Using Rubrics to Improve the Quality of Lab Reports in Eighth Grade Classes

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Abstract

Forty-four eighth grade students in a rural, northwest Ohio school participated in the study during September and October of 2002. The purpose of the study was to determine if the use of rubrics in eighth grade science classes improved the quality of lab reports. Students completed one lab report without a rubric and then students and the researcher created a lab report rubric that the students used to write their second lab report. The researcher evaluated both lab reports in eleven categories and compared the pre-rubric lab report with the post rubric lab report evaluations. Students made overall gains in nine of the eleven assessed categories on the post rubric lab report. They also increased an average of eighteen percentage points on the post rubric lab report compared to the pre-rubric lab report.

Acknowledgments

I would like to acknowledge my sincere appreciation to my advisor, Dr. Jo Ann Burkhardt, for her guidance and encouragement from the beginning to the completion of the project. I would also like to thank all of my supportive colleagues for their offers to help me in any way. Finally, I would like to give many thanks to my husband and sons for their patience throughout this process.

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Chapter I: Introduction

Statement of the Problem

The purpose of this study was to determine if the use of a rubric in eighth grade science classes improved the quality of laboratory reports. The problem was that eighth grade science students were having a difficult time writing a clear and concise laboratory report after completing an experiment in class. Samples were provided to them but they were not consistently followed.

Students had a difficult time with two major parts of the laboratory report. The first difficulty was the formatting of the laboratory report. They did not follow consistently the directions or samples about how to lay out the laboratory report using the computer. The second major difficulty students were having was writing a conclusion. A conclusion had several parts that were required in a certain order and students were not consistently including all of the components in order. Another difficulty students had when writing conclusions was making inferences based on their data.

It was the author's hypothesis that a rubric designed to list all of the requirements of the laboratory report in a format exactly like the laboratory report with points assigned to each part would improve the quality of eighth grade students' laboratory reports.

The research questions for this project were: 1. What were rubrics? 2. What were the advantages of using a rubric? 3. What did the research state about implementing a rubric? 4. Did the use of rubrics in eighth grade science classes improve the quality of laboratory reports?

Justification

It was important for eighth grade science students to learn how to write clear, concise laboratory reports because scientific writing is used in everyday life. Students must be able to follow directions and write exactly what they did and how they did it so that others can repeat their actions based on what they wrote. They also must be able to interpret results whether they are in a science experiment, a recipe or a car. The laboratory report rubric used for eighth grade science classes will be implemented in other high school science classes if an improvement is shown.

Definition of Terms

Laboratory report: A laboratory report for the purpose of this study was a summary of an experiment that was done. The report contained the title of the experiment, the problem that was studied, the hypothesis that was made, the materials and equipment that were used, the data that was collected and the conclusion that was made. Laboratory report and lab report were synonymous terms in this study.

Rubric: The rubric was a guide developed to be used by eighth grade students that detailed what should be included in the laboratory report and how it should be formatted and assigned a point value to each item.

Limitations and Appropriate Use of Results

This research was done with two eighth grade science classes in a small, rural Midwest Ohio high school. The total number of students involved in the research study was forty-four. Due to the small size of students used for this research project, results may not be applicable to larger groups.

Data collection occurred over the course of one grading period, or one quarter. The fall grading period was when the data was collected. Results may have varied had the research been conducted over an entire school year or during a different grading period.

Chapter II: Review of the Literature

The purpose of this study was to determine if the use of a rubric in eighth grade science classes improved the quality of lab reports. Students were having a difficult time consistently following examples on formatting and writing conclusions in their lab reports. The research questions were: 1. What were rubrics? 2. What were the advantages of using a rubric? 3. What did the research state about implementing a rubric? 4. Did the use of rubrics in eighth grade science classes improve the quality of lab reports?

Research Question One: What were rubrics?

The review of the literature stated that rubrics were guides that directed the scoring of an assignment or a behavior. Lim (1997) found that rubrics were usually written as charts with different levels of work performance explained. The criteria being assessed were identified along the vertical axis of the chart while the rating levels were identified along the horizontal axis of the chart. The various rubric levels described specific characteristics to be identified when assessing the student's product to determine whether it was excellent, good or did not meet the given criteria. (Lim, 1997)

Hibbard et al. (1996) found that there were many different kinds of rubrics. Some rubrics were designed for a specific project or assignment while others were more general. Rubrics were used to assess actual student products and also were used to assess student behaviors such as class preparedness, cooperativeness and participation. Montgomery (2000) described the various levels used in rubrics. Some rubrics used exemplars such as superior, good, fair and poor, while others used a number rating system such as five, four, three, two, and one. Goodrich-Andrade

(2000) and Simkins (1999) explained that the number of rating levels varied depending on the assignment being assessed and the experience of the assessor writing the rubric.

Schrock (2000) indicated that there were three main sources for rubrics. The first source was rubrics created by the assessor or the assessor and the students. The second source was to use already prepared rubrics that were available on the Internet or in other educational materials. The third source was to use rubric creating software to customize a rubric based on a software pattern.

In review, the literature found that rubrics were designed to assess student products. They listed the criteria being assessed and matched the different criteria with a rating level. Rubrics came in various designs with different rating levels but all of them could be used to assess student created projects or student behaviors.

Research Question Two: What were the advantages of using a rubric?

Coray (2000) and Goodrich-Andrade (2000) found that rubrics made assessment faster and more efficient. Because the rubric had all of the criteria listed and the level of rating for each criterion they were easy for teachers to use to assess a product with less subjectivity. Coray and Goodrich-Andrade also indicated that rubrics were easily presented to both parents and students to justify a grade received.

Another benefit of rubric use that Goodrich-Andrade (2000) discussed was that when teachers created rubrics they incorporated learning tools into the rubric by stating the criteria to be rated. Eyster (1997), Goodrich-Andrade and Pickett (1999) found out that this helped teachers focus on what they thought was important for the students to learn and the students knew what was important to know. According to Liu (1995), rubrics showed students what they needed to do in order to get a certain grade. Goodrich-Andrade also pointed out that on a

traditional test, questions and answers were kept confidential. Students were not sure of teacher expectations. Using a rubric displayed criteria and rating levels clearly so that teachers, students and parents knew what was expected.

Goodrich-Andrade (2000) pointed out another advantage of using rubrics was that they provided students with more information about their strengths and weaknesses than traditional assessments. A rubric had all of the criteria for an assignment and a level for these criteria in writing. When the teacher assessed the student using the rubric a rating level was given for each criteria or group of criteria. It was easy for a student to check their progress on the assignment and to see where they had done well and where they needed to improve. (Goodrich-Andrade, 2000)

Goodrich-Andrade (2000), Montgomery (2000), and Hibbard et al. (1996) demonstrated that the use of rubrics promoted self-assessment by students. By using the rubrics to complete an assignment, students were continually assessing themselves and their progress based on the desired criteria. One study done by Goodrich-Andrade showed that this type of self-assessment by students using rubrics promoted more learning than occurred with students not using a rubric.

Goodrich-Andrade (2000) also found that using rubrics increased the development of skills. She performed a study on the effect of rubrics on eighth grade student writing skills. One group of students received a rubric for essay assignments while another group of students did not receive a rubric. The student group that received the rubric scored better on two out of the three essays evaluated.

In the same study by Goodrich-Andrade (2000) with eighth grade writing skills, she stated that the development of understanding increased with the use of rubrics. The students were questioned on how they thought their essays were evaluated. The group that did not receive the

rubric did not have concrete criteria for how their essays were graded. The student group that received the rubrics brought up specific criteria listed on the rubric that the teacher looked for the student to achieve a certain grade. Goodrich-Andrade concluded that, "The use of rubrics may help students understand the quality of a good essay." (Goodrich-Andrade, 2000, p. 16)

Thinking skills improved with the use of rubrics in the Goodrich-Andrade (2000) study. When student groups were given a rubric for a persuasive essay it included the criterion to consider the opposite view point and explain how it compared to their own. This was a high level thinking skill that most eighth graders would not have included. The student group that did not receive the persuasive essay rubric did not include this higher level thinking skill in their essays whereas those that received the rubric tended to explain both points of view.

According to Goodrich-Andrade (2000), Montgomery (2000) and Simkins (1999), involving the students in the creation of the rubric increased its meaning. When students participated in the design of the rubric they became stakeholders in the product. They also started to develop an understanding of the assignment from the conception and began to know what would be expected of them. In addition, students had good ideas that improved the rubric quality.

The advantages of rubrics based on the literature review were that they were efficient guides to assess student learning. Rubrics specifically delineated the criteria for an assignment so that they were clear to the teacher, the students and the parents. Designing a rubric made the teacher focus on specific learning outcomes. Having students involved in the rubric design increased student involvement from the beginning of the project. Students could better understand what was expected of them and using rubrics increased their learning and understanding.

Research Question Three: What did the review of literature state about implementing a rubric?

The first step when designing a rubric according to Goodrich-Andrade (2000) and Montgomery (2000) was to review past student work on a similar project with students. Students were shown an excellent project and a weaker project and asked to differentiate between the two qualitatively. An example of this was two different videotaped oral presentations were shown to students. One was an excellent project and the other was a weak project. Students were asked to differentiate between the two projects and the teacher recorded their responses. (Goodrich-Andrade, 2000)

Montgomery (2000) stated that the next step to implementing a rubric was to get student input on criteria. Students and the teacher listed the criteria together. At the same time students were asked about quality levels associated with the criteria. The criteria were then organized and listed on the vertical axis of a chart under specific quality levels on the horizontal axis by the teacher. Goodrich-Andrade (2000) and Simkins (1999) suggested that beginning rubric designers use four levels of quality. Criteria for the best and worst levels were filled in first and then the middle levels were completed.

Montgomery (2000) and Simkins (1999) found that when criteria were written it was important to choose specific words that had the same meaning to all stakeholders. Creative, interesting, and boring were examples of words that were nonspecific and had different meanings to different people. Simkins also found that specific criteria wording was also important to make sure measurable teachable skills were being evaluated. A student could be taught and evaluated on a PowerPoint presentation with ten slides using color background and sound. It would be

nonspecific and immeasurable to evaluate a student on a creative PowerPoint presentation. Simkins and Montgomery stated that student involvement in the rubric design helped eliminate these words when the teacher asked the students to interpret what was meant by the criteria in the rubric draft.

The last step before implementing a rubric according to Goodrich-Andrade (2000) and Simkins (1999) was to show students the rubric draft and make any necessary changes based on their comments. Teachers could then use the rubric to evaluate a student product. Goodrich-Andrade, Lim (1997) and Montgomery (2000) also found that students increased their learning of their strengths and weaknesses when they assessed themselves using the same rubric. Montgomery pointed out that the student's ability to self-assess gave the teacher insight into the student's understanding of the evaluated concepts.

