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ABSTRACT

This practicum addressed the problem of decreased participation of fifth-grade students in the science fair. At this grade level, the science fair guidelines mandate that students enter a research-type project. For many fifth-grade students the desire to tackle this monumental task does not match their developing cognitive skills. The literature disclosed evidence that would support this age students' lack of skill needed for experimenting. The literature also offered a variety of suggestions for successful science fairs. The goals of the practicum were: (1) to improve participation of fifth-grade students in the science fair; and (2) to improve the students attitude toward the science fair. To attain the goals, the writer implemented a program offering a special science class that addressed the need of those fifth-grade students interested in participating in the science fair. The students were guided through all the science process skills necessary to create and develop a science fair project with the use of a step-by-step workbook that was written especially for such students. The data analysis indicates that fifth-grade participation was not increased, but attitudes of both students and parents toward the fair improved. (Author)

P R A C T I C U M

REPORT

Center for the
Advancement of Education
Ed.D. Program

IMPROVING FIFTH GRADE STUDENTS' PARTICIPATION IN AND ATTITUDES TOWARD THE SCIENCE FAIR THROUGH GUIDED INSTRUCTION

BY

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Improving Fifth Grade Students' Participation in and Attitudes Toward the Science Fair Through Guided Instruction

by

Marcia J. Daab

Cluster 24

A Practicum I Report Presented to the Ed. D. Program
in Early and Middle Childhood
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Education

NOVA UNIVERSITY

1988

This practicum took place as described.

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"There is no such thing as a problem without a gift for you in its hands. You seek problems because you need their gifts." Illusions - The Adventures of a Reluctant Messiah by Richard Bach.

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ABSTRACT

A Program to Improve Fifth-Grade Students' Participation in and Attitude Towards the Science Fair Through Guided Instruction. Daab, Marcia J., 1988: Practicum Report, Nova University Ed.D. Program in Early and Middle Childhood. Descriptors: Intermediate Grades/ Fifth-Grade/ Elementary Science Education/ Science Fairs/ Science Projects/ Science Activities/ Attitudes.

This practicum addressed the problem of decreased participation of fifth-grade students in the science fair. At this grade level, the science fair guidelines mandate that students enter a research-type project. For many fifth-grade students the desire to tackle this monumental task does not match their developing cognitive skills. The literature disclosed evidence that would suppport this age students'lack of skill needed for experimenting . The literature also offered a variety of suggestions for successful science fairs.

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The data analysis indicates that fifth-grade participation was not increased, but attitudes of both students and parents toward the fair improved. Suggested revisions however, will probably improve participation and it is recommended that the program be implemented again.

CHAPTER I

INTRODUCTION

Description of Community

The school in which the practicum took place is located in a large suburban community just outside one of the Midwest's more conservative, historical cities. The community's growth has stabilized since its perimeter is surrounded by other developing communities. However, there are occasional pockets of land being developed for new housing. Although the community would be considered residential, its economic foundation would be rooted in the operation of large companies, corporations and retail businesses. It is known as one of the few communities in the area that supports a financially sound school district.

The community has a population of approximately 75,000 residents. Its socio-economic make-up is primarily middle to upper-middle class. Occupations are generally considered as white collar and professional. There are a few scattered apartment complexes within the residential area that house very young and transient families. The population age ranges from young families with school age children to older families with no children.

Author's Work Setting and Role

The school where the practicum was conducted is part of the state's public educational system. It is one of 17 elementary schools in a suburban school district which includes 4 junior high schools and 4 senior high schools. The student population in this K-6 school is 619; 80% are Caucasian, 15% are Black, bussed from the city in compliance with a voluntary transfer program and the remaining 5% includes resident Blacks and other ethnic descents.

The socio-economic make-up of 82% of the school population is primarily that of the community. Most of the 15% voluntary transfer students are from no and/or low-income families. Many of these are living in government supported housing and are eligible for government programs such as free and reduced lunches. The students who comprise the other 3% are from lower-middle class families which include the transient families.

The district's and school's philosophy stresses the development of the total child, emphasizing self-esteem and providing for individual differences. Parents and community resources are integral parts of the learning partnership that has been established. Each child's potential is developed in a caring, positive and disciplined environment.

In order to serve the needs of individual students, classes are grouped into many different reading and math levels. Teaching and testing methods are adjusted for the various learning modalities and disabilities found in each classroom. The average pupil/teacher ratio is 1:18 although average class size is 25 students.

The administration consists of one principal and one administrative intern. The internship is a pilot program in its last year that provides intradistrict training for those eligible and have a desire to become administrators.

The faculty is composed of 34 teachers, one social worker and 6 instructional aides. There are 25 regular classroom teachers; eight support staff including P.E., Music, Art, special reading, gifted, and computers; and one counselor.

Classes are heterogeneously grouped according to the previous year's teacher recommendations. Consideration is also given to boy-girl ratio, special needs children and parental requests. The classes are self-contained with som[illegible] [illegible]rtmentalization in the fourth through sixth gr[illegible] [illegible]l children receive art and music each week and physical education two times per week.

The many special programs offered at the school include a self-contained Phase II room with eight students; resource classes serving 34 learning disabled and behaviorally disordered students; 60 students receiving gifted and talented resource services; 120 children are given special reading assistance; speech therapy is offered to 37 students; and 17 receive occupational therapy. These figures represent a total of 276 students who are served by the school's special programs. Eligibility is determined by state and local criteria.

The writer's educational background includes an undergraduate degree in recreation and outdoor education and a master's degree in elementary education. She is certified in elementary grades 1-8; general science, grades 7-9; and physical education and health, grades 7-12.

Teaching experience for the writer totals 18 years. The first eight years were spent in the parochial school system. Physical education and health were taught in a high school setting (9-12) for two years and seventh and eighth grades were taught for the other six years with an emphasis in science.

In the last 10 years, the writer has served the public school system in her present work position. She has taught fifth grade for seven years and will be completing the third year teaching sixth grade. During this time of

CHAPTER II

STUDY OF THE PROBLEM

Problem Description

Although science fair projects are supposed to be an extension of the science class, in practice this rarely happens. For the most part, teachers at many grade levels do not place great emphasis on the science fair. Their lack of enthusiasm often times determines the enthusiasm of the class. Therefore, there may be a lack of motivation and interest on the part of the students.

From observation, some teachers at the local school also view the science fair as an optional home assignment. They introduce it, disseminate information concerning rules and entry dates, answer individual questions, but offer no real classroom assistance for they consider it a home project. The parents then become a guide and play an important part in their child's science fair project. Although some guidance and information is offered by the school there is a noticeable confusion on the part of the

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The local school holds a science fair so that those interested are eligible to participate in the district and regional fair. The local fair is a type of qualifying fair allowing the winners to become participants at the district fair. The winners at the district fair then, are eligible to participate at the regional fair.

These problem areas have been noticed after many years of involvement with the science fair. However, there is yet another problem at the fifth-grade. At this level, the requirements for the types of projects change. Fifth-grade students can no longer enter a model or collection-type project. They can only enter a project with an experimental design which must follow the criteria for the scientific method. This requirement change seems to put the fifth-grade students at a disadvantage since the experimental process may or may not have been introduced in the classroom. Throughout the writer's career, the process of experimenting has been shown to be a high level cognitive activity. Many fifth-grade students have been observed as not developmentally ready for this task. But for the students to participate they are forced to formally experiment. It was obvious to the writer that a vast amount of time, assistance and guidance were needed for the fifth-grade students to be part of the science fair.

