General Information

Integrated Model Eliciting Activity

**Subject(s):**Science, Social Studies, English Language Arts (B.E.S.T.) Mathematics (B.E.S.T.)

**Grade Level(s):**4

**Intended Audience:**Educators

**Resource supports reading in content area:** Yes

**Keywords:**integrated, science, civics, MEA, Model Eliciting Activity, recycling, renewable, nonrenewable, resources, ocean, trash, pollution, littering, litter, data table

**Instructional Component Type(s): Lesson Plan,**Problem-Solving Task,  Text Resource,  Data Set,  Model Eliciting Activity (MEA) STEM Lesson

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**Resource Collection:**CPALMSSTEM MEAs - Grades K-5

Lesson Content

* **Standards:**
* SC.4.L.17.4 Recognize ways plants and animals, including humans, can impact the environment.
* SC.4.E.6.3 Recognize that humans need resources found on Earth and that these are either renewable or nonrenewable.
* ELA.4.C.1.3 Write to make a claim supporting a perspective with logical reasons, using evidence from multiple sources.
* ELA.K12.EE.1.1 Cite evidence to explain and justify reasoning.
* SS.4.CG.2.1 Identify and describe how citizens work with local and state governments to solve problems.
* MA.4.FR.1.4 Plot, order and compare fractions, including mixed numbers and fractions greater than one, with different numerators.
* **Lesson Plan Template:**Model Eliciting Activity (MEA)
* **Learning Objectives:**
  + Students will explain ways in which human activities can have major impacts on the environment.
  + Student will identify and distinguish between renewable and nonrenewable resources found on Earth.
  + Students will describe how citizens can help solve community and state problems.
  + Students will cite evidence from a text and a data table to explain and justify their reasoning.
  + Students will write to make a claim supporting a perspective with logical reasons, using evidence.
  + Students will use critical thinking skills to analyze data, compare data, and rank and prioritize the data to make recommendations based on real-world scenarios.
  + Students will communicate their thought process and rationale in a problem-solving situation verbally with their peers and in a written format.
  + Students will plot, order and compare fractions, including mixed numbers and fractions greater than one, with different numerators and different denominators.

* **Prior Knowledge**

This lesson is intended as an application of science skills within a social studies context.  Students should have had prior instruction on:

* + Recycling, natural resources, and decomposition
  + Writing to support a position
  + Plotting and ordering fractions

* **Instructional Suggestions**

**Part 1 (Day 1)**

* + Show students a small piece of trash such as a candy wrapper. Formatively assess by asking if they know where it will end up, or what might happen to it if it were to be dropped on the ground outside. Accept all answers. (It will blow away in the wind, be moved by rain, eventually end up in a drain, stream, or river and go to the ocean. It may be eaten by an animal or buried in the soil where it could remain for hundreds of years, eventually breaking down into toxic chemicals.)
  + Provide each student with a copy of **Reading Passage 1** and **Data Set 1**.
  + Have students read Reading Passage 1 (either individually, in small groups, or as a class). Use Readiness Questions to assess students’ understanding of the task.
  + Refer students to Data Set 1. Explain to students this is a collection of data that represents materials being considered for recycling, time it takes for a material to decompose, level of toxins the material releases upon decomposition, whether the material is renewable or nonrenewable, and that it is organized into a table to help see the data more easily.
  + Now explain that the data will be used to develop a procedure/process/model to help solve the problem introduced by the client. Explain that others should be able to apply their method to rank or prioritize solutions, and ensure they know what ranking or prioritizing means.
  + Explain what the data in the columns and each row mean. Depending on your students’ familiarity with Model Eliciting Activities (MEAs) and data tables you may need to scaffold the instruction.
    1. Point along a column as you explain that columns run vertical, or up and down in a table. Point along a row as you explain that rows run horizontal or left and right in a table. Now place your finger inside one cell and have students do the same. Explain that each of these ‘boxes’ in the table is called a ‘cell’. Do your best to stick to this vocabulary throughout the modeling of using data sets to expose students to the meaning of these words within a real-world context.
    2. Model for students how to look at the first row in the data set, have students place their fingers on the first row.
  + Depending on your students’ familiarity with MEAs you may need to scaffold the instruction. You could choose from the following suggestions or create your own based on your students’ needs:
    1. Model aloud or have some students model aloud how to interpret the first row of data. Discuss how to use the given information to assess the importance of properly disposing of each material to protect the oceans. Have students talk through what they are initially thinking in relation to the letter from the client, then have students work in small groups using the rest of the data.
    2. Allow students to work individually to interpret the first row and assess the importance of properly disposing of each material to protect the oceans, then meet with their small group to discuss their thinking. Then, have students work in their groups using the rest of the data.
    3. Allow students to immediately meet in small groups and start the process of interpreting the data without modeling as an entire class. Remind students they will need to assess the importance of properly disposing of each material to protect the oceans using the data provided.
  + Each group needs to decide upon a procedure/process/model before continuing in the lesson.  NOTE: Be sure students understand there is no “wrong” answer as long as they can explain and clearly state their methods and reasoning to the client. Students should know that they must justify their decisions with solid rationale and supporting data.
  + After they arrive at a solution, students will write their letter to a government official clearly stating their procedure, which should be generalizable and supported with their rationale and data-based evidence. For students that are not familiar with this type of thinking and writing, the teacher can scaffold the lesson as needed using **Letter Template 1** provided in the attachments section. You could choose from the following suggestions or create your own based on your students’ needs:
    1. Model aloud or have some students model aloud how to they wrote their letter discussing the step-by-step procedure and how they used the data and content knowledge/skills to help them. Then, have students return to their small groups to complete or improve their own letter.
    2. Allow students to immediately work in small groups and start the process without modeling as an entire class.The teacher should circulate the room and give feedback as needed as to where students can improve their writing and explanation.