After reviewing the literature it was found that the implementation of rubrics involved several steps. A review of past student work of a similar project was done with students. Criteria and quality levels were defined. Specific language was chosen so that the meaning was clear and equal to all stakeholders. Students were asked for comments on a rough draft and revisions were made to get the final rubric. The rubrics were used by the teacher for evaluating student work and by the student for self-evaluation.

In conclusion, the literature review found that there were many different types of rubrics that were used to assess student products. The rubrics listed the criteria being assessed and matched the criteria with a rating level. The advantages to using rubrics were that they delineated the criteria for an assignment so that they were clear to the teacher, the students and the parents. Designing the rubric helped the teacher focus on learning outcomes. Having student

input into the rubric design process increased their involvement and understanding from the beginning of the project. Student involvement in the design of the rubric also helped eliminate language that was not clear. Rubrics helped students better understand what was expected of them and increased their learning.

Chapter III: Methods and Procedures

The purpose of this project was to determine if the use of rubrics in eighth grade science classes would improve the quality of lab reports. The research questions were: 1. What were rubrics? 2. What were the advantages of using a rubric? 3. What did the research state about implementing a rubric? 4. Did the use of rubrics in eighth grade science classes improve the quality of lab reports?

Participants

Forty-four eighth grade students participated in the study. They were enrolled in two heterogeneous classrooms in a small, rural school in northwest Ohio. Thirty of the students were male and fourteen of the students were female. Forty-one of the students were Caucasian and three of the students were of Hispanic descent.

Instruments/Protocols

In order to answer research question number four, Did the use of rubrics in eighth grade classrooms improve the quality of lab reports?, the researcher devised a spreadsheet to record scores in all areas evaluated in the lab report. (See Appendix A.) This spreadsheet was used to record scores of a lab report that was done before students had the rubric and it was used to record scores of a lab report that was done after the students were given the rubric.

The spreadsheet had twelve different columns. The first column was a student number that was assigned to each eighth grade student. The next eleven columns were areas that were evaluated on the lab report. Each area was worth zero to three points with three being the highest score.

The Title was the first area of the lab report assessed. The Title was rated based on its pertinence to the lab experiment. The second area evaluated was whether the Problem was written as a question that pertained to the experiment. Next, the Hypothesis was evaluated to see if it was written as a statement of what would happen in the lab. The Equipment and Materials section of the lab report was then evaluated to check if all materials and their quantities were listed. The next area of the lab report that was assessed was the Procedure to check if it was complete and numbered. After that the Data section was evaluated for completeness, accuracy and presentation in a table. The Calculation section was rated next for inclusion of all formulas used during the experiment.

The Conclusion was evaluated in two areas. The first area that was assessed in the Conclusion was a restatement of the problem, a restatement of the hypothesis and a statement as to whether the hypothesis was correct or incorrect. Then the Conclusion was evaluated for inferences made from the data and explaining the results.

The last two areas of the lab report evaluated were the Formatting and Grammar and Spelling categories. Formatting was assessed for having lab reports typed, sections capitalized and underlined, double spaced between sections and numbered to the far left margin. Grammar and Spelling were evaluated for word choice, word omissions, subject-verb agreement, correct capitalization and spelling errors.

The researcher kept an archival record of student and researcher input as the rubric was being devised to form the rubric rough draft. Initial input from students and the researcher was recorded on an overhead transparency. The input was then photocopied and used by the researcher to make the rubric rough draft. (See Appendix B.) Input was also kept on student and researcher input that was used to revise the rubric rough draft. Again, the input was recorded

onto an overhead transparency and then photocopied. The researcher used this input to form the rubric final draft. (See Appendix C.)

Procedures

The first step in the research process was to obtain permission to perform the action research project from the researcher's principal. The principal was sent a letter that explained the researcher's purpose and reason for the research. At the same time, the principal was given a copy of the letter that the researcher would send to the eighth grade parents for permission. After the principal's permission was obtained, permission from the parents of the eighth grade students that would participate in the research project was obtained. The parents were sent a letter informing them of the purpose of the project and the reason the research was being done.

The first experiment done by the eighth grade students was a paper towel absorbency lab. After the lab was completed the students were given verbal directions by the researcher on how to complete the lab report. They were also given visual instructions on the overhead projector with all sections of the lab report labeled and what should go in each section.

The first section on the overhead for the lab report was the Title. It was centered and underlined and pertained to the lab that was done. The next section was the Problem. It was a question that pertained to the lab. After that the Hypothesis was a statement of what would happen during the lab experiment. The next part on the overhead for the lab report was the Equipment and Materials section. Students were told to make a vertical list of the equipment and materials used along with the quantities used. Following the Equipment section was the Procedure section that listed and numbered completely all steps in the experiment. The next section on the overhead was the Data section. Students were given directions on how to make a table to record data on the computer. Calculations was the next section. Students were directed

to list any calculations used during the experiment. The final section on the overhead was the Conclusion. They were told that it had two main parts. The first part of the Conclusion was a restatement of the problem, a restatement of the hypothesis and whether the hypothesis was right or wrong. The second part of the Conclusion was using the data to make inferences and explain what happened during the lab.

They were also told that the lab report had to be formatted with double spacing between headings, single spacing in the body, numbered items to the left margin, data presented in a table, and name and lab partners names listed in the upper right corner. Students were instructed to use proper grammar and spelling in lab reports. Students were given two class periods to work on the lab reports in the computer lab.

The lab reports were then collected and evaluated by the researcher in each of the eleven categories. A score of zero to three points was assigned to each category with three points being the highest score. The category scores for each student were then recorded on the spreadsheet. After the lab report evaluations were complete each student was apprised of his or her evaluation in each rated category individually by the researcher.

The eighth grade students together with the researcher developed the lab report rubric after the first lab report was completed. After the first lab reports were evaluated by the researcher two samples were prepared by the researcher to present to students. One was an excellent lab report and the other was below standards. Copies were made of these lab reports and given to each student. Students were asked to work in lab groups to evaluate each of the lab reports and come up with criteria of a good lab report in each of the sections that was evaluated and also come up with criteria of a poor lab report in each of the evaluated sections.

The researcher assigned quality descriptors of zero to three points with three being the highest quality. These descriptors were put on an overhead transparency across the top with three being on the far left side and zero on the far right side. The numbers two and one were in between the three and the zero across the top of the transparency.

The students were asked for the criteria that would qualify for a three in each of the categories developed. The student input was recorded on the transparency. The students were then asked for qualities that would be rated a zero in each of the categories. Finally, the students were asked for qualities that would be ranked a one or two in the eleven evaluated categories. The researcher also added criteria on the transparency during the same class period. After class the researcher typed the rubric rough draft (see Appendix B) and made an overhead transparency. The rough draft was shown to the eighth grade students the following class period. An overhead transparency of the rubric rough draft was also displayed. The researcher asked the students to read the rough draft rubric and suggest any changes that needed to be made. Students were asked particularly to make sure that all words were clear and would have the same meaning to everyone in the room. The researcher recorded changes on the overhead. After class the revisions were typed and the final copy of the rubric was made. (See Appendix C.)

The next experiment that was completed by the eighth graders was a coiled spring lab. Students were given a copy of the lab report rubric to complete the coiled spring lab report. They were given two class periods to work on the lab report in the computer lab. The lab reports were then collected and evaluated from zero to three points in the eleven categories using the lab report rubric by the researcher.

After using the rubric, the scores in each category were recorded on the spreadsheet by the researcher. The researcher then compared the spreadsheet from the first lab report that was

completed before using the rubric with the spreadsheet from the second lab report that was completed using the rubric.

Timeline

The first lab report was done in September 2002 and the researcher completed the spreadsheet evaluations of the lab reports at that time. The rubric design was done in mid September 2002 and completed in two class periods. The second lab report was done in late September 2002. The researcher evaluated the second lab reports using the rubric at that time and then recorded the scores in each category on the spreadsheet.

Data Analysis

The researcher assigned a score of zero to three points with three points being the highest score to each of the eleven assessed categories of the lab report. The first category assessed was the Title. (See Appendix C.) The Title was assigned three points if it pertained to the lab with detail. For instance on the first lab to receive three points the Title was "Paper Towel Absorbency." Two points were assigned to the Title if it pertained to the lab but with no detail. "Paper Towel Lab" received two points. If the Title had words from the lab but did not specifically relate to what was done it received one point. "Absorbency" was an example of a Title that received one point. If the Title was missing or had nothing to do with the lab zero points were assigned.

The next category that was assessed was the Problem. (See Appendix C.) To receive three points the Problem had to be a question that told what the lab was trying to solve and it had to end with a question mark. "Which paper towel, brand A, B or C would be the most absorbent?" was an example that received three points on the first lab report. If the Problem had the correct wording asking a question that told what the lab was trying to solve but did not end

with a question mark two points were assigned. A Problem that did not clearly tell what the experiment was trying to solve received one point. Zero points were assigned if the Problem was missing or had nothing to do with the lab.

The Hypothesis section was then evaluated. (See Appendix C.) A Hypothesis that was a guess about what would happen in the experiment with a reason was assigned three points. "The bigger wave will travel faster through the Slinky because it moves faster than the smaller wave." was an example of a three-point Hypothesis in the second lab. A guess about what would happen without any reasoning or a guess that began with "I think" earned two points. "The bigger wave will be fastest." and "I think the bigger wave will be faster than the smaller wave because it has more energy." were both examples of two point Hypotheses in the second lab. A Hypothesis that was a conclusion about the lab instead of a guess about what would happen received one point. An example of a one-point Hypothesis in the second lab was "The smaller wave was faster." If the Hypothesis had nothing to do with the experiment or was missing, one point was assigned.

Equipment was the next evaluated category. (See Appendix C.) A three-point Equipment section included all materials and equipment used and the quantity of each in a vertical list. If one piece of equipment was missing, two points were assigned. If two pieces of equipment were missing, one point was assigned. Zero points were assigned if more than two pieces of equipment were missing.

The fifth category evaluated was the Procedure. (See Appendix C.) A three-point Procedure was numbered with all numbers beginning at the left margin. The three-point Procedure was also a complete list of all steps done in the experiment. If the steps were not clear because they were summarized too much, two points were assigned. One point was assigned if

the steps were too abbreviated to follow or if steps were missing. If the Procedure was missing, out of order or missing many steps, zero points were received.