The lack of time presented another problem. Often the dates of the district fair which are governed by the regional fair limit the preparation time for those students who want to participate in the local fair.

The writer not only noticed the local problems with fifth-grade science fair participation, but also saw a decrease of fifth-grade entrants at the district and regional levels. Participation was not only lower, but there were fewer fifth-grade winners compared to the fifth-grade participants than at other grade levels.

In conclusion, the problem addressed by the practicum was that there was a lack of guidance and direction on the part of the school for science fair students and confusion on the part of the parents. These two problems areas, along with poor attitude or enthusiasm toward the fair, manifested themselves in the lack of participation and success of fifth-grade students at the science fair.

Problem Documentation

Documentation of the problem stated in the previous section is found in many areas. First, the writer collected records of local science fair participation from years 1984 to 1987. The figures indicated that there was a definite decrease in fifth-grade participation at the local level (see Table 1). All years showed a decrease except for the 1986-87 school year. That year showed an increase over fourth-grade by four projects and an increase of one project in the sixth-grade. The numbers by themselves appear inconclusive, but there seems to be a pattern of decreasing participation at the fifth-grade level when the totals are observed.

On the same table the local participants are compared to those local participants who won at the district fair and then went on to win at the regional fair. There also was a decrease in the number of local winners in the fifth-grade at the district fair compared to the fourth and sixth grade local winners at the same fair. However, at the regional fair, the local fifth-grade winners are comparable to the winners in the fourth and sixth grades.

The writer wanted to see if the decrease in fifth-grade participation was just a local problem or if the district experienced the same. Table 2 shows a comparison of the district participants from grades 3-6 and the

Table 1.

Number of Local Science Fair Participants Compared to Local, District and Regional Winners for School Years 1983-84 to 1986-87.

	Grade	Years				Total
		83-84	84-85	85-86	86-87	
	4	14	15	12	11	52
Local	5	10	9	11	16	46
Participation	6	13	11	16	15	55
	4	7	9	7	5	28
Local	5	5	6	5	6	23
Winners	6	5	7	9	8	29
Local	4	3	4	3	4	14
District	5	2	2	2	5	11
Winners	6	2	3	5	6	16
Local	4	0	1	2	0	3
Regional	5	1	2	2	1	5
Winners	6	0	1	3	2	6

Table 2.

Comparison of Participants and Winners at District Fair for School Years 1983-84 to 1986-87.

Year	Grade	No. of Entrants	Increase Decrease	No. of Winners
83-84	3	81		24
	4	92	+11	21
	5	118	+26	37
	6	105	-13	23
84-85	3	84		31
	4	86	+02	26
	5	81	-05	31
	6	69	-12	20
85-86	3	68		18
	4	88	+20	27
	5	68	-20	12
	6	76	+08	29
86-87	3	65		23
	4	52	-25	19
	5	54	+02	18
	6	59	+05	38

winners from the same grades. The number of entrants from third to fourth grade seems to show an increasing pattern each year except for the 1986-87 school year when fourth through sixth grade entrants dropped. It would seem logical that the number of entrants would continue with an increasing pattern for the fifth and sixth grades. However, the fifth-grade entrants decrease from the fourth grade each year except the 1983-84 school year. In two of the four years, 1985-86 and 1986-87, the percentage of fifth-grade winners compared to entrants decreased.

Since the pattern was again found at the district level, the records of regional participation were collected as was a listing of the regional winners from the past four years. The list was acquired from searching back issues of the local newspaper where the winners were announced to the public. Table 3 illustrates the comparison of participants at the regional fair compared to its winners. Again, there were observable trends. First, there was pattern in the number of entrants at the grade levels. The participation figures seem to increase from first grade to the fourth grade. At the fifth-grade the pattern is broken and the entry numbers decrease except for one year, 1985-86. When the percentage of winners compared to participants was viewed, there was a decrease at the fifth-grade level for all four years. In 1984-85, the sixth-grade was assigned to both the elementary fair and the secondary fair

Table 3.

Comparison of Participants to Winners at Regional Science Fair from School Years 1983-84 to 1986-87.

Year	Grade	No. of Entrants	Increase Decrease	No. of Winners	% Winners to Entrants
83-84	K	62	-	23	37
	1	144	+82	66	46
	2	161	+17	65	40
	3	264	+103	122	46
	4	280	+16	173	61
	5	353	+73	174	49
	6	422	+69	216	51
84-85	K	56	-	21	38
	1	175	+119	79	45
	2	230	+55	100	43
	3	245	+15	83	34
	4	389	+144	152	39
	5	423	+34	111	26
	*6	325	-98	128	39

Table 3. (continued):

Year	Grade	No. of Entrants	Increase Decrease	No. of Winners	% Winners to Entrants
85-86	K	91	-	23	25
	1	188	+97	66	35
	2	229	+41	65	28
	3	272	+43	122	45
	4	353	+81	173	49
	5	465	+112	174	37
	*6	327	-98	128	39
86-87	K	82	-	24	29
	1	208	+126	92	44
	2	277	+69	128	46
	3	306	+29	149	49
	4	497	+191	89	18
	5	421	-76	119	28
	*6	332	-89	107	32

* 6th grade could enter elementary or secondary fairs. The figures represent about 70% of total 6th grade entries.

depending on the type of school from which the sixth-grade entered. If the sixth-grade came from a middle-school or junior high school, the sixth-grade competed at the secondary fair. If the sixth-grade came from an elementary school, the sixth-grade was assigned to the elementary fair. So the figures from 1984-85 to 1986-87, only represent about 70% of the total sixth-grade entries that could have participated. The interesting statistic is that even though only 70% of the sixth-grade is represented, the percentage of fifth-grade winners is still less than the percentage of sixth-grade winners.

It seemed evident that there was a lack of participation at the fifth-grade level, but further data was needed to determine if there was a lack of school guidance and/or parental confusion. To provide this documentation, the author asked teachers in third through sixth grade who taught science to answer a questionnaire concerning their treatment of the science fair and their science fair students. Eight of the nine questionnaires distributed were returned and the results of the entire teacher survey are presented in Appendix B. However, a discussion of parts of the document is offered next.

Two of the questions dealt with whether the teacher viewed the science fair as an extension of class or an optional home assignment. There were 6 of 8 teachers that saw it as a home assignment and two saw it as an extension of the classroom. Five teachers did not give science fair students time in class for their projects. However, six teachers thought that student motivation and enthusiasm could be enhanced by their own enthusiasm.

Of the teachers, six thought that experimenting and the scientific method were high level cognitive activities. Five teachers felt that students needed much guidance and direction to be successful with an experimental project.

When asked about their understanding of the scientific process and confidence in helping students with science fair projects, six teachers answered positively.

Five of the teachers thought parents could offer quality assistance to their child, only two thought that parents were confused about how to help their child and four were undecided.

