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ABSTRACT

A common and frustrating problem for most teachers is that despite sincere attempts to meet the needs of all students, many students elect not to participate in classroom learning activities. The purpose of this study was to ascertain whether one type of learning activity generates more participation among middle school science students, especially those students who are normally non-participatory. Findings indicate that the highest percentage of participation among target students occurred in those activities that took place within a cooperative learning or whole class environment. (Contains 13 references.) (WRM)

Classroom Learning Activities That Generate the Most Participation in Middle School Science

by

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CLASSROOM LEARNING ACTIVITIES THAT GENERATE THE MOST PARTICIPATION IN MIDDLE SCHOOL SCIENCE

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The Problem

A common and frustrating problem for most teachers is that despite sincere attempts to meet the needs of all our students, many students elect not to participate in classroom learning activities. The factors contributing to this problem are widespread, but for this project we focused on the links between participation and motivation, setting objectives, and cooperative learning.

Background/Theory

Brophy indicated that "teachers can capitalize on intrinsic motivation by planning academic activities that students will engage in willingly because they are interested in the content or enjoy the task" (Brophy, 1987, p. 44). Teachers should use assignments that are relevant and correlate to students' interests, offer alternative ways to meet instructional objectives to encourage autonomous decisions, provide immediate feedback such as verbal response or answer keys, and incorporate something new or different into each activity.

Agreeing with Brophy's assertions, Dev (1997) stated that "an assigned task with zero interest value is less likely to motivate the student than is a task that arouses interest and curiosity" (p. 13). It is not always possible to use activities that meet the interests of every student; however, the teacher can incorporate elements that most students will find rewarding.

Providing tasks at the correct level of difficulty is also important in encouraging students to participate. "If the assigned task is within the child's ability level as well as…interesting, the child is very likely to be intrinsically motivated to tackle the task" (Dev, 1997, p. 13). Danner and Lonky (1981) indicate that success at moderately difficult or challenging tasks is explained in terms of personal effort and abilities, and these explanations cause feelings of pride, competence, determination, satisfaction, persistence, and personal control, all ingredients of intrinsic motivation.

Karsenti and Thibert (1995) discuss a concept called amotivation, and describe students who possess this characteristic as not understanding why they are going to school. Alderman (1990) said these students consider themselves "helpless" and believe "they can do nothing to prevent failure or assure success" (p. 27). This research is included because we expected to find, and indeed did find, students in our classes that felt or acted as though they could do nothing to prevent failure.

Assignments should be clear and precise, and Wong (1991) stated "if students know what they are to learn, you increase the chances that the student will learn" (p. 210). He calls these objectives "action verbs" and emphasizes they specify what students are to accomplish. The students must know before the lesson begins what they are responsible for learning.

The ability to work with others is almost a prerequisite to success in this world, and cooperative learning groups provide important time to develop this skill. Students work together in small groups to complete assignments, study for tests, and solve problems. According to Johnson and Johnson (1989), cooperative learning provides a structure for intensifying academic achievement while promoting participation. Further, students are much more willing to attempt problem-solving tasks when they work together in groups, rather than by themselves.

Hendrix (1996) supported using cooperative learning strategies in the classroom citing such benefits as increased student participation and achievement, positive attitudes toward learning, higher student self-esteem, and even improved race relations. He says, "cooperative learning activities allow...an interactive, investigatory, and intimate learning environment. The unilateral classroom pattern-from instructor to student-is eliminated, and bilateral, cooperative interaction comes into existence" (p. 335). Students functioning in this environment are empowered to take responsibility for their own learning which fosters increased participation in school.

Kagan (1994) advocated using cooperative learning strategies in the classroom because "the lowest achieving students and minority students in general benefit most, but...not at the expense of the higher achievers; the high achieving students generally perform as well or better in cooperative classrooms than they do in traditional classrooms" (p. 3:1).

This study was modeled after a 1994 Action Research Project conducted by Phyllis Green, an eighth-grade science teacher from the C.W. Ruckel Middle School in Niceville, Florida. There are, however, several important differences.

Ms. Green's target group only included two male subjects, while this study included all students from four science classes (115 students), with a target group of four students from each class (16 students).

The Green study analyzed 43 individual learning activities set within the work environment of whole class, cooperative, or individual activities. This project focused on three different types of learning activities: those done individually, those done within small cooperative groups (3 to 4 students), and those completed as whole-class activities. Additionally, one longer, more comprehensive project, the Higginbottom Salt Project, was selected that blended both cooperative group and individual work.

The purpose of this study was to ascertain whether one type of learning activity generates more participation among students, especially among those students who are non-participatory. The first author, a beginning teacher, is concerned that classroom activities, approaches, and teaching strategies reflect the most current research in education. Consequently, answering our research questions and reflecting upon the first author's role in the classroom helped make adjustments so there may be immediate improvement in teaching abilities.