Data was the next evaluated category. (See Appendix C.) Three points were assigned if the Data section was complete with appropriate units on the tables. A Data section that had a table without appropriate units received two points. One point was assigned to the Data section if some data was missing. Zero points were assigned if the Data section was missing, or not organized in a table or if multiple pieces of data were missing.

The seventh category assessed was the Calculation section. (See Appendix C.) A three-point Calculation section included all formulas that were used in the experiment with the appropriate units and a description of the calculation. For example, a three-point Calculation section for the second lab was: "Average time equals the sum of all times in seconds divided by the number of trials." Two points were assigned to the Calculation section if a formula was given with no explanation of what the formula was. A one-point Calculation section would have some formulas missing. Zero points were assigned if the Calculation section was missing.

The first part of the Conclusion was next to be evaluated. (See Appendix C.) Three points were assigned to this category if all three parts were present: the problem was restated, the hypothesis was restated and the student told whether the hypothesis was correct or incorrect. If one of the three parts was missing, two points were assigned. If two of the three parts were missing, one point was assigned. A zero was given if none of the three required parts of the first part of the Conclusion were present.

The second part of the Conclusion was the ninth section of the lab report to be assessed. (See Appendix C.) If a student explained what happened in the experiment and explained what the data told them, three points were assigned. For example, in the first lab the student first had

to explain that Brand C absorbed more water than Brand A or Brand B. Then the student had to use the price per sheet data to explain that even though Brand C was the most absorbent, Brand B was a better buy because it soaked up more water for the money. Two points were assigned if the student explained most of what happened in the lab but did not go into detail of what the data told. If the student explained which paper towel was the most absorbent in the first lab but did not explain which paper towel was the better buy they received two points. A one sentence Conclusion was assigned one point. "Brand C was the most absorbent because it soaked up the most water." was an example of a one-point Conclusion. Zero points were assigned if this part of the Conclusion was missing or did not explain the data or what happened in the lab.

The tenth category to be evaluated was the Formatting. (See Appendix C.) Three points were assigned if the name of the student was in the upper right hand corner, the title was centered, there were double spaces under each heading and the body was single spaced. If two double spaces were missing under headings or two underlines were missing under headings, two points were assigned. One point was assigned if three to five double spaces or underlines under headings were missing. Zero points were assigned if the Formatting was missing more than five double spaces or underlines under headings or if the lab report was not typed.

Grammar and Spelling was the last category to be assessed. (See Appendix C.) Grammar was assessed for word omissions, subject-verb agreement and word choice. If there was one or no grammatical or spelling errors, three points were assigned to this category. Two spelling and or grammatical errors received two points. Three to five spelling and or grammatical errors were assigned one point. If a student had more than five spelling and or grammatical errors, they received zero points in this category.

After each student's lab report was assessed in each category, the points assigned to each category were recorded under that student's number onto the spreadsheet. This was done for the first lab report and then for the second lab report. The spreadsheets were then compared in each category and in overall points earned on the first lab report and the second lab report.

To answer the research question, Did the use of rubrics in eighth grade science classes improve the quality of lab reports?, forty-four eighth grade students participated in a study in September and October of 2002 in a small, rural school in northwest Ohio. The researcher devised a spreadsheet to record scores in eleven evaluated categories in the lab report. These categories included Title, Problem, Hypothesis, Equipment, Procedure, Data, Calculations, Conclusion Part One, Conclusion Part Two, Format, and Grammar and Spelling. (See Appendix A.) Students completed an experiment in class and were given verbal instructions and visual instructions on the overhead on how to complete their lab reports. The researcher assessed the lab reports in the eleven categories and recorded the scores on the spreadsheet.

Students then completed a second experiment in class. After this experiment they were given examples of a high quality lab report and a poor quality lab report and asked to identity criteria of an excellent lab report in the eleven evaluated categories and criteria of a poor lab report in the eleven assessed categories. Together, the students and the researcher designed a rubric that designated from zero to three points in each of the eleven categories with three points being the maximum score. A rough draft rubric was made from the student and researcher input and given to the students for any corrections or changes. (See Appendix B.) A final draft rubric was given to the students to use when they wrote their second lab report. (See Appendix C.)

The second lab report was evaluated in the eleven categories by the researcher and the scores were recorded on the spreadsheet. The spreadsheet from the first lab report was then compared to the spreadsheet from the second lab report in each category and in overall score.

Chapter IV: Results

The purpose of this study was to determine if the use of a rubric in eighth grade science classes improved the quality of laboratory reports. The problem was that eighth grade science students were having a difficult time writing a clear, concise laboratory report after completing an experiment in class. The research questions were: 1. What were rubrics? 2. What were the advantages of using a rubric? 3. What did the research state about implementing a rubric? 4. Did the use of rubrics in eighth grade science classes improve the quality of lab reports? To answer research question four, Did the use of rubrics in eighth grade science classes improve the quality of lab reports?, a lab report was completed by the students before using a rubric and after using a rubric. The lab reports were evaluated by the researcher in eleven categories and assigned from zero to three points in each category with three points being the highest score.

The first category to be evaluated was the Title. (See Appendix C.) One hundred percent of the students earned three points for the Title in the first lab report. Eighty-six percent of the students earned three points for the Title in the second lab report. The remaining fourteen percent of the students earned two points for the Title on the second lab report. Figure 1 summarizes the data for the Title points earned on the first and second lab reports.

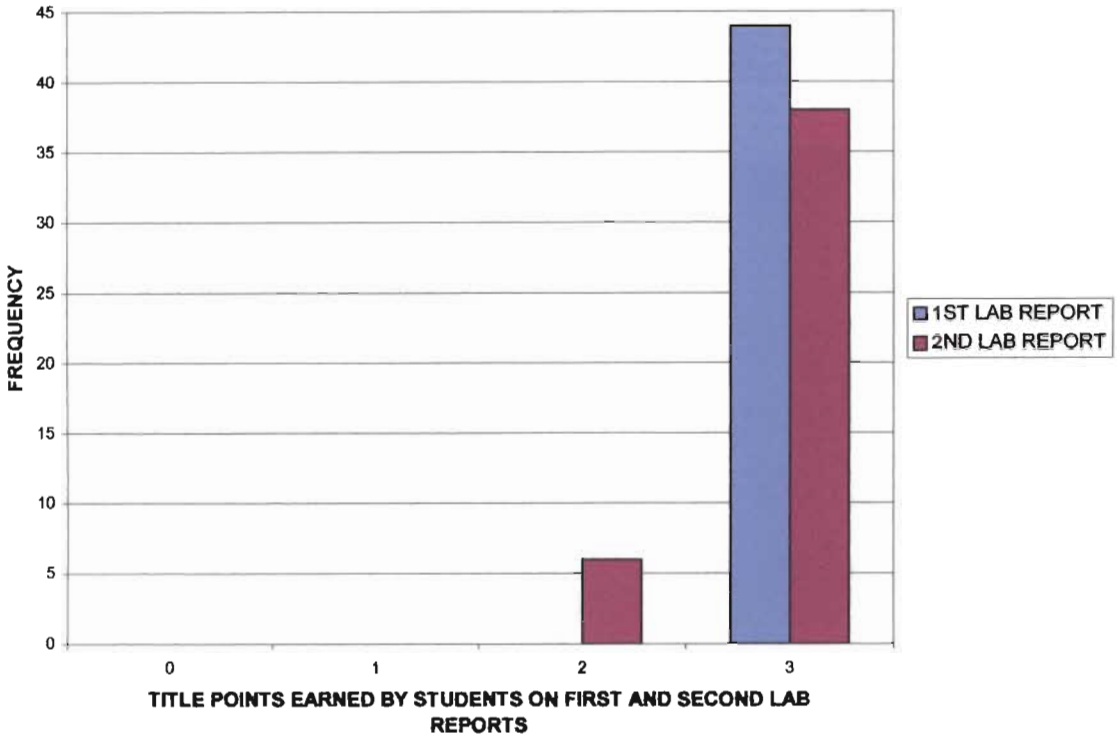

Figure 1. Title Points Earned by Students on First and Second Lab Reports

Figure 1 shows that thirty-eight of the forty-four students, or eighty-six percent, scored three points for the Title on the first and second lab reports. Six students, or fourteen percent, scored two points on the second lab report which was a one-point decrease from the first lab report.

The Problem was the next category assessed on the lab reports. (See Appendix C.) Seventy-seven percent of the students earned three points for the Problem on the first lab report. Twenty percent of the students received two points for the Problem and two percent earned one point for the Problem on the first lab report. Zero percent of the students received zero points for the Problem on the first lab report. For the second lab report, eighty percent of the students earned three points for the Problem while eighteen percent earned two points, two percent earned one point, and zero percent earned zero points. Figure 2 shows the data for the Problem points earned by students on the first and second lab reports.

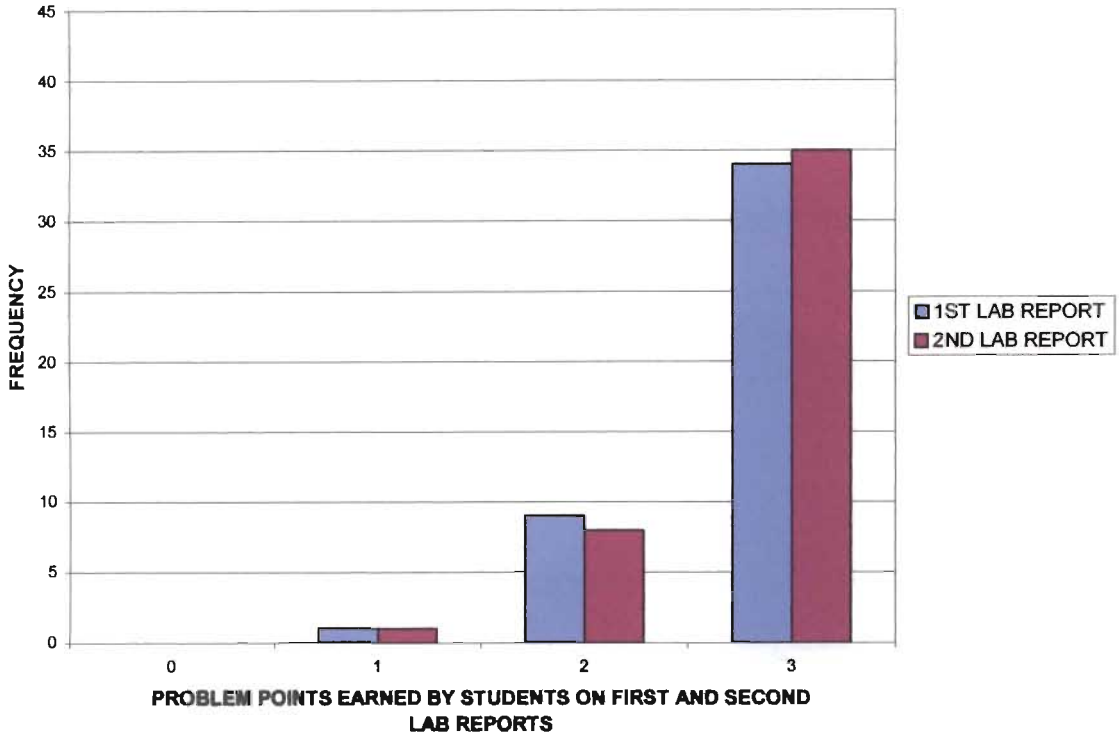

Figure 2. Total Problem Points Earned by Students on First and Second Lab Reports

As seen in Figure 2, six out of forty-four students, or fourteen percent, increased their scores in the Problem section on the second lab report compared to the first lab report. Of those six students, one student, or two percent, increased two points while five students, or eleven percent, increased one point in the Problem section. Thirty-three out of forty-four students, or seventy-five percent, had no change in Problem points from the first lab report to the second lab report. Four out of forty-four students, or nine percent, decreased one point in the Problem section on lab report two compared to the first lab report. One student, or two percent, decreased by two points in the Problem section on the second lab report compared to the first lab report.

