

Chapter 5: Scientific Inquiry in the Inner Curriculum



SCIENCE IS A PROCESS

Science is not a subject area, but a process used to look at the world around us. Scientists are those who use this process to ask questions and find answers. There is not one scientific method; rather, there are many methods of science that are used to ask and answer questions (Hodson, 1988). These methods can be used to investigate the natural world, or used with the inner curriculum to investigate human interaction and inner worlds of the psyche. The inquiry process in education is when methods of science are incorporated into learning. Three methods of scientific inquiry are described in this chapter: (a) creating groups, (b) investigation, and (c) experimenting. One thing to note here is that the activities described in this chapter reinforce processes of science.

CREATING GROUPS

Here the scientist observes a field or an event in order to understand it. As the data are collected and recorded, they are organized into groups. Finally, the scientist describes the field or event in terms of the groups. Below are four activities that use this method of science.

1. The open-ended survey question. Here, students create a one-question survey using an open-ended question (see Figure 5.1). After twenty to fifty responses are collected, students use inductive analysis to look for categories or groups (Johnson, 2002). All responses are assigned to only one group, and the total numbers are reported in terms of groups and numbers within each group. These data can be reported using graphs. Inferences are then made based on the data.

Figure 5.1. Inner curriculum survey questions.

1. What makes you feel happy?
2. What do you like to do on a Saturday?
3. What is your favorite book?
4. What is your favorite TV show?
5. What traits are important in a friend?
6. What do you like to eat for dessert?
7. What things make you feel sad?
8. What would you like to do when you graduate?
9. What is your favorite kind of pet?
10. What is your favorite sports team?
11. What is something that you are good at or do very well?
12. What is something you do not do very well?
13. At what age should it be legal to drink?
14. Name a hero.
15. Name a villain.

16. What do you worry about?
17. What world events cause you concern?
18. What is your favorite thing to do at recess?
19. What characteristics or personality traits do you look for in a boyfriend/girlfriend?
20. What would you like to know more about?
21. What subject would you like included in the school curriculum?
22. What do you value?
23. What famous person would you like to talk with?
24. What would you like to say to the president?
25. How would you like to change?
26. What are you grateful for?
27. What school rule would you like to add?
28. What school rule would you like to take away?
29. What law would you like to add?
30. What law would you like to take away?
31. What is something that is unfair?
32. Name a good leader.
33. What is important to you?
34. When you are feeling badly, what makes you feel better?
35. What is a goal you have for this year?
36. What is a goal that you have for your life?
37. What are the most important events that have happened in the last week? Month? Year? Decade? Century? Millennium?
39. What is the purpose of religion in our society?
40. What kind of music do you like?
41. Who is your favorite musical artist?
42. What do you think about saying prayers in a public school?
43. What problem or problems do you have?

2. Observing behavior. First, the student/scientist makes an initial observation to determine the types of behaviors that are present in a particular location or situation (a pilot study). At school these behaviors could be on the playground, in the cafeteria, at an all-school gathering, in a study hall, or in the hall before school. Outside of school, students might observe behaviors in a shopping mall, a fast-food restaurant, a park, or at a sporting event. These behaviors are then put into four to six categories or groups.

For example, a group of students wanted to do a study to see what behaviors were occurring in a study hall. A pilot study showed there to be five types of behaviors present. These behaviors were used as category headings on a data retrieval chart (DRC) (see Figure 5.2). A DRC is any graphic organizer that is used to gather and organize information. Over the course of the next week, those students observed study halls using the DRC. They put a tally mark in the appropriate category every time each behavior was observed. This information was then used to create a graph or table that describes the type and frequency of various study hall behaviors. This activity can be extended by comparing study hall behaviors at different times of the day, comparing boys to girls, or comparing older students to younger students.

Figure 5.2. DRC for recording behaviors.

study hall behavior					
Behavior ≡	sitting alone - studying	sitting alone -	studying with	talking - pairs	talking -

Andrew P. Johnson, Ph.D.
 Minnesota State University, Mankato
www.OPDT-Johnson.com
dr.andy@charter.net

		not studying	another		groups

3. Life story. Individually, students brainstorm to create a list of important or memorable events from their life. Next, the list is analyzed and inductive analysis is used to put the events into groups (see Chapter 7). The number of events in each group is recorded. These data can also be displayed in graph or table form (see Chapter 9). Students should then be asked to make some sort of inference. “*What do the data tell you about you?*” “*What did you discover?*” “*What surprised you?*” “*What idea or lesson might you take from this?*” This activity can be extended by making it a cooperative learning activity. Here students pool their individual lists and use inductive analysis to create groups.