The survey evidenced the writer's belief that experimental projects are thought to be a high level cognitive activity that needed much guidance and direction. However, the school does not provide adequate class time or guidance to science fair students even though the teachers feel confident of the processes of experimenting. It also pointed out that even though the teachers are a bit undecided about the confusion of parents, they still believe that parents can be guides to their children who wish to enter the science fair with an experimental design.

Causative Analysis

The decrease in participation of fifth-grade students in the science fair had many causes. Perhaps the most important cause was a lack of teacher interest and enthusiasm for the fair itself. The writer believed that if teachers would promote the fair, encouraging participation from science classroom investigations, that student motivation and enthusiasm would be enhanced, thus improving participation.

A second major cause of this problem was that the requirements at the fifth-grade level may be developmentally incorrect for this age child. When a task is not understood or the skill level is beyond the ability of the participant, performance is generally poor, interest wanes, or the task is not shouldered. However, the rules and regulations have been fashioned after those set up by the ISEF (International Science and Engineering Fair) which is sanctioned by the NSTA (National Science Teacher Association). Being eligible to participate in the ISEF is the ultimate goal of the older high school science fair participants. Therefore, it is the belief of the district science coordinator that getting involved at an early age is an advantage to those who wish to participate at a later age. Hence, if fifth-grade students wish to enter the science fair, they must follow the rules and regulations that mandate their entry be an experimental design.

Another cause of decreased participation was the lack of time to prepare the students for the science fair. Since the processes used in experimenting may or may not have been introduced and developed in earlier grades, there needed to be adequate time for their development. However, the local fair date was governed by the district and regional fair dates. Other schools are not influenced by their district, but the writer's school is required to attend and win at the district level in order to continue to the regional fair. The development of the experimental processes takes many years to master. Yet, these students have five months at most, to recognize and understand the processes, select a topic, research it, set-up and run the experiment and write their report.

A probable fourth cause of the problem was the lack of help from the parents. They wanted to assist their child, but often times felt inadequate due to their own lack of understanding the scientific method. They may also have been confused about how much help they could actually give their child.

On the flip side of the issue were the parents who gave too much help to their child. When the project was finished, the child could not explain what the purpose was or tell what happened as a result of the experiment. It is the writer's belief that both too much and/or too little help can cause the child to lose interest and not participate.

The final cause of the prob n was the lack of adequate guidance and direction from the school. There was a guide that had been prepared by the district and regional science fair committees. It was duplicated and disseminated to the local teachers. They in turn, offered it to those students interested in participating in the science fair at the local school. This guide is quite adequate in content. All the necessary information needed concerning the rules for the fair and criteria for the projects are included, but the comprehension level is better suited to the teachers and parents rather than being an elementary student guide. It also lacks concrete examples that this age child needs for understanding. Therefore, the students need much assistance in using the present guide.

The Related Literature

The review of the literature revealed much information which could be beneficial in helping increase participation of fifth-grade students at the science fair. Areas of review include planning, organization and support; goals of the fair; goals of science teaching; requirements for the various grade levels; and judging.

Planning, Organization and Support

Most will agree that success in anything depends a great deal on its planning, organization and support. According to Hansen (1983) elementary science fairs are no exception. Many months of lead time are recommended for the planning and organization. Cramer (1982) agrees that early preparation and communication of all involved cannot be stressed enough. This includes permits for location; set-up and clean-up; purchase of awards; judge recruitment; and publicity. The students also need prior instructions and information. Elementary students need large amounts of time to select a topic and/or identify a problem. It seems that most student delays stem from the lack of a suitable or interesting problem to solve. This makes early intervention a key factor in participation (Cichowski & Markle, 1983; Cramer, 1982; Fort, 1985; Foster, 1983). However, Pearson (1976) warns that preparation time for elementary students should be carefully planned since too much time may cause elementary students' interest to wane before the actual fair date.

A chairman is usually chosen at the onset of the initial idea to carry out the overall plan and others recruited to handle the various components of the fair. The components include: location and layout; judging and awards; and publicity and support (Chiappetta & Foots, 1984; Cichowski & Markle, 1982; Fort, 1985).

The location is generally at the school hosting the fair. And whether to use a classroom or gymnasium will be determined by the size of the science fair planned. There are a variety of logistics used in the layout, but it is recommended that the projects be categorized by grade level and type of project then ordered in some uniform way (Bellipanni, Cotten, & Kirkwood, 1984).

Choosing judges and giving awards are very important to a science fair. According to Fort (1985) good judges can be an important source of success. The fair needs to employ as many as possible so that each project can be evaluated many times. She also suggests that the judges be scientists and educators. Hansen (1983) also agrees that judges should be college science teachers, scientists and/or science supervisors.

Most all agree that there should be some recognition for the work of all students entering the fair (Bellipanni et al, 1984; Knapp, 1975; VanDeman & Parfitt, 1985). Fort (1985) suggests certificates, ribbons, or medals for all entrants. Burtch (1983) also suggests certificates for all students participating. Hansen (1983) recommends a blue ribbon for all participants. First and second prizes would then be gifts from local merchants or items purchased by the local parent organization.

Publicity and support seem to be interdependent. When teachers, parents and the community are well informed, the support base seems to emerge as a very broad and enthusiastic one (Hansen, 1983; Cramer, 1982). Science fairs tend to be vast endeavors not only involving many students, but engaging many adult volunteers. It takes much coordination and energy to guide and manage the many aspects of an elementary science fair. It seems that the best support base for the fair originates from the school's administration and spreads throughout including the teachers, janitors, parents, and community.

Goals of the Fair

The goals of an elementary science fair comprise three areas. They specify mandatory or optional student participation, define the types of student projects that will be accepted, and designate its competition or not.

Student participation has been both required and voluntary. The National Science Teachers Association's (NSTA) official position is that student participation be optional. VanDeman & Parfitt (1985) suggest that if the fair is competitive and awards are offered, students should not be forced to do a project. It could turn off the very interest in science that the fair should encourage. Fort (1985) recommends that if the projects are mandatory they be in tandem with classroom teachers and the science curriculum.

What types of projects should be accepted at the science fair?. They basically fall into two categories: those that are strictly experimental, including formulation of hypothesis, control of variables, record of results and conclusions, and those that are nonexperimental. Those projects that are not classified as experimental would include the models, demonstrations and collections.

There appear to be two sides to the issue. On one side there are those who would agree that the fair should only lend itself to the experimentals. Blume (1985), Hanrick & Hardy (1983) and Smith (1981) all agree that the projects should be strictly problem solving and teach critical thinking and process skills.

On the other side there are those that would accept any topic or type of project that allowed children to sincerely explore. Not all projects would have to be experimental calling for hypotheses and conclusions (Fort, 1985; Knapp, 1975). McNay (1985) emphasizes that nonexperimental projects can excite the spirit and nature of science as fully as investigative ones.

Along with what types of projects should be included, there is the question of whether the fair should support competition or not. Lamb & Brown (1984) cite evidence that competition could decrease participation in the fair since many of their students seemed to favor displaying their work rather than entering it into the fair's competitive section. Burtch (1983) suggests that the fair be a teaching tool rather than a competition. He believes all students should be involved, not just those who are gifted and/or competitive. Hansen (1983) suggests allowing both. Students would be able to display their exhibits noncompetitively and others would be able to enter the competition. However, other science fairs that are competitive have been just as successful (Cichowski & Markle, 1982; VanDeman & Parfitt, 1985). The NSTA's (1985) position is that the emphasis at the fair should be placed on the learning experience rather than on the competition.