The next area to be evaluated was the Hypothesis. (See Appendix C.) On the first lab report eighty-nine percent of the students earned three points on the Hypothesis. Nine percent of the students earned two points, zero percent earned one point, and two percent earned one point for the first lab report Hypothesis. For the second lab report Hypothesis, eighty-four percent of

the students earned three points while eleven percent earned two points, five percent earned one point, and zero percent earned zero points. The data for the Hypotheses on the first and second lab reports is summarized in Figure 3.

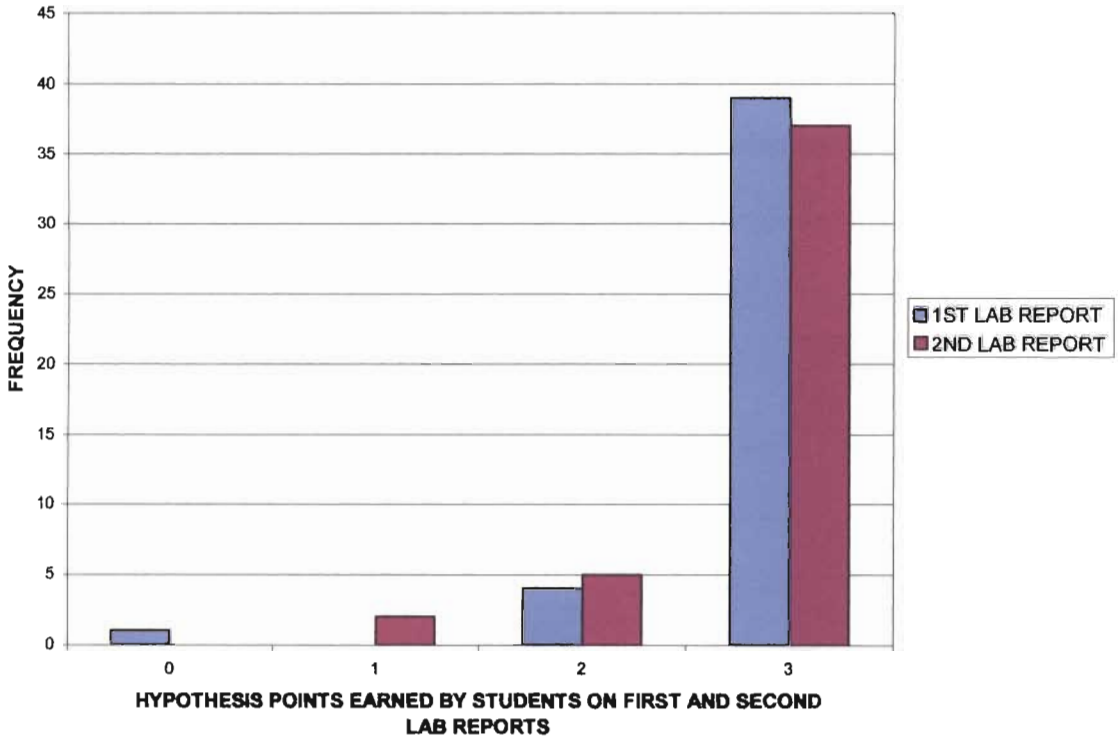

Figure 3. Hypothesis Points Earned by Students on First and Second Lab Reports

As shown in Figure 3, thirty-seven out of forty-four students, or eighty-four percent, scored the same in the Hypothesis section on both the first and second lab reports. Three out of forty-four students, or seven percent, increased one point on the second lab report in the Hypothesis section as compared to the first lab report. Three of the forty-four students, or seven percent, went down one point in the second lab report Hypothesis section as compared to the first lab report. One student, or two percent, decreased by two points in the Hypothesis section from the first to the second lab report.

The Equipment section of the lab reports was then evaluated. (See Appendix C.) Forty-one percent of the students earned three points for the Equipment section of the first lab report.

Two points were received by fifty-four percent of the students and one point was received by five percent of the students. Zero percent of the students received zero points for the Equipment section of the first lab. On the second lab report, ninety-eight percent of the students earned three points for the Equipment section while two percent earned two points. Zero percent of the students earned one or zero points for the Equipment on the second lab report. Figure 4 describes the data earned by students for the Equipment section on the first and second lab reports.

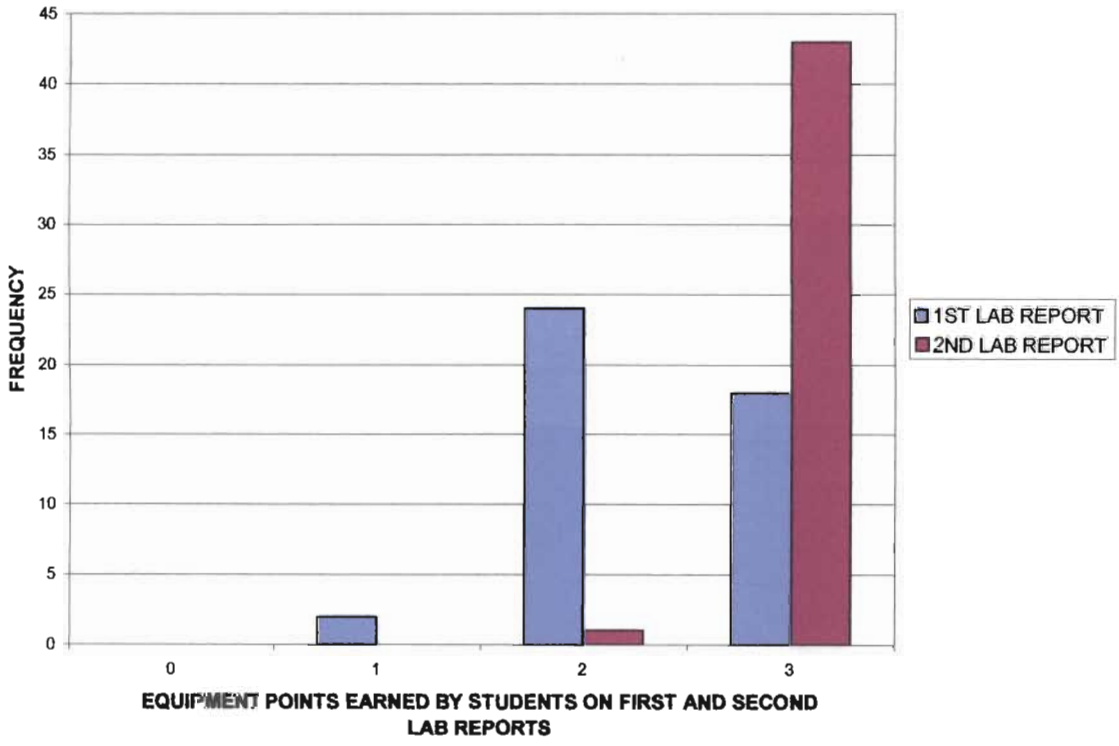

Figure 4. Equipment Points Earned by Students on First and Second Lab Reports

Figure 4 shows that two out of forty-four students, or five percent, increased by two points in the Equipment part of the lab report from the first lab report to the second lab report. In the second lab report, twenty-three out of forty-four students, or fifty-two percent, increased one point in the Equipment section from the first lab report. Nineteen of forty-four students, or forty-

three percent, had scores in the Equipment section that remained unchanged from the first to the second lab report.

The Procedure was the next section to be assessed on the lab report. (See Appendix C.) Seven percent of the students earned three points for the Procedure on the first lab report. Fifty-nine percent earned two points, thirty-two percent earned one point, and two percent earned zero points on the first lab Procedure. For the second lab report, ninety-three percent of the students received three points on the Procedure while five percent received two points, two percent earned one point, and zero percent earned zero points. Figure 5 depicts the data from the Procedure section on the first and second lab reports.

