DOCUMENT RESUME

ED 356 138 SE 052 962

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TITLE The National Student Research Center: The Student Research Center Approach to Instruction Program Development Materials.
INSTITUTION National Student Research Center, Mandeville, LA.
SPONS AGENCY American Petroleum Inst., Washington, D.C.; Department of Education, Washington, DC.
PUB DATE [91]
NOTE 45p.; Funding also provided by South Central Bell Telephone, Intertel Foundation, Springhouse Publishing Corp., Graham Resources, and Chevron Oil Co.
PUB TYPE Guides - Non-Classroom Use (055)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Cooperative Learning; Discovery Learning; Educational Objectives; *Educational Strategies; Elementary Secondary Education; *Interdisciplinary Approach; Manipulative Materials; Middle Schools; Problem Solving; *Program Descriptions; Research Methodology; Science Education; Science Instruction; Scientific Research; *Student Research; *Teaching Methods; *Thinking Skills
IDENTIFIERS Blooms Taxonomy; Hands On Experience; Higher Order Learning; *National Student Research Center; Science Education Research

ABSTRACT

The National Student Research Center (NSRC) is dedicated to promoting student research and the use of the scientific method in all subject areas across the curriculum, especially science and mathematics. The NSRC facilitates the implementation of a nationally recognized, innovative, and highly effective approach to instruction called the Student Research Center (SRC). The SRC approach to instruction incorporates discovery/inquiry learning, hands-on learning, cooperative learning, interdisciplinary study, self-directed learning, problem solving, and a student centered curriculum. Due to multiple requests for program development materials, this booklet has been developed to describe the Student Research Center program. The booklet includes descriptions of: (1) the SRC approach to instruction that lists the program's 16 educational objectives; (2) the relationship between higher order thinking skills and the scientific method; (3) cooperative learning teams formed in the program; (4) the program as practiced at Mandeville, Louisiana Middle School; (5) the research and publication process; and (6) NSRC scientific research management materials. The development materials include an explication of SRC contracts; a description of editing skills and abstracting requirements; sample abstracts from mathematics and science research; and examples of the research and publication process for experimental and survey research. A comprehensive bibliography includes over 70 entries. (MDH)

THE NATIONAL STUDENT RESEARCH CENTER

NSRC

NATIONAL STUDENT RESEARCH CENTER

The Student Research Center Approach To Instruction

Program Development Materials

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This publication is made possible through grants provided by the United States Department of Education, South Central Bell Telephone, American Petroleum Institute, Intertel Foundation, Springhouse Publishing Corporation, Graham Resources, Inc., and Chevron Oil Company. Mandeville Middle School thanks these organizations for their generous support of public education.

The National Student Research Center

John I. Swang, Ph.D.

Introduction:

There is a growing national concern related to the "scientific illiteracy" of our nation's elementary, middle, and secondary school students. President Bush and numerous state Governors (USDE, 1990), the United States Department of Education (USDE, 1991), the National Council on Science and Technology Education, the American Association for the Advancement of Science (AAAS, 1990), the American Chemical Society (ACS, 1989), and the Council of Chief State School Officers (CCSSO, 1990), to mention a few, have all put forth national initiatives which will hopefully ameliorate the problem. The National Student Research Center (NSRC) incorporates many of the recommendations of these national initiatives such as an emphasis on the use of process and higher-level cognitive skills, hands-on learning activities, problem solving activities within a societal context, and the integration of science with other curriculum areas such as math, reading, language arts, social studies, history, and geography. The NSRC also addresses the National Education Goal of significantly improving the science abilities of our students by the year 2000.

The National Student Research Center (NSRC) is dedicated to promoting student research and the use of the scientific method in all subject areas across the curriculum, especially science and math. The NSRC facilitates the implementation of the nationally recognized, innovative, and highly effective approach to instruction called the Student Research Center in classrooms and schools across the country. The Student Research Center approach to instruction has three major

components. First, hands-on learning and the inquiry methods of instruction are emphasized. Second, there is authentic instruction in higher order thinking skills via the use of the scientific method in ongoing student research. And third, there is the regular publication of student research in a scientific journal which is widely distributed throughout the school and the local community (See enclosed issue).

The Student Research Center approach to instruction was featured in the September 1990 issue of Learning Magazine. Due to the national and international coverage of that article and additional advertisements in nationally circulated publications, over three hundred schools and thirty school systems from across the country have requested Student Research Center program development materials. Requests have also been received from schools in Canada, France, the Soviet Union, Egypt, Bahrain, and India. The United States Department of Education has invited the National Student Research Center to submit a membership application for panel review by the National Diffusion Network. A USDE subcontractor, the RMC Research Corporation, is currently providing technical assistance in this matter. A chapter length description of the Student Research Center approach to instruction will appear in the 1992 edition of Bergemann and Reed's college textbook entitled Point Counter Point: An Introduction to Education published by Duskin, Inc..

Student Research Center Approach To Instruction:

The Student Research Center approach to instruction is grounded in an extensive body of knowledge related to the teaching of science, the scientific method, the research process, and higher order thinking skills; contract learning, discovery/inquiry learning, hands-on

learning, cooperative learning, interdisciplinary study, independent self-directed learning, problem solving learning, and student centered curriculum (See: Comprehensive Bibliography).

The following educational objectives are emphasized in the Student Research Center approach to instruction :

a) Increase the utilization of the scientific method by encouraging all students to conduct scientific research projects throughout the school year.

b) Increase the utilization of the scientific method by encouraging all students to conduct scientific research projects in all subject areas across the curriculum.

c) Improve higher order thinking skills by requiring students to regularly conduct scientific research projects utilizing the scientific method.

d) Improve process skills such as problem solving and report writing by providing students with research and publication opportunities on a regular basis.

e) Increase scientific thinking in at-risk, minority, and female students by requiring students to work in cooperative learning teams composed of equal numbers of male and female students, minority and non-minority students, and high, regular and low academic achievers.

f) Provide increased opportunities for interdisciplinary study by requiring students to apply skills and concepts learned in all curriculum areas towards the completion of scientific research projects.

g) Provide increased hands-on learning experiences by requiring students to conduct experimentation as part of all scientific research projects.

h) Improve independent study skills of students by requiring more scientific research efforts outside the classroom by every student.

i) Improve problem solving skills of students by requiring that scientific research projects be related to some problem affecting the community or nation as a whole.

j) Improve library research skills of students by requiring a comprehensive review of the literature as part of all scientific research projects.

k) Improve writing skills by requiring students to write and edit their scientific research papers and abstracts till they are scientifically sound, grammatically correct, and letter perfect.

l) Improve communication skills by requiring students to work in cooperative learning teams and to make formal presentations of their completed research projects to a school audience which are video taped for student/teacher evaluation at a later date.

m) Improve word processing and desk-top publication skills by requiring students to use the personal computer in the writing of the research projects and publishing of their scientific journal.

n) Improve mathematical skills by requiring students to use random sampling techniques in collecting survey data and simple statistics, percents, averages, frequency counts, charts, and graphs in the analysis of data.

o) Create more positive attitudes about science and careers in scientific professions in all students by exposing them to meaningful, enjoyable, and successful scientific research learning experiences.

p) Improve utilization of elementary, middle, and secondary student scholarship by publishing a scientific journal of student research on a regular basis. Student research is a vast national resource which is largely ignored as we attempt to solve

technological, social, economic, environmental, and health problems which face our nation today.