**Part 2 (Day 2)**

* + Lead a class discussion to reintroduce the MEA. Have students describe the task from Part 1 and explain what they have done so far to address the problem.
  + Provide each student with a copy of **Reading Passage 2**and**Data Set 2.**
  + Ensure that students understand this time they are considering the “twist” described in Reading Passage 2 and whether their procedure/process/model should change as a result of the twist. Locate and discuss the new information represented within Data Set 2.
  + Depending on your students’ familiarity with MEAs and how the twist affects the process, you may need to scaffold the instruction. You could choose from the following suggestions or create your own based on your students’ needs:
    1. Model aloud or have some students model aloud their thinking of how this may affect what they have already done. Then, have students work in small groups rethinking their plan and procedure to adjust it as needed.
    2. Allow students to think individually about the twist for a few minutes, then have students discuss their thinking with their small groups. Groups will then rethink their plan and procedure, adjusting it as needed.
    3. Allow students to immediately meet in small groups and start rethinking their plan and procedure, adjusting it as needed.
  + Students should write (rewrite) their letter back to the client clearly stating their procedure that should be generalizable and supported with their rationale and data-based evidence, including how the twist affected their decision. For students that are not familiar with this type of thinking and writing, the teacher can scaffold the lesson as needed using **Letter Template 2** in the attachments section. You could choose from the following suggestions or create your own based on your students’ needs:
    1. Model aloud or have some students model aloud how to adjust their letter discussing the step-by-step procedure and how they used the data/mathematics to help them. Discuss that they need to address how the twist affected them. Then have students return to their small groups to complete or improve their own letter.
    2. Allow students to immediately work in small groups and start the process without modeling as an entire class. The teacher should circulate the room and give feedback as needed as to where students can improve their writing and explanation, ensuring that they address how the twist affected them.

**Closure (debrief)**

* + Wrap up the lesson with a class discussion. Use the Guiding/Reflective Questions to guide the discussion toward the learning objectives for this lesson. Consider having groups share and discuss each other’s solutions, methods, and reasoning.

* **Supplemental Reading**

This infographic can help students to understand how trash gets into the ocean. [How Trash Gets into the Ocean Infographic](https://www.cpalms.org/PreviewResourceLesson/Preview/This%20infographic%20can%20help%20students%20to%20understand%20how%20trash%20gets%20into%20the%20ocean.%206_Degrees_Vertical.jpg%20(900%25C3%25973229)%20(oceanconservancy.org)%25C2%25A0)

* **Guiding/Reflective Questions**

1. Which materials are renewable?
2. What is a renewable resource?
3. What is a nonrenewable resource?
4. Which materials are nonrenewable?
5. Is it more important to recycle renewable or nonrenewable resources? Why?
6. How does recycling affect the ocean environment?
7. What are some ways that you can help to solve the problem of trash getting into the ocean?
8. How can we tell people in our government that we want recycling programs to be better and share some ideas with them?
9. What evidence from the text and data would like to share with them?
10. What should your letter explain?