Research Questions

The questions that guided the research were:

1. Which types of learning activities promote the highest percentage of student participation, especially among those students who typically resist participation?
2. As the first author progresses through her teaching day, do teaching strategies improve in such a way that student comfort and confidence is promoted within the classroom, thereby increasing participation (particularly for the target students)?

Procedures

Data Collection

This study took place during the months of January, February and March of 1998, in a middle school in southeastern Washington, where the first author was assigned to complete student teaching in eighth-grade science. The city has a population of 36,500 and the middle school serves about 700 students primarily from white, upper-class families with a large percentage of parents associated with either the Hanford Nuclear Project or Washington Public Power Supply System. There are some minority families in the area; the middle school has a 13% minority student population.

The participants for this study included all students from four eighth-grade general science classes. This group of 115 students (54 girls and 61 boys) remains together as a team throughout middle school, and they tend to be grouped according to their abilities in mathematics. Because of this, Period 1 and Period 3 would be ranked as average, Period 2 above average, and Period 4 below average. Two groups proved to be challenging: students in Period 2 because of many strong personalities, and they finished activities in shorter time periods compared to the other classes; Period 4 because of management problems, and they consistently took 10 to 15 minutes longer for most activities. This information is relevant because the first author expected her teaching practices and strategies to improve as she progressed through the day, and we believe they did. However, participation rates for Period 4 and the target group in that class, do not necessarily reflect any improvement.

Four students from each class who typically resisted participation were selected as target groups. The first author and her Field Specialist (master teacher for student teaching) used the Student Observation Checklist (Figure 1) and the first author's observations during the first three weeks of student teaching, to help identify those students who were usually non-participatory. Target groups in Periods 1, 2, and 4 consisted of two girls and two boys, while one girl and three boys made up the Period 3 target group.

Adopted from a research study in 1996 by Adams, Cooper, Johnson, and Wojtysiak, the Student Observation Checklist (Figure 1) documents responsible behavior in the classroom by assessing class preparation, and completion of in-class assignments and homework. Signs of students being engaged in learning may be noted through student alertness, participation, and demonstration of understanding.

Immediately following the activities that were included in this study, I asked the students how they felt about those activities by requesting that each student complete a Student Opinion Survey form (Figure 2). Student Opinion Survey forms were color-coded to help simplify data analysis.

The survey form used was modified from the Green study (1995) by changing the opinion rating scale to more closely resemble a standardized Likert scale. Likert scales may start with a particular point of view and all statements favoring a position are scored using a scale value as follows:

	Scale Value
Strongly agree	5
Agree	4
Undecided	3
Disagree	2
Strongly disagree	1

Thus, the rating instrument yields both individual scores for each question as well as a total score for each respondent.

The Likert-type survey instrument does have some limitations; "it is somewhat inexact and fails to measure opinion with precision...and even though the opinionnaire provides for anonymous response, there is a possibility that students may answer according to what they think they should feel rather than how they do feel" (Best & Kahn, 1993, p. 250). However, the Likert scale is widely accepted and we felt that used in conjunction with the actual learning activity, it served as a useful way to find out how the majority of students felt about a specific activity or assignment.

This modified survey form was field tested and validated by a similar grade-level population in a sixth-grade language arts classroom at the same middle school in November, 1997. These students immediately completed a second form, which asked for clarification of ease in filling out the survey form. These form and field test results are included as Figure 3.

After deciding to include the Higgenbottom Salt Project that encompasses both cooperative group and individual work, we further modified this survey form to ask specific questions about aspects of the project (Figure 4).

Student Survey forms were marked according to classroom seating charts; in this way, confidentiality was assured while still allowing access to target group opinions on different learning activities.

The validity of this study was established through triangulation of the following data sources:

1. Student Opinion Surveys
2. Students' work and evaluation of that work
3. Anecdotal journal which includes notation of behaviors and events regarding different classroom activities as well as a record of the first author's reflections about those events
4. Classroom Observation Checklists completed by the first author and her Field Specialist

Data Analysis

Student work included in this study was categorized as individual, small cooperative group, or whole class. Color-coded Student Opinion Survey forms accompanied these activities, and they were separated into class periods. We compared target group percentages to class percentages by activity, including the information that appeared on the accompanying survey forms. This information was categorized using a nominal scale showing different activities within specific class periods for target groups and for entire classes. Although nominal scales are generally considered the least precise method of quantification (Best & Kahn, 1993, p. 208), we used qualitative data to interpret and verify emerging patterns or correlation.

Organizing the anecdotal journal writings into similar observed behaviors and events was the first step in analyzing the qualitative data. We color-coded different categories corresponding to previously described activities. These records provided an opportunity to revisit initial perceptions and to compare changes in those perceptions to determine if patterns existed which could be correlated to the quantitative data.