Goals of Science Teaching

The science fair's goals need to be evaluated with the broader goals of science teaching. NSTA (1985) advises that science teaching should enhance the child's investigative skills which are to be developed along with his/her critical thinking and problem solving skills. So the question arises: Why are the majority of the winning science fair projects still nonexperimental types? Smith (1981) examined answers from elementary science teachers and found that poor science background, lack of science skill and ignorance of the goals of science teaching have contributed to the problem.

Other teachers though, pointed out that the old familiar nonexperimental type projects currently popular represent a "point of entry" into science for the younger student. Both teacher and student feel comfortable with textbook recipes and research reports. This continues until the student reaches secondary school and sometimes as early as fifth grade and then the rules change to experimentals only. This would logically be a possible cause for decreased success at the fair. As Foster (1983) states: Science projects often cause difficulty because

> they appear out of nowhere, like a rabbit out of a hat....Children may not have the process skills needed to do such a project....Requiring a child to do an individual project without this experience is like introducing the alphabet and then expecting the child to write a novel. (p. 16)

Similarly if Piaget's observations are correct, then science instruction in the elementary school according to Herron (1978) may be time wasted. His research results indicate that if students learn ideas that they are incapable of understanding because they lack the necessary cognitive structures, children will merely learn by rote. This would result in poor study habits and attitudes toward school and produce low self image.

During the Sputnik era when the major research first began in science teaching, studies started accumulating evidence that not all children move from the concrete to formal operations at age 11 or 12 as Piaget noted. From a number of studies on formal operations Chiapetta (1976) concluded that most adolescents and young adults have not fully developed formal operational abilities. In the research by Renner (1978) where he tested 600 students from grades 7-12, only 17% of the seventh graders, 23% of the eighth graders and 34% of the twelfth graders exhibited formal thought processes.

Cantu and Herron (1978) explored the use of illustrations, diagrams and models to teach formal and concrete concepts. Their research concluded that no matter what kind of concepts were being taught, students using formal thought processes understood better than students using concrete thought processes. They also pointed out that concrete students did not learn any of the formal concepts very well and that concrete students did learn concrete concepts if formal reasoning was not part of the teaching method employed. Padilla (1983) concludes from the same research that although the populations involved were secondary students and subject matter, it is very likely that similar results would occur with children aged 10-14.

Wolfinger (1984) suggests that an "elementary science program should permit the child to encounter the world on a level where understanding can develop." Her research also indicates that the attitude to work as an adult scientist and to use the scientific method does not develop naturally. The school science program, developmentally structured, should develop the ability of the student to work in a mature and methodical way. The program should be administered gradually and frequently.

After much research on concrete and formal thinkers, Padilla (1981) suggests using consumer science to develop experimental techniques. The process skills involved in scientific thinking are not mastered easily by 10-14 year olds. This type of thinking often does not connect the real world to experimenting. Since these students usually think in concrete terms he suggests that teachers offer the students multiple experiences with process skills using simple yet relevant problems. Consumer science is useful and a relevant topic.

Kuehn & Krockover (1986) analyzed fifth and sixth grade students' acquisition of the inventing process. Their results showed that instruction did increase the degree of inventiveness as shown by the increased mean scores of the students on the inventive measures. However, there were no significant interactions between inventiveness and attitude toward science.

Requirements of Projects

The research of elementary science fairs suggests general requirements for projects at each grade level. However, no specifics are really given. The NSTA (1985), along with many other science experts, emphasizes the importance of considering the nature and development of the child and matching the requirements to this development. It is also of importance to note the vast differences in developmental patterns. Much guidance and direction are needed for elementary investigators for they may not be able to develop an experimental project independently. The teacher and parents then become key figures in the child's project. However, home involvement can be rewarding for both parent and child. Hamrick & Hardy (1983) advise parents to become familiar with all phases of the fair and the project. They suggest parents be the child's guide and teacher, but allow the child to be the scientist.

Foster (1983) surmised that children's prior experiences are a key factor in whether or not they can actually carry out an experimental science project. So if the requirements at a particular grade level are inconsistent with the child's past experiences in science, that particular child may be at a distinct disadvantage.

Smith (1981) then suggests that what is missing or underemphasized are transition projects. These take the student from the nonexperimental type project to a deeper look at his/her topic and finally to the process of investigation.

On the other hand, McNay (1985), a proponent of the nonexperimental science fair project, suggests that whatever interests the science student and the method by which it is explored, should be allowed as a valid entry. The elementary science fair requirements should permit this to happen.

The position of the National Science Teachers' Association (1985) states that the science fair should supplement other educational experiences rather than jeopardize them.

Judging

Judging is another very crucial area related to the success of the science fair. Not only is the selection of judges important, but how the projects are evaluated and judged seems just as important. According to Goodman (1981) there are two major problems: (a) there is a lack of objective and uniform evaluation criteria; and (b) the goals of the science fair are not well defined.

The lack of objective and uniform evaluation criteria tends to make the judging, at best, subjective According to Goodman (1981) judges traditionally evaluate projects using a scheme composed of the following: Creativity (30 points); Logical thought (25 points); Thoroughness (10 points); Skill (15 points); Clarity of presentation (15 points); Other science fairs follow or have adapted the criteria from those of Science Fairs International. Hansen (1983) lists the categories: Creative ability (35 points); Scientific thought (35 points); Thoroughness (20 points); Neatness (10 points). These rules tend to reward experimentation rather than neatness, but they also seem to be vague enough to invite a variety of interpretations. Chiappetta & Foots (1984) agree that the availability of objective criteria which focuses the evaluator's attention to specific elements of the project with a given number of points would benefit students, teachers and judges. Bellipanni et al (1984) suggest objective criteria also be designated for each type of project. For example, models should have different criteria than experiments. They also state that the judges are not informed of the goals of science teaching and that experimentals are judged in the same category as the nonexperimentals.

The goals of the science fair, as examined previously, include three large areas of focus. When these areas are combined, the fair could feasibly follow a variety of paths. Whatever the path, the judges need to be thoroughly informed of this. Should there be a mismatch of information with the fair's goals, its success may be in jeopardy (Bellipanni et al, 1984; Smith, 1981).

In conclusion, the review of the literature showed the importance of many factors that must be addressed to make the science fair a success and insure maximum participation. The themes that run through the literature are that of organization and planning, strategies for guidance and instruction, and communication.

CHAPTER III

ANTICIPATED OUTCOMES AND EVALUATION INSTRUMENTS

Statement of General Goals

The development of early attitudes toward problem solving is very important for future scientists. As a result, the major goal of this practicum was to increase participation and success in the science fair at the fifth-grade level. A second goal was to improve students' attitude toward the science fair through increased participation and success at the fair.

Behavioral Expectations

There were four behavioral objectives for this practicum. They were as follows:

1. Over a period of 12 weeks, fifth-grade students will increase their

participation numbers in the science fair by an actual count of 10 students over the average number of participants from the past 4 years.

2. Over a period of 12 weeks, fifth-grade students participating in the local science fair will increase their numbers of winning projects by an actual count of 5 projects over the average number of winners at the local fair for the past 4 years.