4. Events over time. Similar to the life-story activity above, at the end of the week, students work in small groups to brainstorm and record interesting or important events occurring in school in students’ lives. These events are put in groups and described in terms of groups and numbers within each group. The following week, students use the same categories and find the number of interesting or important events. Eventually, line graphs can be created to show the change in the number of events over time. You may want to try for some sort of consistency by allowing students no more than eight to ten events.

5. Inner curriculum survey questions. To help students begin to see the universality of the human condition, any of the survey questions can be used in small groups. Here students first generate their own responses to the question. Then they meet in small groups, pool their lists, and use inductive analysis to look for and create groups.

INVESTIGATION

This type of inquiry is highly dependent on first asking or identifying a specific question. Students then become detectives who investigate to find data or clues to answer the question. An example of this would be to ask students, “*What kind of books do students in our grade like to read?*” First, a pilot study is run to get the initial categories. Here small group of scientists ask a few individuals to name one of their favorite books. These answers are recorded. When many responses have been collected, students use the list to create inductive categories. Next, the categories are used to create a DRC (see Figure 5.3). Then, students simply ask individuals to name a favorite book category. Tally marks are used to record the number of responses in each category. Finally, these data are quantified and communicated using a table or graph. This inquiry can be extended by comparing females to males, older students to younger students, or adults to children.

Figure 5.3. DRC for a book inquiry.

Inquiry Question: What type of books do 5th grade students prefer?

Fantasy		Action/Sci-Fi		Realistic Fiction		Comedy/Humor	
male	female	male	female	male	female	male	female

Other types of inquiry questions include the following: Which flavor of ice cream is most popular? What is the most popular sport to play? What do most students do on Saturday? What kind of shoes do most people wear? What kinds of TV shows are most popular? What radio station is most popular? What type of music do most students enjoy? What are the religious preferences of students in our class?

Lab Reports and Technical Writing

Lab reports provide structure for students when reporting results of their investigation. The lab report is also a realistic and practical way to teach technical writing. Technical writing is when concise, objective language is used to report data or information. A lab report helps students communicate their ideas and consists of three parts:

Conditions. This describes the inquiry question; what went on before the experiment, observation, or inquiry; and how students gathered information.

Results. Just the facts are presented here. Students tell exactly what happened or describe the data collected using as few words as possible. If students are doing an inquiry that uses numerical information, graphs, charts, and tables can be used here (see Chapter 9).

Ideas. Here students add their ideas, tell what the data might mean, or describe how it could be used.

Figure 5.4. Lab report for book investigation.

Lab Report
<p>Investigation: Favorite type of book.</p> <p>Conditions: We conducted an investigation to find out what type of book students in our 4th grade class like to read. First, we asked ten people what their favorite book or books. From these, we found four major categories: fantasy, action/sci-fi, realistic fiction, and comedy/humor. We used these for headings for a DRC. At noon recess, Pat and I asked every student on the playground what their favorite type of book was. We put a tally mark next to that category.</p> <p>Results: Our investigation showed that comedy/humor was the most popular category, followed by realistic fiction,</p>

Action/Sci-Fi, and Fantasy. Most females preferred realistic fiction. Most males preferred comedy/humor.

	Fantasy		Action/Sci-Fi		Realistic Fiction		Comedy/Humor	
	male	female	male	female	male	female	male	female
	3	12	17	6	8	17	23	11
Totals:	15		23		25		34	

Ideas: This information could be helpful in helping teachers choose books for our class to read for literature units. It might also help parents who are looking for books to buy kids for presents.

Investigating Attitudes

Investigating attitudes is another type of investigation. An attitude rating scale can be used to assess attitudes. These ask people to respond to one or a series of statements in a way that indicates their level of agreement or disagreement. An attitude rating scale is a simple way to provide data about people's attitudes and yields quantitative data that can be used to make comparisons. A five-point rating scale is usually most effective. Figure 5.5 shows an example of an attitude rating scale.

Figure 5.5. Attitude rating scales.