Second, we described the purpose of the activities, the viewpoints of the participants, and the effects of the activities on the participants. Next, we interpreted the data in an attempt to find out why specific events occurred during different learning activities, hopefully attaching significance to particular patterns and results which will help provide meaning to all the words and numbers accumulated throughout the project.

Finally, we noted and provided explanations when it was observed that insufficient time was given for students to complete activities, or when we determined that students' weak skills contributed to difficulty with assignments. By describing events we felt were significant, and providing a discussion within the Data Analysis section of this research report, our study is meaningful and results are as accurate and informative as possible.

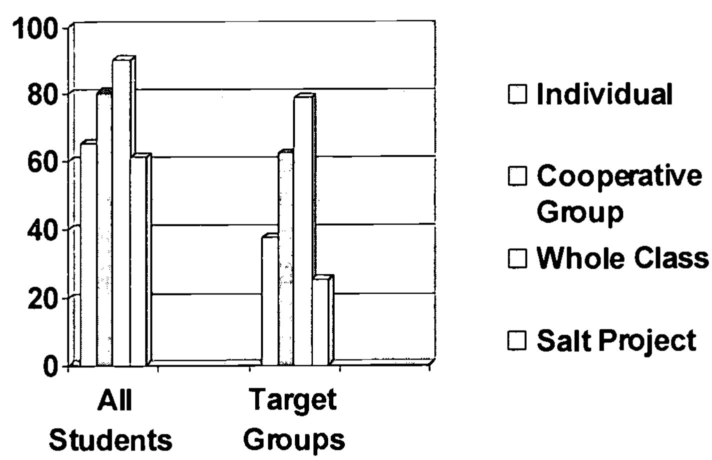
Our data indicated that on assignments done individually, the participation rate for the whole class was 66% while the target group only performed at 38%. For assignments done within the cooperative group environment, the entire class participation rate was 81% and the target at 63%. The assignment done as a whole-class activity showed whole class rates at 91% and the target group at 79%. The whole-class participation rate for the Higginbottom Salt Project was 61% and the target group's rate was 25% (Table 1).

Table 1.
Participation by Assignment

	Individual	Cooperative Group	Whole Class	Salt Project
Period 1 Class	65%	92%	84%	64%
Period 1 Target	50%	75%	100%	25%
Period 2 Class	85%	88%	94%	55%
Period 2 Target	50%	100%	100%	0%
Period 3 Class	67%	78%	96%	70%
Period 3 Target	50%	50%	50%	75%
Period 4 Class	45%	64%	88%	56%
Period 4 Target	0%	25%	66%	0%

According to data in the following chart, students in the target group showed the highest participation when the work occurred within a cooperative group or whole class setting.

Figure 5.
Class and Target Group Percentage Participation



The individual assignment used was an activity called a Dichotomous Key (Figure 6). In this activity students practiced the same methods used by scientists to categorize or "key out" unknown organisms, by grouping them according to similarities and differences. Students were asked to look at a collection of common household items and follow the descriptions on their worksheets until a particular item was categorized or "keyed." That item was then assigned a nonsense name. This activity was done in class and no one was allowed to complete it at home because the items remained at school. It should be noted that there was less structure to this activity than to some other individual activities and this may have contributed to the target group's lower participation score.

The cooperative group project selected for this research was frog dissection. Students spent two class periods actually dissecting frogs working in teams of four students and one frog. There were worksheets to complete (Figure 7) about organs and features including size, texture, color, etc. Students seemed quite enthusiastic about this activity and journal entries were made about how engaged everyone, including the target group in each class, appeared to be. It should also be noted that more students participated in the actual dissection of the frog than completed the worksheets; the percentages were computed on the number of students who completed the worksheets. Students in each team were allowed to share information on this worksheet and they were even encouraged to appoint a recorder at their table so all the information could be written down. After frogs were cleaned up and disposed of, students were given time in class to discuss their findings and fill out the remaining worksheets.

We selected a jigsaw activity to use as the whole class assignment (Figure 8); it was also a new activity for the students. Here, seven or eight teams of students (3 or 4 in each team) were each given a different article to read; these articles were short, about one page in length, on science mysteries. Students read these articles a few days before and on the day of the activity, were given ten minutes to review the article and confer with their teammates making sure that everyone was familiar with the article's main points. Next, each team sent out a "teacher" to a different table and taught that article in four minutes while other students took notes. At the end of the teaching time, "teachers" returned to their home tables and another "teacher" rotated to a different table to share the article with a different set of students. This activity continued until all tables received information about all articles, and everyone had an opportunity to teach at least once, sometimes twice.

This activity showed the greatest participation in both whole class and for the target groups. We believe that the relatively short duration of teaching time with all students participating as "teachers," in addition to the general excitement caused by moving around the room and the noise of seven or eight people talking at once, contributed to getting the students involved. Even shy students did not appear too uncomfortable because they were speaking to only two or three of their classmates at any one time.