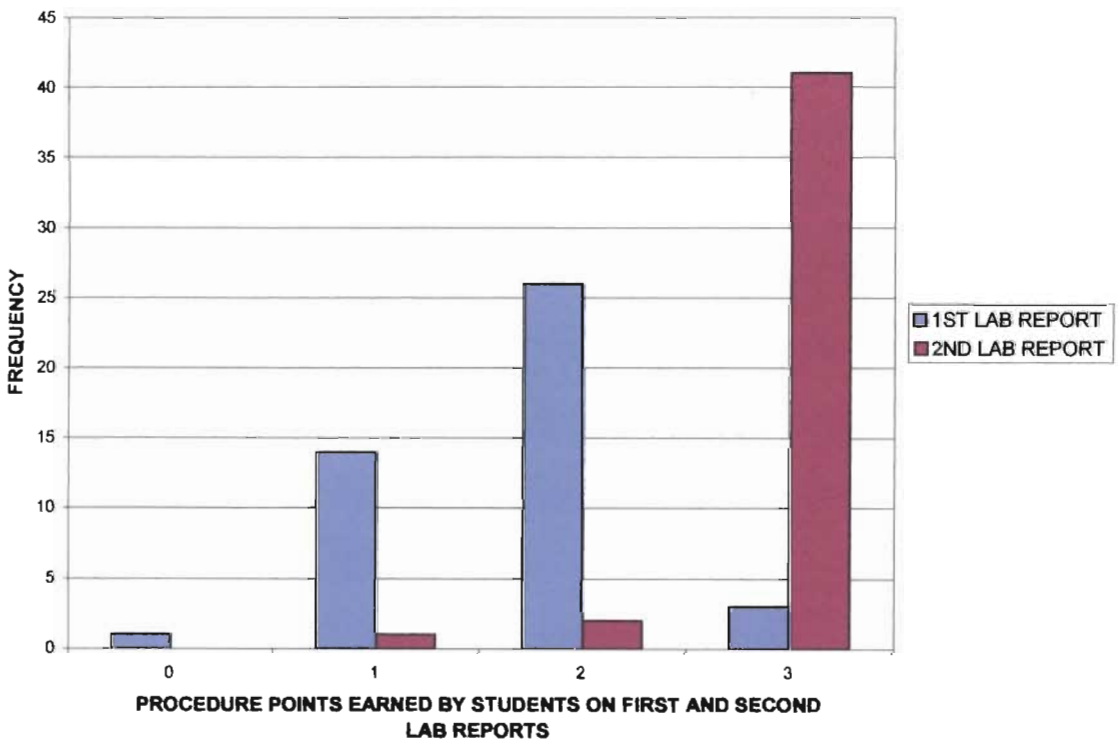

Figure 5. Procedure Points Earned by Students on First and Second Lab Reports

Figure 5 shows that thirty-nine out of forty-four students, or eighty-nine percent, had increased scores in Procedure on the second lab report compared to the first lab report. Of those thirty-nine students, one student, or two percent, increased by three points, thirteen students, or

thirty percent, increased by two points, and twenty-five students, or fifty-seven percent, increased by one point on the Procedure. Figure 5 also shows that four students, or nine percent, had no change in amount of points earned on Procedure from the first lab report to the second lab report. One student, or two percent, decreased in Procedure points on the second lab report compared to the first lab report.

The Data section was next to be evaluated. (See Appendix C.) On the first lab report, eighteen percent of the students earned three points for the Data section. Sixty-one percent of the students earned two points, twenty percent earned one point, and zero percent earned zero points in the Data section. For the second lab report, eighty percent of the students scored three points, twenty percent scored two points, and zero percent scored one or zero points in the Data section. Figure 6 summarizes the results of student Data points for the first and second lab reports.

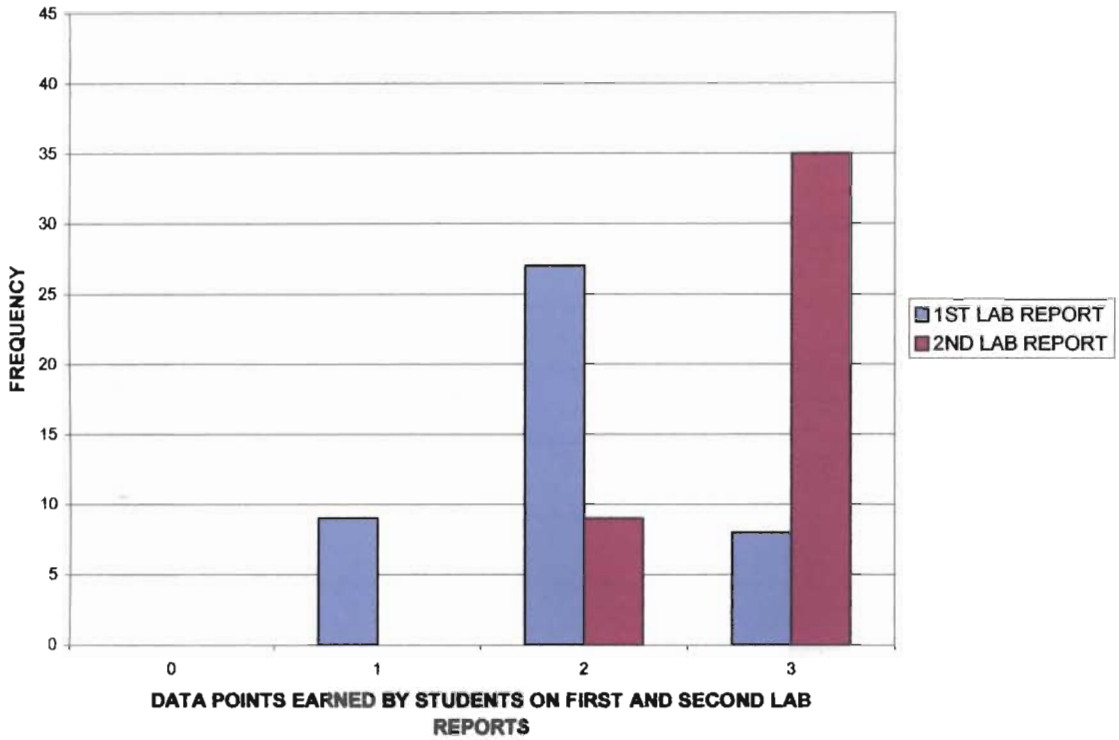

Figure 6. Data Points Earned by Students on First and Second Lab Reports

As shown in Figure 6, five out of forty-four students, or eleven percent, increased by two points in the Data section in the second lab report compared to the first lab report. Twenty-six students of forty-four, or fifty-nine percent, increased their Data points by one and thirteen of forty-four students, or twenty-nine percent, had Data points that remained unchanged in the second lab report compared to the first lab report. No students decreased in Data section points in the second lab report as compared to the first lab report.

Next to be assessed was the Calculations section. (See Appendix C.) On the first lab report, two percent of the students scored a three in the Calculations section. Two percent of the students scored two points and two percent of the students scored one point for Calculations. Ninety-three percent of the students scored zero points in the Calculation section for the first lab report. In the second lab report, eighty-four percent of the students scored three points in Calculations, seven percent of the students scored two points, two percent scored one point, and

seven percent scored zero points. Figure 7 depicts the student data in the Calculation section of the first and second lab reports.

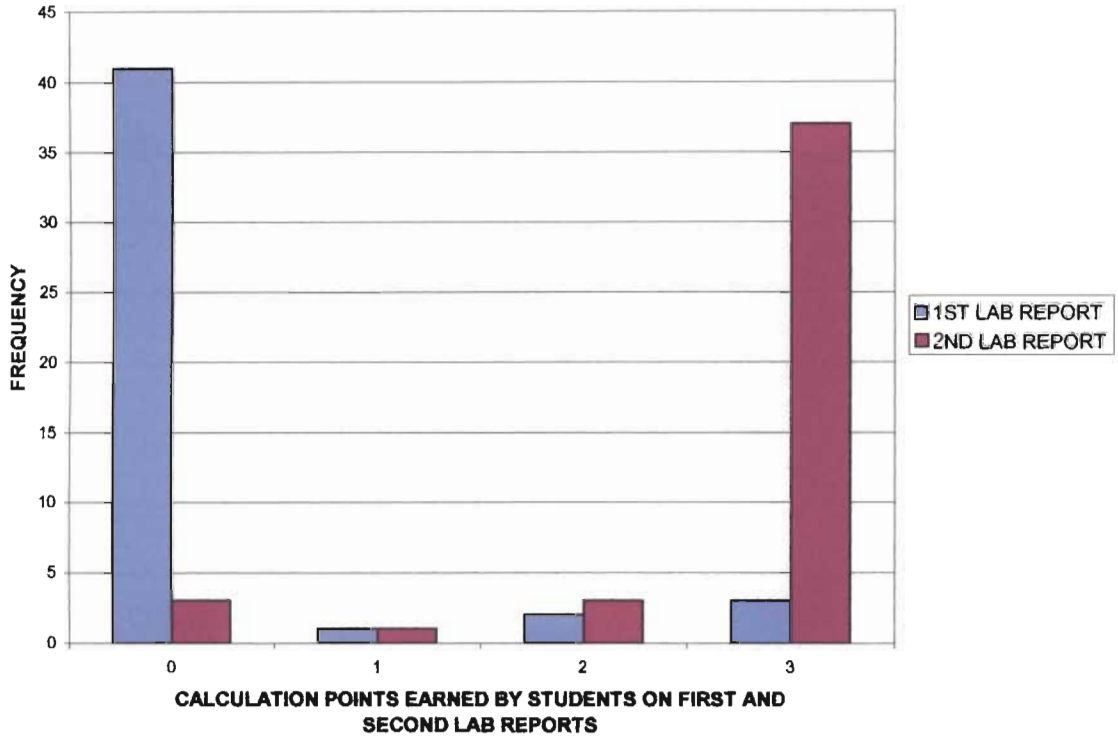

Figure 7. Calculation Points Earned by Students on First and Second Lab Reports

Figure 7 shows that thirty-four of forty-four students, or seventy-seven percent, increased three points in the Calculation section on the second lab report compared to the first lab report. Four students, or nine percent, increased by two points in the Calculation section. Two students, or five percent, increased by one point and four students, or nine percent, increased by zero points in the Calculation section. No students decreased in Calculation points in the second lab report as compared to the first lab report.

The first part of the Conclusion was the next area to be evaluated. (See Appendix C.) On the first lab report, eighty percent of the students earned three points for Part One of the Conclusion. Thirteen percent earned two points, five percent earned one point, and two percent

earned zero points. On the second lab report, ninety-one percent of the students received three points for the first part of the Conclusion, while two percent received two points, five percent received one point, and two percent received zero points. Figure 8 summarizes the students' Part One Conclusion points on the first and second lab reports.