Student Research Center learning activities include the following steps. First, students are assigned to cooperative research teams. Cooperative teams usually have no more than four members. Next, students cooperatively choose a topic of study in which they have a personal interest. Then the students complete an independent study contract and scientific method time-line for completion of the research project. They also write a statement of purpose or research idea. The students then conduct a review of the literature related to the research topic. Afterwards, the students develop a hypothesis to be tested. Next, the students carefully develop a research methodology. The utilization of a control and experimental group are encouraged for classical research. Sound questionnaire development and random sampling techniques are emphasized for survey research. A list of materials needed to conduct the research is also developed. Students then delegate responsibilities for completion of all methodological requirements. The students usually spend two to three weeks actually conducting the research, making observations, gathering information, and recording data in a systematic way. Afterwards, the students will compile their data. Then they will complete an analysis of the data using simple statistics and present the data in chart and graph form. Then the students will accept or reject their hypothesis and write a summary and conclusion. The students then make a formal presentation of their research project to a school audience, usually their classroom. The presentations are video taped for teacher and peer evaluation at a later date. Finally, the students will write ar abstract of the entire research project for publication. Students then complete desk-top publication of their school-based journals and

disseminate them throughout the school and local community. Journals are cataloged into the reference sections of all school libraries. The journals of student research are published on a regular basis during the school year. It should be noted that all learning activities are just as applicable to students who choose to work individually.

Higher Order Thinking Skills and the Scientific Method:

The teaching of science, the royal road to discovery and empirical knowledge which is characterized by the dispassionate application of the scientific method within the research process, is a creative art requiring both teacher and student to utilize the highest forms of rational and intuitive thought.

Too often, current curriculum and teaching methods are oriented to lower order thinking skills such as memorization and recall of facts and figures. While instruction of content must still be evident in the classroom, the Student Research Center approach to instruction takes more of a process orientation to instruction. Instruction moves away from passive student drill and memorization of facts and figures. Instruction moves toward active, hands-on, problem solving, student-centered involvement in the research and publication process as a mechanism for learning higher order thinking skills and broad concepts, as well as facts and figures.

The Student Research Center approach to instruction teaches the four "R's" of education: Reading, Writing, Arithmetic, and Research. The process of research and the scientific method are emphasized in order to develop higher order thinking skills (HOTS) in students. Bloom (1956), in his great work, A Taxonomy of Educational Objectives: The Classification of Educational Goals, and Brunner (1977), in his

classic, The Process of Education, have clearly demonstrated that the scientific method is one of the most objective, logical, rational, and highest form of thought.

The utilization of the scientific method and research process by the students is an excellent vehicle with which to teach numerous higher order thinking skills in a interactive and enjoyable way. Each step of the research process affords meaningful opportunities for students to utilize the following critical thinking skills: comprehension, conceptualization, hypothesizing, designing plans, observation of detail, comparison, deriving relationships, analysis, evaluation, assessment, synthesis, interpretation, drawing conclusions, generalizing, application, composition, and abstracting (See: Chart A).

Recently, the Council of Chief State School Officers in a new policy statement adopted in 1990 underscored the importance of higher order thinking skills being taught in all classrooms and made available to all students, especially to disadvantaged children (CCSSO, 1990). The Student Research Center approach to instruction strongly emphasizes the teaching of higher order thinking and process skills through the curriculum-wide utilization of the scientific method and research process. High level instruction is targeted to all students with special emphasis directed towards at-risk, minority, and female students who have traditionally lacked mastery of scientific and mathematical skills. The instructional approach provides highly verbal and hands-on learning experiences within a cooperative learning environment.

The National Student Research Center strongly believes that students should possess the critical thinking skills learned via the scientific method and research process so as to better cope with the

complexities of modern societal living. The Student Research Center approach to instruction prepares students to be efficient consumers and producers of research. It also encourages students to make significant contributions to the scientific body of knowledge both now and in the future.

Chart A

SCIENTIFIC METHOD AND HIGHER ORDER THINKING SKILLS

SCIENTIFIC METHOD SKILLS	BLOOM'S HIGHER ORDER THINKING SKILLS
1. STATEMENT OF PURPOSE OR RESEARCH IDEA	CONCEPTUALIZATION
2. REVIEW OF LITERATURE (TWO SOURCES)	COMPREHENSION
3. DEVELOP HYPOTHESIS	APPLICATION HYPOTHESIZING
4. METHODOLOGY (@ CONTROL/EXPERIMENTAL)	DESIGNING PLANS
5. LIST OF MATERIALS	DESIGNING PLANS
6. OBSERVATION @ DATA COLLECTION FORM	DESIGNING PLANS
7. BEGIN EXPERIMENTATION/OBSERVATION AND DATA COLLECTION	OBSERVATION MEASUREMENT
8. ANALYSIS OF DATA (SIMPLE STATISTICS/ CHARTS/GRAPHS)	ANALYSIS DERIVING RELATIONSHIPS COMPARISON EVALUATION ASSESSMENT
9. SUMMARY AND CONCLUSIONS	SYNTHESIS INTERPRETATION DRAWING CONCLUSIONS GENERALIZING
10. COMPLETE REPORT DUE	COMPOSITION
11. ABSTRACT DUE	ABSTRACTING
12. SEND TO LOCAL/NATIONAL JOURNAL	PUBLICATION

Cooperative Research Teams:

The Student Research Center approach to instruction emphasizes a cooperative classroom environment. The Student Research Center approach to instruction ensures that all students have equal opportunity for high quality educational experiences such as higher order thinking instruction, computer assisted learning, and student centered/driven curriculum through an emphasis upon constituting cooperative research teams which include appropriate numbers of disadvantaged and non-disadvantaged students working collaboratively.

