STEM and Science Project Planning Guide

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Instruction and Assessment of Science Skills - Rubric

Science Fair Rubric - Instruction and Assessment of Science Skills

Science Skill	Exceeding - 4	Meeting - 3	Approaching - 2	Working Below - 1
PP1 - Propose Scientific Question	Testable question that includes what is measured/ observed as well as tested	Scientific question that includes the variable to test	Question has a yes/no answer; does not indicate what should be tested	Any other answer
PP2 - Prediction	Make a prediction which is: - relevant to the question - testable - includes a reason **and is explained in detail**	Make a prediction which is: - relevant to the question **- testable** **- includes a reason**	Make a prediction, including a **reason, which may be relevant** but is not clearly expressed	Any other answer
PP3 - Variables		Identify and control most relevant variables for a fair test	Controlling variables that are not relevant to the investigation	Any other answer
PP4 - Planning an Investigation	Students can independently - procedures have a set of steps to test a single question - procedures are detailed enough to be repeated by someone else **- procedures identifies relevant measurements and/or observations to be made** **- procedures has one independent variable and is written in a way that controls most major variables**	Students can independently perform **all** the following: - procedures have a set of steps to test a single question - procedures are detailed enough to be repeated by someone else - procedures identifies needed equipment and materials - procedure is written in a way that controls most major variables	Students can independently perform **some** of the following: - procedures have a set of steps to test a single question - procedures are detailed enough to be repeated by someone else - procedures identifies needed equipment and materials - procedure is written in a way that controls most major variables	Any other answer

Science Skill	Exceeding - 4	Meeting - 3	Approaching - 2	Working Below - 1
PP5 - Collecting and Recording Data	Students are recording as many numbers as accurately as possible. They are detailed in their working and accounting for every piece of relevant data possible	Students are recording some numbers and are recording most relevant data	Students are not recording number data as a priority and are focussed on irrelevant observations	Any other answer
AE1 - Organizing and Displaying Data	Charts and graph having all appropriate titles and labels and information is plotted correctly. Graphs with number scales using **2,5,10, etc**	Charts and graph having **all appropriate titles and labels and information** is plotted correctly. Number scales using 1,2,3 (one-to-one correspondence)	Data or information need to be plotted correctly but a minor error in the labels may occur	Any other answer
AE2 - Pattern/ Trends/ Relationship		Describes an appropriate pattern/ trend/relationship	Pattern/trend/ relationship is unclear or overly simplistic	Any other answer
AE2 - Discrepancy		Identifies a discrepancy, suggesting an explanation	Identifies a discrepancy, but is unable to suggest an explanation	Any other answer
AE3 - Conclusions	- Conclusion states a relationship between variables and supporting evidence - Is relevant to initial question and prediction - **Must** include suggestion to improve experimental design	- Conclusion states a relationship between variables and supporting evidence - Is relevant to initial question and prediction - **May** include suggestion to improve experimental design	Conclusion restates only the recorded results and observations	Any other answer
AE4 - Applications of Learning	Students can draw relevancy of what they have learned to the real world and they can write a new question to test based on what they have learned in this project	Students can either draw relevancy of what they have learned to the real world or can write a new question to test based on what they have learned in this project	Students have difficulty to draw relevancy of what they have learned to the real world and to write a new question to test based on what they have learned in this project	Any other answer

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Student Worksheets

My Science Project

Even though I am working in a group, I still need to show what I have learned...

1. The first thing I need to do is figure out what we are going to test. That does not mean that you need to a title, we can get that at the end. It does mean that we need to what we are going to test and what we are going to measure. (PP3)
What we are going to test:_____

What we are going to measure: _____

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2. Now that we know what we are going to test, we need to write that in the form of question. (PP1)

for example...if I am going to create a diet coke and mentos geyser then my items could look like this... What we are going to test: *the reaction of 3 mentos in diet coke vs coca-cola* What we are going to measure: *how high (cm) the geyser goes at its highest point*

_____

_____

_____

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3. A big part of being a scientist is using what you already know about your subject to

If I add 3 mentos to both diet coke and coca-cola, then I expect the diet coke geyser to fly higher. Because, most youtube video uses diet coke so it must have chemical that makes it react more with mentos.

predict what you think will happen in your project. (PP2)
If _____,

then_____.

