

## Writing a Procedure: Lego Activity

<b>Grade and Content Area</b>	Grade 10 Science
<b>Title</b>	Writing a Procedure: Lego Activity
<b>GLEs/GSEs</b>	<b>W-10-6.2 In informational writing, students organize ideas/concepts by...</b> Selecting appropriate and relevant information (excluding extraneous details) to set context
<b>Context of the Lesson</b>	<p>Students will use Legos to build a structure and write a detailed procedure for the construction of that structure. The activity focuses on Lego building instead of on an actual biological experiment because the Legos are concrete and non-threatening to the students. This allows the students to focus on identifying the necessary components of a well-written procedure. Once the written procedure is completed, students will evaluate their procedures and make revisions if needed. Students will then exchange their procedures with other groups. Using an identical set of Legos, students will build the structure following the given procedure. Students will compare and contrast their structures to the original ones designed. Students will comment on the procedures they were given and then return the structure to the group that designed it. Students will review the comments and suggestions made by the other group and revise their procedure.</p> <p>This lesson is designed to provide students with an opportunity to practice writing an appropriate procedure. Students will be given the opportunity to test the accuracy of their procedure and revise their work based on the findings and suggestions of their peers.</p> <p>It is important for students to be able to design and follow a scientific procedure. Science students are often required to follow a written procedure when performing an experiment. In addition, students are commonly asked to design their own experiments, which will require them to record their experimental design. Students should realize that in order for data to be scientifically accepted, the experiment must be able to be performed by others. Students need to know that their procedures must be clear enough and easy to follow so that it can be reproduced several times.</p> <p><i>Follow-up Activity:</i> Have students re-evaluate their procedures and make adjustments based on the comments and suggestions of their peers and on the criteria developed in class together. In addition, as an extended activity, ask students to write a procedure for making a peanut butter and jelly sandwich using the established criteria.</p> <p>The time required to complete this activity depends on the amount of detail given during the introduction and in the number of students in the class. Part I of the activity, which includes the introduction, procedural design, and the actual construction of the structure, requires approximately 45-60</p>

	<p>minutes. Part II is approximately 30-45 minutes. During this time, students attempt to build the structure following the procedure written by another group. In addition, they need to evaluate the procedure and provide written suggestions for the writers of the procedure. The time required varies depending on how many attempts you allow during the closure discussion (generation of Criteria List).</p> <p><b>Note:</b></p> <p><i>In the past, I have completed the entire activity in one class period (block of 80 minutes). Although it is possible, I have found that most students feel rushed and miss some of the major points of the activity. Also, when trying to complete it in one block, you must limit the student involvement during the engagement and the closure, which then makes the activity more teacher driven. When the activity is divided into two parts, students are more involved during the discussions, they go into greater detail when designing their procedures and analyzing the activity. The extended time also provides students with greater opportunity to work cooperatively in generating the Criteria List and providing feedback to their peers.</i></p>
<b>Opportunities to Learn</b>	<p><b>Materials</b></p> <ul style="list-style-type: none"> <li>• Student worksheet</li> <li>• Lego set A</li> <li>• Lego set B</li> <li>• Cardboard shield</li> <li>• Examples of procedures (e.g., recipes, instructions)</li> </ul> <p><b>Classroom Climate/Organization</b></p> <p>Students will be randomly placed in pairs. Each pair must work together to design a structure using the set of Legos given. Students should be told that their grade is not based on building the structure but on how they design their own procedure and how they evaluate their peers' procedures. This activity is used to introduce students to the necessary components of a scientific procedure.</p> <p>It is important for the classroom climate to be one of respect and order that supports peer review. The teacher should reinforce that students' grades will not be based on their ability to correctly build their peer's structure. Students should be encouraged to discuss the design of their procedure with their partner before it is exchanged with another group.</p>
<b>Objective(s)</b>	<p><b>Students will be able to:</b></p> <ol style="list-style-type: none"> <li>1. Write a specific and organized procedure.</li> <li>2. Follow and evaluate a written procedure.</li> <li>3. Identify the important factors that are necessary for writing an accurate procedure.</li> </ol>