Johnson and Johnson (1986), in their Circles of Learning: Cooperation in the Classroom, have clearly shown the benefit of cooperative learning experiences for all students, but especially for the underachieving student. The mastery and enjoyment of learning engendered in students through cooperative hands-on experiences have been repeatedly and clearly demonstrated to significantly improve student learning and attitudes about learning. This is especially germane to educational initiatives which attempt to increase scientific literacy in students and improve student attitudes about the study of science and future careers in the scientific professions.

Cooperative research teams are composed of equal numbers of male and female students, minority and non-minority students, and high, regular and low academic achievers. In this manner high achieving students can work with low achieving students in an collaborative fashion. The teachers' role in the cooperative research and publication process is to provide all the necessary guidance and resources for conducting the research project, manage the cooperative research teams, and monitor the daily progress and work completion on the scientific method time-line contracts.

Other Program Elements:

The Student Research Center approach to instruction establishes high standards and expectations for achievement by requiring a minimum of two scientific research projects from each student per school year and by requiring that the projects be letter perfect, grammatically correct, and scientifically sound before acceptance by the teacher for publication in the scientific journal of student research. Many students are capable of four to eight research projects per year.

Student assessment is broad based, "student friendly," and product oriented. Assessment includes: the evaluation of each student's portfolio of published research projects, the quality and quantity of their cooperative research team work, the punctuality of meeting all deadlines on their scientific method time-line learning contract, the review of the video tape of the presentation of their research projects, and the formal evaluation of growth in high order thinking skills and concept mastery during the year.

The Student Research Center approach to instruction encourages students to use computers in writing and editing their scientific papers and abstracts. Improving word processing skills is one curriculum goal. Students also use desk-top publication software to publish their local scientific journals of student research during the school year. The computer also facilitates random sampling procedures in survey research and in computing simple statistics; percents, averages, and frequency counts, in the analysis of all data. Computer aided design and production of charts and graphs depicting the data collected is also encouraged.

The Student Research Center approach to instruction contributes to teacher development by providing program development and instructional materials in the areas of teaching the scientific

method, using the inquiry method of instruction, conducting the research and publication process, teaching higher order thinking skills, managing cooperative learning teams, utilizing the scientific method time-line learning contracts, and computer skills.

The Student Research Center approach to instruction institutes accountability for educational outcomes by training all participating teachers to conduct (pre and post) measurement of higher order thinking skills and attitudes towards science at the beginning and ending of the school year. Teachers are also requested to monitor the number of research projects completed before and each year after the Student Research Center is established in their classrooms.

The Student Research Center approach to instruction promotes closer school and community ties and support in several ways. First, parents at each participating school are strongly encouraged to become involved in their child's research projects. Parents are also instrumental in the distribution of the scientific journals of student research throughout the local community. Second, the business and professional community express great pleasure in knowing that the children of their community are being educated at such a high level. Science professionals and businesses that rely upon science are especially excited about the Student Research Center approach to instruction. They see the curriculum as relevant to their needs for an educated populace of future workers and consumers of their products and services. Third, the business and professional community and grant sources are quite generous in support of a Student Research Center. (For example, during the past three years, the NSRC has raised over $42,000 from the following companies and organizations through school partnership programs: Chevron Oil Company, South Central Bell Telephone Company, American Petroleum Institute, Graham

Resources, Inc., Springhouse Publishing Corporation, and the United States Department of Education.)

In addition to the previously mentioned elements of the Student Research Center approach to instruction, there will soon be local and national networking of all Student Research Centers in order to share research findings and conduct inter-center collaborative research, the establishment of a national telecommunications data bank of student research projects with which students can freely store and retrieve abstracts of student research, the publication of a refereed national journal of student research, and the convening of a national conference of Student Research Centers where centers can share ideas and students can present exemplary research projects to a national audience.

Mandeville Middle School's Student Research Center:

During the 1988-1989 school year, the Student Research Center was founded at Mandeville Middle School. It facilitated the research and publication efforts of its student population. During the 1989-1990 school year, membership in the Center was extended to all 42 schools and 26,000 students in the St. Tammany Parish School System in Louisiana. During the 1990-1991 school year, the National Student Research Center (NSRC) was founded and is currently disseminating the Student Research Center approach to instruction pioneered at Mandeville Middle during the prior two years.

Over the last three years, the Student Research Center approach to instruction at Mandeville Middle School in Mandeville, Louisiana has been associated with a significant increase in the number of scientific research projects completed by students. During the 1986-87 school year prior to the establishment of the Student Research

Center, a total of 42 research projects were completed. At the end of this 1990-1991 school year, a total of 976 research projects were completed by our students (See: Table A). The Center has also been associated with significant gains in higher order thinking skills as measured by the California Achievement Test. A three-year longitudinal tracking of Mean National Percentiles (MNP), Mean Normal Curve Equivalents (MNCE), and Mean Standard Scores (MSS) clearly demonstrates the gains (See: Tables B). It is my experience that this success can be achieved by other schools with the implementation of the Student Research Center approach to instruction and the publication of a scientific journal of student research.

Table A

Mandeville Middle School

Number of Scientific Research Projects Completed in All Subject Areas

School Year	Research Projects Completed	Student Population
1986-1987	42	(N= 600)
1987-1988	358	(N=1,000)
1988-1989	618	(N=1,000)
1989-1990	588	(N=1,100)
1990-1991	976	(N=1,200)

Table B

Mandeville Middle School

* Three Year Tracking of Selected CAT Scores for the 1987 Class

Science	Grade Four (1987-1988)	Grade Five (1988-1989)	Grade Six (1989-1990)	Total Change
MNP	68.1	60.1	75.0	+ 6.9
MNCE	61.0	55.4	64.7	+ 3.7
MSS	668.3	678.6	724.1	+55.8
Social Studies	**Grade Four (1987-1988)**	**Grade Five (1988-1989)**	**Grade Six (1989-1990)**	**Total Change**
MNP	65.5	66.7	71.7	+ 6.2
MNCE	58.1	59.1	61.5	+ 3.4
MSS	680.8	698.6	720.0	+39.2
Reading Comprehension	**Grade Four (1987-1988)**	**Grade Five (1988-1989)**	**Grade Six (1989-1990)**	**Total Change**
MNP	62.5	63.6	80.2	+17.1
MNCE	58.0	57.3	66.7	+ 8.7
MSS	713.8	730.2	759.7	+45.9