<p>Key: 5 = strongly agree; 4 = agree; 3 = no opinion; 2 = disagree; 1 = strongly disagree</p> <p>1. Students should be able to choose their reading material for reading class: 5 .. 4 .. 3 .. 2 .. 1</p> <p>2. Reading is important: 5 .. 4 .. 3 .. 2... 1</p> <p>3. Time should be provided every day for students to read: 5 .. 4 .. 3 .. 2... 1</p> <p>4. The stories in the basal are generally interesting: 5 .. 4 .. 3 .. 2... 1</p> <p>5. The skill sheets and vocabulary sheets used in reading class make reading easier: 5 .. 4 .. 3 .. 2... 1</p> <p>6. Reading a good book is enjoyable: 5 .. 4 .. 3 .. 2... 1</p>

These are the “what-do-you-think” investigations. When students put together an investigation like this, they should generally try to put together a survey that has from two to eight questions. Depending on the age of students, attitudes related to the following areas could be investigated: laws, current events, presidential candidates, social issues, personal issues, school activities, homework, the future, etc.

Investigating Frequency of Behaviors

Students can investigate the frequency of behaviors by using a rating scale. A rating scale is used to determine how much, how often, or how many times something occurs. A four-point rating scale is usually most effective. Figure 5.6 shows an example of a rating scale. These are

“how-often” investigations. Depending on the age of students, behaviors related to the following inner curriculum areas could be investigated: social behaviors, friendship behaviors, academic behaviors, school behaviors, healthy behaviors, or emotional behaviors or outbursts.

Figure 5.6. Rating Scale-

Key: 4 = often, 4 = some, 2 = little, 1 = not at all.	
1. I get eight or more hours of sleep at night:	4 .. 3 .. 2 .. 1
2. I eat a healthy breakfast:	4 .. 3 .. 2 .. 1
3. I exercise:	4 .. 3 .. 2 .. 1
4. I drink alcohol:	4 .. 3 .. 2 .. 1
5. I use tobacco products:	4 .. 3 .. 2 .. 1
6. I eat between meals:	4 .. 3 .. 2 .. 1

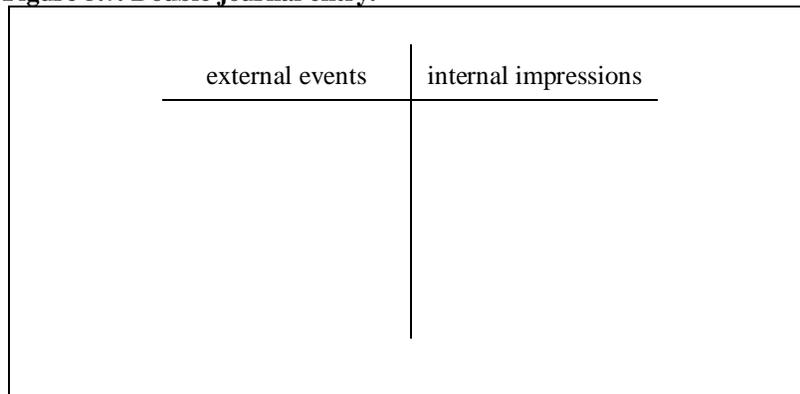
The Arts

The arts are another way of seeing the world and can be used to bring a different level of understanding to research. Elliot Eisner (1998) suggests that literature and poetry be used as a research device to capture and illuminate some portion of reality. Art and research are very much alike in that both are lenses through which reality is interpreted, translated, and re-presented. To use the arts as an investigative tool, ask students to describe a place or experience using poetry, creative writing, visual art, or drama (see Chapter 7). Have them visit that place or experience several times.

Double Journal Entry

The double journal entry was described in Chapter 5. Scientists use a form of the double journal entry when they make observations. The left side is used to record or describe external events using concise, objective language (see Figure 5.7). The right is used to describe impressions, feelings, interpretations, analyses, or general ideas related to the observation.

Figure 5.7. Double journal entry.



1. Differences in perception. To highlight differences in human perception and multiple interpretations, have several students use the double journal entry to observe the same event. As they compare entries, they will discover that “objective” reality is not quite as objective as they

might have initially thought. Students could be posted in different parts of the playground to observe at recess, or in the lunchroom, at a sporting event, a social function, or some place in the community.