<b>Instructional Procedures</b>	<p><b>Opening</b></p> <ol style="list-style-type: none"> <li>1. Begin the lesson by asking students what a procedure is. Ask students if and when they have followed written procedures.</li> <li>2. Discuss with students the different types of procedures. Make sure students realize that following a recipe or set of instructions is the same as following a written procedure.</li> <li>3. Ask students to identify the factors that make a written procedure easy to follow. Provide students with examples of various procedures. For example, you can use an instruction insert on how to construct a template needed to assemble a staircase rail. To do this, make an overhead of the procedure and ask students to identify the important factors. Some of the factors the students should identify may include: <ul style="list-style-type: none"> <li>• Having a materials list</li> <li>• Being written in numbered steps</li> <li>• Containing illustration/figures to refer to</li> <li>• Containing bold print to emphasize the “cautions”</li> </ul> </li> </ol> <p><b>Engagement</b></p> <p><i>Part I. Designing the Structure &amp; Writing the Procedure</i></p> <ol style="list-style-type: none"> <li>1. Students are given a numbered set of Legos and a cardboard shield. <ul style="list-style-type: none"> <li>• Tell students to record their set number on the student worksheet.</li> <li>• Explain to students that they must design and build something out of the Legos they were given.</li> <li>• Tell them that they are to use all the Legos in the bag and that they should use the cardboard shield to hide their structure from the other groups.</li> </ul> <p><i>During this time, walk around the classroom making sure students stay on task. In addition, read some of the procedures and ask questions to aid students if it seems like they need help. Students should be given a time limit (20-30 minutes), otherwise they spend too much time designing intricate structures and miss the point of the activity.</i></p> </li> <li>2. Remind students that they need to be writing a procedure on how they are assembling their structures. Students can write the procedure as they go along or after their structure is completed.</li> <li>3. Once students are finished building their structures and writing their procedures, they need to place their assembled structures in the bag and bring it to the teacher. Students should make sure the Lego set number is included on the procedure.</li> <li>4. At this time, ask students how many of them think they have written a good procedure. Ask them to explain their answers.</li> <li>5. Instruct students to answer questions 5 &amp; 5b of Part I on the student handout.</li> </ol> <p><i>Part II. Following a Procedure: Building the Structure</i></p> <ol style="list-style-type: none"> <li>1. The teacher needs to provide each group with another group’s procedure</li> </ol>
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<p><b>Instructional Procedures Continued</b></p>	<p>and corresponding Lego set.</p> <ol style="list-style-type: none"> <li>2. Instruct students that they are to follow the procedure given and build the structure. Remind them that their grade is not based on building the structure but on how they designed their own procedure and how they evaluate their peers' procedure. Students should be instructed that they are not to ask the group who wrote the procedure any questions.</li> <li>3. Once the students complete the procedure, they should bring the assembled structure to the teacher who will compare it to the original structure built by the original group.</li> <li>4. The teacher will then determine if the structure matches the original. <ul style="list-style-type: none"> <li>• If the structure matches, they are now able to complete the evaluation section (Part II #5-7 of the student handout).</li> <li>• If the structure does not match, allow students to give it one more try.</li> <li>• If on their second try their structure still does not match, allow students to compare their structure to the original one. At this point, students should be able to complete the evaluation section (Part II #5-7 of the student handout).</li> </ul> </li> </ol>
	<p><b>Closure</b></p> <ol style="list-style-type: none"> <li>1. Once everyone has finished the activity, call for the students' attention.</li> <li>2. Ask students to share their experiences. Ask students which method resulted in writing a better procedure. Typically, students who write the procedure as they go along produce more detailed and accurate procedures than those who write it after. Students who write it after often have missing steps.</li> <li>3. Ask them to share some of the things that were included in the procedure that made it easy to follow.</li> <li>4. Ask them to point out some of the things they found that made the procedure hard to follow. Remind students that they are providing constructive criticism and that they should speak appropriately.</li> <li>5. Together, generate a list of important elements of a good procedure: <i>Criteria for Writing a Procedure</i>. Have students copy the list and place it in their binder for future reference.</li> <li>6. After students generate the list, ask them to form a list of rules that will take care of each of the problems they identified. The completed Criteria List should include the following:</li> </ol> <p><i>When writing a procedure, you should:</i></p> <ul style="list-style-type: none"> <li>• Include a materials list</li> <li>• Write clearly; type the procedure if possible</li> <li>• Organize the procedure so that it is in a step format</li> <li>• Number each step</li> <li>• Use diagrams if possible</li> <li>• Make sure diagrams are titled so you can make reference to them in</li> </ul>