3. Over a period of 12 weeks, fifth-grade students participating in the district science fair will increase their numbers of winning projects by an actual count of 3 projects over the average number of winners at the district fair for the past 4 years.

4. Over a period of 12 weeks, fifth-grade students will show an improved attitude toward the science fair as measured by a 15% increase in the mean score on a teacher-made attitude

scale to be given at the beginning and end of the implementation period.

Evaluation Instruments

The first objective was to be measured by using the actual number of fifth-grade participants entered at the local science fair. These numbers are kept by the science facilitator as records for the fair and as an index of trends. This record was chosen for it measures the number of participants and can be compared to the average number of participants from previous years yielding concrete figures.

The second objective was to be measured by using the actual number of fifth-grade winners at the local science fair. These numbers are also kept by the science facilitator as records for the fair and as a listing of those students who are now eligible to enter the district fair. It measures the actual number of winners at the local level which can be compared to the average number of winners at the local level from the past 4 years.

The third objective was to be measured by using the actual number of fifth-grade local winners at the district fair. These numbers are kept as records for the school district and as a listing of those students who are now eligible to enter the regional fair. The previously described records were to supply the actual figures that compared the number of fifth-grade local science fair winners at the district fair to the average number of local fifth-grade winners from the previous 4 years.

The fourth objective was to be measured by a written teacher-made rating scale containing the questions relating to the students' attitude toward the science fair. A lower attitude rating may exist on the scale when it is given prior to implementation. Students who previously entered the science fair may not have had the most enjoyable experience or students may have had a preconceived idea of the science fair being an unenjoyable event. And then again, attitude may be very good according to prior experience. However, at the end of the implementation period and based on their participation and success at the science fair, these students would show a higher rating on the post-implementation rating scale.

CHAPTER IV

SOLUTION STRATEGY

Discussion and Evaluation of Possible Solutions

There are many factors involved that could influence participation and success at science fairs. The review of the literature disclosed a number of viable suggestions which could be easily adapted to meet the needs of the students involved along with their teachers and parents. The solutions that are addressed come from several distinct areas that are interrelated with the entire science fair. The first area deals with the planning, organization and support of the total fair. As with anything, if it is planned and organized so that it runs smoothly, all those involved contribute to their fullest giving maximum support. Planning would include securing a location, coordinating dates and times, planning the physical set-up, selecting awards, recruiting judges, and directing publicity. According to Hansen (1983) this would be one of most basic solutions applicable to any program.

Within the organizational plan, there must be vast amounts of time for preparation and good lines of communication. Numerous studies suggest that early preparation and communication not only be stressed among the adults, but with the students also. Elementary students especially need large amounts of time to select a topic and/or identify a problem. This makes early intervention a key factor in participation. Thus, early preparation and communication must be considered as part of the solution since it can be so easily carried out.

Another basic solution to the lack of participation in the science fair is that of setting goals for the fair. The goals comprise three issues that must be decided at the very beginning of the planning phase. They are whether or not students should be mandated to enter or be given the option; whether or not the fair should be competitive; and what type projects would be accepted at each grade level. There are sound arguments for both competitive and noncompetitive fairs and both successfully exist with good participation. The choice just needs to be initially decided in order that all are informed and can make a decision concerning their participation. However, if the local fair is a type of pre-fair for participation in a district or regional fair, the local school goals generally follow those of the district and region.

Types of projects fall into two categories: Those that are experimental, including hypotheses, variables, results and conclusions, stressing problem solving and critical thinking, and those that are nonexperimental such as models, collections, and demonstrations. Both types are supported in the literature, but there are drawbacks to both. If students are to experiment they must have the necessary skills to do so. In some studies, it was found that if students' skills needed for experimenting were inadequate because they lacked the necessary cognitive structures to understand them, attitude towards school decreased and produced low self-image. Other studies have also concluded that formal operational abilities are not fully developed in most adolescents and young adults. If the science fair goals mandate experimenta projects for students younger than this it could put them at a great disadvantage. However, if nonexperimentals were the set goal, those students who wanted to enter an experimental may not want to participate. Accepting both types would be a viable solution.

The previous solution is very complex and one in which the decision is not easily made. Yet, there are suggestions that are supported by the literature to help solve these. Cramer (1982) found that communication was a key factor in the success of any science fair. She strongly suggested that the students be one of the first to know all about it so that they would be given the necessary preparation time. Wolfinger (1984) also suggests that young scientists may not be able to develop an experimental project independently. So the teacher must take time to offer much guidance and direction in a way that corresponds to the developmental level of the student.

However, the processes of experimenting take time to master. These should be gradually introduced and developed very systematically through the science curriculum. But often, teachers who teach science fail to develop these processes in lieu of the science content in the scope and sequence of the subject area. Therefore, many students do not develop a foundation for experimenting. Children's prior experiences are a key factor in whether or not they can actually carry out an experimental project. As a solution, the teacher would be encouraged to walk those interested students through the whole process of experimenting if the requirements at the fair called for experimentals at a particular grade level. The NSTA (1985) suggests that the fair should supplement other educational experiences so the time would be justified. It may take time away from the regular science curriculum to complete an entire project, but the guidance and direction must be there. Yet, there is still another problem to this. What if the teacher is unable or unwilling to give the needed guidance and direction? The answer creates another solution.

The parents then become key figures in their child's participation at the science fair. Parents can give their children great support and guidance with their science fair projects. But they also need to be totally informed of every aspect of the fair and be properly guided. This must be directed from the school. A solution such as this and the previous one concerning the teacher as a guide should seriously be considered. It is the responsibility of the school to prepare and guide students desiring to participate in a science fair. If such direction can not be provided directly by the teachers then some form of help needs to be given to the parents so they may assist their children.

The solutions previously discussed include planning and organization, setting goals prior to the fair, allowing adequate time for preparation, offering systematic guidance to students and explicit directions to parents. All are feasible and with some effort and time on the part of a teacher or many teachers, can be effected within the strict curriculum guidelines set by the district and state.

Description of Selected Solution

The solution to the problem of decreased participation of fifth-grade students at the science fair was based on a blending of the various suggestions, methods and strategies previously described. Each consideration was adapted to meet the needs of the science fair students and their teachers within the local school routine with approval from the administration.

The first consideration was given to planning and organization. A committee of two was formed. The one member represented grades K-4 and the author represented grades 5-6. It was so divided because the requirements for the types of projects change at the fifth-grade level and the author has considerable experience and knowledge of the curriculum and science fair requirements at this grade level. The other member has considerable experience and knowledge of the K-4 curriculum and science fair requirements.

The committee decided all the physical logistics such as dates, times, recruitment of judges, maintenance and set-up of the site. The aforementioned strategy was just common sense for the success of any program. Good planning and organization manifest good support from all inv[illegible]ed.

The next area considered concerned the goals of the fair. However, there was little to be decided since those were predetermined a[illegible]d mandated by the district which takes its lead from the guidelines set down by the regional fair. They included optional student participation, a competitive fair and set criteria for the types of projects that could be entered at certain grade levels. Grades K-4 entered nonexperimental and experimental designs. The experimental designs at this level are judged on a set of simple criteria, but the majority of students enter the nonexperimental type project. At fifth-grade, the students are required to enter the experimental design only and the judging criteria becomes more complex. Since the goals were preset, the solutions that follow had to work within those boundaries.