The Higginbottom Salt Project which was included as a separate category was a problem-solving activity in which students worked cooperatively to set up a problem, tested one hypothesis, and shared their results; the required worksheet packet was completed individually (Figure 9). We feel that two factors contributed to low percentage participation; these students had no prior experience with a problem-solving activity involving numerous steps, and no stated procedure on how to solve the problem.

Before students began working on this activity, we reviewed several pages of the packet along with related concepts. For example, we extracted pertinent information from the introductory memorandum and inserted that information onto the appropriate work pages. We also reviewed the required math functions on three different occasions, and sample computations and explanations were presented. We did not, however, read every word to them nor were students told exactly how to present their results and conclusions in the final memorandum (the information for the requested memorandum is that which would normally be presented in a lab write-up; the only difference was the format). The projects that were turned in were extremely creative and complete, and only one team from all four classes elected to pool their efforts and create one memo. The number and type of student questions combined with classroom observations, indicate that many students neglected to read the packet for instructions.

The survey results for the numerically ranked questions that accompanied each activity are shown in the following tables:

Table 2.
Individual (Dichotomous Key)

Ranking:

Strongly Agree	5	
Agree	4	
Undecided	3	
Disagree	2	
Strongly Disagree	1	

	Class Average Score	Target Average Score
1. I enjoyed today's class.	4.0	3.1
2. I feel that I learned a lot today.	2.9	2.3
3. The activity was too hard.	1.9	1.6
4. I am interested in this topic.	3.0	2.4
5. I can really use what I learned today.	2.9	2.5

Note. The target group in this survey expressed negative reaction to the individual activity, and corresponds to their low participation as illustrated in Figure 5. Although students seemed to enjoy looking at the various objects and talking about how they should be categorized, more students might have participated if the activity had been more realistic by actually looking at plant and animal samples rather than common household items.

Table 3.
Cooperative Group (Frog Dissection)

Ranking:

Ranking		Class Average Score	Target Average Score
Strongly Agree	5		
Agree	4		
Undecided	3		
Disagree	2		
Strongly Disagree	1		
1. I enjoyed today's class.		4.4	4.2
2. I feel that I learned a lot today.		4.4	4.2
3. The activity was too hard.		1.6	1.8
4. I am interested in this topic.		3.4	3.1
5. I can really use what I learned today.		3.5	3.5

Note. Students seemed to enjoy the entire frog unit, which ended with the two-day frog dissection. This was apparent by the responses for both whole class and target group average scores, as well as the higher percentage participation, which is seen in Figure 5. Generally, students in both groups rated this activity as interesting and useful although more students participated in the frog dissection than actually completed the lab worksheet. With two students opting to complete an alternate assignment in the library and not be present during dissection, the percentage of whole class dissection participation was 98.2% , compared to 81% completing the worksheet. 100% of the target group students participated in the dissection while only 63% completed the worksheet.

Table 4.
Whole Class (Mystery Jigsaw)

Ranking:

Strongly Agree	5		
Agree	4		
Undecided	3	Class	Target
Disagree	2	Average	Average
Strongly Disagree	1	Score	Score
1. I enjoyed today's class.		3.6	2.9
2. I feel that I learned a lot today.		3.6	3.4
3. The activity was too hard.		1.9	2.0
4. I am interested in this topic.		3.0	2.9
5. I can really use what I learned today.		3.0	2.8

Note. This activity had the highest participation rates for all students as well as the target groups. Although the target groups did not particularly like this activity or find it difficult, they did feel they learned something but were not sure how they would use what they learned. We felt one important factor affecting the participation in this activity was that every student was responsible for teaching a short article to a small group of students. The activity was fast-paced and very focused; each student had a job to do with others depending on him/her for their information.

Table 5.
Higginbottom Salt Project

Ranking:

Strongly Agree	5
Agree	4
Undecided	3
Disagree	2
Strongly Disagree	1

	Class Average Score	Target Average Score
1. I enjoyed the Higginbottom Project.	3.2	2.6
2. I can really use what I learned from this project.	3.0	2.9
3. I enjoyed working with my teammates on this project.	3.4	3.6
4. I liked working alone on this project.	2.5	2.2
5. This activity was too hard.	2.3	2.7

Note. The Higginbottom Salt Project survey asked slightly different questions. Here, two questions asked in different ways established whether students enjoyed working alone or with other members of their team. The target group had a higher indication that they enjoyed working with their teammates than the class average even though they did not enjoy the project.

In general, the target groups rated the difficulty of the activities higher than the class average with the exception of the individual Dichotomous Key activity. The target scoring was also more negative in the other four questions on the survey forms.

Findings

Initial research suggested that underachieving or non-participating students lack intrinsic motivation, and are less willing to participate in an assigned activity that is either not relevant to students' lives or is not interesting in and of itself. We definitely found this to be true during this student teaching experience for the target group as well as for the entire class.