* Three Year Tracking of Selected CAT Scores for the 1988 Class

Science	Grade Four (1988-1989)	Grade Five (1989-1990)	Grade Six (1990-1991)	Total Change
MNP	66.4	68.6	77.2	+10.8
MNCE	60.5	60.2	65.8	+ 5.3
MSS	665.9	691.1	726.8	+25.2
Social Studies	**Grade Four (1988-1989)**	**Grade Five (1989-1990)**	**Grade Six (1990-1991)**	**Total Change**
MNP	69.6	73.0	75.0	+ 5.4
MNCE	59.9	62.9	63.2	+ 3.3
MSS	685.0	704.5	722.5	+37.5
Reading Comprehension	**Grade Four (1988-1989)**	**Grade Five (1989-1990)**	**Grade Six (1990-1991)**	**Total Change**
MNP	60.2	68.3	21.2	+21.2
MNCE	56.6	60.0	66.3	+ 9.7
MSS	708.8	735.7	758.6	+49.8

* Areas of curriculum most impacted by the Student Research Center approach to instruction.

Mandeville Middle's local scientific journal of student research, The Researcher, is published quarterly. It is freely distributed to all students who publish and all schools which participate in the research and publication process. The Center has published 12 editions of The Researcher which have contained over 600 abstracts of student research projects. The Center has circulated over 3,000 copies of The Researcher to students, teachers, schools, and libraries in the St. Tammany Parish School System, the State of Louisiana, and the nation during the last three school year. The journal is permanently cataloged into the reference section of all school libraries in the St. Tammany Parish School System and elsewhere.

Rationale:

The National Student Research Center espouses the education of scientifically literate students who have an ability to think scientifically and are able to apply that ability to the betterment of their personal lives and the society in which they live. If the United States of America is to remain a leader in the scientific world, our elementary, middle, and secondary school students must be afforded research and publication opportunities such as those offered by the National Student Research Center.

The Research and Publication Process:

The following is a compilation of some of the most salient materials used in the student research and publication process. Permission is granted for teachers and schools to freely use these materials in developing, implementing, and managing their Student Research Center approach to instruction:

THE NATIONAL STUDENT RESEARCH CENTER

Program Development Materials

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NATIONAL STUDENT RESEARCH CENTER

SCIENTIFIC RESEARCH MANAGEMENT MATERIALS

Scientific Research Contracts

Basically, the scientific method consists of six distinct steps: 1) careful planning, 2) development of a hypothesis, 3) research design, 4) data gathering, 5) data analysis, and 6) interpretation. The enclosed teaching materials described below can be most helpful in improving the quality and facilitating the completion of a student's scientific research efforts.

In order to help the student clarify his/her research project, the Scientific Research Learning Contract should first be completed (See: Attachment 1). Brainstorming sessions and in-depth discussions between student and teacher and parents are most helpful at this time. The KISS or Keep It Simple Simon Rule is paramount in helping a student achieve a clear picture of his/her research project. Once this contract has be completed, the student and teacher may then complete a Scientific Method Time-Line Contract.

The Scientific Method Time-Line Contract provides a structure for research project completion by clearly explicating the steps of the scientific method and indicating the date upon which each step is to be completed. The enclosed Scientific Method Time-Line Contracts represent only two of several different scientific methodologies, the classical or experimental design and the survey research design. The field research, case study, evaluative, epidemiological, prospective, and longitudinal research designs may also be incorporated into at time-line contract format and utilized by the student researcher.

Classroom learning activities associated with the use of the Scientific Method Time-Line Contract for experimental research projects include the following steps (See: Attachment 2). First, students choose a topic of study in which they have a personal interest. Then the students complete the research learning contract and time-line contract for completion of the research project. Please note the due dates for rough and final drafts of each step. They also write a statement of purpose or research idea. Next, the students complete a review of the literature related to the research topic. Afterward, the students develop a hypothesis to be tested. Then the students develop a methodology utilizing a control and experimental group. A list of materials needed to conduct the research is also developed. The students usually spend two to three weeks actually conducting the experiment, making observations, and recording data in a systematic way. Afterward, the students will complete an analysis of data using simple statistics and present the data in chart and graph form. Then the students will accept or reject the hypothesis and write a summary and conclusion. The students then make a formal presentation of the research project to a school audience. Finally, the students will write an abstract of the entire research project for publication in the scientific journal.

Classroom learning activities associated with the use of the Scientific Method Time-Line Contract for survey research projects include the following steps (See Attachment 3). First, students choose a topic of study in which they have a personal interest. Then the students complete the research learning contract and time-line contract for completion of the research project. Please note the due dates for rough and final drafts of each step. They also write a statement of purpose or research idea. Next, the students complete a review of the literature related to the research topic. Afterward, the students develop a hypothesis to be tested. Then the students develop a methodology utilizing a "students questioning students" format. Here the students construct a questionnaire about their research topic. Then the students draw a random sample of the school's student population to which they will administer the questionnaires. Once the questionnaires are completed and returned, the students will score them. Afterward, the students will complete an analysis of data using simple statistics and present the data in chart and graph form. Then the students will accept or reject the hypothesis and write a summary and conclusion. The students then make a formal presentation of the research project to a school audience. Finally, the students will write an abstract of the entire research project for publication in the scientific journal.

Remember that all parties involved with the scientific research project (student, teacher, and parents) must sign the contracts. A copy of each contract should be given to students and parents for posting at home. A copy should also be placed in the students classroom folder for frequent reference. These teaching materials can greatly clarify students' thinking about their research projects and facilitate their timely completion.

Student Editing and Abstracting Skills

It is very important that peer and teacher editing of each research step be completed before moving on to the next step of the process. Each step must be grammatically correct, letter perfect, and scientifically sound. Editing skills to be taught to and used by students are provided (See Attachment 4).

After the entire research project has been completed, students must summarize their work into an abstract for publication in the local and/or national scientific journal of student research. The abstracting requirements and standardized format are provided (See Attachment 5). Examples of science, social studies, math, and language arts research abstracts which were published in Mandeville Middle's local scientific journal are attached (See: Attachment 6, 7, 8, and 9).

Research and Publication Process

A detailed description of the research and publication process for experimental and survey research is provided (See: Attachment 10 and Attachment 11). Both descriptions assume completion of the research and publication process in approximately nine weeks. The process can be slowed down and expanded to longer periods of time (ie; semester).