Because, _____

_____.

4. Your teacher will help your group tailor your materials and procedures. It is your groups responsibility to identify and gather the materials that you will need. (PP4)

Insert your materials and Step by Step procedures here

5. While you are conducting your experiment, it is each students responsibility to make and record relevant observations and measurements. The goal should be to record as much detail as possible. Because, when you go to reflect on what you learned you will need all these notes and numbers. (PP5)

Try to record your observations with as many numbers (based on what you are trying to measure from section 1)

6. Once you have recorded all of your data and observations, you should try to make sense of what those numbers are telling you. The best way in science to do this is to create a graph. (AE1)

The best thing to do is use a graph type that you have used in Math class.

7. Please remember that nobody is perfect and you are not expected to do everything without fault. Sometimes, when we are doing science projects we get to the end and we realize that something is not right with my data or the way I recorded my data was not the same for each.

Do Not Worry About It! This is the sections where you identify and suggest explanations for patterns and discrepancies in your data and recordings (AE2)

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8. Now that you have finished your project, you need to figure out what you learned (in terms of SCIENCE). (AE3)

First, you need to propose an answer to an initial question

Next, draw simple conclusions based on what you learned

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9. Finally, the last step is to figure out how what you have learned in your project relates to the real world. (AE4)

Also, you should be able to identify any new questions that you could now test about this subject.

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Teacher's Guide

My Science Project

Even though I am working in a group, I still need to show what I have learned...

1. The first thing I need to do is figure out what we are going to test. That does not mean that you need to a title, we can get that at the end. It does mean that we need to what we are going to test and what we are going to measure. (PP3)

> for example...if I am going to create a diet coke and mentos geyser then my items could look like this...
>
> What we are going to test: *the reaction of 3 mentos in diet coke vs coca-cola*
>
> What we are going to measure: *how high (cm) the geyser goes at its highest point*

What we are going to test:_____

What we are going to measure: _____

At the early elementary level, students may not be able to identify variables on their own. This section is not assessed on the rubric, so help from the teachers would be welcomed so that they can correctly identify what they planning to test (independent variable) and what they plan on measuring (dependent variable).

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2. Now that we know what we are going to test, we need to write that in the form of question. (PP1)

Teachers should be using the same format for writing a question in science as they do in language arts. Be mindful that the noun and verb are replaced by the variable to test and the variable to measure.

I.E. Does the type of soda, diet coke or coca-cola, reacting to three mentos make a higher (cm) geyser stream at the highest point?

Students should be writing the questions with the variable to test and how they are specifically going to measure it?

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3. A big part of being a scientist is using what you already know about your subject to predict what you think will happen in your project. (PP2)

If I add 3 mentos to both diet coke and coca-cola, then I expect the diet coke geyser to fly higher. Because, most youtube video uses diet coke so it must have chemical that makes it react more with mentos.

The scaffold of if...then...because should be followed

students should be able to identify their prediction of which product in this example will give a higher (cm) geyser

Also, it is crucial to the skill that students can justify based on science they know as to why they think this will happen.

4. Your teacher will help your group tailor your materials and procedures. It is your groups responsibility to identify and gather the materials that you will need. (PP4)

Insert your materials and Step by Step procedures here

Students in early elementary will struggle in have 100% independence in the creation of procedural steps.

Since this outcome is not based on independence, the focus of proficiency would be that Students have all materials they need on time and are ready to follow the procedures when the conducting starts

The collaboration of student ideas and what the teacher has to help them with should be pasted here.

Teachers should be aware that GOOD SCIENCE has students doing 3-5 trails of each condition...that will eliminate any bad trials.