The third area that the solution was selected from was that of preparation time and student guidance. Again, common sense pointed out that students must be given time to initiate and prepare a project for the fair. Since the fifth-grade student is just beginning to develop formal operations according to Piaget, and the literature tells us that it takes many years for the cognitive operations to adequately develop, it seemed logical that fifth-grade students would not only need vast amounts of time, but a great amount of expert guidance as well, in order to experiment independently. The author believes that the time and direction should be the responsibility of the school. However, it is up to the teacher in the classroom whether or not this is done. With this in mind, the author was prepared to work with any students interested in participating in the science fair at the fifth-grade level. Arrangements were made with the other fifth-grade science teachers if they chose not to deal with the science fair.

It was a trade off program, where those students who were not interested in the fair were distributed among the other science teachers for instruction in another area of science. Both the science fair group and the non-science fair group were given grades based on their performance within that class. This was not to say that the science fair group would be graded on their participation and success at the fair, but rather on their performance with the processes and content being taught while constructing and completing their projects.

The fourth consideration stemmed from the need of a step-by-step guided program for the students wishing to participate in the science fair. Since many students would not have even begun to master the processes necessary for experimenting, a clear, concise, visually concrete guide needed to be developed that would be understandable and easy to use by fifth-grade students. This way they could use it at home as well as at school. Often times, some experiments were such, that the home was a better place to carry out the actual experimenting because of equipment or apparatus used. However, the format and initial planning were done at school along with the research and writing of the report, conclusions and exhibit construction.

The guide was also used by other teachers, not only in the fifth-grade, but in the sixth grade as well or by the students themselves should they wish to participate without the guidance of their teacher. It provided very uniform direction for the students as well as the teachers. The guide might also be a vehicle that would prompt more teachers to involve themselves and their students to participate in the science fair since it would be a guide that both could use.

The last area for consideration concerned informing the parents and supplying them with sufficient knowledge so they could adequately assist their children with science fair projects. The parents were informed by a letter from the school indicating that their child had expressed a desire to participate in the local fair. All the necessary information concerning dates and deadlines were contained in the letter. It also informed the parents of a workshop they could attend with their children. During the workshop, both parent and student viewed the guide that would be used in the science fair class. The parents were given guidelines dealing with what their child should be capable of doing and how much parental involvement would be needed. The length of time on task for that age child and how to set up a working schedule to meet deadlines were also discussed. The school phone number was offered with a specific time that questions could be answered by the school science fair committee concerning any aspect of the fair.

In the event that the parents were unable to attend the workshop, the initial letter included information about the guide concerning the science fair that their child would be using at school.

The author believed that the selected suggestions and methods that comprised the solution used would increase fifth-grade participation in and attitude toward the science fair.

Report of Action Taken

The solution strategy used in this practicum involved four phases: the planning and organization phase: the information phase: the action phase: and the evaluative phase. During the initial phase the science fair committee of two was formed. A third-grade teacher was chosen to coordinate the students in grades K-4 and the author chaired grades five and six. The committee chose dates for both the pre-fair workshop and the local science fair. The library in the local school was reserved for the three days of the fair and a recruiting system for judges was created. It was decided that the judging criteria used at the local fair would be the same criteria that would be used at the district and regional fairs.

It was decided by the author along with the other fifth-grade teachers to develop mini-courses so the science fair students could be helped at school. Those students not wanting to participate in the science fair could choose a science mini-course taught by one of the other fifth-grade teachers. The courses would be about four weeks in length and letter grades would be issued as an evaluation of student progress.

Also at this time a letter was formulated concerning the students' intent to participate in the fair. It included information about the science fair workshop and the actual fair dates.

After all the organizational plans had been approved by the administration the second phase of the solution strategy was implemented. Both committee members began disseminating information appropriate to their corresponding grade levels. The traditional K-4 pre-fair science packet was prepared for distribution, but it was decided that the traditional fifth and sixth-grade pre-fair science packet would not be used. A new guide for students who would enter a research-type project in the fair had been created. So the _Science Fair Workbook_, written and illustrated by the author, was also prepared for distribution (see Appendix B).

The letter of intent to participate was passed out at this time, not only to fifth-grade students, but to any who indicated their desire to participate in the local fair with a research-type project. The letter served three purposes. It informed the parents of their child's intent to enter the science fair, detailed the workshop and identified those students who would be asked to complete the attitude survey concerning participation in the science fair. And so began the third phase of the solution.

The one-hour science fair workshop was conducted on a school night in the early evening with about sixty parents and students in attendance. The new Science Fair Workbook was distributed, previewed and discussed. Guidance was given to the parents concerning how they could help their children with the projects and ended with questions and answers dealing with the fair. An evaluation was filled out by both parents and students to measure the workshop's worth and its need in the future (see Appendix D).

The following day, the science fair class and the mini-courses began. The number of students participating in the science fair class was overwhelming. The ideal number of students designed for the class was approximately 20, even though this number was considered a bit high for one teacher. The number of students wanting to be in the class grew to over 30. So the author accepted as many students as would fit in the classroom and asked an instructional aide to help with management and individual student problems. The final number of students in the science fair class totalled 27.

The first day was taken with organizational plans such as getting acquainted, setting goals, developing a schedule for the various components of the investigation and discussing just what a science project was all about. The students also filled out the attitude survey presented in Appendix E. The purpose of this survey was to measure the students' understanding of a research-type project, how guidance would affect their success and their attitude concerning prior science fairs. They would repeat this at the end of the implementation period for comparison. After that, each day was spent discussing and working on the needed parts of the experiment, report and exhibit.

The next few days were to be spent generating ideas for suitable topics, but most students had a particular topic in mind. However, each topic had to be thoroughly discussed to make sure it was truly a topic that could be used for a research-type project. Many times students had wonderful ideas, but they would not fit the research model. Each student had to be helped individually by either the author or the instuctional aide to facilitate workable topics with a narrowed purpose. Once the topics were in place, the whole class converted its individual topics into investigatable questions.

Students began their search for relevant information on their topic. Several sets of encyclopedias were brought into the classroom for use and small groups of students were able to go to the library for additional research. The librarians had been informed of the science fair class and were prepared to help the students with their searches. The students followed the format in the Science Fair Workbook to begin writing the background information report. The author and instructional aide assisted with the formation and style of the report. The students however, were familiar with the essay style writing through the language classes. Learning to list references took a bit more time to grasp since the concept was relatively new to most students.

After the students had a good foundation and much information concerning their topic, they were ready to suggest an answer or hypothesis to their posed question. Again, each student was met individually by the author or the instructional aide to make sure that the hypothesis agreed with the background information and was a logical extension of the question. Three days were taken with this procedure. All information had to be read and roughly edited. It was suggested that the students have their parents also read and edit the report information and the bibliography.

The whole group was instructed on how to design a method to investigate a hypothesis. Several designs were modeled and discussed. In doing so, the students were to list all the materials that would be necessary to carry out the design for the investigation. The students were also asked to list the procedures they would use to actually do the experiment. Once more, each student's design had to be checked to see that all materials were listed and the procedures in a logical order for experimenting. Some students had already designed their experiment. This allowed those students to be helpers and guides for the other students.