The highest percentage of participation for the target group occurred in those activities within a cooperative learning or whole class environment. Further, the target group revealed they preferred working with their teammates versus working alone in the Higginbottom Salt Project survey. As stated in the Green (1995) study, "the activity required less risk taking than it would have if they had had to work alone" (p. 29).

The lowest percentage participation occurred in the individual assignment and the Higginbottom Salt Project. One of the journal entries noted that several members of the target group sat idly at their desks, while several others wandered around the room not working on the task at hand. Although these students were redirected on several occasions, they never became engaged with the material.

These findings also fit with the concept of amotivation discussed earlier, where students do not understand why they are going to school and actually consider themselves "helpless," not able to do anything that would prevent failure. We believe there were several students in the target group who may have this characteristic and participated less than 25% of the time.

One of our original goals was to evaluate teaching strategies and methods for improvement as the first author moved through the day. We were unable to empirically test this hypothesis for two reasons. First, the classes were somewhat ability-ranked, which altered the perception of performance because the lowest-average class was the last class of the day. Second, watching videotapes of the first author teaching should have provided some insight; however, there was no videotaping done in any classroom during this time.

Implications

As we reflect on the six-week, science education experiences with these eighth-grade students, we understand that at least part of the time students need to have some input during lesson or unit planning so they share "ownership" of their learning. Student teaching offers an excellent training time in the classroom; however, stepping into another teacher's routine, curriculum, and discipline system is not always conducive to working through a research project such as this one.

It was also found that well-defined objective(s) tend to generate more participation than objectives that are either not clear or that are not stated at the beginning of a lesson or activity. Additionally, the research on cooperative learning shows that communication, thinking, and the social skills necessary for successful functioning within a group increase student involvement; however, these strategies had not been incorporated into the science classes, so there was some resistance to using them. Because of the relatively short period of time devoted to student teaching, it was not possible to teach, model, and practice many of these strategies.

Following this action research, it is understood more fully how important it is to choose activities that are meaningful in themselves in addition to providing opportunities for discovery and skill mastery for students. The more we, as teachers, focus on topics that are relevant to students' lives and that they have chosen, the more students will be intrinsically motivated to participate. There should be activities available for a range of student abilities and although teachers cannot always provide activities that will be interesting to every single student, every attempt can be made to design tasks that are engaging and pique students' curiosity.

References

Adams, N., Cooper, G., Johnson, L., & Wojtysiak, K. (1996). *Improving student engagement in learning activities* (Report No. PS 024590). Lincolnshire, IL: Saint Xavier University. (ERIC Document Reproduction Service No. ED 400 076)

Alderman, M. K. (1990, September). Motivation for at-risk students. *Educational Leadership, 48*(1), 27-30.

Best, J. W., & Kahn, J. V. (1993). *Research in Education* (7th ed.). New York: Allyn and Bacon.

Brophy, J. (1987, October). Synthesis of research on strategies for motivating students to learn. *Educational Leadership, 45*(2), 40-48.

Bujan, J., Havlin, J., Hendzell, P., Lokes, M., & Pries, M. (1996). *Increasing students' responsibilities for their own learning* (Report No. PS 024581). Lincolnshire, IL: Saint Xavier University. (ERIC Document Reproduction Service No. ED 400 072)

Dev, P. C. (1997, January/February). Intrinsic motivation and academic achievement: What does their relationship imply for the classroom teacher? *Remedial and Special Education, 18*(1), 12-19.

Danner, F. W., & Lonky, D. (1981). A cognitive-developmental approach to the effects of rewards on intrinsic motivation. *Child Development, 52*, 1043-1052.

Green, P. (1995). What type of learning activities are more likely to increase the involvement of non-participating students? In S. A. Spiegel, A. Collins, & J. Lappert (Eds.), *Action Research: Perspectives from Teachers' Classrooms* (pp. 17-32). Tallahassee, FL: SouthEastern Regional Vision for Education.

Hendrix, J. C. (1996, July/August). Cooperative learning: Building a democratic community. *The Clearing House, 69*, 333-336.

Johnson, D. W., & Johnson, R. T. (1989/1990). Social skills for successful group work. *Educational Leadership, 47*(4), 29-33.

Kagan, S. (1994). *Cooperative Learning*. San Juan Capistrano, CA: Author.

Karsenti, T. P., & Thibert, G. (1995). *What type of motivation is truly related to school achievement? A look at 1428 high-school students* (Report No. PS 036448). Montreal, Quebec: University of Quebec at Montreal. (ERIC Document Reproduction Service No. ED 391 783)

Wong, H. K., & Wong, R. T. (1991). *The first days of school.* Sunnyvale, CA: Author.

