

THE EFFECTS OF AN INQUIRY-BASED  
TRAINING PROGRAM ON TEACHERS'  
TEACHING STYLES

MASTER'S PROJECT

Submitted to the School of Education  
University of Dayton, in Partial Fulfillment  
of the Requirements for the Degree  
Master of Science in Education

by

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Official Advisor

## ACKNOWLEDGEMENTS

This project is dedicated to my husband, Mark, who encouraged me to finish what I had started; and to my daughter, Missy, and my son, Mark, who wanted to spend more time with me when I was working on my project. Thank you for your love and patience.

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## CHAPTER I

### INTRODUCTION

#### Purpose of the Study

Science instruction in the United States has undergone some drastic changes in the last few years. One of these changes that has begun to attract quite a bit of attention lately is the inquiry-based method of instruction, a method that uses hands-on activities to guide students to discover answers themselves rather than the teacher or the text giving students the answers.

Inquiry-oriented instruction continues to receive considerable attention from science education reform documents. Both the National Research Council(NRC,1994) and the American Association for the Advancement of Science (AAAS,1994) have devoted a significant portion of text to inquiry-oriented curriculum and instruction (Flick,1995).

Science education has traditionally been that of lecturing and textbook teaching. In these methods, students are exposed to large quantities of material and can parrot back what they have been taught, but they do not necessarily understand the concepts. Even on standardized tests, which emphasize recall over reasoning, student achievement has been less than adequate because of the lack of understanding concepts. According to the most recent data from the National Assessment of Educational Progress, scores have been steadily dropping compared to 1969-70. The average (science) achievement in 1992 was higher at age 9, essentially the same at age 13, and lower at age 17 (Willis,1995).

Many students are bored with the traditional style of teaching science. They are faced with vocabulary that is often difficult to understand and concepts that are even harder to conceptualize without real-world experience. Students lose interest in science and our nation loses potential scientists, inventors, and mathematicians. Faced with these problems, the science education community is working zealously to reform itself. Major organizations—such as the National Science Foundation (NSF), the National Science Teachers Association (NSTA), the American Association for the Advancement of Science (AASS), and the National Academy of Sciences—are vigorously promoting hands-on, inquiry-based activities.

Students are not the only ones frustrated with the way science is taught. A large number of teachers have relied on the textbook all these years because they also concede to a lack of fundamental understanding of the concepts taught in science. Perhaps this is because of the way they were taught themselves. Recently, teachers across the nation have been taking advantage of hands-on, inquiry-based training programs that are being offered. One such program in Ohio is Project Discovery. This is a statewide systematic initiative, funded by the National Science Foundation and the state of Ohio to improve the teaching of science and mathematics. Research into the effects of such a program is useful in determining the success of such a drastic change in teaching styles. Success in teaching material through inquiry could prove that students learn easier and retain more through this type of hands-on, inquiry based teaching method.

## Reforms in Teaching

Major organizations such as the National Science Foundation (NSF), the National Science Teachers Association (NSTA), the American Association for the Advancement of Science (AAAS), and the National Academy of Sciences-are vigorously promoting reforms in science education. Strong themes in the reform literature include:

- Learning of concepts should be emphasized over memorization of terms and facts.
- Students should have ample opportunities for hands-on learning. Concrete experiences with actual phenomena should precede more abstract lessons.
- Science instruction should be inquiry-based, at least in part. Students should have opportunities to pose their own question, design and pursue their own investigations, analyze data, and present their findings.
- Teachers should explain concepts thoroughly before introducing the terminology associated with them, to ensure real understanding rather than parroting.
- Teachers should teach fewer concepts, in greater depth, rather than covering a great many topics superficially. (“Less is more.”)
- Students should have opportunities to apply science knowledge and to make connections between what they learn and their everyday lives.
- Teachers should build on students’ prior understandings and prod them to rethink their misconceptions.
- All students should become science literate, not just the college-bound. Schools should prepare science-literate citizens, not just future scientists.
- Educators should begin to integrate the various science disciplines (biology, chemistry, physics), as well as integrating science with other subject areas (Willis,1995).

## Concerns of the New Reforms

Although many teachers know the hands-on, inquiry-based teaching standards put forth by the national science organizations are effective with students, many have reservations regarding implementation. A concern about the time consuming task of putting together inquiry lessons and the need for lots of consumable materials that small

science budgets cannot finance make some teachers hesitant to be enthusiastic about this approach to learning. Other teachers are concerned with the amount of curriculum that they are already responsible for teaching. They fear that they will not be able to cover all of these objectives if they have to spend a great amount of time teaching topics in depth and re-teaching to correct misconceptions that some students have learned. High school teachers are reluctant to change because they still feel accountable to colleges and universities so they are under pressure to prepare students for college with a vast storage of facts, definitions, and tables memorized. Still another concern is the fact that some teachers are not confident in their ability to teach some of the content areas in science and they cling to the textbook and worksheets for security. Since hands-on , inquiry- based leaning sometimes seems noisy and disorderly, many teachers are concerned with how it might “look” when other teachers and administrators pass by their classroom. They are concerned that they will be thought of as not having good control of their classes.

Inquiry involves a major change in thinking for most educators. The major adjustment is the concept of inquiry itself, not the traditional content areas. (Short and Burke, 1996). If educators truly believed this there would not be so many concerns with the amount of content taught, however superficially, but with the depth of the content taught. Students would not have a large amount of facts and figures floating around in their head with no idea of how they relate to other things; and students would learn how to find the answers to questions themselves without being told the information that has been pre-arranged for them to learn. They would venture farther on their own to discover answers to possible questions that have not been asked yet. When students are able to do



this, they can be considered true life-long learners; and when they are life-long learners, we will not have to worry about whether our country has enough scientists or inventors because the love of learning for learning's sake will guide many students into a field where they will continue asking questions and trying to find answers.

### Attitudes Concerning Hands-on, Inquiry-based Teaching

Many teachers are excited about this new way of teaching despite some of the concerns others may have with time, organization, and material. A 1993 National Survey of Science and Mathematical Education conducted by Horizon Research, Inc., with funding from the National Science Foundation asked approximately 6,000 U.S. teachers of math and science in grades 1-12 about their training, pedagogical beliefs, and instructional practices:

- Nearly all teachers believe hands-on activities should be part of science instruction.
- Most teachers believe that science instruction should provide students with concrete experiences before exposing them to abstract treatments. About 84 percent of high school teachers, and more than 90 percent of teachers at other levels, hold this view.
- Most teachers believe that students learn best when they study science in the context of personal or social applications. More than 90 percent of teachers at the elementary and middle school levels hold this view, as do 86 percent of teachers at the high school level.
- Most teachers support the use of cooperative learning in science classes. More than 80 percent of teachers at the high school level, and more than 90 percent of teachers at other levels, hold this view (Weiss, 1993).

### Problem Statement

The purpose of this study is to determine whether teachers have changed their teaching style to a more hands-on, inquiry-based method of teaching after being trained in an inquiry-based program of Project Discovery.

### Assumptions

In order to conduct this study a survey was used to gain information from teachers trained in an inquiry-based teaching program, entitled Project Discovery. The survey was used to gather and analyze teacher response data on teaching styles before and after the training. The author assumes the survey obtained the necessary information needed to complete the study and that the study was reliable. The author also assumes the participants answered honestly.

### Limitations

The study was limited to teachers who participated in Project Discovery from Ohio between 1993 and 1996. Furthermore, the study was limited geographically to the Dayton area. Teachers who participated in the study took part in the math, life science or physics portions of Project Discovery.

### Definitions

Inquiry-based teaching is a philosophy of education that states that students learn significantly easier and retain more by discovering answers for themselves through concrete experiences incorporating hands-on, cooperative learning.

Project Discovery Training Program is a program offered to educators that teaches teachers how to teach in an inquiry-based, hands-on style. The program holds sessions in math, life science, and physics. Through intense hands-on, cooperative learning, teachers not only learn concepts in these areas, but how to teach using this approach. The program consists of three or six week sessions, five days per week, for approximately seven hours

per day. Students are required to take chapter tests, as well as pretests and posttests to determine how much they learned over the course. Students are also required to demonstrate lessons in an inquiry-based method.

## CHAPTER II

### REVIEW OF LITERATURE

#### Reasons for a Hands-on, Inquiry-based Program

For years teachers have taught science through lecturing and relying heavily on textbooks. Students have been made to read chapters, memorize information, and recite this information back on tests for the teacher, all in an effort to prove that the student had learned the material. This method of teaching known widely as the read-recite-discuss method of instruction is the most widely used science instruction method in the United States today as stated by Mechling and Oliver (1983). Students become bored easily with these methods and soon lose interest in science. Some students stop taking science courses at the first opportunity. As students progress through high school, the number enrolled in science classes drops by roughly half each year, experts say (Willis, 1995).

Recently, it has come to the attention of the science education community that these methods need to be changed in order for our students to compete with the rest of the world. Perhaps the launching of Sputnik in 1957 was the first wake up call for Americans to reevaluate our science program and how it is being taught. Since the Sputnik era, where the emphasis was placed on creating scientists and engineers, science education has gone through more reforms. A collaborative goal set forth in 1990 by educators, government officials, and chief scientific officers was to have “scientific literacy” by the year 2000 (Education Week, 1990). In order for this to occur, changes will have to be made in the way teachers are presenting material to all students.

In the past, science education has been presented as a body of knowledge to be absorbed, rather than a process of inquiry and a way to make sense of our world

(Willis,1995). This type of thinking has given science a bad reputation among students. Science classes are looked upon as being “hard” to understand by students. If prior knowledge has not been mastered then it is difficult for many to understand the concepts being taught. When the first opportunity arises for students to drop science classes from their school schedules, many of them do, and who can blame them? Wolkomir (1993) states that because of the instructional style being used in the United States, American students’ test scores in science and mathematics are consistently near the bottom and at times dead last when they are compared to the scores of other industrialized countries. Science has been taught in such a way in the past, many students believe that this is an area for the elite: those that are capable of memorizing formulas, tables, and a multitude of facts. National Science Teacher Association’s retired executive director, Bill Aldridge stated that most people, including science educators, believe that science at certain in-depth levels can’t be comprehended by the general public. Yet the evidence contradicting this belief—from countries that teach demanding science to a far greater proportion of students than the United States does—is monumental (Willis,1995).

Many students do indeed “learn” facts and concepts, if rote memorization is learning. They struggle through the course, memorizing facts, tables, and definitions for test. However, many have no real understanding of what these facts, tables, and definitions really mean. The traditional ‘telling’ approach has allowed science teachers to cover a great many topics, however, the quality of student learning that it has yielded has proven disappointing, experts in the field say. Many students can parrot back what they’ve been taught, but their understanding of the actual concepts is often seriously inadequate (Willis,1995).

### Studies Indicating a Need for a Change

The American Association for the Advancement of Science (AAAS) conducted a study entitled “Project 2061: Science for all Americans” which identified science literacy for all citizens as its central goal (Santa and Alverman, 1991). This project was designed as a long term effort to produce standards, curriculum models, and blueprints from which local planners might develop their own curriculums (Reichard, 1994; Fallon, 1993). In an effort to increase student literacy, AAAS suggested that students should have more real life experiences with everyday material, laboratory equipment, and computer software, as well as reference materials and trade books (Fallon, 1993).

Hands-on experiences, along with cooperative learning and an inquiry-based method of teaching appear to be the best methods to teach students. The research on strategies and methodologies for teaching science in elementary schools has clearly shown that students in activity-based programs learn more than students in traditional text-book programs (Walton and Butler, 1990).

Students enjoy working together and discovering answers for themselves rather than being told the answers and not really comprehending the meaning behind the answers. Furthermore, hands-on science arouses high levels of interest, enthusiasm, and curiosity (Kyle, 1988). When students have a positive attitude toward science they are more inclined to continue wanting to learn more about it and not be intimidated by it.

Zietler, Barufaldi, and Hurd (1988, 1994) believed that in order to create students who are proficient in science, students must be able to engage in scientific inquiry. According to the National Science Education Standards, inquiry involves observing,

posing questions, examining books and other sources of information to see what is already known, planning investigations, reviewing what is already known in light of experimental evidence, proposing answers and explanations, and communicating the results (National Science Education Standards,1995).

### Benefits of Hands-on, Inquiry-based Programs

Furthermore, scientific inquiry teaches students to learn for the sake of learning, not to just memorize facts and definitions in order to pass a test. Short and Burke (1990) note that through inquiry, students arrive at new understandings that are temporary; they do not arrive at final answers. They do not cover a topic; they begin a lifelong inquiry. Gerhard Salinger, a program director at the National Science Foundation, states that inquiry-based learning yields deeper understanding because it challenges students to focus on the question ‘how do we know?’ Although teachers can simply tell students facts—for example, that the earth has seasons because it rotates on a tilted axis—students will understand and remember such concepts better if they explore why we believe them to be true (Willis,1995).

### Research Question

Many teachers have been given the opportunity to be trained in an inquiry-based method of teaching, such as Project Discovery, which offers professional development in the areas of life science, physics, and mathematics. The program is designed to help teachers learn the concepts of one or more of these programs through the inquiry method. Thus, teachers not only learn content, but also the method of inquiry teaching so they will

be able to teach inquiry lessons in their own classrooms when they leave the program.