(Attachment 1)

THE NATIONAL STUDENT RESEARCH CENTER

SCIENTIFIC RESEARCH LEARNING CONTRACT

DATE:_____

STUDENT'S SIGNATURE:_____

PARENT'S SIGNATURE:_____

TEACHER'S SIGNATURE:_____

1. I WOULD LIKE TO DO A SCIENTIFIC RESEARCH PROJECT ON_____

2. I AM INTERESTED IN THIS TOPIC BECAUSE_____

3. SOME OF THE QUESTIONS I WANT TO ANSWER ARE_____

4. I WILL COLLECT INFORMATION FROM THESE SOURCES (MINIMUM OF 2)

_____ ENCYCLOPEDIAS
_____ BOOKS
_____ NEWSPAPER ARTICLES
_____ JOURNALS
_____ INTERVIEWS
_____ MAGAZINES
_____ QUESTIONNAIRES
OTHER_____

5. I WILL COMPLETE MY RESEARCH PROJECT BY_____

(Attachment 2)

THE NATIONAL STUDENT RESEARCH CENTER

TIME-LINE CONTRACT FOR COMPLETION OF EXPERIMENTAL RESEARCH PROJECT

TITLE:_____

STUDENT SIGNATURE:_____

PARENT SIGNATURE:_____

TEACHER SIGNATURE:_____

DATE:_____

STEPS	DATES	
	ROUGH DRAFT DUE DATE	FINAL DRAFT DUE
DATE		
1. STATEMENT OF PURPOSE OR RESEARCH IDEA		
2. REVIEW OF LITERATURE (TWO SOURCES)		
3. DEVELOP HYPOTHESIS		
4. METHODOLOGY (@ CONTROL/EXPERIMENTAL)		
5. LIST OF MATERIALS		
6. OBSERVATION @ DATA COLLECTION FORM		
7. BEGIN EXPERIMENTATION/OBSERVATION AND DATA COLLECTION		
8. ANALYSIS OF DATA (SIMPLE STATISTICS/ CHARTS/GRAPHS)		
9. SUMMARY AND CONCLUSIONS		
10. COMPLETE REPORT DUE		
11. ABSTRACT DUE		
12. SEND TO LOCAL/NATIONAL JOURNAL		

(Attachment 3)

THE NATIONAL STUDENT RESEARCH CENTER

TIME-LINE CONTRACT FOR COMPLETION OF SURVEY RESEARCH PROJECT

TITLE: _____

STUDENT SIGNATURE: _____

PARENT SIGNATURE: _____

TEACHER SIGNATURE: _____

DATE: _____

STEPS	DATES	
	ROUGH DRAFT DUE DATE	FINAL DRAFT DUE
DATE		
1. STATEMENT OF PURPOSE OR RESEARCH IDEA		
2. REVIEW OF LITERATURE (TWO SOURCES)		
3. DEVELOP HYPOTHESIS		
4. METHODOLOGY		
5. DEVELOP QUESTIONNAIRE		
6. DRAW RANDOM SAMPLE POPULATION		
7. ADMINISTER QUESTIONNAIRES		
8. SCORE QUESTIONNAIRES		
9. ANALYSIS OF DATA (SIMPLE STATISTICS/ CHARTS/GRAPHS)		
10. SUMMARY AND CONCLUSION		
11. COMPLETE REPORT DUE		
12. ABSTRACT DUE		
13. SEND TO LOCAL/NATIONAL JOURNAL		

(Attachment 4)

NATIONAL STUDENT RESEARCH CENTER

EDITING SKILLS

Editing of all work is first done by students in cooperative learning groups. One-on-one teacher/student editing is done afterwards. Students are taught the following editing skills (Malkofsky, 1982):

ORDER OF PRESENTATION: Do sentences and ideas flow in a way that makes sense? Look for sentences that are separated, but belong together. Also, look for sentences and ideas that are clumped together, but should be separated.

MISSING WORDS/IDEAS: Add words, details, or ideas that are needed to clarify your message.

EXCESS BAGGAGE: Cross out words or ideas that add nothing to your message.

WORDING AND FLOW OF LANGUAGE: Listen to the flow of your wording. Try to make the words sound natural and pleasing to the ear.

SPELLING: Check the spelling of any words you are not sure how to spell. Read the writing backwards to check for misspelled words.

PUNCTUATION: Are periods, commas, question marks, colons, semicolons, quotation marks, exclamation points, apostrophes, and underlinings used where they are needed? Have you used the correct punctuation mark?

CAPITALIZATION: Have you capitalized the first word, last word, and all the important words in the title? Have you capitalized the first word of each sentence?

GRAMMAR: Do nouns and verbs fit together so that your sentences are clear and correct?

VOCABULARY: Are words precise? Are your words lively? Do they help us make a picture in our minds? Can you find wrong or vague words?

SENTENCE STRUCTURE: Is the sentence structure appropriate and varied? Do you have some long and some short sentences? Do you have any run-on sentences? Do all of your sentences give complete thoughts?

ORGANIZATION OF PAPER: Have you told about things in an order that makes sense?

CLARITY OF IDEAS: Have you written things clearly enough so that we can understand exactly what you meant? Are ideas clearly expressed?

(Attachment 5)

NATIONAL STUDENT RESEARCH CENTER

ABSTRACTING REQUIREMENTS AND FORMAT

The abstract writer must decide a) what to include (main ideas), b) what to eliminate (supporting details), c) how to reword and reorganize information, and d) how to ensure that the summary accurately reflects the text of the research paper. All abstracts must meet the following requirements:

1. No library reports or demonstration type projects can be published. Only research utilizing the scientific method will be published.

2. Abstracts must be typed, single spaced, and not exceed 350 words or one side of a standard 8 1/2 x 11 inch sheet of paper. Side margins should be no less than 3/4 of an inch and top/bottom margins should be at least one inch.

3. Teachers must edit the abstracts to ensure that they are scientifically sound, grammatically correct, and letter perfect.

4. Abstracts must adhere to the following standardized form.

Title

Student Author(s):
Grade:
Teacher(s):

School:
Address:

Statement of Purpose and Hypothesis:

(What do you want to find out? What do you think will happen?)

Methodology:

(How will you test for what you think will happen? List all the materials you will need. Explain how your research is to be conducted.)

Analysis of Data:

(What did the data you collected indicate about what happened in your research project? Include all data here.)

Summary and Conclusion:

(What did you find out? Did you accept or reject your hypothesis?)