Following the procedures, the variables were explained and the students attempted to identify the variables in their own experiment. The whole class participated orally so the identification procedure would be repeated many times. The students would be able to see a pattern or recognize the clues indicating the variables.

The whole class was also was taught how to record data on data tables and reviewed the different types of graphs. The students had already studied and used various graphs in math, reading and social studies so this was familiar information.

At this point, the students were ready for experimenting. They were given a choice about where to conduct their experiments. They could do it at school or at home and all wanted to do it at home where they knew their parents would be there to help them. It was actually a wise choice on the students' part. There was little space to spare with that many bodies in the room. Not only that, the facilities are not adequate for that much experimenting going on at one time.

However, while the experiments were being conducted at home, the students at school were given the materials to make the lettering and matting for their exhibits. Exhibits from past years were brought in as models. From these, the students created their own designs about where and how to present the information about their own experiments..

After the art work was completed and the displays designed the students began the last segment of the process. Conclusions of experiments were discussed generically to insure students' understanding of the concept. Then each student was helped individually. Some students claimed that their experiments were not completed, but that they understood the concept and they would have their parents help them with the conclusions to their projects.

At this point, five weeks had elapsed. The students were reminded that the written report needed to be either rewritten in their best handwriting or typed by someone. The scoring sheet was also reviewed so the students had a list of criteria that they could check their project with. Whatever was not finished at this time had to be completed at home with their parents. There were two more weeks to finish before the local fair. Although the author had no classroom contact with the science fair students after this, they could come to her classroom at anytime to ask questions or seek advice about the final touches on their projects.

During all phases of the solution strategy, the author kept what was supposed to be a weekly log, daily. The purpose of the log was to summarize the successful and unsuccessful components of the whole implementation period. It afforded the author the opportunity to record teacher, student, and parent concerns.

The final phase of the program was an evaluative one. The first activity was to repeat the attitude survey taken by the science fair students (see Appendix E). The next activity was to collect the results of the local fair by recording fifth-grade participants and winners. Upon completion of this activity, results of the district fair were recorded and compared. There was then a final discussion of the overall program by the principal, science fair committee and other interested teachers.

CHAPTER V

RESULTS, CONCLUSIONS, AND RECOMMENDATIONS

Results

Objective one was measured by recording the actual number of fifth-grade students entering the 1987-88 local science fair. The specific objective, "Over a period of 12 weeks, fifth-grade students will increase their participation numbers in the scier e fair by an actual count of 10 students over the average number of participants from the past four years," was not met. Table 4 summarizes this by

Table 4.

Comparison of 1987-88 Participation at Local Fair to Average Participation for the Past 4 Years

Grade	Average participation for past 4 years	Entries for 1987-88
4	13	4
5	11.5	12
6	14	3

grade levels. At the fifth-grade level, the average number was 11.5 and the actual number that entered was 12. Since this is less than one student, there was no increase.

However, there is a pattern to these falling figures. At the fourth and sixth grade levels there is a significant drop in participation for this year. There is a decrease of 9 entries at the fourth-grade and 11 at the sixth-grade level. So in the fifth-grade, the number could be seen as an increase compared to the pattern of the past four years where the fifth-grade has been shown to have had the fewest participants.

Objective two was measured by recording the actual number of local winners and comparing that number to the average number of winners from the past four years. The specific objective "Over a period of 12 weeks, fifth-grade students participating in the local science fair will increase their number of winning projects by an actual count of 5 projects over the average number of winners at the local fair for the past four years," was also not met. Table 5 shows the comparison by grade levels.

Table 5.

Comparison of 1987-88 Local Winners to Average Number of Winners From Past 4 Years

Grade	Average number of winners from past four years	Winners for 1987-88
4	7	2
5	5.5	6
6	7.25	3

Again there is no real increase at the fifth-grade level. However, there is no decrease either. Yet at the fourth and sixth grades the decrease in winners are 5 and 4 respectively.

The third objective was measured by recording the actual number of winners at the district science fair. The specific objective "Over a period of 12 weeks, fifth-grade students participating in the district science fair will increase their numbers of winning projects by an actual count of 3 projects over the average number of winners at the district fair for the past 4 years," was also not met. Table 6 summarizes this.

Table 6.

Comparison of 1987-88 District Winners to the Average Number of District Winners from the Past 4 Years

Grade	Average number of winners from the the past 4 years	Winners of 1987-88
4	3.5	1
5	2.75	2
6	4.0	1

Again as the objective is not met, the overall pattern indicates something quite different from the obvious. The decreased number of fourth-grade winners is 2.5 and the sixth-grade decrease is 3. However, the decrease in the fifth-grade number of winners measures less than one compared to the average number of winners from the past four years.

The last objective, "Over a period of 12 weeks, fifth-grade students will show an improved attitude toward the science fair as measured by a 15% increase in the mean score on a teacher-made attitude scale," was measured through the use of a student attitude survey (see Appendix E). This assessment instrument was administered at the beginning and at the end of the implementation period. The scores for all questions are presented and as one can see objective four was only successfully met by 15% on two questions, #2 and #6. Number 2 stated, "If you had help with your science fair project at both school and home, you will have a better chance of winning at the science fair". The pre-implementation mean score was 3.722 on a scale of 1 to 5. The post-implementation mean score was 4.476. This represented a 17% increase in the mean scores and indicated that more students realized that help from both school and home was needed for success.

The responses to Number 6 "I like to enter the science fair'" produced a pre-implementation mean score of 3.638 and a post-implementation mean score of 4.285. This represented a 16% increase in the mean scores from beginning to end. It seems that a significant number of students believed that the science fair class was a positive experience.

On the other hand, responses to the statement "I will enter the science fair again," produced a decrease from the pre-implementation mean score of 3.722 to the post-implementation mean score of 3.571. It may indicate that although students enjoyed the experience, they may have found out that science fair projects involved long and hard work causing indecision about participation in future years. One has to keep in mind that at the fifth-grade level, the students are required to enter "research-type" projects for the first time . This is totally new and possibly overwhelming for many students who may have entered a less rigorous-type project in prior years.

The decrease in the pre-implementation mean score of 4.111 for the statement "When using a guide to help me, my science fair project is easier and more fun to do," to the post-implementation mean score of 3.904 may also be due to the rigors of the research-type project. The students were required to do much more writing and researching before they even attempted to test their hypothesis, which was the experiment. Many students at this age are still very tactile and concrete and the "doing" of the experiment is the whole project to them.

The pre-implementation responses to "I know how to set up an experiment" produced a mean score of 4.083 and a post-implementation mean score of 4.380. This indicates a 7% increase. It does not meet the necessary increase of 15% to satisfy the objective, but it does point out that not only for the students involved, but also the parents. He received no phone calls concerning the science fair. In past years, many calls were taken to clarify dates, times, and rules. He did however, receive many compliments from the parents concerning the guidebook. In general, it was believed to be an improvement over the other science fair packet and was in one case described as "truly a gift to our children". The guidebook was also recommended and given to the assistant superintendent of the district for use with his child who attended school in a neighboring school district.

The principal agreed that the number of students in the science fair class was much too large and possibly contributed to objectives 1 and 2 not being met. He was willing to help suggest ways to eliminate overcrowding next year.