Through cooperative learning, teachers work in teams to discover answers to problems in experiments and activities. Through guiding and questioning from facilitators, teachers discover for themselves concepts in science and math.

Three or six week sessions are offered in the summer at different college campuses. Courses are offered in mathematics, life science, and physics. Although the courses are content-specific, all three are “taught” in the inquiry method. Students are grouped together in clusters of four for the entire course. Each day the group tackles the problems of having to solve the day’s lesson. The lesson is presented from a text and all group members read the text and attempt to solve the answers to the problems the text asks. Using the information they have received from the text, the group applies that knowledge to solving questions asked at the end of the text. The group works together to solve the questions, and no one moves ahead until the group has been checked by the facilitator (teacher).

The facilitator may ask a question that is not in the text to check understanding of material. The group may have to demonstrate the answer to prove they have mastered the material. An example of demonstrating an answer might be that a group would have to show what an open circuit, or a closed circuit looks like using the equipment provided. Students may be asked to show how to balance a single nut on the left side of a balance beam with three nuts on the right, thus demonstrating knowledge of distance and mass. Another example includes predicting and proving whether certain items will sink or float if they have the same volume but different masses.



All groups work at their own pace. However, no one is allowed to continue on through the text unless first being checked or “tested” by the facilitator. So the group is only as strong as its weakest link. Therefore, group cooperation and support and is essential.

After spending a large amount of time and energy in an inquiry-based training program, what are the effects on the teaching styles of those teachers who have completed the program?

## CHAPTER III

### METHOD AND DESIGN

#### Subjects

The subjects of the study were teachers who had successfully completed Project Discovery, a training program for inquiry-based teaching from 1993 through 1996. All of the teachers were from the Dayton area. Some of the teachers were elementary school teachers, therefore, they have taught all subjects. Other teachers were middle school teachers or high school teachers and have taught several sections in one or more subjects. Not all of the courses being taught by the middle school and high school teachers were science related courses. The teachers had a variety of backgrounds in science education. Some had an immense amount and others had only a minimum amount. The teachers then completed one or more of the three inquiry-based programs—life science, physics, or mathematics in Project Discovery.

#### Instruments

The instrument used was a phone survey. Teachers were asked to respond to twenty statements concerning inquiry-based teaching. They were asked to respond with: Strongly Agree, Agree, Undecided, Disagree, or Strongly Disagree for each item. Items were designed to discourage “undecided responses”.

## Procedures

A pilot test was given to the teachers in the school where the researcher teaches. Any ambiguous or leading questions were revised. An expert in the field of education also reviewed the survey and made suggestions for revisions where they were deemed necessary. A new survey was used for a group of fifty randomly selected teachers from the Dayton area that have completed a Project Discovery course between 1993 and 1996. The results of the survey were analyzed by this researcher and the outcome of the survey is reported in this research paper.

## CHAPTER IV

### NARRATIVE SUMMARY OF INQUIRY-BASED LEARNING SURVEY

Fifty teachers who had participated in the Project Discovery Inquiry-Based Training Program from 1993 to 1996 and lived in the Dayton area were randomly chosen through a Project Discovery Directory to participate in this survey. The teachers were a diverse group that included primary, middle school, high school, and special education teachers.

Furthermore, the group surveyed had varied years of experience not only with teaching in general, but teaching with the inquiry-based method, as well. Teachers surveyed also taught a variety of subjects. Not all of the teachers taught science or math, which are the subjects that Project Discovery emphasizes in their program.

While conducting the phone survey, the researcher found that the participants were very eager to participate in the survey. The survey took about ten minutes for each participant to answer the statements and make comments.

Most respondents agreed with the statement in Chart 1 that states, "Students grasp the concepts easier since I have been teaching with an inquiry-based approach." In fact, fifty-eight percent agreed, twenty-six percent strongly agreed (SA+A= 84%), sixteen percent were undecided, and no one in the survey disagreed or strongly disagreed.

In Chart 2, forty-six percent disagreed with the statement, "I spend less time preparing lessons for inquiry-based teaching than I do for traditional teaching." Another thirty-six percent also strongly disagreed with this statement (D+SD=82%). Four percent

were undecided, eight percent agreed, and six percent strongly agreed with this statement.

Forty-two percent agreed with the statement in Chart 3 that “Students who have learned through inquiry-based techniques have fared as well on tests as students from the past who were taught the same material through traditional methods.” Another twenty-four percent strongly agreed with this statement (A+SA=66%). However, twenty-four percent were undecided, and ten percent disagreed, and no one strongly disagreed.

In Chart 4, more than half of the participants (fifty-two percent) agree with the statement, “As a teacher, I understand the concepts I am trying to teach better than before I started practicing inquiry-based teaching.” Another twenty-four percent strongly agreed with this statement ((A+SA=76%). Only two percent were undecided, eighteen percent disagreed, and four percent strongly disagreed.

Fifty-four percent agree with the statement in Chart 5 that, “Teaching hands-on lessons costs more money to teach than teaching traditional type lessons.” Another thirty-two percent strongly agree with this statement (A+SA=86%). However, ten percent disagree, two percent strongly disagree, and two percent were undecided.

In Chart 6, the statement, “In a school year, I am able to teach more material using inquiry-based teaching than I can with more traditional type teaching” brought a range of responses. Twelve percent strongly agreed with this statement, as well as twenty-six percent who agreed also(SA+A=38%). However, fourteen percent were undecided. Thirty-eight percent disagreed with this statement, as well as ten percent who strongly disagreed (D+SD=48%).

A strong majority agreed (fifty-two percent) or strongly agreed (thirty percent) with the statement in Chart 7 ( $A+SA=82\%$ ) that states, "Students stay on task better when I am teaching with an inquiry-based method." Only eight percent were undecided on this statement. Ten percent disagreed and no one strongly disagreed.

In Chart 8, fifty-two percent of the participants in the survey agreed with the statement, "All students participate fully in a cooperative learning group in a Discovery Classroom." Another fourteen percent strongly agreed with this statement ( $A+SA=66\%$ ). Fourteen percent were undecided, twenty percent disagreed, and no one strongly disagreed.

There was an overwhelming majority that either strongly agreed (fifty percent) or agreed (forty-six percent) to the statement in Chart 9 that stated, "Since completing the Project Discovery training program, I tend to use inquiry methods of teaching more than I did before the training." Only two percent were undecided and two percent disagreed. No one in the survey strongly disagreed.

In Chart 10, sixty-eight percent agreed with the statement, "Weaker students in an inquiry-based group grasp the concepts as well as the other students in the group." Eight percent strongly agreed with this statement. Only six percent were undecided, and eighteen percent disagreed. No one in the survey strongly disagreed.

Fifty-two percent disagreed with the statement in Chart 11, which stated, "Stronger students in an inquiry-based cooperative group 'carry' the rest of the group by 'giving' them the answers rather than letting them discover them for themselves." Another twelve percent strongly disagreed with this statement ( $D+SD=64\%$ ). Twenty-two percent agreed, no one strongly agreed, and fourteen percent were undecided.

In Chart 12, fifty-eight percent disagreed with the statement, “The noise level while I am teaching an inquiry-based lesson is quieter than when I am teaching in a more traditional style.” Another thirty-two percent strongly disagreed with this statement (D+SD=90%). Four percent were undecided, six percent agreed, and no one strongly agreed.

A majority of those surveyed either strongly agreed (thirty-eight percent) or agreed (fifty-four percent) with the statement in Chart 13 that stated, “Students are more excited about learning when I teach with an inquiry-base method.” Only six percent were undecided about this statement, and two percent disagreed. No one in the survey strongly disagreed.

Fifty-four percent agreed with the statement in Chart 14 that, “Students want to learn more on their own about a topic when I teach in an inquiry-based method.” Another twenty-two percent also strongly agreed (A+SA=76%). Sixteen percent were undecided on this statement. Six percent disagreed and only two percent strongly disagreed.

In Chart 15, participants were almost equally divided in agreeing (forty-two percent) and disagreeing (forty percent) with the statement, “I teach in an inquiry-based method the majority of the time.” Only ten percent strongly agreed with this statement, four percent were undecided, and four percent strongly disagreed.

An overwhelming majority either strongly agreed (forty-eight percent) or agreed (fifty percent) with the statement in Chart 16, that states, “I believe that students benefit socially from working in inquiry-based cooperative learning groups.” Only two percent were undecided. No one disagreed or strongly disagreed with this statement.

Again an overwhelming majority agreed (seventy-six percent) or strongly agreed (twenty-two percent) with the statement in Chart 17 that states, “Stronger students help weaker students grasp the concepts when they work together in groups.” Only two percent were undecided, and no one disagreed or strongly disagreed with this statement.

In Chart 18, fifty-two percent agree and fourteen percent strongly agree with the statement, “Inquiry-based teaching can be used to teach all concepts in science and math” (A+SA=66%). Only twelve percent were undecided, twenty percent disagree, and two percent strongly disagree.

Fifty-eight percent agree and twelve percent strongly agree with the statement in Chart 19 that states, “Textbooks are not needed as the major resource in an inquiry-based approach to learning” (A+SA=70%). Ten percent were undecided, sixteen percent disagreed, and four percent strongly disagreed.

Sixty percent agreed and twenty-six percent strongly agreed with the statement in Chart 20 that states, “Students who once thought that science and/or math were too difficult to learn have had more success toward these subjects since learning through inquiry methods.” Twelve percent were undecided, two percent disagreed, and no one strongly disagreed.