Figure 1

OBSERVATION CHECKLIST

Teacher: ____________ Class: ____________ Date: ____________

Target Skills: ____________

Ratings:
+ = Frequently
✓ = Sometimes
O = Not Yet

NAMES OF STUDENTS	participates	completes assignment	follows directions	cooperates	displays effort	displays initiative	uses time wisely	displays realistic self-assessment	COMMENTS
1.									
2.									
3.									
4.									
5.									
6.									
7.									
8.									
9.									
10.									
11.									
12.									
13.									
14.									
15.									
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26.									
27.									
28.									
29.									
30.									

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Figure 2

STUDENT OPINION SURVEY

The following statements represent opinions, and your agreement or disagreement will be determined on the basis of your particular beliefs.

Kindly circle your position on the scale as the statement first impresses you. Indicate what you believe, rather than what you think you should believe.

Ranking:		
	Strongly Agree	**5**
	Agree	**4**
	Undecided	**3**
	Disagree	**2**
	Strongly Disagree	**1**

		Your Ranking Score				
1.	I enjoyed today's class.	5	4	3	2	1
2.	I feel that I learned a lot today.	5	4	3	2	1
3.	The activity was too hard.	5	4	3	2	1
4.	I am interested in this topic.	5	4	3	2	1
5.	I can really use what I learned today.	5	4	3	2	1

Figure 3

SURVEY FOLLOW-UP

Circle **YES** or **NO** to the following questions.

1) The Student Opinion Survey was easy to understand. **YES NO**

2) I needed additional help to fill out the survey. **YES NO**

Survey Field Results

1. The Student Opinion Survey was easy to understand.

   Yes - 25

   No - 2

2. I needed additional help to fill out the survey.

   Yes - 1

   No - 26

Questions asked by students:

* What was the activity?

* If I thought it (the activity) was easy how do I score it?

Figure 4

STUDENT OPINION SURVEY

The following statements represent opinions, and your agreement or disagreement will be determined on the basis of your particular beliefs.

Please circle your position on the scale as the statement first impresses you. Indicate what you believe, rather than what you think you should believe.

Ranking:		
	Strongly Agree	**5**
	Agree	**4**
	Undecided	**3**
	Disagree	**2**
	Strongly Disagree	**1**

		Your Ranking Score				
1.	I enjoyed the Higgenbottom project.	5	4	3	2	1
2.	I can really use what I learned from this project.	5	4	3	2	1
3.	I enjoyed working with my teammates on this project.	5	4	3	2	1
4.	I liked working alone on this project.	5	4	3	2	1
5.	This activity was too hard.	5	4	3	2	1

Date: ________________ Names: ______________________________________

DICHOTOMOUS KEY

INTRODUCTION: Once plants and animals have been assigned by scientists to certain families, how do you figure out their names or species? This is done by using a device called an identification key.

OBJECTIVE: In science, organisms are identified and classified according to characteristics that they possess. These characteristics may be either similar to or different from those of other organisms. When differences are observed so that the presence or absence of a characteristic determines which category the organism (or object) falls into, the identification tool is called a DICHOTOMOUS KEY. In this activity, we will use a dichotomous key to give household items nonsense names.

PROCEDURE: 1. For each item provided, start with description number 1 and follow the instructions at the end of the line of the description that fits your item until the end of the line provides a name for that item.
2. In the space beside each nonsense name provided, write in the actual name of the household item.

1 a. Object is partly or completely made of metal .... go to 2
1 b. Object has no metal on it .... go to 16

2 a. Object has nonmetal parts .... go to 3
2 b. Object is completely made of metal .... go to 5

3 a. Object is less than 10 cm in length .... whippersnapper ____________
3 b. Object is 10 cm or greater in length .... go to 4

4 a. Object is pointed at one end .... tapered doodad ____________
4 b. Object is not pointed at one end .... common doodad ____________

5 a. Object is greater than 10 cm .... go to 6
5 b. Object is 10 cm or less .... go to 9

6 a. Object has a twisted area .... thingamajig ____________
6 b. Object has no twisted area .... go to 7

7 a. Object has three or more prongs .... left-handed monkey wrench ____________
7 b. Object has no prongs goto8

Date: ____________ Names: ______________________________

8a.Object has a cutting edge .... geegaw ________

8b.Object has no cutting edge .... scooperdoo ________

9a.Object has spiral grooves .... go to 10

9b.Object has no spiral grooves .... go to 11

10a. Object has a hole .... cashew ________

10b. Object has no hole .... whatsit ________

11a. Outside edge is a circle .... go to 12

11b. Outside edge is not a circle .... go to 13

12a. Object is silver-colored .... Quinto ________

12b. Object is not silver-colored .... uno ________

13a. Object is silver-colored .... go to 14

13b. Object is not silver-colored .... go to 15

14a. Object is less than 4 cm in length .... micro whatnot ________

14b. Object is 4 cm or more in length .... macro whatnot ________

15a. Object is brass-colored .... skyhook ________

15b. Object is not brass-colored .... dingus ________

16a. Object is white .... go to 17

16b. Object is not white .... go to 24

17a. Object has holes .... wadget ________

17b. Object has no holes .... go to 18

18a. Object is a circle in at least one dimension .... go to 9

18b. Object is not a circle in any dimension .... go to 20

Date: ________________ Names: ____

19a. The circumference of the circular dimension is 6 cm or less.............bric-a-brac ____________