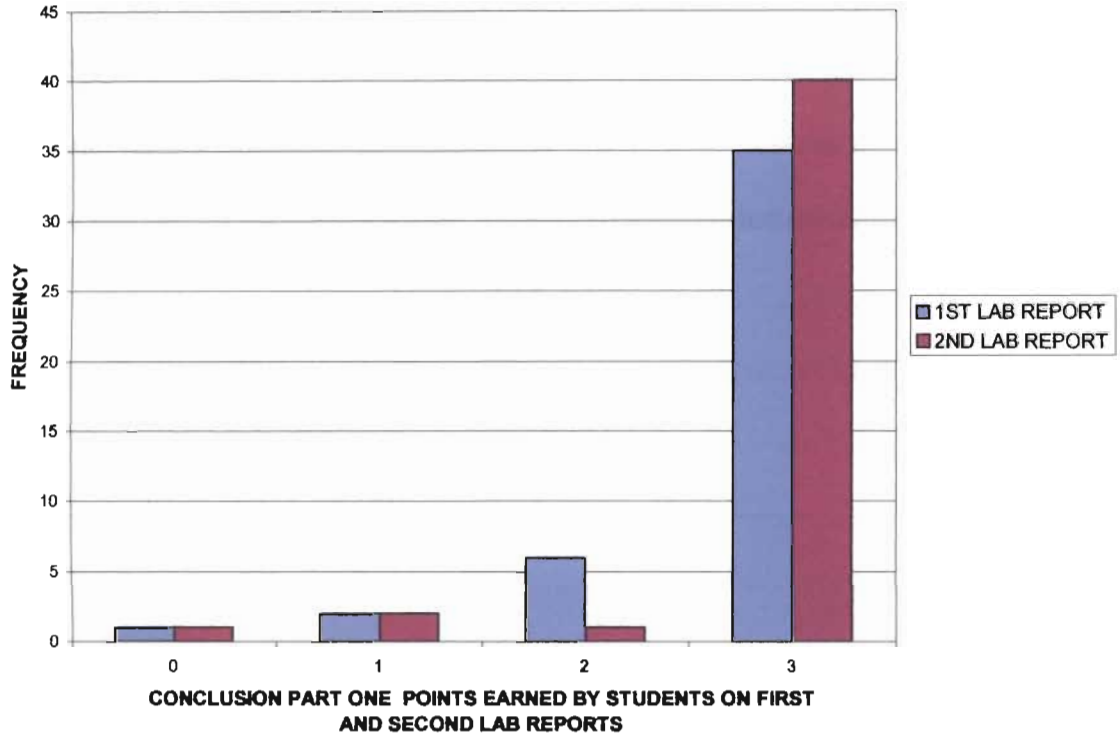

Figure 8. Conclusion Part One Points Earned by Students on First and Second Lab Reports

As Figure 8 shows, one student of forty-four, or two percent, increased three points in Part One Conclusion points on the second lab report compared to the first lab report. One student, or two percent, increased two points, five students, or eleven percent, increased one point, and thirty-four students, or seventy-seven percent, increased zero points in Part One Conclusion points on the second lab report compared to the first lab report. Three students, or seven percent, decreased in Part One Conclusion points in the second lab report as compared to the first lab report. Two of those students, or five percent, decreased by one point and one student, or two percent, decreased by three points in the Part One Conclusion section.

The next assessed area was the second part of the Conclusion. Twenty percent of the students earned three points on the second part of the Conclusion of the first lab report. Twenty-seven percent of the students earned two points, thirty-four percent earned one point, and eighteen percent earned zero points on the first lab report for the second part of the Conclusion. On the second lab report, twenty-five percent of the students received three points on the second part of the Conclusion, while forty-one percent earned two points, eighteen percent earned one point, and sixteen percent earned zero points. Figure 9 that follows summarizes the data from the first and second lab reports for the second part of the Conclusion.

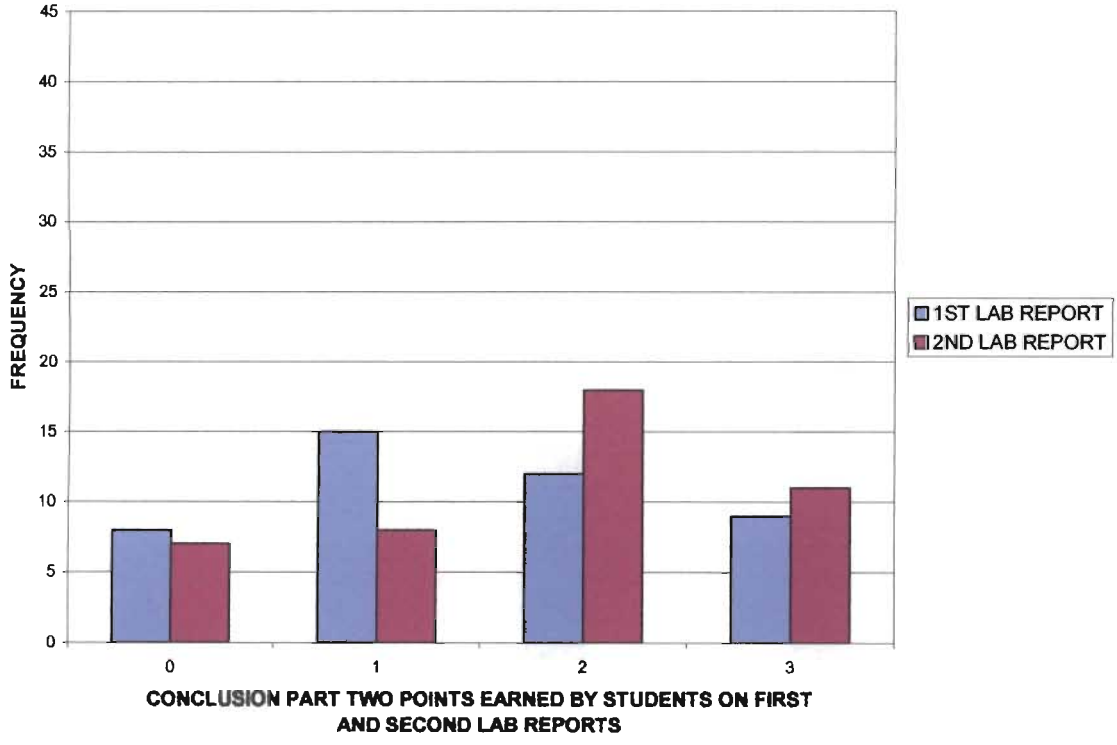

Figure 9. Conclusion Part Two Points Earned by Students on First and Second Lab Reports

As shown by Figure 9, zero percent of the students' Conclusion Part Two scores increased by three points. Ten students' conclusion part two scores, or twenty-three percent, increased two points on the second lab report as compared to the first lab report while eight students, or eighteen percent, increased one point and thirteen students, or twenty-nine percent,

increased zero points. Thirteen students, or twenty-nine percent, earned fewer points on the second part of the Conclusion in lab report two compared to lab report one. Of those thirteen students, ten students' scores, or twenty-three percent, decreased by one point, two students' scores, or five percent, decreased by two points, and one student's score, or two percent, decreased by three points.

Formatting was the next section evaluated on the lab reports. (See Appendix C.) Thirty percent of the students earned three points on Formatting in the first lab report. Sixty-eight percent earned two points, two percent earned one point, and zero percent earned zero points for Formatting the first lab report. On the second lab report ninety-five percent of the students earned three Formatting points, two percent earned two points, two percent earned one point, and zero percent earned zero points. A summary of the formatting data can be seen in Figure 10.

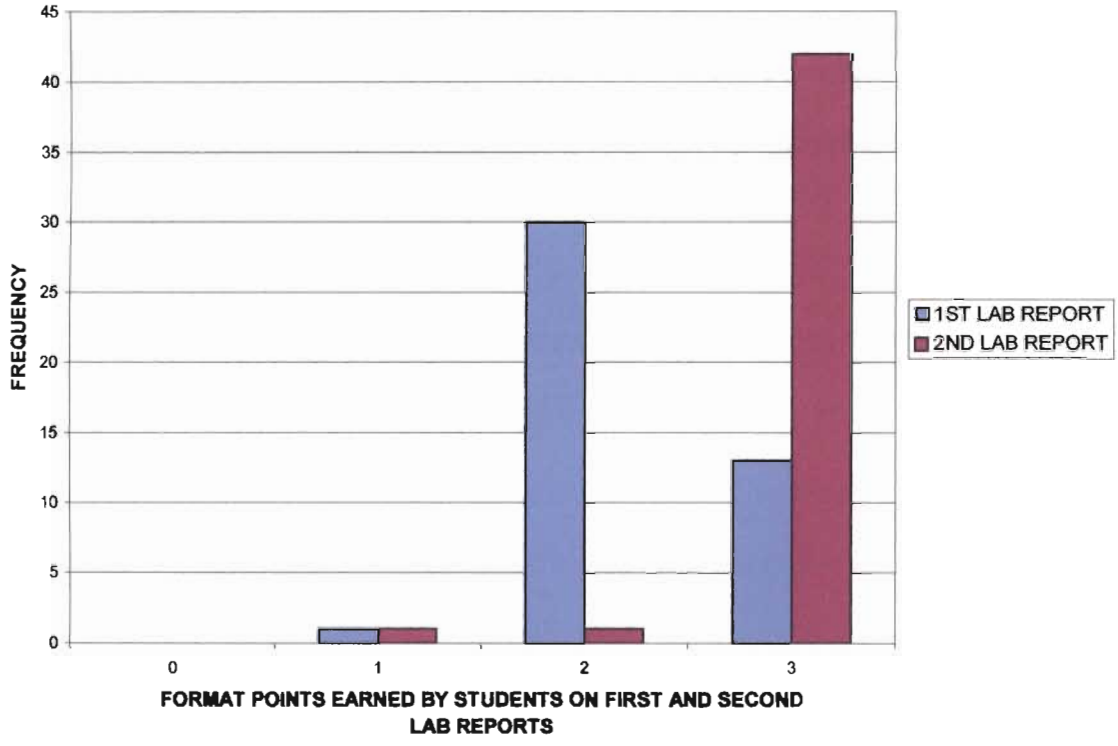

Figure 10. Format Points Earned by Students on First and Second Lab Reports

Figure 10 shows that zero percent of the students improved their scores by three or two points in Formatting from the first lab report compared to the second lab report. Thirty students, or sixty-eight percent, increased their Formatting scores by one point in the second lab report compared to the first lab report. Thirteen students, or thirty percent, increased their score by zero points in the Formatting section of the second lab report compared to the first lab report. One student, or two percent, decreased by one point in Formatting from the first lab report to the second lab report.

The Grammar and Spelling section was the last to be evaluated in the lab reports. (See Appendix C.) Sixty-six percent of the students earned three points in the Grammar and Spelling area of the first lab report. Thirty percent earned two points, four percent earned one point, and zero percent earned zero points on the first lab report for Grammar and Spelling. On the second lab report eighty-nine percent of the students earned three points for Grammar and Spelling while two percent earned two points, seven percent earned one point, and two percent earned zero points. The Grammar and Spelling data for the first and second lab reports is summarized in Figure 11.