Chart 1

**Students grasp the concepts I am teaching easier since I have been teaching with an inquiry-based approach.**

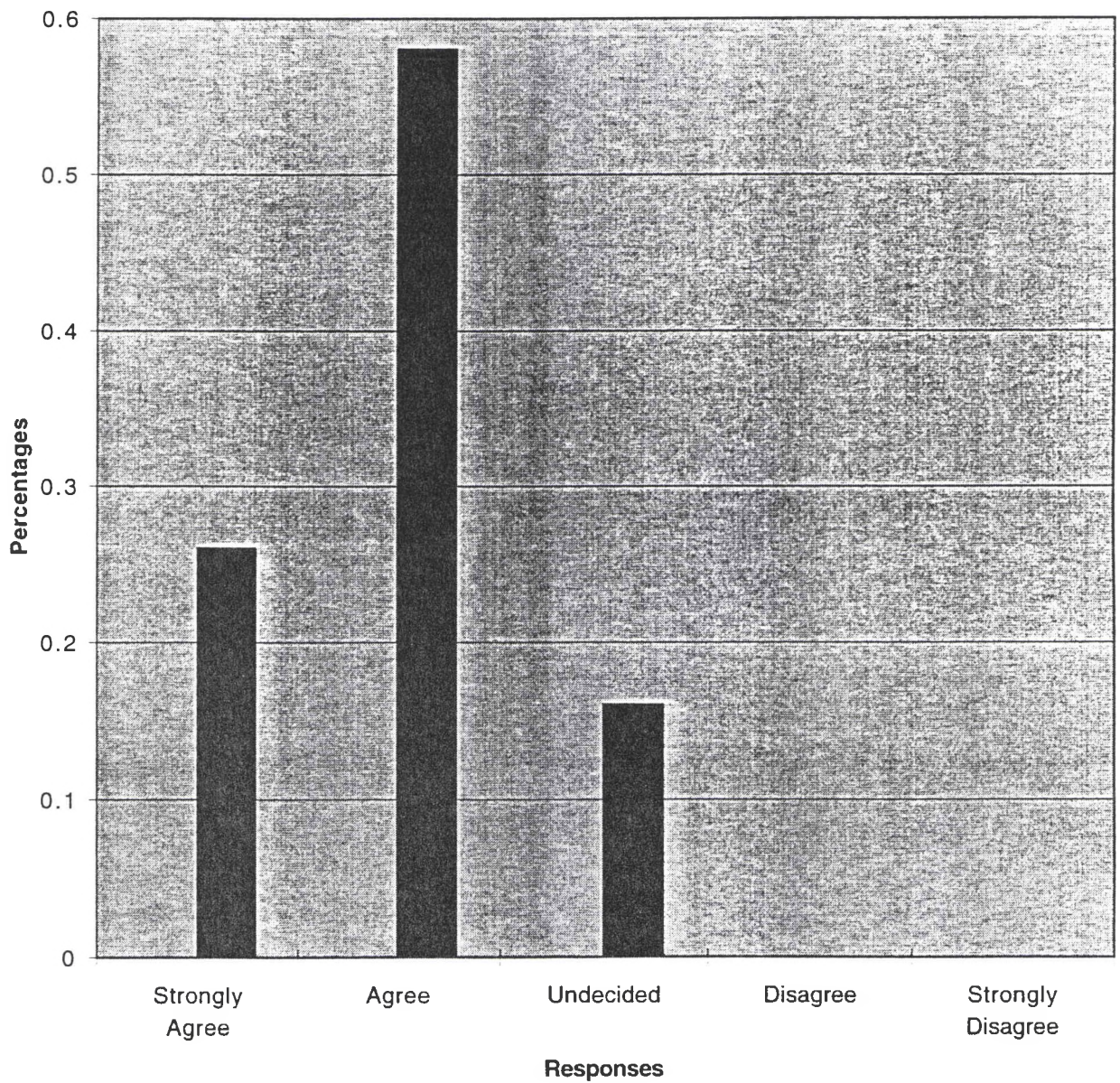


Chart 2

**I spend less time preparing lessons for inquiry-based teaching than I do for traditional teaching.**

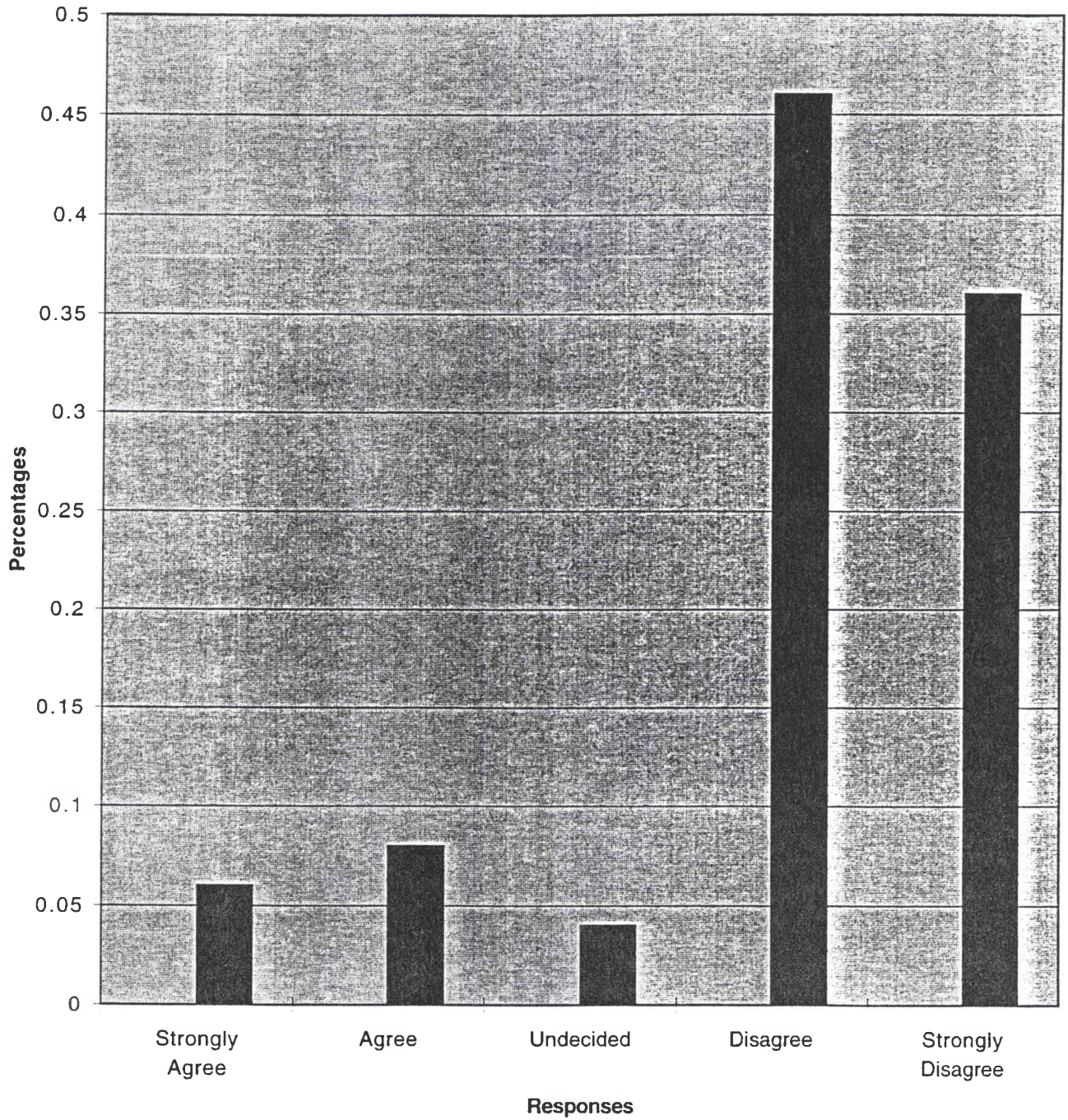


Chart 3

**Students who have learned through inquiry-based techniques have fared as well on tests as students from the past who were taught the same material through traditional methods.**

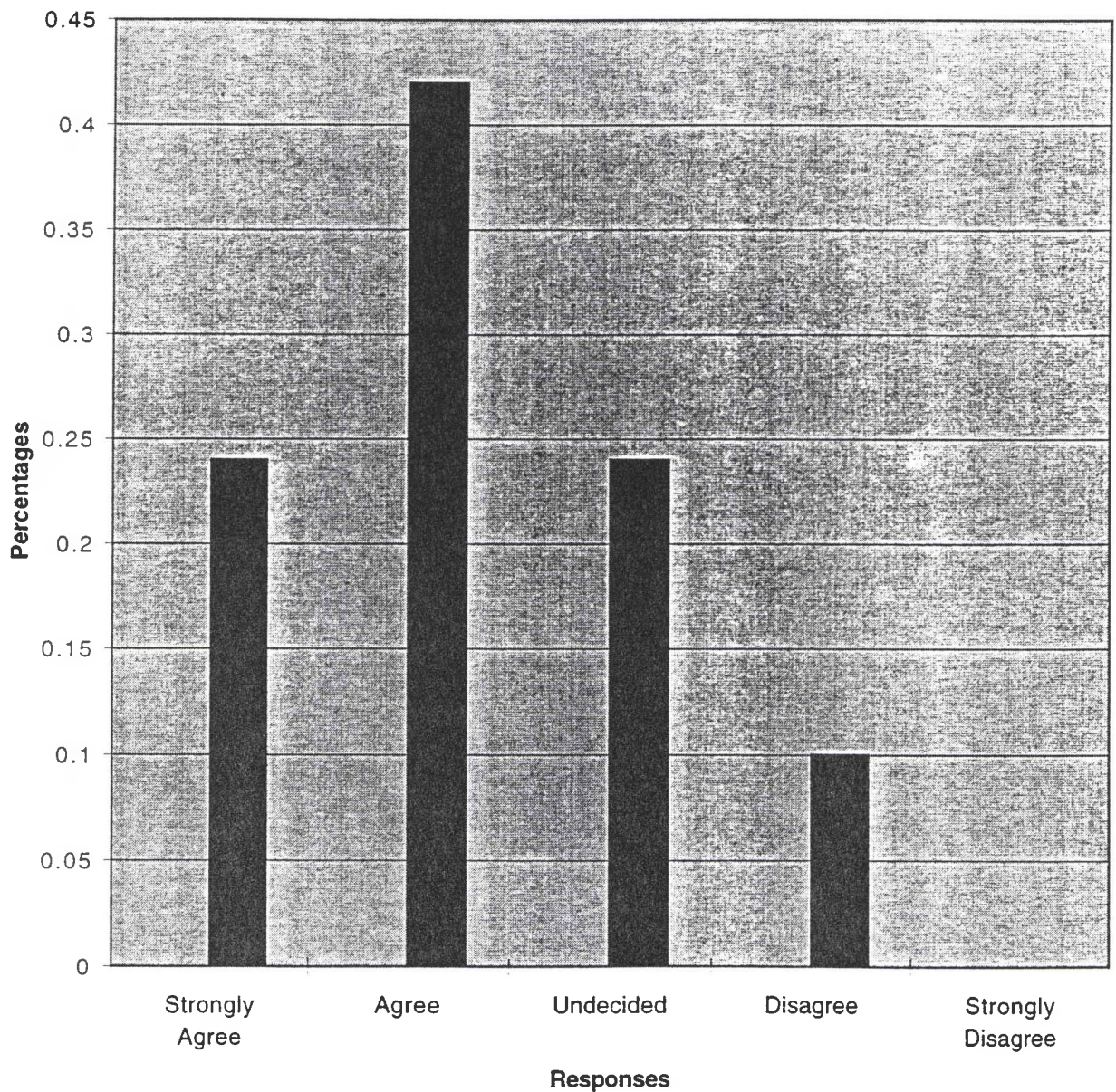


Chart 4

**As a teacher, I understand the concepts I am trying to teach better than before I started practicing inquiry-based teaching.**