(Attachment 6)

(Science Abstract)

POLLUTION AND THE GERMINATION OF SEEDS

STUDENT AUTHOR: LAURIE SELTZER
GRADE: 6
TEACHER: LINDA KYLE, M.ED.

SCHOOL: MANDEVILLE MIDDLE
2525 SOULT ST
MANDEVILLE, LA 70448

I. STATEMENT OF PURPOSE AND HYPOTHESIS

I wanted to find out if pollution affects the germination of seeds. My first hypothesis stated that water pollution will have an effect on the germination of pinto bean seeds. My second hypothesis stated that increasing amounts of pollutant should result in more of the seeds failing to germinate.

II. METHODOLOGY

I tested these hypotheses by presoaking pinto bean seeds for twenty-four hours in regular tap water. I then prepared solutions of water containing a liquid detergent pollutant in increasing concentrations of 0%, 20%, 40%, 60%, 80%, and 100%. Six groups of ten presoaked beans were placed between two paper towels and then saturated with each concentration of polluted water. The group saturated with plain tap water (0% pollution) was my control group. The other five groups of beans were my experimental groups. The groups of beans were then placed in a separate zip lock bag and sealed. After twenty-four hours, the bags were opened, the seeds examined, and the results recorded.

III. ANALYSIS OF DATA

The results showed that the more pollution in the water, the fewer the seeds that germinated. All ten seeds germinated in my control group saturated in regular tap water with 0% pollution. Eight of the ten seeds germinated in the experimental group saturated with water containing a 20% concentration of pollution. Three of the ten seeds germinated in the experimental group saturated with the 40% concentration. Only two of the ten seeds germinated in the experimental groups saturated with the 60% and 80% concentrations. None of the seeds germinated in the experimental group saturated with the 100% pollutant concentration.

IV. SUMMARY AND CONCLUSION

My data confirmed that the germination of pinto bean seeds is affected by the presence of a liquid detergent pollutant. The number of seeds able to germinate was related to the amount of the pollutant present. The higher amounts of pollution were associated with more seeds failing to germinate. I accepted both of my hypotheses.

(Attachment 7)

(Math Abstract)

THE PROBABILITY THEORY

STUDENT AUTHOR: R.J. SMITH
GRADE: 6
TEACHER: JOHN SWANG, PHD

SCHOOL: MANDEVILLE MIDDLE SCHOOL
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MANDEVILLE, LA 70448

I. STATEMENT OF PURPOSE AND HYPOTHESIS

Probability is the science of change. Probability is defined as the relative expectancy of an event's occurrence. For instance, if you flip a coin, the probability of getting a head or a tail is 1 out of 2 chances. I want to see if probability theory is really true. My hypothesis states that if I flip a coin 300 times, I will get 150 heads and 150 tails.

II. METHODOLOGY

First, I will do my review of literature, statement of problem, and hypothesis. I will then collect the materials I need to conduct the experiment. Then I will conduct my experiment and collect my data. I will flip a coin 100 times and observe how many heads and how many tails I get. I will repeat this process three times and then summarize my data. Next, I will analyze my data, accept or reject my hypothesis, and write a summary and conclusion. Then I will publish an abstract of my research.

III. ANALYSIS OF DATA

I flipped a coin 300 times and came up with 157 heads and 143 tails. The expected numbers, according to probability theory, were 150 heads and 150 tails.

IV. SUMMARY AND CONCLUSION

I found out that if I flip a coin three hundred times, I will come up with just about 150 heads and 150 tails. If I flipped the coin an additional 300 times, it is very likely that the number of heads and tails recorded would be an even closer approximation of the frequencies predicted by probability theory. Therefore, I accepted my hypothesis which stated that if I flip a coin 300 times, then I will get 150 heads and 150 tails.

(Attachment 8)

(Social Studies Abstract)

ANIMAL ABUSE AND EXPERIMENTATION

STUDENT AUTHOR: RAYMOND JONES
GRADE: 6
TEACHER: JOHN SWANG, PHD

SCHOOL: MANDEVILLE MIDDLE
2525 SOULT ST.
MANDEVILLE, LA 70448

I. STATEMENT OF PURPOSE AND HYPOTHESIS

I wanted to know what students at Mandeville Middle School know about animal abuse and experimentation. My hypothesis stated that the majority of students at MMS are aware of animal abuse and experimentation in our community.

II. METHODOLOGY

I reviewed the literature about animal abuse and experimentation. Then I wrote my statement of problem and hypothesis. I developed my questionnaire, drew a random sample population of twenty-five students, and administered my questionnaires to them. Then I scored the questionnaires, wrote an analysis of data, and summary and conclusion. Finally, I wrote my abstract and published my completed project.

III. ANALYSIS OF DATA

The majority of students knew that animal abuse is a problem in our community. Students agreed that animals have rights just like people do. The majority knew that research on animals is being conducted in our community at a local university. When students see animal abuse, the majority feel angry and think abusers should be taken to jail. The majority do not personally know anyone who abuses or neglects animals. The majority support the Society for Prevention of Cruelty to Animals. One third of the students agreed that animal research is necessary, one third disagreed that animal research was necessary, and one third was undecided. Some of the main causes of animal abuse cited by students were drug abuse, heartless people who don't care, stupid people, fur coat manufacturers, and animal experiments.

IV. SUMMARY AND CONCLUSION

The majority of students at MMS know that animal abuse is a problem in our community. They also know that animal experimentation takes place in our community. Therefore, I accepted my hypothesis which stated that the majority of students at MMS are aware of animal abuse and experimentation in our community.

(Attachment 9)

(Language Arts Abstract)

C.S. LEWIS

STUDENT AUTHOR: JOHN SIMMONS
GRADE: 5
TEACHER: S. SCHOENTHALER

SCHOOL: MANDEVILLE MIDDLE SCHOOL
2525 SOULT ST.
MANDEVILLE, LA 70448

I. STATEMENT OF PURPOSE AND HYPOTHESIS

I wanted to find out what the students at MMS know about C.S. Lewis's books. My first hypothesis stated that 25% of the students surveyed would have read at least one of his Narnia books. My second hypothesis stated that Aslan would be the favorite character of students who have read his books. My third hypothesis stated that, of those who had read his works, the favorite book would be The Last Battle. My fourth hypothesis stated that everyone who had read his books would have enjoyed them. My last hypothesis stated that one percent of the students surveyed would have read all seven of the Chronicles of Narnia.