<b>Instructional Procedures Continued</b>	<p>your instructions (For example: figure 1)</p> <ul style="list-style-type: none"> <li>• Underline or bold print important steps</li> <li>• Make side notes or cautions stand out</li> </ul>
<b>Assessment</b>	<p>Students work is assessed using a Rubric (see Rubric) that focuses on:</p> <ul style="list-style-type: none"> <li>• Teacher observation of student's participation during the activity (time on task) and participation during class discussions</li> <li>• Evaluation of the student's written procedure</li> <li>• Evaluation of the student's procedure revisions</li> <li>• Evaluation of the student's analysis of their peers' procedure design</li> <li>• Evaluation of the student's completed activity sheet.</li> </ul>
<b>Reflection</b>	<p><b>Student Work Sample 1: Approaching Proficiency</b></p> <p>Student's work does not demonstrate proficiency due to the absence of two major components. The student did not include a materials list or any diagrams showing the correct placement of the Lego pieces. Although the student used very descriptive terms in the written procedure, the directions at times were confusing. The use of diagrams would have made the procedure much easier to reconstruct.</p> <p><b>Student Work Sample 2: Proficient</b></p> <p>Student's work demonstrates proficiency in that; the procedure was organized into individual steps and illustrated using diagrams. Although the procedure lacked a materials list, all required components were illustrated in the diagrams. The student could have exceeded proficiency by using terminology that is more descriptive and by including a materials list.</p> <p><b>Student Work Sample 3: Exceeds Proficiency</b></p> <p>Student's work demonstrates a level of understanding that exceeds the proficiency level expected. Although the student's written procedure did not include a materials list, the other components were extremely detailed. The student included detailed diagrams that were labeled. The student's written procedure was organized into steps and stated using complete sentences. It was neatly written and easy to follow.</p> <p><b>Lesson Implementation</b></p> <p>The goal of the lesson is to teach students how to write a scientific procedure. As a result of the activity, students should be able to identify the specific components needed to write an accurate scientific procedure.</p> <p>In addition to establishing a list of required components (criteria), the lesson should illustrate to students how extremely specific and detailed a written procedure needs to be. By having students attempt to follow and evaluate another group's procedure, students are able to identify which components were most valuable when trying to replicate the procedure. They are also able to identify the problem areas that may make a procedure difficult or impossible to replicate.</p> <p>After students exchange procedures and attempt to replicate it, the role of</p>

<p><b>Reflection Continued</b></p>	<p>the teacher becomes extremely important. During this section of the lesson, the teacher needs to work closely with students who were not given a well-written procedure in order to balance their level of frustration. When this occurs, students should be told to focus on identifying the “problems” with the procedure and to focus on making a list of suggestions to improve the procedure. It is important once again, to remind these students that their grade is not based on being able to replicate the other group’s structure.</p> <p>After students evaluate each other’s procedures, they should be given ample time to get together and share their findings. Due to time restraints, I sometimes rush this step but from past experiences, this is when students learn the most. Having students explain to their peers why they were not able to follow the procedure seems to have a greater impact than hearing it from me.</p> <p>To wrap-up the activity, I have students bring their procedures home and make the necessary revisions as part of a homework assignment. Before using this activity, I used the “peanut butter and jelly sandwich activity” to teach this skill. Now, I use that activity to reinforce this newly acquired writing skill. The procedures written as part of the follow up assignment now include a detailed materials list that is written in numbered steps, has diagrams incorporated into it, and are much more specific than the procedures that were written prior to completing the Lego activity.</p>
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Name \_\_\_\_\_ Block \_\_\_\_\_ Date \_\_\_\_\_

Partner \_\_\_\_\_

## Designing a Procedure

**Task:** Your job is to build a structure using all the lego pieces in the bag you were given. In addition, you must write a procedure on how to build the structure you designed. Remember, another team of students is going to follow your procedure and try to replicate the structure you built so, your procedure must be specific and easy to follow!

### ***PART I. Designing the Structure & Writing the Procedure***

1. Please record the lego set you are using: \_\_\_\_\_
2. Using all the lego pieces build a structure.
3. Use the cardboard shield to hide your structure from the other teams.
4. On the sheet provided, write a procedure for building your structure.
5. Read the procedure you wrote and answer the following:
  - 5a. Do you think the other team will be able to replicate your structure following the procedure you wrote? \_\_\_\_\_ Yes/No
  - 5b. Please explain what you think was “good” about your procedure? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
6. Place the structure you built back in the plastic bag and give it to your teacher. You also need to give both copies of your procedure to the teacher.

### ***Part II. Following a Procedure: Building the Structure***

1. Please record the lego set you are using \_\_\_\_\_
2. Using the procedure and set of lego pieces given, try to assemble the structure as instructed.  
*You cannot ask the teams who designed it any questions.*
3. When you are finished building the structure, bring it to your teacher so it can be compared to the one built by the original team.

4. If the structures match, go on to the next step. If the structures do not match, you can try again.

### Evaluation Section

5. When completed, please answer the following:

5a. Were you able to follow the procedure and build the structure correctly?  
\_\_\_\_\_ Yes/No

5b. Was the procedure easy or hard to follow? \_\_\_\_\_ Easy/ Hard

5c. Please explain what made the procedure easy to follow or hard to follow.

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6. List three things you found “good” about the procedure.

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7. Make two suggestions on how the other team could improve their procedure.

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