5. While you are conducting your experiment, it is each students responsibility to make and record relevant observations and measurements. The goal should be to record as much detail as possible. Because, when you go to reflect on what you learned you will need all these notes and numbers. (PP5)

Try to record your observations with as many numbers (based on what you are trying to measure from section 1)

During the conducting phase, students should be recording all relevant information that they may need in the future to respond to their learning.

The primary struggle for students is that they do not know what is relevant and that they do not record what measurements they were supposed to get.

As the teachers, regularly conference with students to ensure that they are recording the number (in this example the centimeters of geyser stream) each time they perform a trial or at a regularly scheduled time.

Next, encourage students to record everything, get as much detail as possible. As a learning activity, you can have each of them narrow down and eliminate irrelevant info. They need to get as much in order to narrow things down.

This section is dedicated to only raw numbers....graphing will come in the next section.

The proficiency goal for this outcome is Students are recording as many numbers as accurately as possible. They are detailed in their working and accounting for every piece of relevant data possible

6. Once you have recorded all of your data and observations, you should try to make sense of what those numbers are telling you. The best way in science to do this is to create a graph. (AE1)

The best thing to do is use a graph type that you have used in Math class.

Students are expected to be able to take the raw data they have recorded and graph those units.

From the Grade 3 Mathematics Curriculum Document
Outcome SP2: Construct, label and interpret bar graphs to solve problems
Page 98

In elementary school, students are expected to develop an understanding of graphs and how graphs communicate information. **Bar graphs** use the lengths or heights of bars to represent quantities. This is an extension of the Grade 2 outcome, where students created concrete graphs using models such as linking cubes. In Grade 3 it is helpful for students to work on grid paper to ensure the squares are all equal in size. **Bar graphs** can be constructed as **vertical** and **horizontal** displays. It is important for their displays to include **labels** and a **title**. Bar graphs in Grade 3 should be limited to a one-to-one correspondence (i.e., the number scale uses 1, 2, 3, etc., and not multiples of 2, 5, 10, etc.).

Once students have constructed a graph, it is important for students to have an opportunity to make observations and interpret the data. They should also be given experiences discussing other graphs that they can find, such as in newspapers and magazines, and on television and the Internet.

Sample bar graph:

Proficiency with this outcome would mean that students can create a graph with the features presented in the sample bar graph.

7. Please remember that nobody is perfect and you are not expected to do everything without fault. Sometimes, when we are doing science projects we get to the end and we realize that something is not right with my data or the way I recorded my data was not the same for each.

Do Not Worry About It! This is the sections where you identify and suggest explanations for patterns and discrepancies in your data and recordings (AE2)

Students in early elementary SHOULD have several sources of error. This section is intended for students to state these errors and omission and predict how they affected the results.

Based on the procedures and the recorded observations these errors should be evident to the teacher and thus each should be stated.

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8. Now that you have finished your project, you need to figure out what you learned (in terms of SCIENCE). (AE3)

First, you need to propose an answer to an initial question

Based on the Language Arts standards of the class in terms of writing standards. For science purposes, students should answer a restated version of the question.

Does the type of soda, diet coke or coca-cola, reacting to three mentos make a higher (cm) geyser stream at the highest point?

Yes, the type of soda does make a higher geyser stream. Diet Coke had the higher geyser stream.

The trends from the graphs should act as evidence, lets say that the Diet Coke has a geyser of 345cm and Coca-Cola was only 245cm.

Next, draw simple conclusions based on what you learned

This supports (or refutes) my hypothesis because the Diet Coke has a geyser of 345cm and Coca-Cola was only 245cm.

A simple conclusion mentions how their prediction was affect (support or refutes) and give the main number value that backs up this claim.

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9. Finally, the last step is to figure out how what you have learned in your project relates to the real world. (AE4)

Students should be able to identify how the experiment that they have done applied to the real world. In the case of Diet Coke and Mentos they could apply this learning to reactions in their stomach that make them feel bloated (for example)

Also, you should be able to identify any new questions that you could now test about this subject.

Students should then be able to write the next questions that they would want to study based on what they learned in this experiment.

Does adding more than three mentos to diet coke make a higher geyser stream?