II. METHODOLOGY

First, I read each of Lewis's seven Chronicles of Narnia. Then I developed my hypotheses. Next, I developed my questionnaire. Then I made 20 copies. I randomly selected 20 fifth grade students at MMS. Then I passed the surveys out. When I got the surveys back, I scored them. Then I analyzed my data.

III. ANALYSIS OF DATA

I found that 40% of the students had read at least one of Lewis's books. Their favorite character was Prince Caspian. The students favorite book was The Lion, the Witch, and the Wardrobe. My data indicated that 38% of the students surveyed did not like Lewis's books. I also found out that 13% of the students surveyed had read all of the Chronicles of Narnia.

IV. SUMMARY AND CONCLUSION

I rejected all of my hypotheses. More students had read at least one of Lewis's books than I had hypothesized. More students than I predicted disliked his books. Also, the students' favorite character was Prince Caspian and favorite book was The Lion, the Witch, and the Wardrobe.

(Attachments 10)

NATIONAL STUDENT RESEARCH CENTER

RESEARCH AND PUBLICATION PROCESS: EXPERIMENTAL

1. Complete Scientific Research Learning Contract.
2. Develop Time Line for research project completion.
3. Write Statement of Purpose or Research Idea (What do I want to find out?).
4. Review literature.
5. Develop Hypothesis (What do I think will happen?).
6. Teacher/student edit till letter perfect and students present to class for peer evaluation.
7. Develop Methodology (How can I test what I think will happen?).
8. List Materials needed to conduct research.
9. Develop Observation and Data Collection Form.
10. Edit/present.
11. Record observations/collect data.
12. Edit/present.
13. Analysis of Data (What happened?).
14. Summary and Conclusion (What did I find out? Accept or reject my Hypothesis?).
15. Edit/present.
16. Prepare Abstract.
17. Edit/present.
18. Video-tape presentation for teacher/student evaluation.
19. Abstract is entered into school-based scientific journal.
20. Publish Journal - Cooperative Effort.
21. Distribute to authors and families, classrooms for a Drop Everything and Read (D.E.A.R.) Program, the community, and cataloged into reference section of school library, etc..

EXAMPLE OF EACH STEP ON EXPERIMENTAL TIME-LINE CONTRACT:

MINERAL CONTENT OF WATER AND PLANT GROWTH

BY ADRIENNE POTTER

I. STATEMENT OF PURPOSE OR RESEARCH IDEA

I want to find out how the mineral content of water affects plant growth. I want to observe the effects of using distilled water, tap water, and salt water on plant growth.

II. REVIEW OF LITERATURE

Water contains many minerals which are necessary for good plant growth. These minerals include iron, calcium, magnesium, phosphorus, potassium, and nitrogen.

If a plant is lacking or has too much of any of these minerals the plant may die or not grow into a healthy plant. For instance, if the water has little or no nitrogen or calcium the roots will be large, but the leaves will be small. If there is too much or too little potassium or iron the leaves will be discolored.

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III. HYPOTHESIS

My hypothesis states that there will be a significant difference in the growth of three plants watered with distilled water, tap water, and salt water.

IV. METHODOLOGY

To do my project I am going to grow three pots of seeds, one control and two experimental. I will give them all the exact same amount of light and soil. The seeds will be planted in the same kind of pots and be planted to the same depth. They will be given the same amount of water. The only difference in treatment will be the mineral content of the water. My control seeds will be given tap water. My first experimental seeds will be given distilled water and the other experimental seeds will be given salt water. I will record my data

for twenty days: when seeds sprouted, number of seeds sprouted, height of plants, color of leaves, and number of leaves. I will then analyze my data, accept or reject my hypothesis, and write a summary and conclusion.

V. MATERIALS

3 Flower pots
18 Seeds (6 per pot)
1 Large bag of potting soil
Tap water
Distilled water
Container of salt
Data Collection Form

VI. ANALYSIS OF DATA

Four seeds in the control group watered with tap water sprouted on days 6, 7, and 8, of the experiment. The plants grew to an average height of 15 centimeters and had a total of 16 leaves. Six seeds in the experimental group watered with distilled water sprouted on days 7, 10, and 15. The plants grew to an average height of 22 centimeters and had a total of 26 leaves. No seeds in the experimental group watered with salt water sprouted.

VII. SUMMARY AND CONCLUSION

The plants watered with distilled water grew the tallest and had the most leaves. The plants watered with tap water were shorter and did not have as many leaves as the plants watered with distilled water. The seeds watered with salt water never sprouted.

I accepted my hypothesis because there was an observable difference in the rate of growth of plants watered with tap water, distilled water, and salt water. The mineral content of water does affect the growth of plants.

(RESEARCH PROJECT ABSTRACT)

MINERAL CONTENT OF WATER AND PLANT GROWTH

AUTHOR: ADRIENNE POTTER
GRADE: 6
TEACHER: JOHN SWANG, PHD

SCHOOL: MANDEVILLE MIDDLE SCHOOL
2525 SOULT ST.
MANDEVILLE, LOUISIANA 70448

I. STATEMENT OF PURPOSE AND HYPOTHESIS

I wanted to determine the effects of using tap water, distilled water, and salt water on the growth of plants. My hypothesis stated that there would be a significant difference in the growth of plants watered with water of varying mineral content.

II. METHODOLOGY

I took eighteen seeds and planted them in the same amount of soil. I planted six per three pots. I treated all planted seeds equally except for the kind of water used. I used tap water in one pot. I used distilled water in the other pot. I used salt water in the last pot. I observed for three weeks and recorded my data: color of leaves, height of plants, number of leaves, number of seeds sprouted, and when seeds sprouted.

III. ANALYSIS OF DATA

Four seeds in the control group watered with tap water sprouted on days 6, 7, and 8, of the experiment. The plants grew to an average height of 15 centimeters and had a total of 16 leaves. Six seeds in the experimental group watered with distilled water sprouted on days 7, 10, and 15. The plants grew to an average height of 22 centimeters and had a total of 26 leaves. No seeds in the experimental group watered with salt water sprouted.

IV. SUMMARY AND CONCLUSION

In conclusion, because of the visible differences in height and number of leaves, I accepted my hypothesis which stated that there would be a significant difference in the growth of plants watered with water of varying mineral content. The mineral content of water does affect the growth of plants.