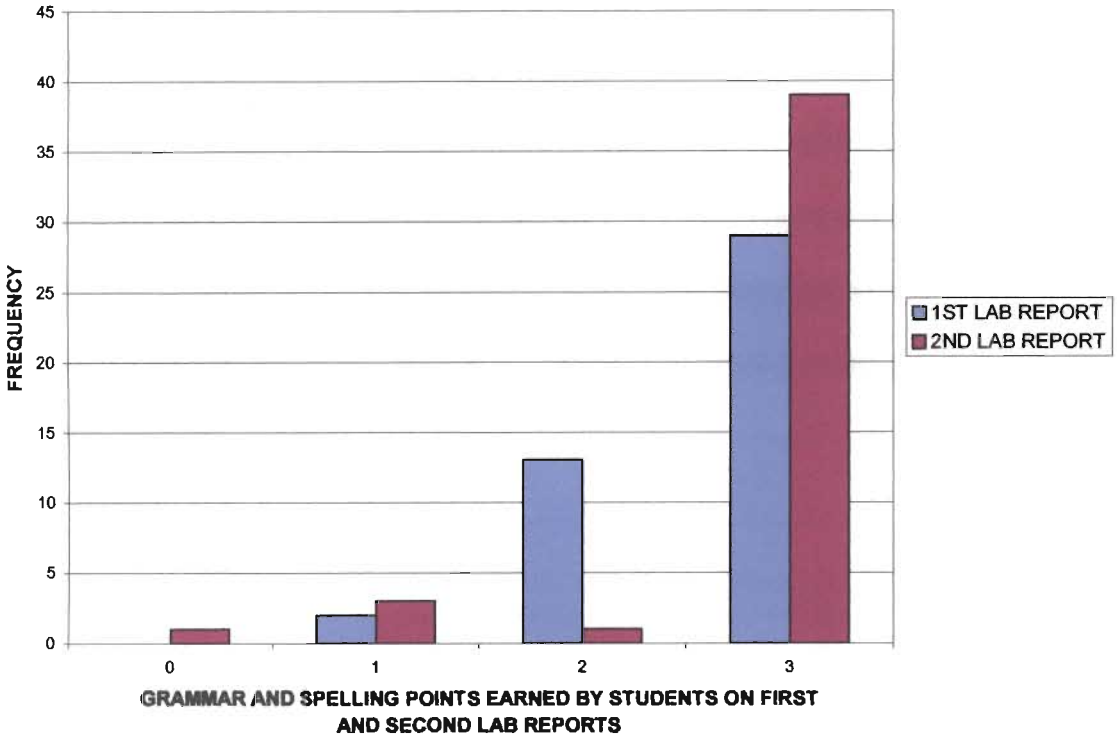

Figure 11. Grammar and Spelling Points Earned by Students on First and Second Lab Reports

The graph shows that twelve students, or twenty-seven percent, increased their Grammar and Spelling scores on the second lab report compared to the first lab report. Of those students that increased their scores, one student, or two percent, increased by two points while eleven students, or twenty-five percent, increased their score by one point. Twenty-eight students, or sixty-four percent, had scores that remained unchanged in Grammar and Spelling on the second lab report compared to the first lab report. Four students, or nine percent, had scores that decreased in Grammar and Spelling on the second lab report as compared to the first lab report. Of those students that decreased in points, two students, or four percent, decreased by one point and two students, or four percent, decreased by two points in Grammar and Spelling.

Finally, the total points earned on the first and second lab reports were compared. On the first lab report the range of scores was from eighteen to twenty-nine points with thirty-three total available points. The range was equivalent to fifty-four percent to eighty-eight percent on the

first lab report. The mean for the first lab report was twenty-four points or seventy-three percent. The second lab report scores ranged from twenty-two to thirty-three points with thirty-three points possible. This was equivalent to sixty-seven percent to one hundred percent for the range on the second lab report. The mean score on the second lab report was thirty points or ninety-one percent. The mean score increased by six points or eighteen percent on the second lab report compared to the first lab report. Figure 12 summarizes the total points data from the first and second lab reports.

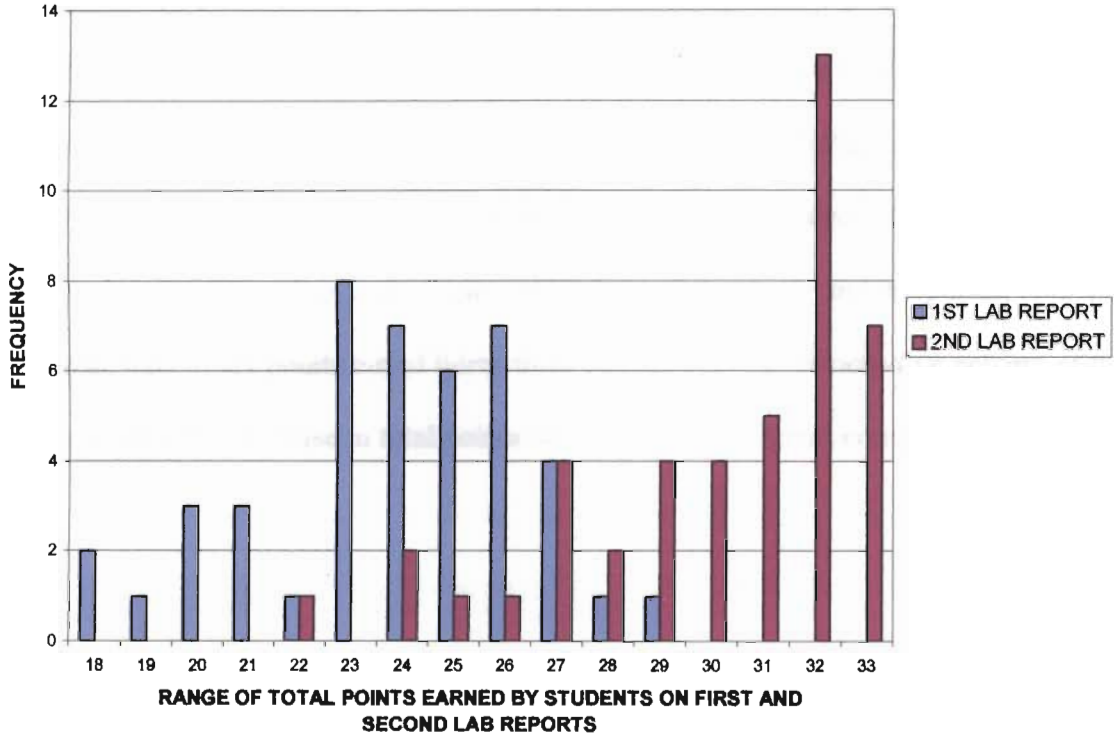

Figure 12. Range of Total Points Earned by Students on First and Second Lab Reports

As Figure 12 shows, forty-two students, or ninety-five percent, increased their total scores on the second lab report compared to the first lab report. The range of increases were from one point to twelve points which translated to an increase from three percentage points to thirty-six percentage points. One student, or two percent, had no change in their score from the first lab report to the second lab report. One student's score, or two percent, decreased by two

points or six percentage points. Overall the mean change per student from lab report one to lab report two was six points or eighteen percentage points.

In summary, to answer research question four, Did the use of rubrics in eighth grade science classes improve the quality of lab reports?, a lab report was completed by students before they had a rubric and then after using a rubric. The lab reports were evaluated by the researcher in eleven categories which were Title, Problem, Hypothesis, Equipment, Procedure, Data, Calculations, Conclusion Part One, Conclusion Part Two, Format, and Grammar and Spelling. (See Appendix C.)

Students made overall gains in points in the Problem section, Equipment section, Procedure section, Data section, Calculations section, Conclusion Part One section, Conclusion Part Two section, Format section, and Grammar and Spelling section. (See Appendix C.) Students decreased in points in the Title and Hypothesis sections. In total points, students made an average gain of six points out of thirty-three possible points. Ninety-five percent of the students showed an increase in total points on the second lab report compared to the first lab report.

Chapter V: Discussion

The purpose of this study was to determine if the use of rubrics in eighth grade science classes improved the quality of laboratory reports. The problem was eighth grade science students were having a difficult time writing a clear, concise lab report after completing an experiment in class. They especially had difficulty with formatting the lab report correctly and writing conclusions correctly. It was the researcher's hypothesis that if a rubric was designed by the researcher and the students that listed all of the requirements of the lab report with points assigned to each category that the quality of the eighth grade students' lab reports would improve. The research questions were: 1. What were rubrics? 2. What were the advantages of using a rubric? 3. What did the research state about implementing a rubric? 4. Did the use of rubrics in eighth grade science classes improve the quality of lab reports?

Discussion

Students had a difficult time understanding what was required when writing a lab report for the first time. Even when verbal and visual directions were given, they did not write complete, quality lab reports. Providing students with an example of a high quality and poor quality lab report helped them to identify criteria to create a rubric and also helped them create higher quality lab reports.

When the rubric was prepared with the students, it was difficult for the students to identity criteria for the two points and one-point columns for each of the categories. They had no problem identifying the highest three points column and the lowest zero points columns but the ones in the middle the researcher had to offer prompts. Once the prompts were given for the two points and one-point columns, the students were able to give more input. For example, on Grammar and Spelling the students came up with the number of grammar and spelling errors for

each point designation. On some categories, qualifiers like some and more were used because of the nature of experiments. Data and Calculations, for example, can vary by experiment in quantity so specific numbers such as one data missing could not be used in each category to assign points.

The rubric provided additional benefits to the researcher. The use of the rubric made scoring the lab reports less subjective for the researcher. With each section broken down into four quality descriptors, points assigned were also more consistent when using the rubric.

Students overall scores increased in nine of the eleven evaluated categories. Even though there were some students that decreased in points in these categories the majority increased in points for an overall net increase in these categories.

A small percentage of students, fourteen percent, decreased by one point in the Title section. The second lab report dealt with waves and coiled springs were used. It is the researcher's opinion that the students were caught up in the fact that a Slinky was used and forgot to write that waves were part of the title also. In the Hypothesis section there was also a net decrease of overall points on the second lab report compared to the first lab report. Again, the percentage of students was small, nine percent, that had a decrease in Hypothesis points. For the second lab report a three-point hypothesis was lengthy and some students stopped with just telling which wave they thought would be faster and did not give a reason why. This resulted in a decrease from three points to two points in the Hypothesis section.

The largest increase of points was in the Calculations section. In the first lab report, ninety-three percent of the students omitted this section. Even after verbal and visual explanation, it is the researcher's opinion that the students thought the Data section was the same as the Calculations section. They did not understand that the Calculations section included all

formulas used to compute the data written out in words. On the second lab report, ninety-one percent of the students included the Calculations section.

Intermediate overall gains were made in the Equipment section, Procedure section, Data section, Conclusion Part One section, Conclusion Part Two section, Format section, and Grammar and Spelling section. It is the researcher's opinion that after creating and using the rubric students were more aware of the requirements in each section and were more careful to include those requirements.

Overall total points increased an average of six points per student out of a possible thirty-three points. This translated to an increase of eighteen percentage points which is an increase of one to two letter grades on the ten point grading scale used by the researcher.

