrent through knowledge based in physics, chemistry, and biology classroom. On development prototypes or products, students could not only apply various kinds of knowledge (e.g. science, math, economic, law, values, culture and so on) but also fluid skills (cooperation, thinking skills, leadership, partnership and so on) to optimize their prototypes or products. In test and evaluation of the solution stage, it allows students to apply scientific and other knowledge to develop framework of testing and evaluating their prototypes and products. Here again, students may learn some engineering process. In the socialization and completion decision stage, it enhance students to learn how it works as human need and revising their ideas through learning from people reflections on final prototype final exhibition. This may share some ideas of how to develop STEM education learning activities through team teaching in school setting.

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