* **Reading Passage 1**

Use **“Ocean Heroes Reading Passage 1"** in the attachments section to introduce students to the client and their problem.

* **Readiness Questions**
  + Who is the client?
  + What is the problem they want you to solve?
  + What will you need to do in order to solve the problem?
  + What things will you need to include in your solution?
  + Do you think there is more than one way to address the client’s problem? Why or why not?
  + Why do people litter even though it is against the law?
  + What does it mean to lobby the government?
  + How do they want you to lobby your state and local government?
  + What criteria are they using to decide which materials are most important to recycle?

* **Data Set 1**

Use **"Ocean Heroes Data Set 1"** in attachment section. Be sure to review this information with all students and answer any questions as this may be a first for many students working with a data set. Each group/team should also have their own copy of the data set to refer to.

* **Comprehension/Readiness Questions**
  + What are renewable and nonrenewable resources?
  + Which materials are renewable?
  + Which materials are nonrenewable?
  + What will happen if we run out of these nonrenewable resources?
  + What is recycling?
  + What kinds of things have you recycled?
  + What is decomposition?
  + What happens to materials when they decompose?
  + Which materials decompose the fastest?
  + Which materials take the longest amount of time to decompose?
  + How does the time it takes for an item to decompose affect how long it is in the ocean as trash?
  + Why is keeping trash out of the ocean important?
  + Why is it important for citizens to work with the government to solve problems?
  + What do the Ocean Heroes want you to do to help?

* **Letter Template 1**

Use **“Ocean Heroes Letter Template 1"** in attachments section to help students structure their response to the client. Provide a copy of this letter template to each group to record their solution and reasoning. Alternatively, based on the ability of your students, you may choose to have groups write their own response letter to the client.

* **Reading Passage 2**

Use **“Ocean Heroes Reading Passage 2"** in attachments section to introduce students to the "twist" from the client.

* **Reflection Questions 2**

These questions can be asked upon presenting students with the second part of the problem, the “twist”.

* + What new information is presented in the second part of the problem?
  + Will your procedure/process/model change? If so, how?  If not, please explain why.
  + Which materials are already being recycled the most? Least?
* **Data Set 2**

Use **“Ocean Heroes Data Set 2"** in attachments section. Review the data set thoroughly to ensure students understand what it is presenting. Be sure each group/team has a copy to refer to.

* **Letter Template 2**

Use **“Ocean Heroes Letter Template 2"** in attachments section to help students structure their response to the client. Provide a copy of this letter template to each group to record their solution and reasoning. Alternatively, based on the ability of your students, you may choose to have groups write their own response letter to the client.

* **Additional Instructions or Materials**

[Trash Free Seas: Outreach & Education - Ocean Conservancy](https://oceanconservancy.org/trash-free-seas/outreach-education/) This website provides information for students and teachers about keeping trash out of the ocean. These materials can be used if you would like your students to do research into ocean trash and solutions to the problem.

* **Formative Assessment**

Model-Eliciting-Activities, MEAs, allow students to critically analyze data sets, compare and contrast information and require students to explain their thinking and reasoning.  While there is no one correct answer in an MEA, students should work to clearly and rationally explain their thinking.  Therefore, teachers should ask probing questions and provide feedback to help students develop a coherent, data-as-evidence based approach within this learning experience.

* **Feedback to Students**

There are no single correct answers when solving a Model Eliciting Activity (MEA). Instead, there are many possible solutions and procedures because solutions are meant to be generalizable. Students are encouraged to use a specific type of thinking and process the information given, as well create a logical answer to the problem that they are then able to explain.

The students will receive immediate feedback throughout the lesson. The teacher will introduce the lesson, then allow the students to work either individually or in small groups. As students are working on developing their procedures, the teacher will ask the students reflection questions (set 1) as a whole group. The teacher will give feedback specific to each group (or individual) regarding their process and/or procedure for solving the problem.

* **Summative Assessment**

With MEAs, the answers are open-ended. This means that all solutions should be generalizable. The solution to an MEA is a process and a "way of thinking" that we would like the students to achieve. This resource should demonstrate the students' improvement in conceptual difficulties and should thus allow the teacher to measure the impact of this resource on student learning.