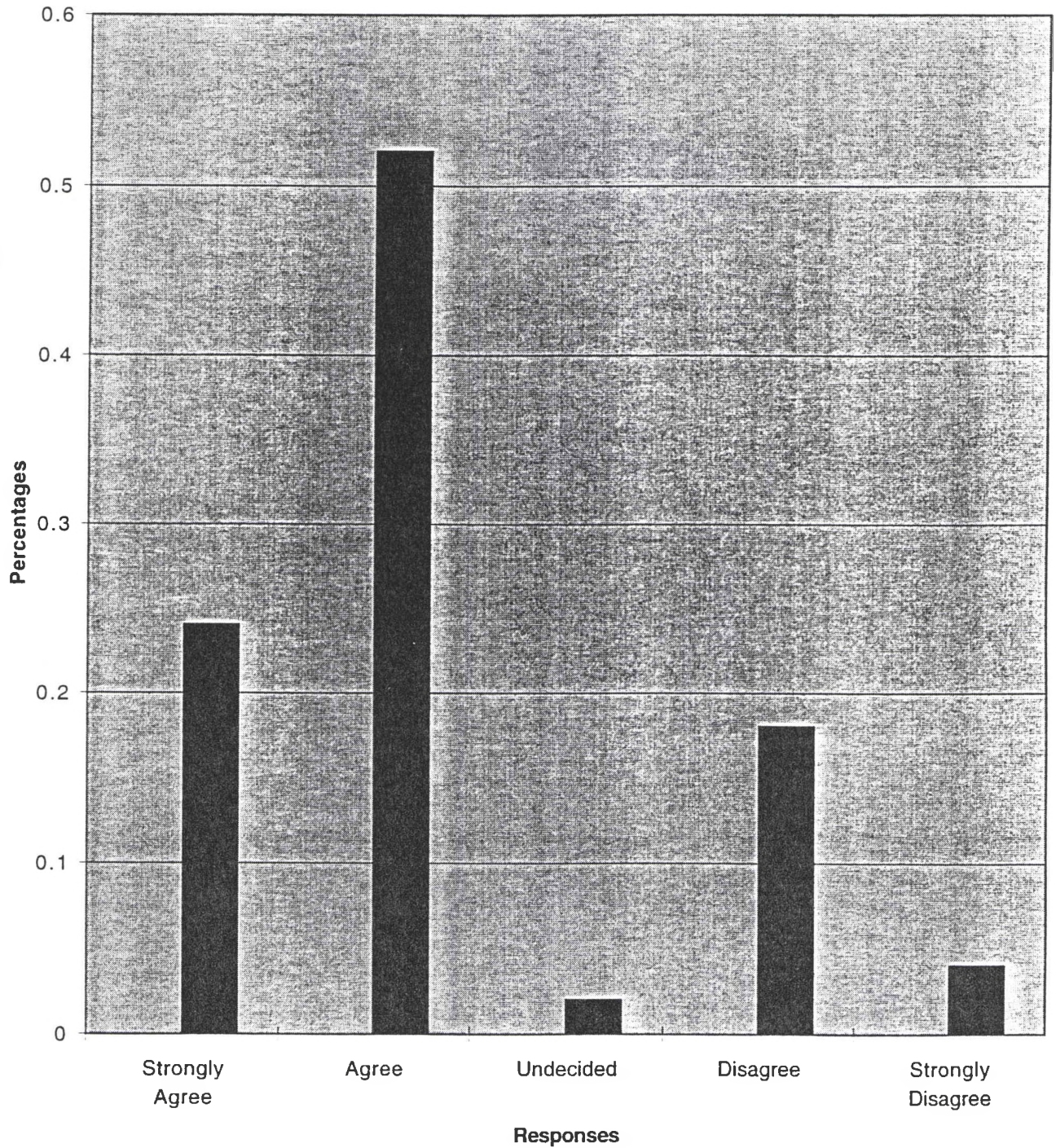


Chart 5

**Teaching hands-on lessons costs more money to teach than teaching traditional type lessons.**

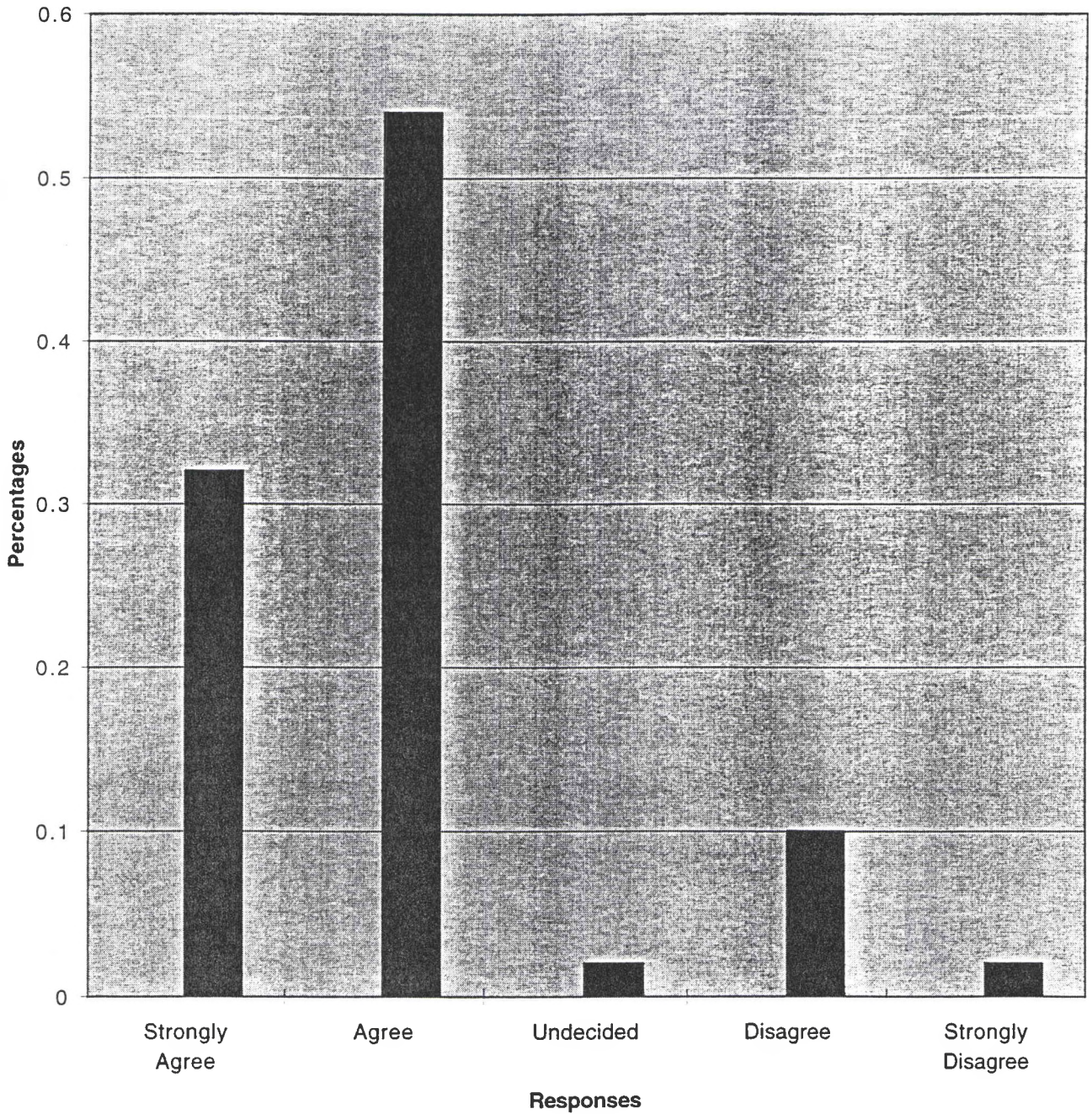


Chart 6

**In a school year, I am able to teach more material using inquiry-based teaching than I can with more traditional type teaching.**