19b. The circumference of the circular dimension is greater than 6cm......Roundabout ____________

20a. Object is made of plastic ....go to 21

20b. Object is not made of plastic ....go to 23

21a. Object has 3 or more prongs .... doohickey ____________

21b. Object has no prongs goto22

22a. Object has a cuffing edge .... gismo ____________

22b. Object does not have a cuffing edge ....flim flam ____________

23a. Object appears to have a string running through its center ....Wickey ____________

23b. Object does not appear to have a string running through its center ....scrubadub ____________

24a. Object is made of plastic ....go to 25

24b. Object is not made of plastic ....go to 28

25a. Outer edge of the object is round ....go to 26

25b. Outer edge of the object is not round ....whatchamacallit ____________

26a. Object has holes goto27

26b. Object has no holes ....spinaroo ____________

27a. Object has 2 holes ....bihole ____________

27b. Object has 4 holes ....Tetrahole ____________

28a. Object is made of glass ....seethru ____________

28b. Object is not made of glass ....go to 29

29a. Object is yellow in color ....screecher ____________

29b. Object is not yellow in color ....Soaky ____________

Figure 7

Name: ______________

Period: ______________

Digestive	Respiratory	Muscular
Circulatory	Skeletal	Nervous
Endocrine	Excretory	Reproductive

Figure 8

MYSTERY ARTICLE

Name ______________________________ Period _________ Date______________________

Teacher:

Article Title:

Main Ideas:

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Other Information to Stress:

Teacher:

Article Title:

Main Ideas:

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Other Information to Stress:

Teacher:

Article Title:

Main Ideas:

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Other Information to Stress:

Teacher:

Article Title:

Main Ideas:

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Other Information to Stress:

Figure 9

HIGGENBOTTOM EGG CO.

WHERE THE ONLY FRESHER EGGS ARE STILL UNDER THE HEN

To:	Mrs. Pringle's Science Lab at Chief Joseph Middle School
From:	Elaine Higgenbottom, Owner
Date:	Monday, March 2, 1998
Re:	Accident at Warehouse #5

We have a terrible mess here at my company! Last Tuesday we received our weekly shipments of supplies. As you know, we must have huge quantities of supplies so our company can produce our products. Everything was going fine until the "BIG MIX-UP" happened. I am very concerned that this is going to cost us a lot of money if we don't get an answer soon. I sure hope all of you can help me!

Problem: Last Tuesday, we received our usual shipment of sand. We use a lot of sand because, well you know, we have 15,000 chickens laying eggs and, well...they eat a lot of food. We use the sand to clean up after the se chickens and then we spread it out in our farm to help fertilize the crops we are growing. Warehouse #5 holds our sand supply. Banker Gravel delivered 100,000 kg of sand on Tuesday.

One of our other products is called HiggenGrow, which is a high-energy chicken feed that helps our hens lay more eggs. We use about 50,000 kg of NaCl per week to make that product. This product is always delivered to Warehouse #4. Last Tuesday, one of our new employees, Chick Hiller, was guiding the delivery trucks to the warehouses (since we have 15 warehouses, it's a big job!). He told Banker Gravel and D&G Salt to deliver to the same warehouse. And that's the problem! The two trucks mixed the NaCl and sand together in one huge pile.

If the hens eat feed with sand in it, it will kill them. I guess we could just write-off the NaCl as a complete loss and just use it with the sand to clean up after the chickens. The problem with that though, is that the NaCl may hurt the plants we are growing out in the farm. Information for your consideration:

The NaCl cost us $0.15 per kg. The sand cost $0.001 per kg.

We would be willing to write-off the sand as a complete loss, but what about the salt? Can you help me? I need to announce our plan to the Board of Directors in two weeks. They want to know the following:

- The problem. State the problem very clearly.
- What we're going to do about the problem.
- Design for what we're going to do. Some drawings here might help.
- Data from any experiments that we've done to solve the problem.
- The costs involved. If we can save the NaCl, how many percent we save. Final outcomes from your experiments.

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THE BIG MIX-UP WRITE-UP FOR SCIENCE

This packet is designed to help you with the final write-up. IT IS **NOT YOUR FINAL WRITE-UP!**! The final write-up is due Thursday, March 12 before I leave the building at 4:00.