The teacher will determine if the students have reached the learning targets for this resource after data set 1/letter 1 are completed and by repeating the educative assessment after the second data set/letter 2. If the students have explained their procedure in detail and defended their choice, they have met the target for this lesson. Use the rubric in the attachments section to help evaluate student learning by scoring both letters, including their strategy and procedure, generated by the students as well as understanding of the science concepts (renewable, nonrenewable, decomposition) and overall participation in the lesson.

Accommodations & Recommendations

* **Accommodations:**
  + Read the letters aloud while discussing and marking the text to model how to find important information.
  + If students do not understand the terms “renewable” “nonrenewable” and “decompose” pre-teach these concepts.
  + Provide a number line from 0-1 with benchmark fractions.
* **Extensions:**
  + International Coastal Cleanup Day happens every September. Type International Coastal Cleanup Day into a search engine to find out about coastal cleanup events in your area, and to access articles and information.
  + [Trash Free Seas: International Coastal Cleanup® - Ocean Conservancy](https://oceanconservancy.org/trash-free-seas/international-coastal-cleanup/) In partnership with volunteer organizations and individuals around the globe, the International Coastal Cleanup® (ICC) engages people to remove trash from the world’s beaches and waterways.
  + Use the Clean Swell app. [Trash Free Seas: Clean Swell® App - Ocean Conservancy](https://oceanconservancy.org/trash-free-seas/international-coastal-cleanup/cleanswell/)  Clean Swell® makes it easy for anyone to make an impact for our ocean. When you head out to clean up in your neighborhood, beach, or park use Clean Swell to be a part of long-lasting solutions. With this app you can easily record each item of trash you collect, which helps scientists and advocates around the world tackle ocean trash at a global scale.

Attachments:

Letter 1

Dear Florida Students,

We are a group of kids who want to keep the Earth clean and safe for our futures. We are called Ocean Heroes. We work to protect the oceans. More than half of our oxygen comes from ocean plants, the ocean also supplies a large amount of the food people eat. When the ocean is polluted, it hurts all the people on Earth by making our air less healthy and making food harder to get and more expensive. It is very hard to fix damage done by ocean pollution. It is much better to prevent pollution from getting into the ocean.

We have a big problem. Our oceans are being polluted with trash. This trash is harming marine life, ruining our beautiful Florida beaches, and making people and animals sick. **Many ocean animals such as sea turtles and dolphins become** get injured, sick, and die because they became tangled in or ate plastic trash. Plastic is being eaten by fish that people and other animals eat and it can make us sick too. Pollution can kill ocean plants that make the oxygen we need to breath.

When someone litters on the street or parking lot, rainwater can move the trash into storm drains that empty into streams, rivers, and other bodies of water or the wind can blow it there. Those rivers and streams can eventually carry the trash to the ocean.

**Florida has laws against littering that were passed by the people of Florida, however, trash continues to get into our water. Sometimes it is because people break the law and drop litter on the ground, other times it is because trash cans overflow or tip over. Either way, ocean pollution comes from us. Humans are the source, and every single person has the power – and the responsibility – to prevent it. As Americans it is our right and privilege to be able to work together with our state and local government to solve problems. We want your help asking our government to take action to reduce the amount of trash that reaches our oceans. Some ways that can be done include enforcing littering laws, providing more and better trash cans in public parks and beaches, and a requiring people to pay a deposit on plastic bottles that they can get back when they recycle the bottles.**

**We are lobbying our local and state government to do more to protecting our oceans. Lobbying is when people do things to try to persuade the government to change its policies. This is where we need your help. We want to be able to share what children all over the state of Florida can do to prevent trash from getting into the ocean and what materials we should work to prevent from entering the ocean. We want you to be our advisors and let us know what we should say.**

**Please join us and become an Ocean Hero! Here’s How:**

1. **Evaluate the data we have sent you.**
2. **Rank the material we should ask our state and local governments help keep out of the ocean. List the materials in order of importance from most to least important.**
3. **Some materials are non-renewable. Non-renewable means that if we use all of it up, we will not be able to get any more during our lifetime.**
4. **Some materials can be recycled, this means taking the materials that were going to be thrown away and changing them into new toys, bottles, cans, and other things.**
5. **Write a letter back to us to explain how you made this decision.**