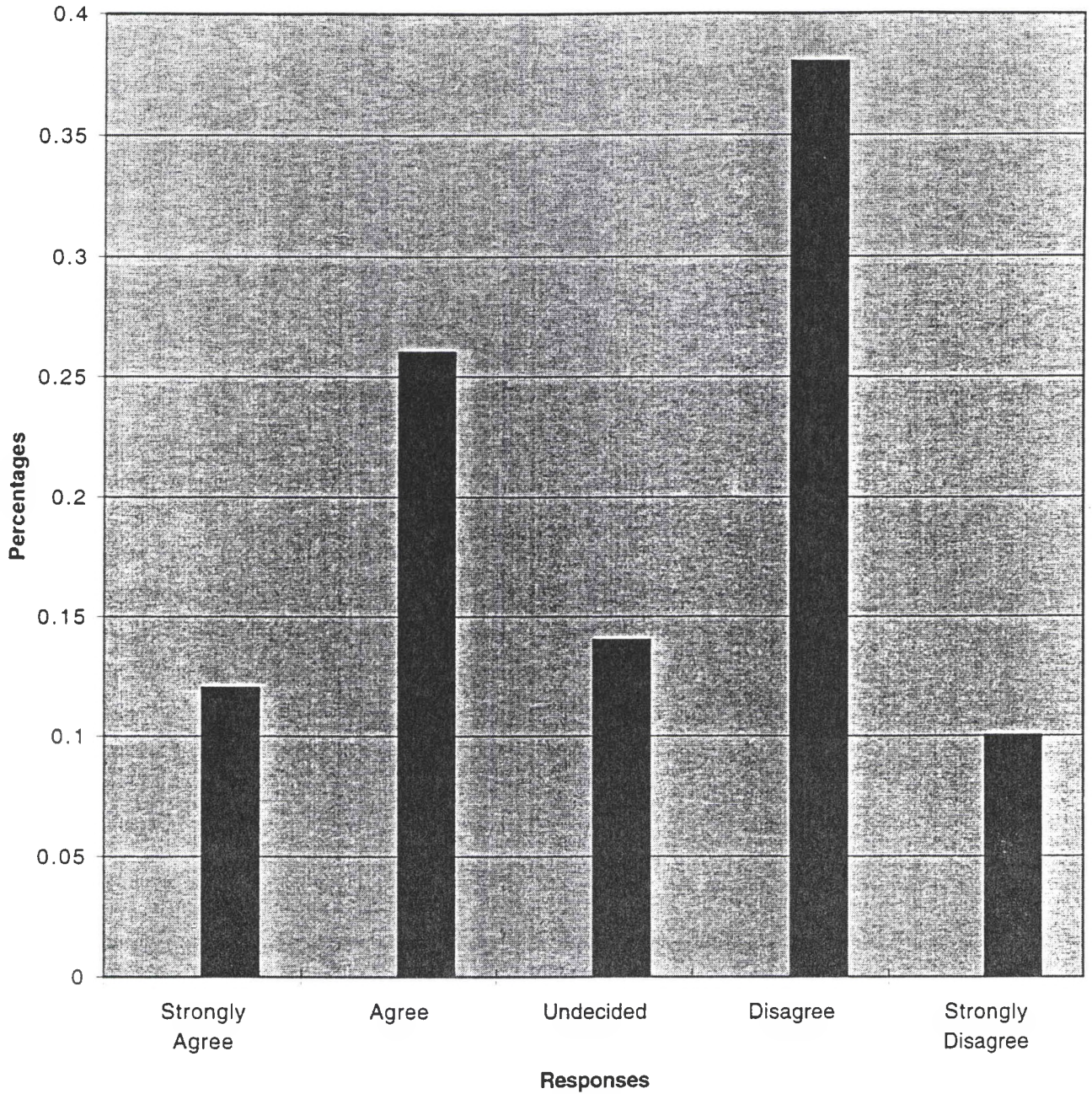


Chart 7

**Students stay on task better when I am teaching with an inquiry-based method.**

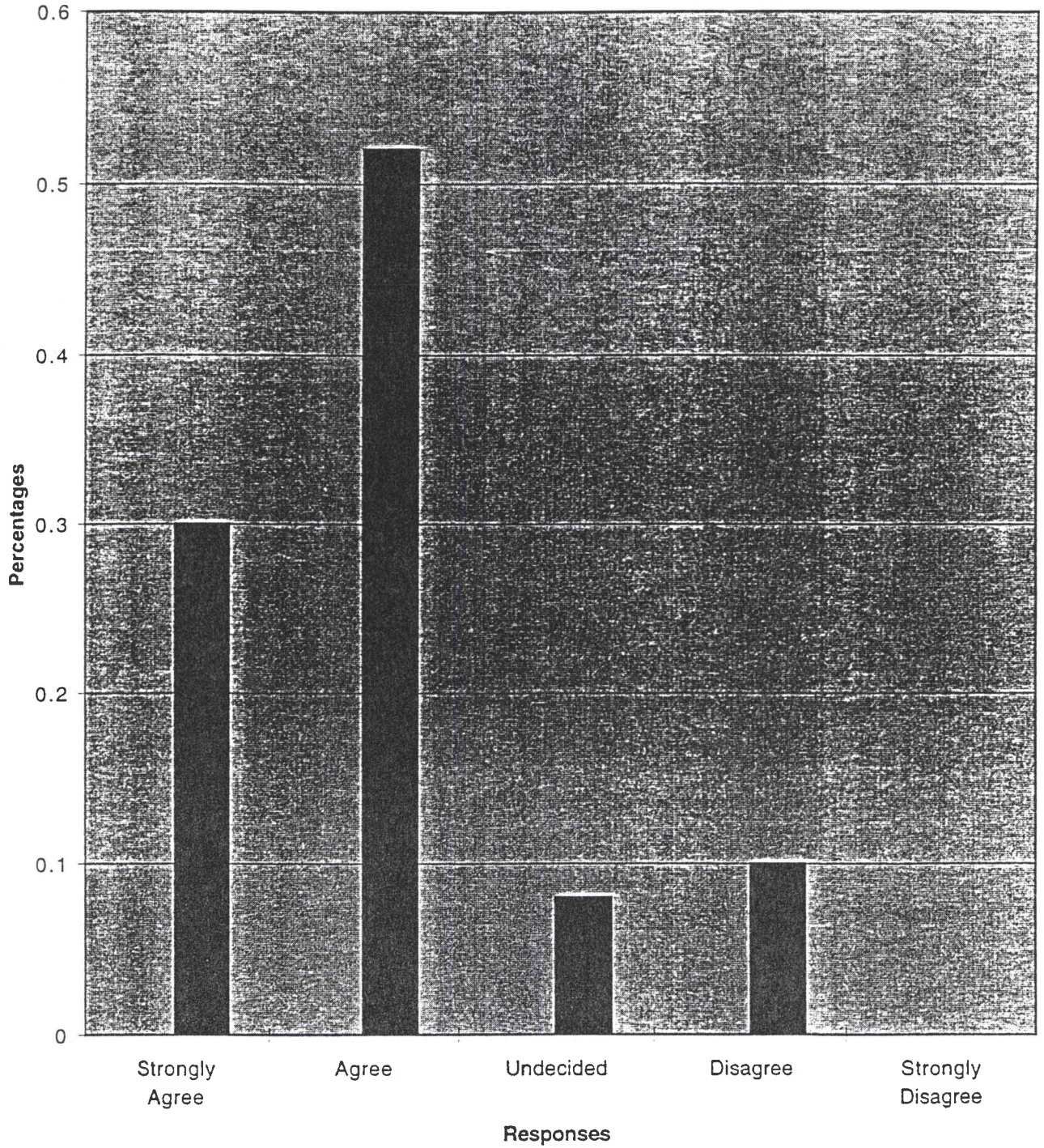


Chart 8

**All students participate fully in a cooperative learning group in a Discovery Classroom.**

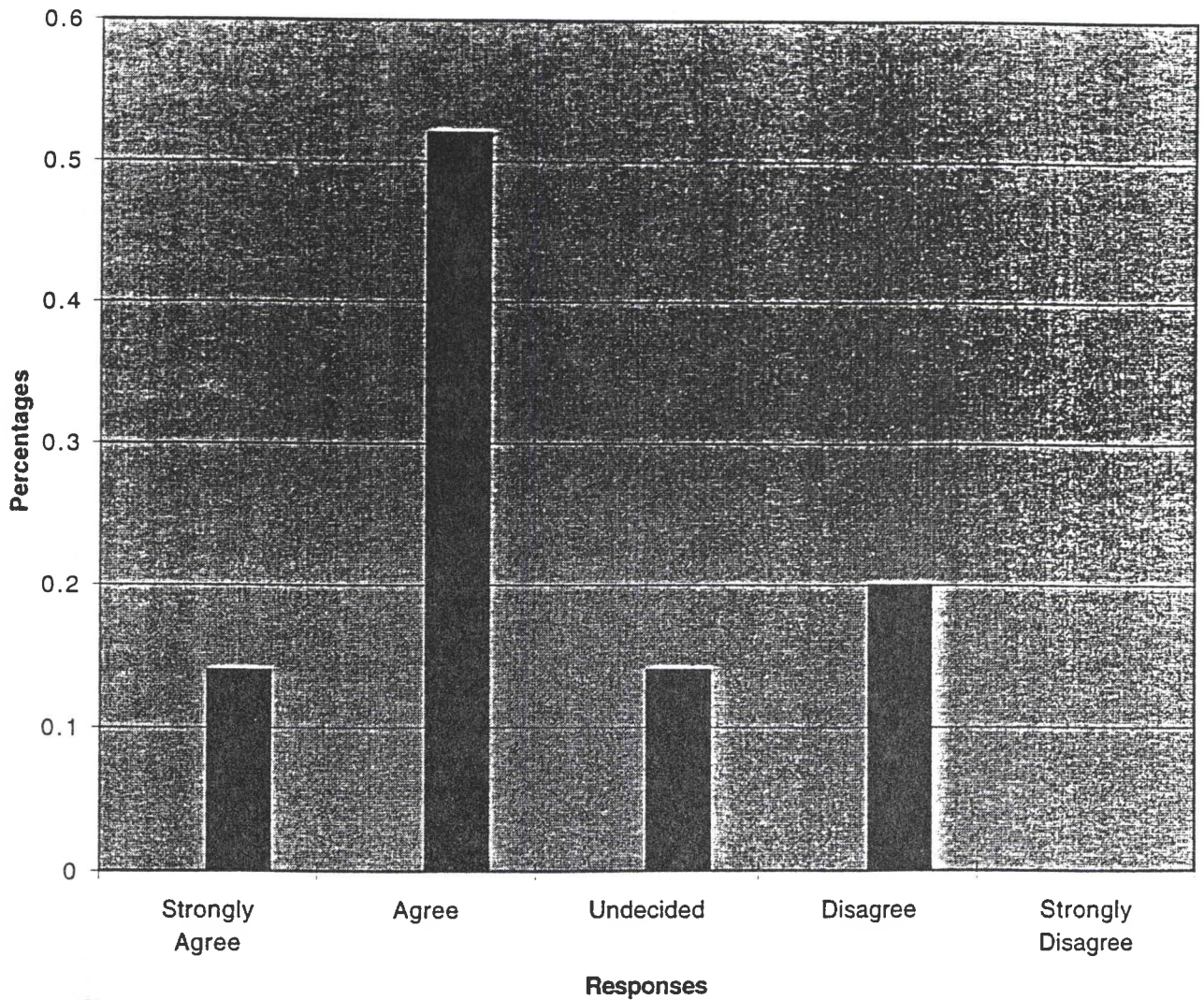
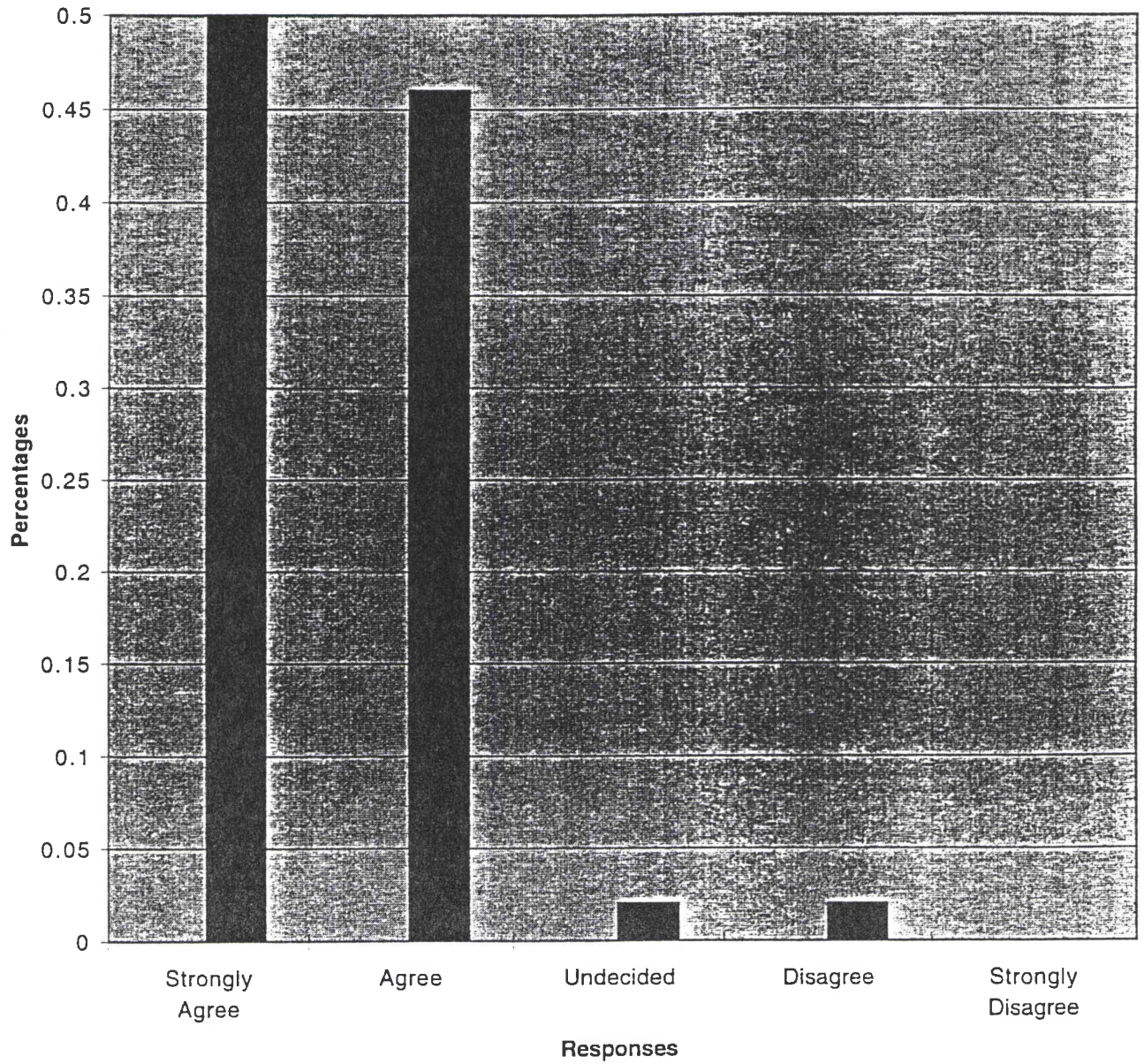


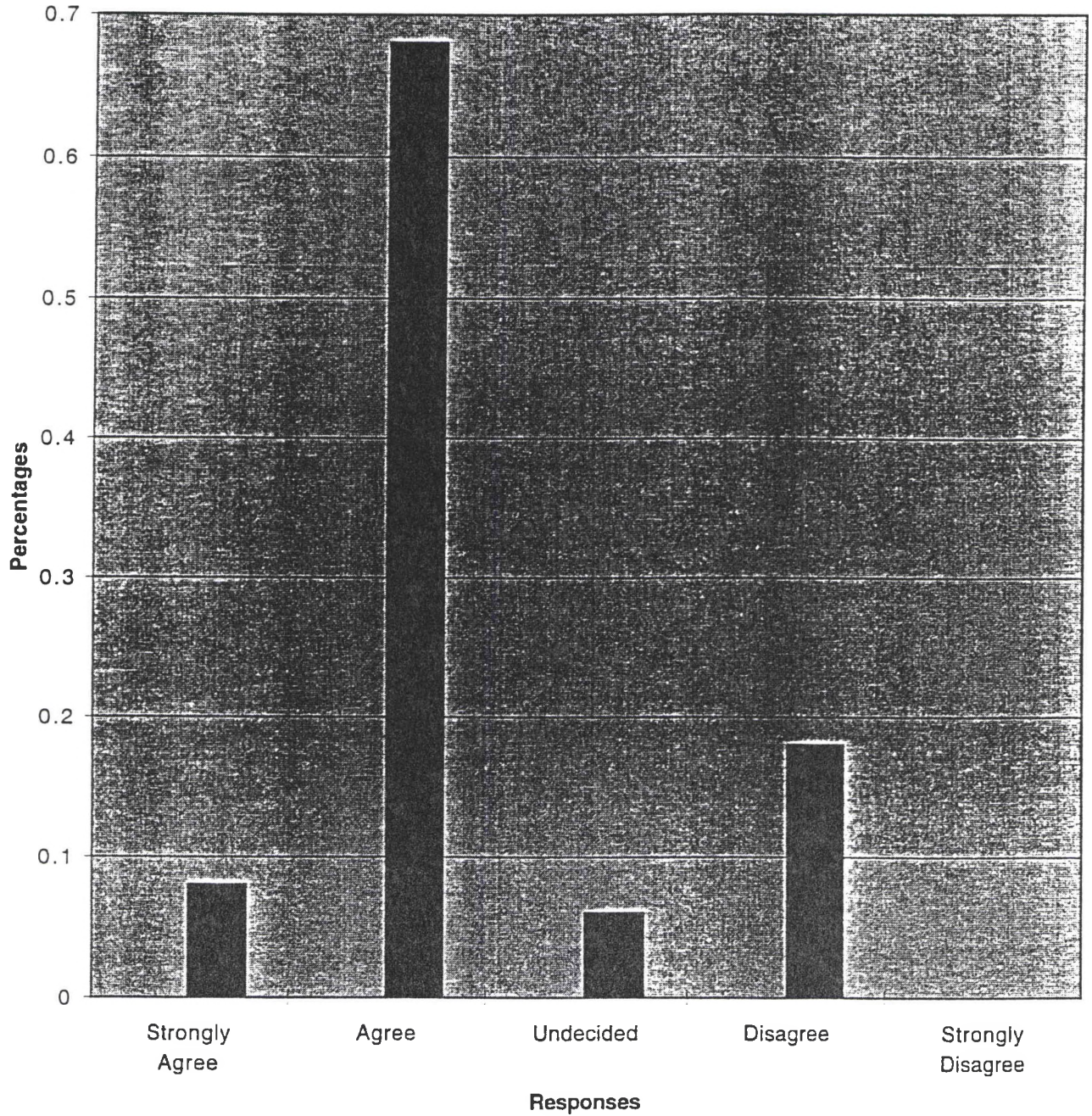


Chart 9

Since completing the Project Discovery training program, I tend to use inquiry methods of teaching more than I did before the training.



**Weaker students in an inquiry-based cooperative group grasp the concepts as well as the other students in the group.**



**Stronger students in an inquiry-based cooperative group "carry" the rest of the group by "giving" them the answers rather than letting them discover them for themselves.**

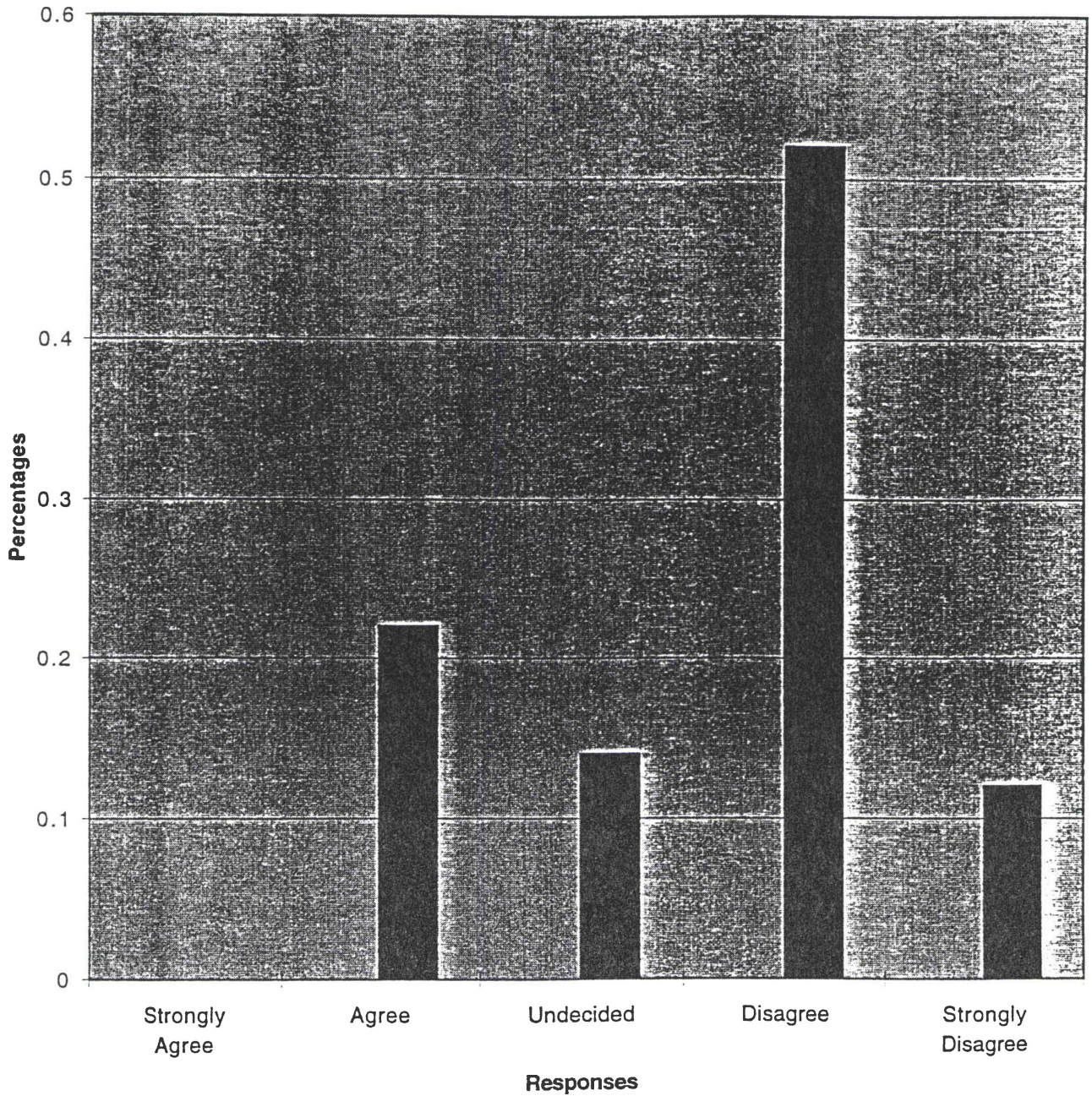


Chart 12

**The noise level while I am teaching an inquiry-based lesson is quieter than when I am teaching in a more traditional style.**