The penalty for late work is 10%, and you will NOT have the opportunity to rewrite for a higher grade. No late work will be accepted after Monday, March 16.

Having said that, if you're one of those students who turn in your work early, you'll have an opportunity to earn a 10% bonus! And the people who turn their assignments in on time have the opportunity to rewrite this lab for a higher grade. Pretty good deal? I think so.

Part 1: The Data

Beginning weight of sand and salt mixture ______grams

Ending weight of sand ______grams

Ending weight of salt ______grams

Total ending weight of mixture ______grams

Part 2: The Math

Percentage recovered from your experiment ________%

What formula did you use to get that percentage?

Show me the math:

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THE BIG MIX-UP WRITE-UP FOR SCIENCE

Part 3: How Much $$$ Can You Save Higgenbottom?

What was the price per kg of salt? __________

How much salt did Higgenbottom buy from D&G Salt? __________

What was the bill for the salt from D&G? __________

What was the price per kg of sand? __________

How much sand did Higgenbottom buy from Banker Gravel? __________

What was the bill for the sand from Banker Gravel? __________

What is the EXACT quote from Mrs. Higgenbottom that tells you which most interested in recovering?

Based on the percentage of recovery from Part 2, how much money can you save Higgenbottom? Please make the following assumptions when you calculate the savings in money:

1. She is now prepared to throw all of the sand and salt away at this point. Any savings would be appreciated.
2. The process to recover the sand/salt costs nothing. I know that's not real, but go with it anyway.

Savings for Higgenbottom:

Please show me the math:

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ARE STILL UNDER THE HEN**

THE BIG MIX-UP WRITE-UP FOR SCIENCE

Part 4: The Scientific Method

Use the scientific method to **pre-write your memo to Mrs. Higgenbottom.**

What's the problem?

What background information have you learned about this problem?

What was your hypothesis?

Describe - **IN DETAIL** -your plan to test your hypothesis. Include drawings.

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ARE STILL UNDER THE HEN

THE BIG MIX-UP WRITE-UP FOR SCIENCE

Part 5: Error Analysis

Why didn't you get 100% of the sand or salt back? Where could the sand/salt have gone?

Why would I be suspicious of results that are greater than 100%?

Part 6: The Memo

Write a memo to Mrs. Higgenbottom that communicates EVERYTHING you've done to solve her problem. Use the scientific method as your guide.

Memos must be clearly written, proofread for mistakes, and in black ink or word processed. Please skip lines or double space.

Part7: What Do I Turn In?

Make sure you have the following in your report IN THIS ORDER:

1. **Neatly designed cover entitled "Higgenbottom Egg Company Big Mix-Up". Other designs are yours to choose. Include your name on the cover.**
2. **Final draft of your memo to Mrs. Higgenbottom.**
3. **This completed lab packet.**
4. **All rough drafts, notes, and/or other data collected from your experiments.**
5. **Bear in mind: NEATNESS COUNTS. See the grading sheet for the lab.**

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ARE STILL UNDER THE HEN**

The page following these notes contains a grading sheet of how I will determine your grade for the Higgenbottom Egg Company Big Mix-Up Problem.

Look at On-Time Performance! 10% of your grade is whether or not you turned in the write-up on time. But if you look more closely you not only DON'T receive 10% for on-time, you LOSE an additional 10% for late work. Advice: Get your work in on time!!

This write-up also asks you to make a cover for your report. Keeping your rough drafts and notes is important as well.

Working with others can be a real chore. Don't you hate it when one of the group members does nothing? You are responsible only to work as a group during the investigation - the write-up can be your own thing. If you would like to turn in one (1) write-up for a group, you'll need my permission first.

Good luck to all of you as you begin writing up the BIG MIX-UP AT HIGGENBOTTOM EGG COMPANY.

Mrs. Pringle

Higgenbottom Egg Company's Sand and Salt Problem: The Big Mix-Up

Grade Sheet

Due Date		
Early? (of your earned grade)	**+10%**	____________
On-Time?	**30**	____________
Late? (of your earned grade)	**- 10%**	____________
Cover		
Cover Essentials	**15**	____________
Cover Creativity	**15**	____________
Memo		
Format	**15**	____________
Problem Stated?	**15**	____________
Background Info	**15**	____________
Hypothesis	**15**	____________
Experiment Discussed in Detail?	**15**	____________
$$ Saved H. Egg?	**15**	____________
Pre-Write Packet		
Part 1: % Saved	**15**	____________
Part 2: Math	**30**	____________
Part 3: Money	**30**	____________
Part 4: Scientific Method	**30**	____________
Part 5: Error	**15**	____________
Drafts		
Roughs, Notes	**15**	____________
Overall Look		
Neat & Quality	**15**	____________
Points	**300**	____________
Grade		____________

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Signature: Valarie L Akerson
Printed Name/Position/Title: VALARIE L AKERSON Assistant Professor