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## **Science and Information Lesson Plan(s) Preliminary Research for Science Fair**

### **Foreword:**

Every time I assign students to enter the science fair, I'm amazed at how difficult the research part is for them. I expect my students to look into background information for their topics before starting original experiments, and so information literacy is a must. Because of this, close work with the school librarian/media specialist is required.

### **Goal**

Students will see and practice research of background materials preparatory to a science fair project. Students will then research and report on a chosen topic and present this information as a research paper.

### **Scope of Plan**

This was designed for use in a 9-12 science class, or possibly for 6-8<sup>th</sup> grades with advanced learners or more scaffolding. This is merely an introduction, and further explorations into research will need to take place. This lesson set is designed to either take the bulk of a single class period, a couple class periods, or it can be used modularly and broken up over several class periods.

Students should have previously been notified that they will be participating in the science fair, and have been given a chance to narrow down a list of topics to one or two. For more information on science fair preparation, materials may be found at <http://science.pageofmystery.com/scifair/index.html>.

### **Standards**

The standards listed below are the most obvious standards met by this assignment. Many other standards, both of the Utah State Core and the AASL core may be met through this and related events.

#### **Utah State Core Curriculum Standards:**

##### **Standard 1. Use Science Process and Thinking Skills**

Sub-standard a: Observe objects, events and patterns and record both qualitative and quantitative information.

Sub-standard e: Plan and conduct experiments in which students may:

- Identify a problem.
- Formulate research questions and hypotheses
- Analyze data, check it for accuracy and construct reasonable conclusions.
- Prepare written and oral reports of investigations

##### **Standard 2. Manifest Scientific Attitudes and Interests**

Sub-Standard e. Evaluate scientifically related claims against available evidence.

##### **Standard 4. Communicate Effectively Using Science Language and Reasoning**

Sub-standard d. Use reference sources to obtain information and cite the sources.

## **AASL 21<sup>st</sup> Century Learning Standards:**

- Skills 1.1.2 Use prior and background knowledge as context for new learning
- Skills 1.1.3 Develop and refine a range of questions to frame the search for new understanding.
- Skills 1.1.4 Find, evaluate and select appropriate sources to answer questions

### **Preparation**

Days or weeks before:

- \* Discuss the assignment with the school library/media specialist. Discuss the desired outcomes of the science fair, the needs of the students, and resources needed. Get tips and formulate a strategy. Reserve time in the library for research.
- \* Prepare students by helping them understand what is expected with preliminary research for science fair. Teach them how to select topics and narrow selections. Guide them into data-friendly topics that lend well to student research. Have a deadline for selection of a favorite topic and a secondary topic.
- \* Acclimate students to the library. Students should be generally familiar with where resources are located and how to find information before formal research begins. (A library scavenger hunt is a great idea.) Demonstrate and explain approved library behavior.

Immediately before (lesson preparation):

- \* You will need to project your computer screen for the class. Make sure the LCD projector is working and ready. Ensure your computer can access all needed information.
- \* There is always a risk of power or Internet problems. Have backup materials at hand.
- \* If using printed materials as guides, make sure sufficient copies are available. The Big6 information should also be available.
- \* Ideally, you will also have available real research time and sufficient computers. There should be at least one computer for every 2-3 students.
- \* Choose temporary partners for the students for the practice exercises, or have students work with their pre-approved science fair partnerships.
- \* If holding this lesson within the library rather than the classroom, make sure all needed resources are available and readily at hand. Also discuss needs with the librarian.

## **Modules / Delivery**

(This incorporates the “Big6 Information Problem Solving” methods as proposed by Eisenberg and Berkowitz, and uses those six modules as a format for research. Each step of the “Big6” can be used as small, separate modules, if necessary, with the introduction either attached to the first module or also as a stand-alone.)

### ***Introduction***

Have the LCD projector on at the beginning of class with a note for the students to spark their interest or get their attention. A phrase like “DON’T DO THIS” or “IS THIS YOU?” may be appropriate. At the start of class, get the students’ attention. Then start play-acting a bad researcher. Start mimicking a poor student doing research. (Do not mimic any individual student!) This part should take no more than five minutes. Here is some suggested patter.