2. Observing life. On the left, students observe and describe those events happening in their lives. Here they can observe a particular life event or events in general. On the right side, they record their impressions and analysis. This activity helps students gain perspective. This can be extended by sharing with another student and getting their analysis and perspective.

3. Observing the past. The double journal entry can also be used to help students understand a past event or period in their lives.

Investigating Time

1. Activities. List five major activities done each week. How much time do you spend in each? Create a DRC and record the amount of time for each.

2. Helping others. How much time do you spend helping others? How many times did you help somebody else? Create a DRC and keep track of this for one week. You can extend this by setting a goal for the week and sharing results in small group.

EXPERIMENTING

This type of inquiry is what is most often associated with the scientific method. The only difference between this and *Investigation* is that *Experimenting* has a test or procedure that is run in order to answer a question. This type of inquiry is also highly dependent on first having identified a question. These can be a lot of fun and can even get silly at times, which is okay. The important thing to remember is that you are teaching a process. Also, with these sorts of inquiries, students naturally begin to talk about validity, reliability, and sample size. These activities then become excellent vehicles for talking about these advanced scientific concepts. Examples of this type of inquiry are described here:

1. Gender characteristics. The question is: Are males and females perceived differently? Without telling them the question, ask four mice (students) to step outside the laboratory (classroom). Select two female and two male mice. The other students in the laboratory are scientists recording important data. One at a time, bring a mouse into the laboratory. Ask the mouse to think of a female they know about, either famous or not. Then, ask that mouse to describe that female. As they describe, scientists record the order of characteristics: hair, height, personality, activities, physical stature, etc. Do the same with the male mouse. What characteristics are described first or near the top of the list for each gender? This inquiry experiment works very well with students in grades 6-8.

2. Where are the jellybeans? How long does it take for a mouse to learn where the jellybeans are? What paths do they take? Again, send four mice out into the hall in order to set up the experiment. Students create a map of the room to use as a DRC to record the path that each mouse takes. Jellybeans are put someplace in the room. As each mouse enters the room, that mouse is asked to find the jellybeans. A stopwatch is started to record the time. Students use lines on their maps to record the path each mouse takes in the room. A different colored pencil or crayon should be used for each mouse. The time and the path that each mouse takes are recorded along with other notes or insights.

3. Small-group behaviors. What kinds of behaviors do individuals in a small group use to solve a problem? Does a leader emerge? If so, how? This experiment works well if you are using cooperative learning activities in the classroom or if you are teaching social skills. Send

four mice out into the hall as you prepare the laboratory. When they come in, they are told that they will have four minutes to create a TV commercial to get students to read a particular book. For the finished product, this group will need a speaker to present their commercial, some sort of picture or visual aid, and a director. After four minutes, they will be asked to perform.

There are many variations that can be used here. With older students, you might ask the scientists to simply record the interesting or important things they observe. With a unit on leadership, you might create a DRC chart for your scientists with specific leadership or small-group social behaviors listed along the top (see Figure 5.8). Students here would use tally marks to indicate the frequency of occurrences.

Figure 5.8. DRC used for small group inquiry experiment: leadership

Behaviors	Occurrences
gets group on task	
clarifies task or idea	
assigns tasks	
affirms ideas of others	
seeks consensus	

If creativity or creative-thinking skills are being studied, students could look for specific types of thinking during the small-group session (see Figure 5.9).

Figure 5.9. DRC used for small group inquiry experiment: creative thinking.

Types of Thinking	Occurrences
brainstorming - frequency	
fluency	
elaboration	
originality	
piggy-backing	

If social skills or communication are being studied, the DRC could list the specific verbal and nonverbal skills you are teaching or will be teaching. Also, a DRC could be designed to record who does the talking (see Figure 5.10).

Figure 5.10. DRC used for small group inquiry experiment: creative thinking.

Mice	Comments or Times They Talked
mouse 1	

mouse 2	
mouse 3	
mouse 4	

There are two things to consider when doing an inquiry experiment: First, always ask for volunteers to be the laboratory mice. Give volunteers a sense of what they will be asked to do when they return to the laboratory. Students enjoy being the mice and you should have no trouble getting volunteers. Second, remember that it is the process that is important. It is okay to do “bad science” as long as you focus on the process. At the end of every inquiry experiment, the teacher should ask, “What could have done differently to make this experiment better?” This will, in turn, lead to new and interesting inquiry experiments.

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