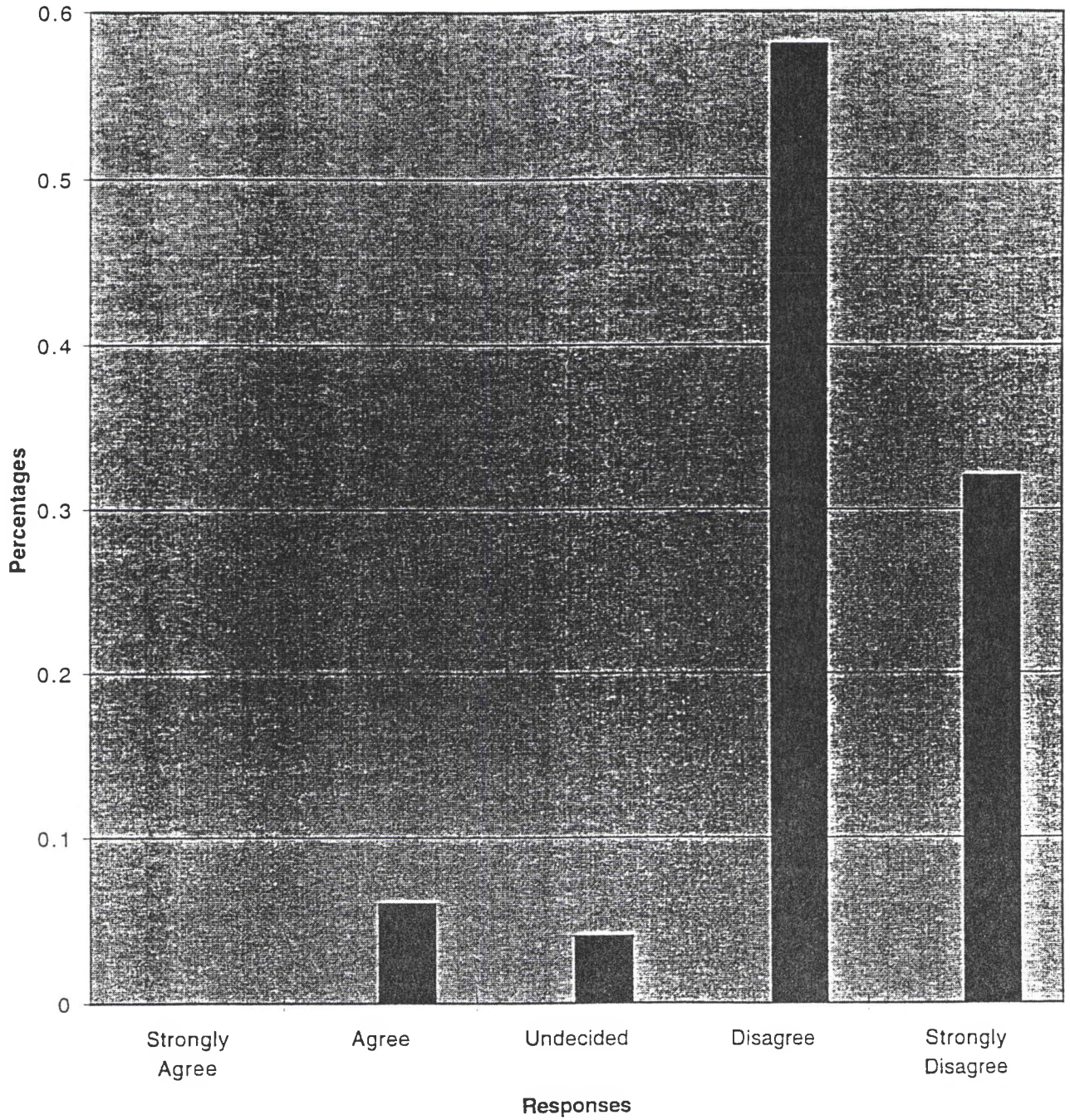
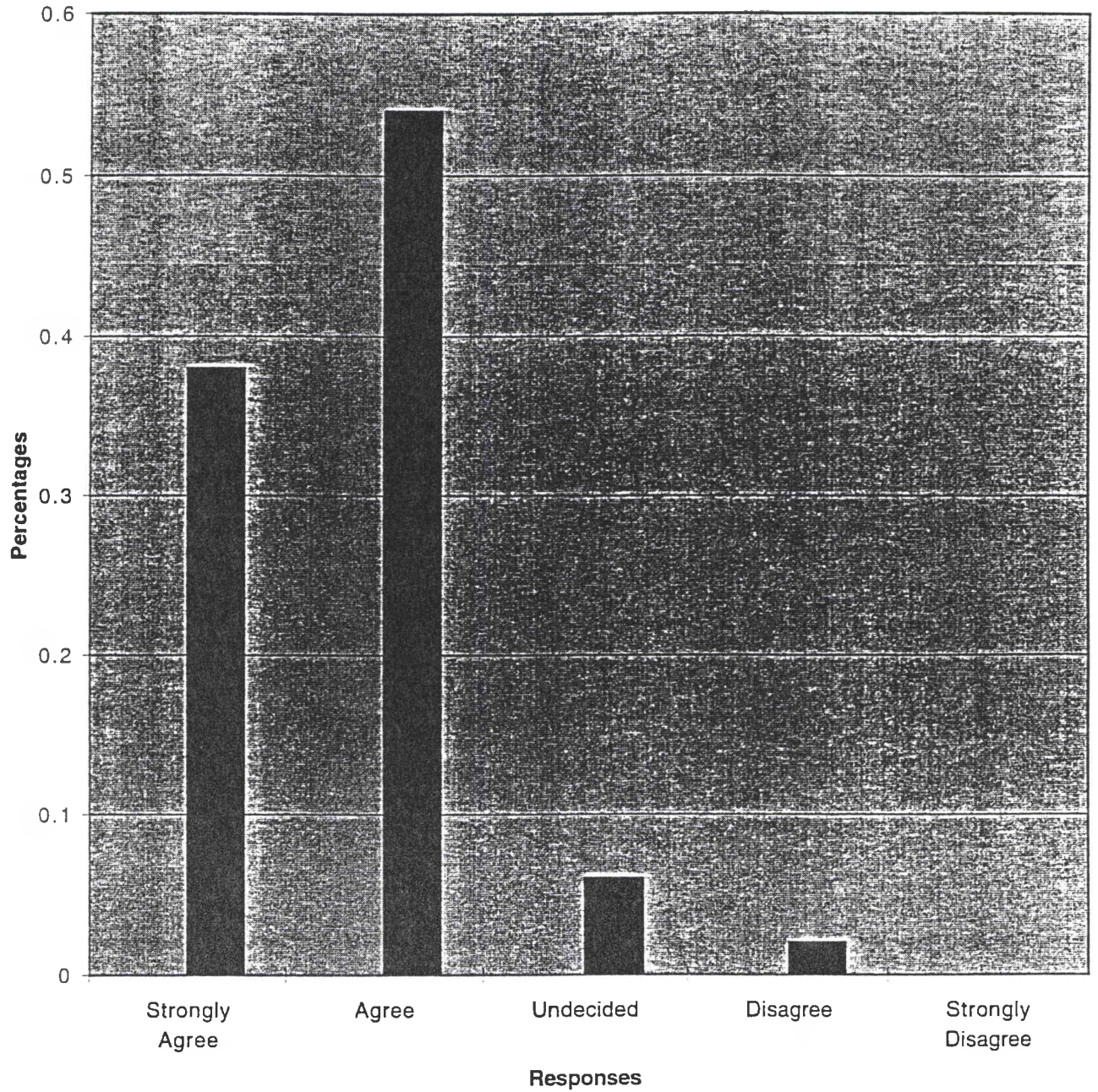
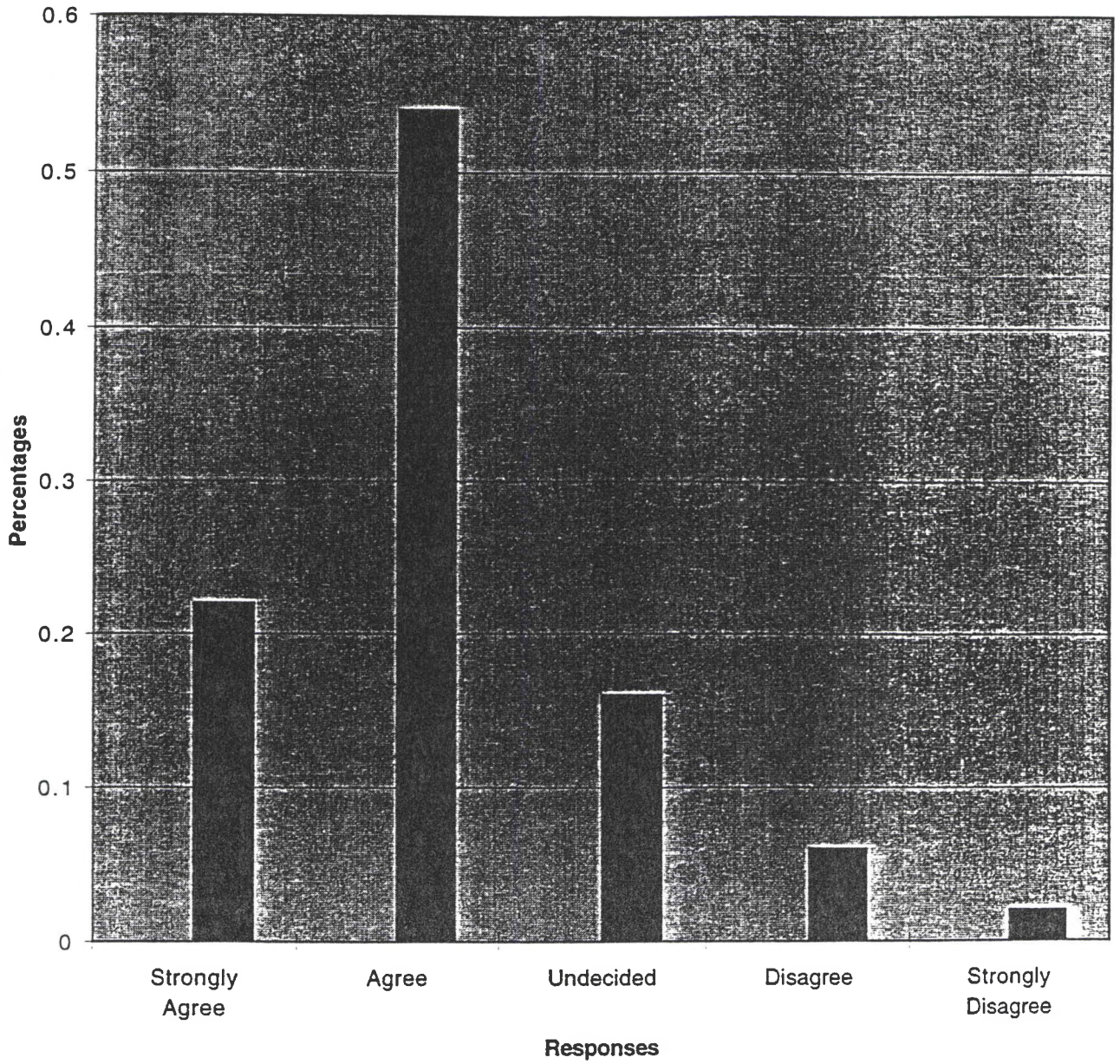


Chart 13

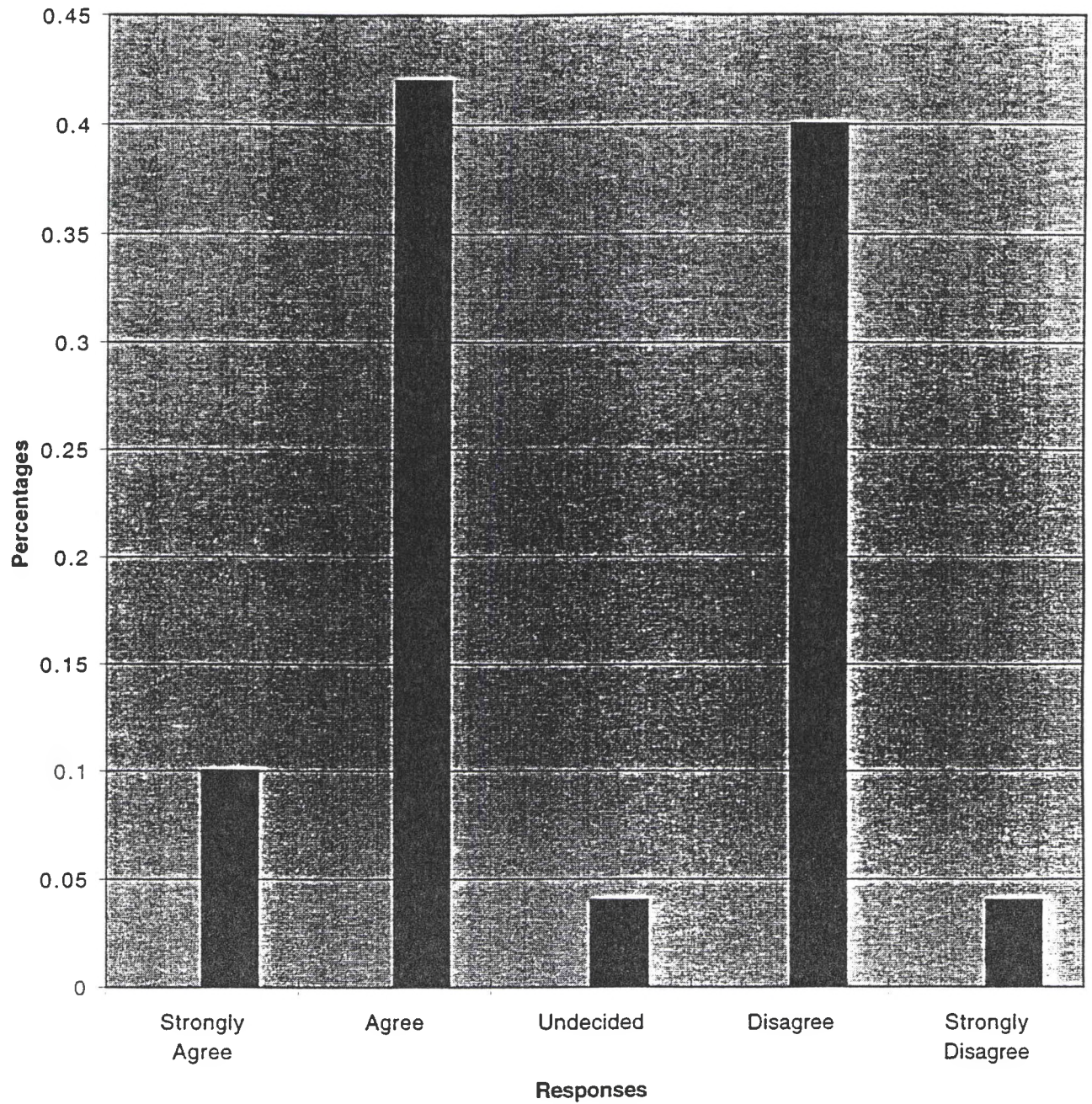
**Students are more excited about learning when I teach with an inquiry-based method.**