The two main areas of concern that the researcher had at the beginning of the project were the format and conclusion of the lab report. The students performed better in the Format section of the lab report than expected by the researcher. Ninety-eight percent of the students scored three points or two points on the Format section of the first lab report with a higher percentage of students scoring two points. On the second lab report, ninety-seven percent of the students scored three points or two points on the Format section with a higher percentage of students scoring three points than two points. It is the opinion of the researcher that the examples of lab reports that were given to the students when the rubric rough draft was prepared gave the students visual cues on how to format the lab reports. The verbal directions that were given several times and discussed when the rubric rough draft was created reinforced the format requirements. For the Format section, visual and verbal directions were enough to reinforce what was required.

The students also performed better than expected by the researcher on the first part of the Conclusion. On the first lab report, eighty percent of the students scored three points in the Conclusion Part One section. Ninety-one percent scored three points on the Conclusion Part One section of the second lab report. In the researcher's opinion this increase is statistically large enough to attribute the gain to the use of the rubric.

The most difficult part of the lab report was the second part of the Conclusion. This was where students had to make inferences based on the data they collected during the experiment. In this section increases were made in the two and three points categories. On the first lab report, twenty percent of the students scored three points on the Conclusion Part Two section while twenty-five percent of the students scored three points in this section on the second lab report. Twenty-seven percent of the students scored two points on the Conclusion Part Two section of the first lab report compared to forty-one percent on the second lab report. Decreases were made in the one and zero points categories. Thirty-four percent of the students scored one Conclusion Part Two point on the first lab report while only eighteen percent of the students scored one Conclusion Part Two point on the second lab report. Students scoring zero percent in this section decreased from eighteen percent on the first lab report to sixteen percent on the second lab report. Overall there was a net gain in part two Conclusion points but the mean change per student was only one third of a point or one percentage point. This part of the lab report required the students to think about what happened during the lab. This was the only part of the lab report that is not concrete and required abstract thought. For example, in the paper towel lab students had to realize that they had to use the price and absorbency to interpret which paper towel was the most absorbent for the money. It is the researcher's opinion that students improved in this

area through the use of creating and using the rubric. However, this is an area that the researcher will have to continue to emphasize to prompt students' thinking.

Summary

The purpose of this study was to determine if the use of rubrics in eighth grade science classes improved the quality of lab reports. The research questions were: 1. What were rubrics? 2. What were the advantages of using a rubric? 3. What did the research state about implementing a rubric? 4. Did the use of rubrics in eighth grade science classes improve the quality of laboratory reports? To answer research question four, Did the use of rubrics in eight grade science classes improve the quality of laboratory reports?, forty-four eighth grade students participated in a study in September and October of 2002. The study took place in a small, rural school in northwest Ohio. The researcher devised a spreadsheet (See Appendix A) to record scores in eleven evaluated categories in the lab report. These categories included Title, Problem, Hypothesis, Equipment, Procedure, Data, Calculations, Conclusion Part One, Conclusion Part Two, Format, and Grammar and Spelling. (See Appendix C.) Students completed an experiment in class and were given verbal instructions and visual instructions on the overhead on how to complete their lab reports. The researcher assigned from zero to three points with three being the maximum available to each of the eleven categories in the lab report and recorded the scores on the spreadsheet.

Students then completed a second experiment in class. After this experiment, students were given an example of a high quality lab report and a poor quality lab report, both devised by the researcher. Students were asked to work in groups to identify criteria of a high quality lab report and criteria of a poor quality lab report in the eleven categories. Together, the students and researcher devised a rubric that designated from zero to three points in each of the eleven

categories with three points being the maximum score. A rough draft rubric was made from the student and researcher input and given to students for any corrections or changes. (See Appendix B.) A final draft rubric was given to students to use when they wrote their second lab report. (See Appendix C.)

The researcher evaluated the second lab report and the scores were recorded on the spreadsheet. The spreadsheet from the first lab report was then compared to the spreadsheet from the second lab report in each category and in overall score.

Students made overall gains in points in the Problem section, Equipment section, Procedure section, Data section, Calculations section, Conclusion Part One section, Conclusion Part Two section, Format section, and Grammar and Spelling section. Students decreased in points in the Title and Hypothesis sections. In total points, students made an average gain of six points out of thirty-three possible points or eighteen percentage points. After using the rubric, ninety-five percent of the students showed an increase in total points on the second lab report compared to the first lab report.

Recommendations

The researcher made several recommendations to improve this study. One recommendation was to put a copy of a generic, high quality lab report on the back of the rubric so that students could refer to both when writing their lab reports. This would make an easy visual for the students to quickly see the sequence of the lab report and the correct format of the lab report.

Another recommendation was to increase the number of lab reports that would be included in the study. The researcher recommended an increase in the number of lab reports done before using the rubric and after using the rubric. This would increase the amount of data

available and would make results more statistically valid. Having several teachers participate in the study with their students would also increase the amount of data and therefore the statistical validity of the study.

Portfolio assessment was another recommendation to improve the study. Students would keep a portfolio of all of their lab reports. This portfolio would be a visual for students, parents and the researcher to see improvement in lab reports after using the rubric. These portfolios could be used at parent-teacher conferences to show student progress.

Recommendation for further study would be to devise a method that would interpret student's reactions to the use of the rubric. Students could be given a self-evaluation scoring sheet with all eleven evaluated lab report categories and asked to circle from three to zero with three being the highest number of points available for each category. They could be given this evaluation form for an assignment before using a rubric and after using a rubric and the forms could be compared. Also, a questionnaire could be generated to determine if students felt using the rubric made the assignment easier, and if so, how. Questions could also be added to this questionnaire to determine if students felt their input was important in creating the rubric.

In conclusion, recommendations to improve the study include providing a copy of a generic, high quality lab report on the back of the rubric page for the students to reference. Increasing the amount of data included would increase the statistical validity of the study. This could be done by including more lab reports both before and after using the rubric and or including more teachers and students in the study. The final recommendation to improve the study would be to include portfolio assessment. The portfolio would provide visual confirmation to students, parents and the researcher of improvement on lab reports. The researcher's

recommendation for further study was to devise a method to interpret the student's reactions to creating and using the rubric.

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Appendix A

Lab Report Score Sheet

Student #	Title	Problem	Hypoth.	Equip.	Proced.	Data	Calc.	Conc. 1	Conc. 2	Format	Grammar/Spell
1											
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Appendix B

Lab Report Rubric Rough Draft

	3	2	1	0
le	Title pertains to lab with detail	Title pertains to lab	Title has words from lab	Title missing or has nothing to do with lab
blem	A question that tells what the lab is trying to solve ends with a ?	Tells what the lab is trying to do but doesn't end with a ? mark	Does not tell clearly what expt. is trying to solve, not a ?	Problem missing or has nothing to do with lab
pothesis	A guess about what will happen in the lab with a reason	A guess about what will happen in the lab with no reason OR starts with I think	Gives conclusion instead of a guess of what would happen	Hypothesis missing or has nothing to do with lab
ipment	A vertical list of all equipment used and how much	Missing 1 equip. or missing quantities	Missing 2 equip.	Equipment missing or missing 3 or more pieces of equipment
cedure	A complete list that anyone could follow. Numbered with each number starting at left margin	Steps not perfectly clear because they were summarized too much	Too abbreviated to follow	Procedure missing, not in order, missing 3 or more steps
ta	Complete with units on tables, charts & graphs	Missing units	Some data missing	Data missing, not organized into table, graph or chart
culations	All formulas used in lab are listed with units, description	Formulas listed with no explanation	Some formulas missing	Calculations missing
nclusion t 1	Problem restated & hypothesis restated & tell whether hypo. right or wrong.	Problem & hypo. restated, OR hypo. & right/wrong, OR problem & right/wrong	Problem restated OR hypo. restated OR hypo. right/ wrong	Problem, hypothesis not restated, does not tell whether hypothesis is right or wrong
nclusion t 2	Explain what happened in lab, explain data and what it tells	Explains most of what happened in lab & data, no detail of what data tells	One sentence conclusion of lab, all data not explained	Does not explain what happened in lab, does not explain data
mat	Names upper rt. corner, title centered, double space under headings, body single spaced	2 double spacings under headings missing or 2 underlines missing	3-5 double spacings under headings missing or 3-5 underlines under headings missing	Formatting very messy, headings not underlined, no double spacings between headings, body not single spaced and not at left margin
mmar/ lling	No spelling or grammar errors	2 spelling/grammar errors	3-5 spelling/ grammar errors	Many spelling/grammar errors

Appendix C

Lab Report Rubric Final Draft

	3	2	1	0
le	Title pertains to lab with detail	Title pertains to lab	Title has words from lab	Title missing or has nothing to do with lab
blem	A question that tells what the lab is trying to solve ends with a ?	Tells what the lab is trying to do but doesn't end with a ? mark	Does not tell clearly what expt. is trying to solve, not a ?	Problem missing or has nothing to do with lab
pothesis	A guess about what will happen in the lab with a reason	A guess about what will happen in the lab with no reason OR starts with I think	Gives conclusion instead of a guess of what would happen	Hypothesis missing or has nothing to do with lab
ipment	A vertical list of all equipment used and how much	Missing 1 equip. or missing quantities	Missing 2 equip.	Equipment missing or missing 3 or more pieces of equipment
cedure	A complete list that anyone could follow. Numbered with each number starting at left margin	Steps not perfectly clear because they were summarized too much	Too abbreviated to follow, missing 1-2 steps	Procedure missing, not in order, missing 3 or more steps
ta	Complete with units on tables, charts & graphs	Missing units	1-2 pieces of data missing	3 or more pieces of data missing, not organized into table, graph or chart
culations	All formulas used in lab are listed with units, description	Formulas listed with no explanation	Some formulas missing	Calculations missing
nclusion t 1	Problem restated & hypothesis restated & tell whether hypo. right or wrong.	Problem & hypo. restated, OR hypo. & right/wrong, OR problem & right/wrong	Problem restated OR hypo. restated OR hypo. right/ wrong	Problem, hypothesis not restated, does not tell whether hypothesis is right or wrong
nclusion t 2	Explain what happened in lab, explain data and what it tells	Explains most of what happened in lab & data, no detail of what data tells	One sentence conclusion of lab, all data not explained	Does not explain what happened in lab, does not explain data
mat	Names upper rt. corner, title centered, double space under headings, body single spaced	2 double spacings under headings missing or 2 underlines missing	3-5 double spacings under headings missing or 3-5 underlines under headings missing	Formatting very messy, headings not underlined, no double spacings between headings, body not single spaced and not at left margin
mmar/ lling	No spelling or grammar errors	2 spelling/grammar errors	3-5 spelling/ grammar errors	6 or more spelling/grammar errors