Complain about science fair

Type in “science fair.com” (ALWAYS make sure sites are safe ahead of time)

Google “science fair”: Look at one or two entries. Start complaining to yourself about not finding anything.

Pick a topic. Google it. (I like “tigers” because the Detroit Tigers or Tiger Woods or the Princeton Tigers sometimes comes up.) Complain that it’s not what you want. Look through the pictures... maybe open one in Paint and color on it like you’re distracted. Then pretend you remember where you are and get back to work. Complain about Google. Try another search engine.

Pretend like you had a brain wave and go to Wikipedia.

Then remember that the teacher won’t let you cite Wikipedia and complain loudly.

Go to the first actual page that may be useful. Cut and paste everything into a Word document and save it. (Don’t save the URL.)

Call out “Ms. (Mr.) \_\_\_\_\_ I’m done researching.” “I’m bored.” “Research is dumb” or other phrases while acting silly-bored in front of the class.

Take another two minutes to process with the class what was good and bad about your research steps. Ask them what would be more effective. Get lots of input on why each step failed to get the research necessary. Make a list. The more input you can get from students the better. In small groups, let students come up with a better plan of attack and have students share their ideas.

By the end of this module, students should have a list of good research techniques and ideas as compiled from the class. These should be kept for use on research days.

## ***Task Identification***

Tell students that they should have selected one or two topics for research. They will be narrowing down their topics to a single question.

Bring up the topic of “Tigers.” Discuss: What is wrong with that topic?

Ideas to bring out:

It’s too broad

What kind of tiger?

What about them?

It’s not really a question.

It would be really hard to do a science fair project on tigers.

Most people don’t have access to tigers

Original experiments are impossible (although data can be gathered).

Many sites you encounter won’t help you...

Multiple definitions of tiger

Must be more specific

Without specifics, you’re likely to find unusable information.

Give examples of appropriate questions, such as “What is being done to help endangered tigers in the wild?” or “What is the diet of the Siberian Tiger?” Show how these topics are broad enough for research, yet specific enough for research.

Let the students know that for the task, they can either use their own topics, or the one suggested in class. They will be working with their chosen or assigned partners for this. For the assigned topic, make sure it is not one that students will be using. I recommend “Baking soda and vinegar” or something simple.

Students should look at a topic and then

1. Word that topic as a well-defined question
2. Identify what information will be needed to answer the question

note: these are reworded from the sub-stages of the Big6 model.

Encourage students to write those down, and I recommend at least five pieces of information for part 2. Part 2 can be worded in the form of questions as well. Help students think through questions. Once students have been able to formulate their questions, they should share them with another group. The other group can provide feedback as to whether the topic is too broad or narrow, and whether they have correctly identified the needed information. The instructor should be supervising the groups and listening to the feedback.

Remind students that if they didn’t work on their own questions, that they must before researching. They are welcome to get help from friends, family, or other people in formulating their questions and research needs.

## ***Information seeking strategies***

For this module, I recommend planning on paper, and not on computer directly. There is too much temptation to start researching and skip the planning stages.

Have the students retrieve the questions and needed information from the previous module.

Example:

What is being done to help endangered tigers in the wild?  
Where do wild tigers live?                      Why are they endangered?  
Who is helping the tigers?                      What do tigers need to survive?  
Why are people helping tigers?              How can people help tigers?  
How long have tigers been endangered?

In their partnerships, have students brainstorm places where they can find answers to their questions. Brainstorming rules apply – no answer can be excluded in this section. Roam around and listen to the question. Offer suggestions that students may not have thought about. (non-Internet, or specific locations especially!) Remind students of the people and resources available to them, especially community resources they may not be as familiar with. Also, encourage them to think deeper than the answer “the Internet” to specific sites that might have information.

Once sufficient time has been given for brainstorming within partnerships, have partnerships group up and review lists. Let them offer suggestions.

After the lists are fairly complete, let students put stars next to sources that they believe will give them the best answers to their questions. Students can put a line through sources that will not give them good information. Some items may be left blank (without star or line).