(Attachments 11)

NATIONAL STUDENT RESEARCH CENTER

RESEARCH AND PUBLICATION PROCESS: SURVEY

1. Complete Scientific Research Learning Contract.
2. Develop Time Line for Research Project completion.
3. Write Statement of Purpose or Research Idea (What do I want to find out?).
4. Review Literature.
5. Develop Hypothesis (What do I think will happen?).
6. Teacher/student edit till letter perfect and students present to class for peer evaluation.
7. Develop Methodology (How can I test what I think will happen?).
8. Develop Questionnaire - Cooperative effort.
9. Draw Random Sample Population - Cooperative effort.
10. Edit/present.
11. Administer Questionnaires.
12. Score Questionnaires.
13. Develop Data Collection Form.
14. Edit/present.
15. Analysis of Data (What information did I collect?).
16. Summary and Conclusion (What did I find out? Accept or reject my hypothesis?).
17. Edit/present.
18. Prepare Abstract.
19. Edit/present.
20. Video-tape presentation for teacher/student evaluation.
21. Abstract is entered into school-based scientific journal.
22. Publish Journal - Cooperative effort.
23. Distribute to authors and families, classrooms for a Drop Everything and Read (D.E.A.R.) Program, the community, and cataloged into reference section of school library, etc..

EXAMPLE OF EACH STEP ON SURVEY TIME-LINE CONTRACT:

ATTITUDES ABOUT GARBAGE DISPOSAL IN ST. TAMMANY PARISH

BY JASON SCARBOROUGH

I. STATEMENT OF PURPOSE OR RESEARCH IDEA

St. Tammmany Parish is having a serious garbage disposal problem. I would like to know what the students at Mandeville Middle School think about our garbage disposal problem.

II. REVIEW OF LITERATURE

In St. Tammany Parish we dispose of our garbage by using landfills. We are running out of room for landfills, so people are thinking about other ways to dispose of our garbage. Parish leaders are considering incineration, recycling, and shipping our garbage somewhere else. Incineration is not desirable because of air pollution problems. Recycling is expensive and not socially popular at this time. Shipping garbage to another location is expensive and politically troublesome.

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2. Brown, M. (1952). The Toxic Cloud. New York: Harper and Row Publishers. PP. 66, 72, 245, 275.

III. HYPOTHESIS

My hypothesis states that there is a consensus of opinion among the students at Mandeville Middle School about how garbage should be disposed of in St. Tammany Parish.

IV. METHODOLOGY

I will develop a questionnaire to find out what students at MMS think should be done about the garbage disposal problem in St. Tammany Parish. I will take a random sample of 15 students at MMS from the 4th, 5th, and 6th grades. I will administer the questionnaires to the students. Next, I will collect and analyze my data. Then I will accept or reject my hypothesis. Finally, I will write a summary and conclusion.

V. QUESTIONNAIRE

1. Have you ever thought about what happens to St. Tammany's Garbage?
_____Yes _____No

2. St. Tammany Parish disposes of its garbage by using a landfill. Do you have any problem with the way we dispose of our garbage?
_____Yes _____No

SA=Strongly Agree A=Agree D=Disagree SD=Strongly Disagree

3. St. Tammany's garbage should be disposed of by incineration.
_____SA _____A _____D _____SD

4. St. Tammany's garbage should be recycled.
_____SA _____A _____D _____SD

5. St. Tammany's garbage should be shipped to another place for disposal.
_____SA _____A _____D _____SD

6. What do you think the environmental effects would be if we used an incinerator to dispose of our garbage?

7. What do you think the environmental effects would be if we recycled the garbage?

8. What do you think the environmental effects would be if we shipped the garbage to another place for disposal?

9. What do you think are the environmental effects of using a landfill?

10. List any ideas you have on how we should dispose of our garbage?

11. What grade are you in? __4th, __5th, __6th

VI. ANALYSIS OF DATA

A majority of students have thought about the problem of garbage disposal in St. Tammany Parish. They think that landfills could hurt the environment. A majority of students feel the need for recycling and incineration of our garbage. A majority of students are against shipping garbage to another place. Most students thought there would be lots of air pollution if the garbage was incinerated.

VII. SUMMARY AND CONCLUSION

I accept my hypothesis which stated that there would be a consensus in how the students at MMS feel about garbage disposal. The majority of the students felt the best was to control our garbage would be to recycle what could be recycled and have an incinerator with a good filter to incinerate the rest.

(RESEARCH PROJECT ABSTRACT)

GARBAGE DISPOSAL IN ST. TAMMANY PARISH

AUTHOR: JASON SCARBOROUGH
GRADE: 6
TEACHER: JOHN SWANG, PHD

SCHOOL: MANDEVILLE MIDDLE SCHOOL
2525 SOULT ST.
MANDEVILLE, LOUISIANA 70448

I. STATEMENT OF PURPOSE AND HYPOTHESIS

I wanted to know what the students at MMS thought about garbage disposal in St. Tammany Parish. My hypothesis stated that there would be a consensus in what the students thought about garbage disposal.

II. METHODOLOGY

First, I did a review of the literature. Then I conducted a survey of the students at MMS. I randomly chose 15 students. I developed a questionnaire and administered it to the students. Then I analyzed the data.

III. ANALYSIS OF DATA

I found that a majority of students at MMS had thought about the problem of garbage disposal. The majority of students thought that we should recycle what can be recycled and incinerate the rest. The incinerator should have a good filter. The majority are against shipping our garbage to another place.

IV. SUMMARY AND CONCLUSION

I accepted my hypothesis which stated that there would be a consensus of opinion about garbage disposal. Overall, the majority of students felt the same way. They thought we should recycle.

(Attachment 12)

OTHER IDEAS:

I. Process vs. Content

A. Teaching the scientific method, and the research and publication process takes up class time.
B. Teachers must make decisions about what curriculum content can be deleted without negatively impacting standardized test scores.

II. Motivation for Time-Line Completion

A. Daily monitoring of work
B. Students present work to class on Wednesdays and Fridays
C. Publication in school journal
D. Daily assignment grade
E. Lowering of letter grade on assignment for each due date missed

III. Journal Publication and Student Participation

A. Students name it
B. Students type it
C. Students Xerox it
D. Students collate it
E. Students staple it
F. Students (and parents) deliver it

IV. Provide Audience for Student Research

A. Parents
B. Student body - D.E.A.R Program
C. Community at large
D. Classmates
E. Other schools
F. Next year's students
G. Place bound copy in library

V. Get Entire School Involved

A. Train teachers in scientific method and inquiry method
B. Publish all science, math, and social studies fair projects that are school level finalists and/or use the scientific method.

VI. Community Support

A. Funding for publication of journal via community donations and business grants.
B. Sell advertising space on inside of front cover sheet and both sides of back cover sheet.

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