**Thank you for being an Ocean Hero!**

Data Set 1

|  |  |  |  |
| --- | --- | --- | --- |
| **Material** | **Renewable or Nonrenewable** | **Is it Recyclable?** | **Time to Decompose** |
| Plastic | Nonrenewable | Yes | 450 years |
| Plastic bags | Nonrenewable | Yes | Up to 500 years |
| Paper and cardboard | Renewable | Yes | 6 weeks |
| Cotton clothing | Renewable | Yes | 2-5 months |
| Tin can | Nonrenewable | Yes | 50 years |
| Aluminum can | Nonrenewable | Yes | 200 years |
| Disposable diaper | Mixture of nonrenewable and renewable materials | No | 450 years |
| Waxed paper carton | Renewable | No | 3 months |
| Glass bottle | Nonrenewable | Yes | 4000 years |
| Styrofoam | Nonrenewable | No | 500 years |

Letter Template 1

Dear \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_,

We are citizens of Florida and the United States and students at \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. We are concerned about the future of our planet. The oceans are being polluted and we want your help to keep them clean and healthy. Creating ways to help more trash get recycled is one way to keep it out of the ocean. Based on data we chose the 4 most materials that are most important to recycle and have ranked the materials in order from most important to recycle to least important to recycle.

Here is our list:

1.

2.

3.

4.

The reason we ranked them in this order is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Sincerely, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Letter 2

Dear Ocean Heroes,

**Thank you for being an Ocean Hero!**

Thank you for sending us your advice! We brought what you recommended to our government officials. They responded to us and want to know more about how they can help by creating programs to recycle materials to prevent them from becoming ocean pollution. They have asked for more information about which materials it is most important to recycle.

When you write back to them to explain which materials we should focus on recycling, please consider:

* Some materials are renewable – this means we can make more of them.
* Some materials are nonrenewable, if we use them up we cannot get more of them during our lifetime. Recycling them can help prevent us from using them up.
* Recycling is a way to use a material over and over again by changing it into something new. Some materials can be melted and made into things.
* There are not currently any ways to recycle diapers, Styrofoam, or waxed paper cartons so please cross those items off the recycling list.
* Plastic bags are one of the deadliest threats to ocean animals. Plastic bags cannot be recycled in curbside recycling bins. To recycle plastic bags, people have to take them back to a grocery store that has a special bin for them.
* Glass remains in the ocean for 4,000 years, but does not harm sea life.
* Trash that falls on the ground is moved by wind and water and eventually ends up in our oceans.

Keep in mind that we want to choose one material and increase the amount of it that is recycled to prevent damage to the ocean environments.

1. **Evaluate the new data we have sent you.**
2. **Rank the material we should ask our state and local governments to fund recycling programs for.**
3. **List the materials in order of importance from most to least important.**
4. **Write back to us to explain how you made this decision**
5. **We are also interested in other ways to prevent litter. It would be awesome if you would also share some ideas that we can use to prevent littering in the future and keep our oceans clean and healthy.**

**Thank you,**

**Ocean Heroes**

**Ocean Heroes Data Set 2**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Material** | **Time to Decompose** | **Fraction of this material waste that is currently recycled** | **Renewable or Nonrenewable** | **Is It Recyclable?** |
| **Plastic** | 450 years | 4/100 | Nonrenewable | Yes |
| **Plastic bags** | Up to 500 years | 1/100 | Nonrenewable | Yes |
| **Paper and cardboard** | 6 weeks | 6/10 | Renewable | Yes |
| **Cotton clothing** | 2-5 months | 3/5 | Renewable | Yes |
| **Tin can** | 50 years | 1/12 | Nonrenewable | Yes |
| **Aluminum can** | 200 years | 8/100 | Nonrenewable | Yes |
| **Disposable diaper** | 450 years | 0 | Mixture of nonrenewable and renewable materials | No |
| **Waxed paper carton** | 3 months | 0 | Renewable | No |
| **Glass bottle** | 4000 years | 1/16 | Nonrenewable | Yes |
| **Styrofoam** | 500 years | 0 | Nonrenewable | No |

Letter Template 2

Dear \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_,

We are citizens of Florida and the United States and students at \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. We are concerned about the future of our planet. The oceans are being polluted and we want your help to keep them clean and healthy. Creating ways to help more trash get recycled is one way to keep it out of the ocean. We have received more data and learned more about pollution in our ocean. Based on data we chose the 4 most materials that are most important to recycle and have ranked the materials in order from most important to recycle to least important to recycle.

Here is our list:

1.

2.

3.

4.

Our new procedure for ranking (did/did not change) Here is how we decided the order of importance for recycling these materials:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Sincerely, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_