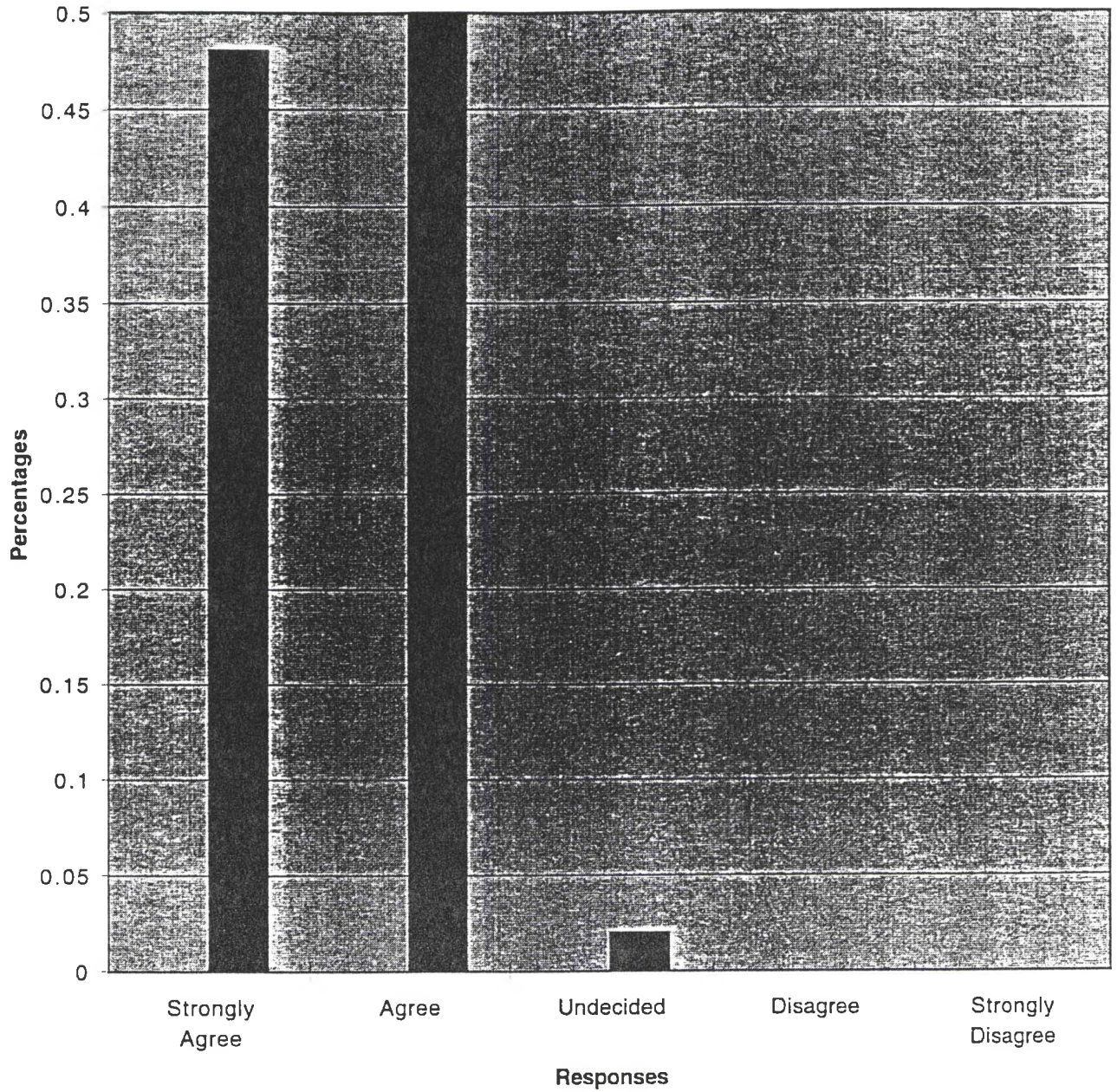
**Students want to learn more on their own about a topic when I teach in an inquiry-based method.**



**I teach in an inquiry-based method the majority of the time.**



**I believe that students benefit socially from working in inquiry-based cooperative learning groups.**





**"Stronger" students help "weaker" students grasp concepts when they work together in groups.**

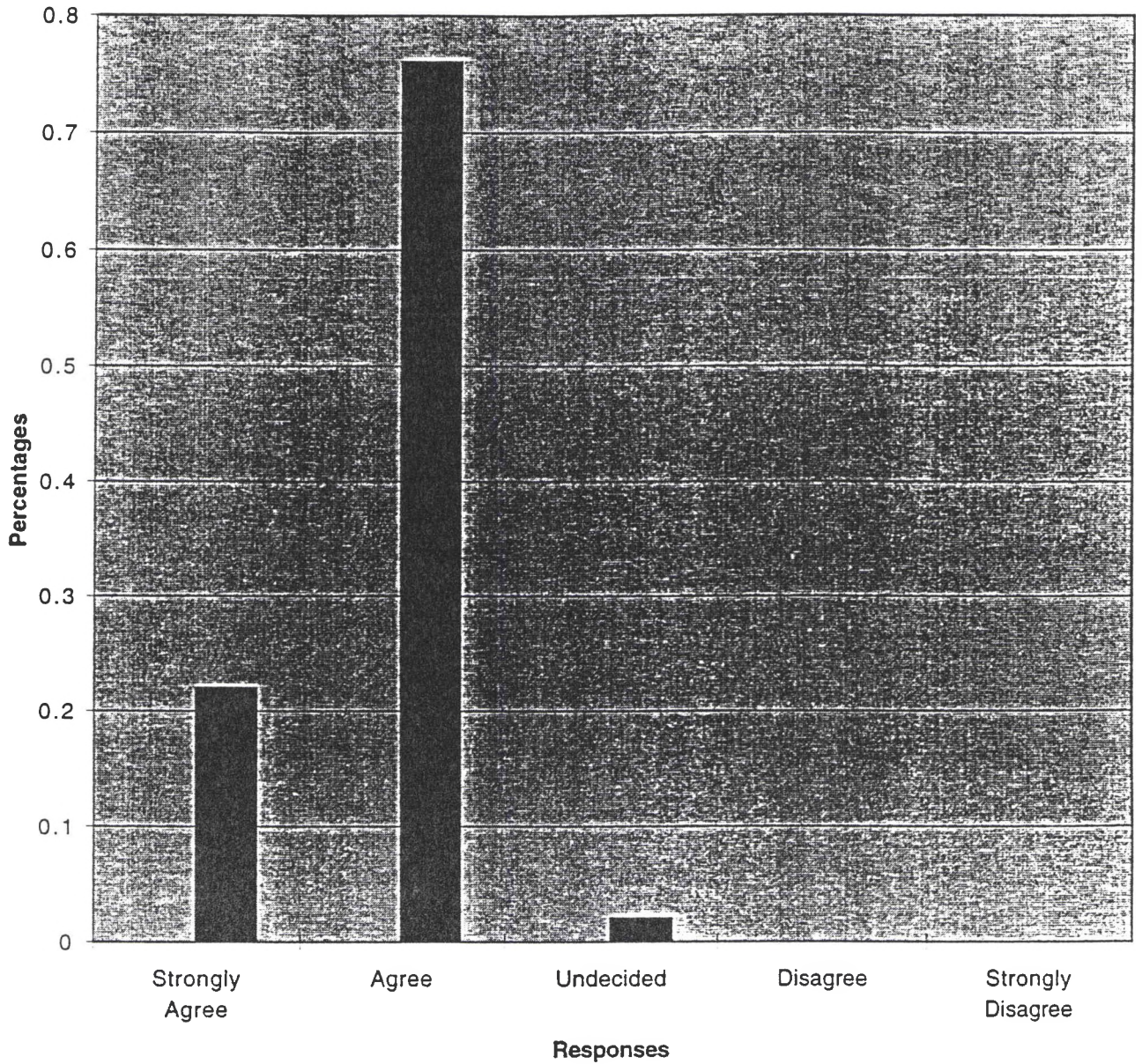
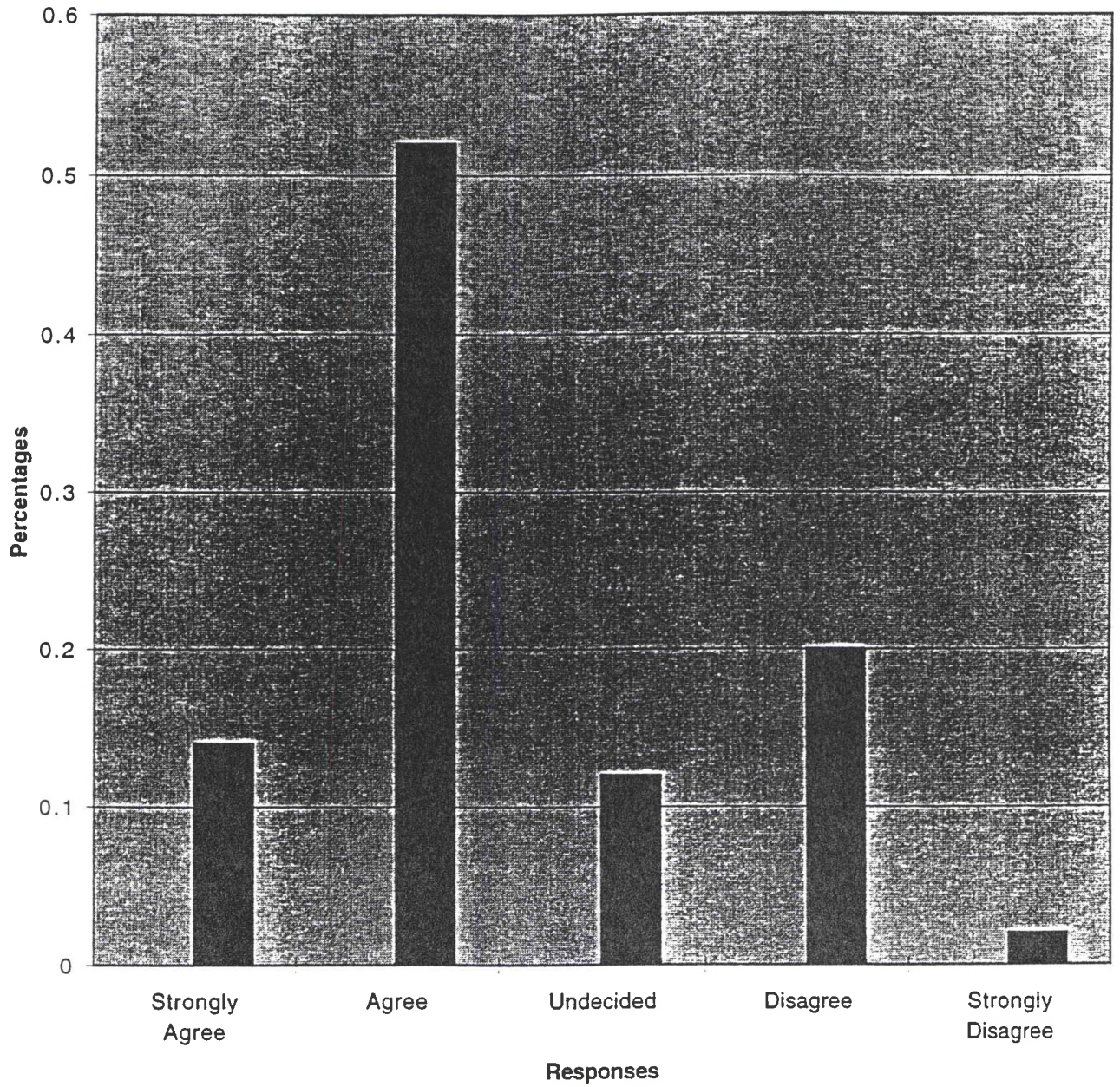
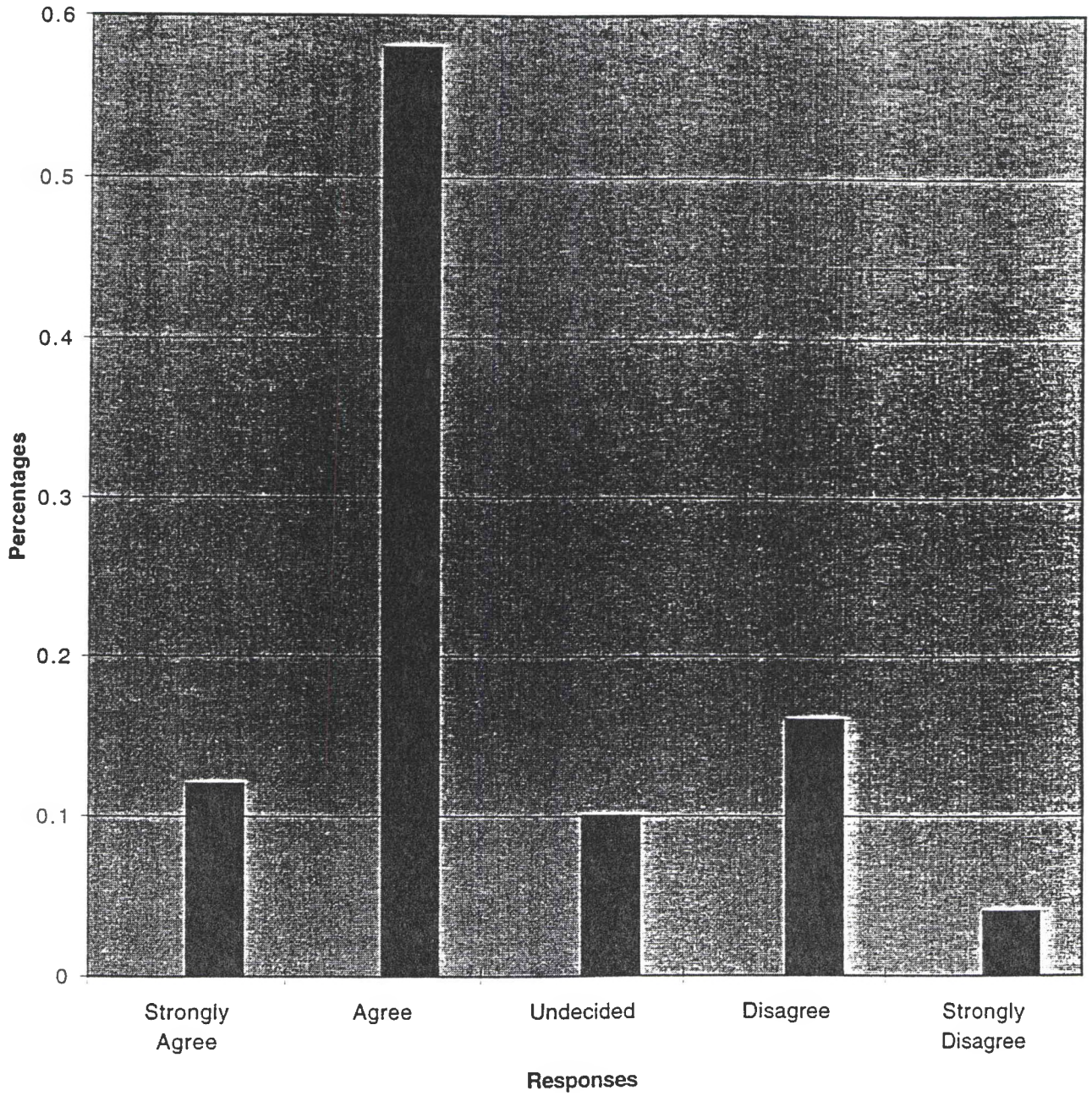