Have students prioritize their lists from best to worst. Items crossed out can be left off the list.

More suggestions can be made at this time.

These lists should be saved for future research.

It is also suggested that these questions can be reworded into an outline for the research paper. Show students how to do this.

## ***Location and access***

Reminder – students should already be familiar with the library / media center before this lesson. If not, orientation should be made before continuing.

Reminder – If at all possible, this should take place in the media center/ library. Rather than spending large amounts of time demonstrating how to find sources, more time should be spent with the students looking and the instructor assisting.

Task: Students should use their lists of questions and sources to find information.

Before students are “turned loose” they should be reminded about library rules and research techniques. Remind them that sadly, some people when put in front of a computer, they resort to just Googling and using ineffective techniques.

Choose one source and question from a student. Model on the LCD projector how a person would combine the source and question to find an answer. Help students understand that they may have to try multiple sites. Use different keywords and model this as well. Also model how to find the author of the source and record that information.

Remind students that the Internet is a great place to find professionals who are researching, and access to groups and organizations. Model finding contact information for this.

Let students know that they are to show what information they have found by the end of the module. Even if their searches have not been successful, they are to track what they’ve tried.

Allow students and partners individual research time.

During the last moments of the module, allow students to explain their techniques to the other students.

Have the students save this information, and any source information with their previous materials.

## ***Information Use***

This module may be combined with the previous one, or used alone.

The instructor begins by reading aloud the chosen search question. For example, the former list of:

What is being done to help endangered tigers in the wild?"  
Where do wild tigers live?                      Why are they endangered?  
Who is helping the tigers?                      What do tigers need to survive?  
Why are people helping tigers?                How can people help tigers?  
How long have tigers been endangered?

Ask students why the questions are being re-read?

Prepare for this lesson by printing off a very short article on endangered tigers. Have the students raise their hands if any part of that article answers the question.

Read a paragraph of the article. When the appropriate points are reached, look for student response. Use a highlighter to mark that part of the article. Write which question that the highlighted portion answered. When finished with the paragraph and pertinent parts are marked, ask students what else should be marked.

Prompt the response (or give it) that the author, page, and source information should also be noted.

Have students select a source they have gathered. With their questions present, have them find the relevant information within their source. If the text is a book, have students copy the information with source information either electronically or manually.

Have students proceed to do this with additional sources if desired and store the information in their research materials.

## ***Synthesis and Evaluation***

Eventually, students will be writing a research paper, but the synthesis process should be modeled first.

You will need highlighted materials, the original questions reworded into an outline, and the LCD projector attached to your computer. If possible, computers for students are ideal.

Show students several sources that are marked. Point out which of the sources are answering the same question. Re-read the highlighted portions of the articles.

Ask for suggestions on how you would write a paragraph or two using those ideas. After student response, demonstrate how to turn related ideas into a paragraph or two with topic sentences and transition/conclusion sentences. Show students how to cite sources at this time.

Have students use their own sources, or additional sources from the demonstration to create a paragraph.

### **EVALUATION**

Students should review their paragraph(s) to determine how effective they are at answering the questions. Let the students determine grade themselves (non-recorded) on the paragraph. This can also be given to students from another group and they can determine how well the questions were answered, and how well the paragraphs turned out. Suggestions can be given on how to improve the product.

Students may then think through the process they have experienced from identifying the problem through the finished product. They should be allowed to discuss or respond in writing regarding what parts worked and what they would improve next time. Questions and concerns should be addressed at this time, and materials checked by the instructor.



### ***Completion / Next Step(s)***

Students should be allowed to comment, vent frustration, suggest ideas, and internalize this process in small-group discussion. Six to eight students in a group is ideal. Have them share with each other their evaluations, and then discuss strategies for writing the research paper.

The full scope of the research paper including rules, page limits, expectations, and deadlines should be given at this point. Students should be allowed to discuss with their partners a strategy for completion of their papers, and help each other through the process of research.

Dates for library research should be arranged, and given to the students as soon as possible.

Students should have available a copy of the Big6 Information Problem Solving steps, as well as examples at hand.