Chart 18

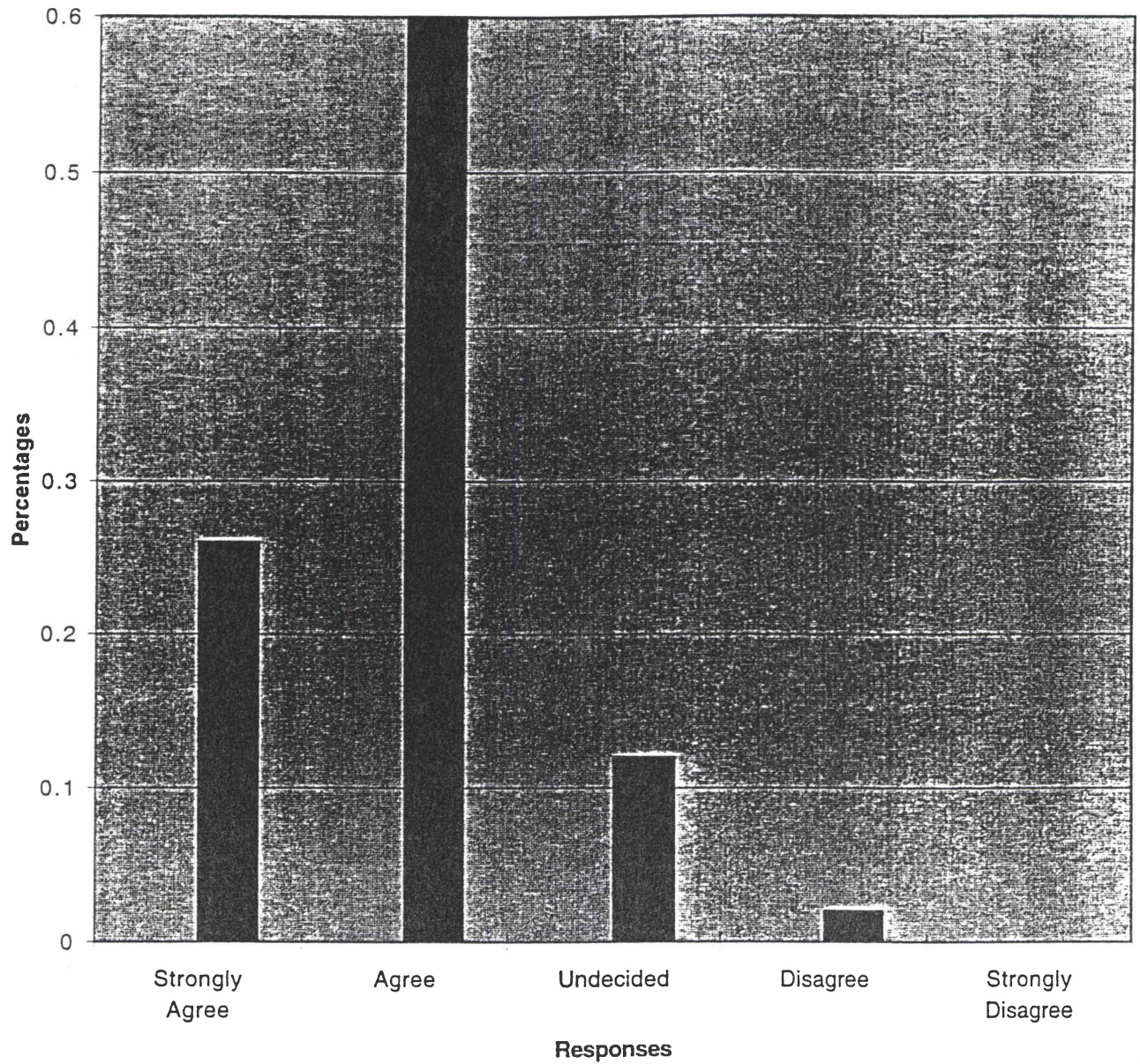
**Inquiry-based teaching can be used to teach all concepts in science and math.**



**Textbooks are not needed as the major resource in an inquiry-based approach to learning.**



**Students who once thought that science and/ or math were too difficult to learn have had more success toward these subjects since learning through inquiry methods.**



## CHAPTER V

### SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

#### Summary

Recently, math and science instruction in the United States has begun to change because of decreasing national test scores. Teachers and administrators are eagerly seeking programs or methods that will help increase students' understanding and test scores. One such program that is making an impact is Project Discovery. This is a statewide, systematic initiative, funded by the National Science Foundation and the State of Ohio to improve the teaching of science and mathematics.

The purpose of this project was to determine the effects of this program on beliefs teachers have about their teaching styles. This writer surveyed classroom teachers through a telephone interview to determine their perceptions about inquiry teaching. A Likert-type survey was developed and used. The survey was completed in February, 1997 by fifty teachers of varying teaching experience in the Dayton, Ohio area. It is interesting to note that every person contacted agreed to provide information.

The results of the survey show that the teachers who responded feel that students stay on task better, benefit socially and academically, and enjoy learning more. They also felt that teaching in this method costs more for materials, takes more time to prepare lessons, and creates a noisier environment than teaching in a traditional method.

During the course of the survey, many comments were made about the inquiry program. Many teachers expressed great enthusiasm for the method of teaching, however, those that taught students in special education had varying opinions on the success of this method with this particular group of students. Some expressed concerns

that the method did not give enough structure to the students. Others commented that for this very reason their students were more enthusiastic about learning.

Many teachers remarked that the program is only as effective as the teacher is. They all agreed that after the students had experience in this type of learning that the classes ran smoother. Once the novelty of inquiry teaching wore off students enjoyed learning in this manner and did not look upon working in groups as an opportunity to “goof-off”, but to actually work together to solve problems.

### Conclusions

The researcher concludes that the teachers surveyed agreed that inquiry-based teaching is beneficial to students both socially and academically. Furthermore, the writer concludes that even though inquiry-based teaching has both pros and cons, for the teachers surveyed, the advantages outweigh the disadvantages of the program. The writer also concludes (from comments in the telephone interview) that teachers enjoy different levels of success with the inquiry approach to learning, depending on what subjects they are teaching, and what age group or intellectual group of students they are teaching.

### Recommendations

The writer would like to recommend that more studies be done on the effects of an inquiry-based training program on teachers. Perhaps separate studies could be done on high school, middle school, elementary, and special education teachers to determine where the greatest success or failure is in the program. Another study that would be useful in determining the effects of an inquiry-based teaching program is one that would survey teachers that teach any subject other than science or math. It would be interesting

to note whether this kind of a training program would be as successful in other teaching areas other than science and math.

## APPENDIX



## SURVEY OF TEACHERS' PERCEPTIONS OF INQUIRY-BASED TEACHING

1=STRONGLY AGREE

2=AGREE

3=UNDECIDED

4=DISAGREE

5=STRONGLY DISAGREE

1. Students grasp concepts I am teaching easier since I have been teaching with an inquiry-based approach.  
1 2 3 4 5
2. I spend less time preparing lessons for inquiry-based teaching than I do for traditional teaching.  
1 2 3 4 5
3. Students who have learned through inquiry-based techniques have fared as well on tests as students from the past who were taught the same material through traditional methods.  
1 2 3 4 5
4. As a teacher, I understand the concepts I am trying to teach better than before I started practicing inquiry-base teaching.  
1 2 3 4 5
5. Teaching hands-on lessons costs more money to teach than teaching traditional type lessons.  
1 2 3 4 5
6. In a school year, I am able to teach more material using inquiry-based teaching than I can with more traditional type teaching.  
1 2 3 4 5
7. Students stay on task better when I am teaching with an inquiry-based method.  
1 2 3 4 5
8. All students participate fully in a cooperative learning group in a Discovery Classroom.  
1 2 3 4 5
9. Since completing the Project Discovery training program, I tend to use inquiry methods of teaching more than I did before the training.  
1 2 3 4 5

10. Weaker students in an inquiry-based cooperative group grasp the concepts as well as the other students in the group.  
1 2 3 4 5
11. Stronger students in an inquiry-based, cooperative group “carry” the rest of the group by “giving” them the answers rather than letting them discover them for themselves.  
1 2 3 4 5
12. The noise level while I am teaching an inquiry-based lesson is quieter than when I am teaching in a more traditional style.  
1 2 3 4 5
13. Students are more excited about learning when I teach with an inquiry-based method.  
1 2 3 4 5
14. Students want to learn more on their own about a topic when I teach in an inquiry-based method.  
1 2 3 4 5
15. I teach in an inquiry-based method the majority of the time.  
1 2 3 4 5
16. I believe that students benefit socially from working in inquiry-based, cooperative learning groups.  
1 2 3 4 5
17. “Stronger students help “weaker” students grasp concepts when they work together in groups.  
1 2 3 4 5
18. Inquiry-based teaching can be used to teach all concepts in science and math.  
1 2 3 4 5
19. Textbooks are not needed as the major resource in an inquiry-based approach to learning.  
1 2 3 4 5
20. Students who once thought that science and/or math were too difficult to learn have had more success toward these subjects since learning through inquiry-methods.  
1 2 3 4 5

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