The K-4 science fair committee chairman thought the local fair went well. He received a few phone calls, but they were from parents checking to see if their children had forgotten to bring information home concerning the district and regional fairs. He also had a few questions from the other teachers who had students involved with the science fair. The upper grade (5-6) chairwoman received one call from a parent regarding the purchase of display material for her son's project. The chairwoman also received many compliments on the new guidebook and science not only for the students involved, but also the parents. He received no phone calls concerning the science fair. In past years, many calls were taken to clarify dates, times, and rules. He did however, receive many compliments from the parents concerning the guidebook. In general, it was believed to be an improvement over the other science fair packet and was in one case described as "truly a gift to our children". The guidebook was also recommended and given to the assistant superintendent of the district for use with his child who attended school in a neighboring school district.

The principal agreed that the number of students in the science fair class was much too large and possibly contributed to objectives 1 and 2 not being met. He was willing to help suggest ways to eliminate overcrowding next year.

The K-4 science fair committee chairman thought the local fair went well. He received a few phone calls, but they were from parents checking to see if their children had forgotten to bring information home concerning the district and regional fairs. He also had a few questions from the other teachers who had students involved with the science fair. The upper grade (5-6) chairwoman received one call from a parent regarding the purchase of display material for her son's project. The chairwoman also received many compliments on the new guidebook and science fair workshop.

The other fifth-grade teachers had been most cooperative throughout the implementation. They enjoyed the special mini-classes they taught and also indicated their pleasure in working with some of the other fifth-grade students whom they normally would not meet during the year. One teacher commented about the interest their homeroom students had shown in the science fair class. He said that one student who never seemed to be interested in school at all came to him frequently to give him an update on her science fair project. Overall it was agreed that the program was a positive experience and they would be willing to do it again.

Conclusions

According to the results presented in the previous section, one may conclude that this particular program's success is quite suspect. None of the four objectives were met resulting in the seeming failure of the major goal which was to improve fifth-grade participation in the science fair. The quantitative results are very visible statistics, but there are many qualitative conclusions to be drawn from some of the less obvious data.

As discussed in the previous section, the first objective concerning increased participation in the science fair at the fifth-grade level was not met. Yet, 27 students chose to be in the science fair class. This figure represents an increase of 15 actual students over the average participation for the past four years. It could be concluded that there was definite interest in developing science fair projects. The author believes that the students' positive attitude toward the fair was partially due to teacher enthusiasm and the school giving them a chance to create and complete their projects at school. It was treated as part of the curriculum rather than an optional, but extra home science assignment. These reasons are similarly supported by the NSTA (1985) and other authors (e.g., Fort, 1985; VanDeman & Parfitt, (1985).

Although 27 students began the program, 12 finished and entered the fair. There seem to be many reasons for this. Some students just didn't finish. They lacked the perseverance a student must have to complete a project that extends over a period of time. Some lacked the skills to complete the project because of their mismatched stage of cognitive development (Chiapetta, 1976; Foster, 1983; Herron, 1978; Renner, 1978). There could also have been too little teacher assistance and/or parental help for some of the students. The science fair class was much too large for one teacher and aide. Others could have possibly balked at the competition of the contest. The literature cited authors (e.g., Lamb & Brown, 1984; Burtch, 1983) who indicated that many students liked science projects, they just had reservations about entering a competition.

The second and third objectives involved winning entries at the local and district fairs. They were not met as evidenced by the data in the previous section. However, the number of winners was down in the other grade levels compared, except for the fifth-grade. The actual number of fifth-grade winners was equivalent to its respective past four year average. The major implication here is that winners at the fourth and sixth-grade level decreased from past years, therefore fifth-grade winners should also have decreased. Yet, this was not the case. According to the past pattern of winners, it could be concluded as an increase in number of winners at the fifth-grade level.

The last objective regarding the students' attitude toward science fair also seems to have fallen short as shown previously. It needs to be pointed out however, that the mean scores were extremely high after the pre-implementation survey and that to expect major increases at the post-implementation survey would have been ludicrous. An important observation is made about the two survey questions that were increased to meet the criteria of the objective. Some students at the beginning of the program didn't believe that help from both home and school would produce a better project. At the end of the program it seems many students changed their minds and believed that it did make a difference. Students saw the importance of home and school working together for their benefit. Hamrick & Hardy (1983) would have agreed.

The other survey statement that increased its mean score satisfactorily concerned the students' interest and feelings about entering the science fair. Although over half the students did not enter their project, the mean score increased considerably indicating that the students did enjoy doing the project. A major implication for teachers is that research-type projects should be put into the curriculum whether they are for a science fair or not. The NSTA (1985) and Foster (1983) stressed the importance of supplementing the existing educational experiences.

There were some very unanticipated outcomes of the practicum. The writer originally wrote the guidebook with the student in mind. She knew the old guidelines were much too sophisticated and lacked clear, easy directions for use by elementary students. The students enjoyed coloring the illustrations contained in the book, but according to the results of the survey, the guidebook may have been a bit overwhelming. However, the parents were most impressed with the new guidebook. They liked its clarity, and step-by-step approach. They seemed extremely satisfied that they had a book that they understood and could offer help to their child.

A second unexpected outcome was the large number of parents and children that attended the science fair workshop. The author believed that 20 parents and students would have been a substantial number, yet 60 participants were in attendance. This implies that there is much interest in the science fair, the school just needs to provide the leadership.

A very surprising development came from a parent who was employed by a publishing company. He suggested to the author that the guidebook be reviewed professionally by other interested publishing editors. The guidebook was not appropriate material for his company, but in his opinion it would be suitable for other companies. The author took his advice. At the present time, the guidebook is seriously being considered for publication by an educational publishing company.

In conclusion, this practicum project did not meet its objectives, nor did it improve fifth-grade participation in the science fair. It did, however indicate the interest students have in experimenting and the willingness of parents to serve as educational partners with the school. It was considered by the administration, teachers and parents as a very positive experience for the students. It also has been strongly recommended for inclusion into next year's school curriculum.

Recommendations

The writer recommends that the program be repeated next year and in years to come with three specific modifications. First, offer the workshop again, but alter the format. Its format would include two parts. The first would be the new part. It could be a topic generating session for all in attendance, but in particular for students and parents who had attended the first workshop. At the end of this session, experienced students and parents could leave.

Part two would be for those students and parents who were involving themselves for the first time. The guidebook would be explained as well as general procedures and rules given. The whole workshop would again be approximately one hour in length.

The second modification would be to reduce the science fair class size to a reasonable working number for one teacher. Ask the instructional aid to help with the mini-classes if their attendance expanded because of the reduced number in the science fair class.

Modification three would have the local fair be both competitive and noncompetitive. Those students entering the competitive fair would be eligible to enter the district and regional fairs. The noncompetitive fair would be more of an exhibition than a contest, displaying any projects that students may have completed in their science classes.

It is the writer's opinion that participation will increase at the fifth-grade level as this program continues.

Dissemination

The results of this practicum project were shared in three ways. The first way was by the submission of the practicum and its results to the writer's principal, who in turn made it available to other members of the school staff.

Secondly, the practicum results were submitted to the district's science curriculum coordinator. She may disseminate its contents to the other elementary schools in the district as needed.

Finally, the writer submitted a copy of this practicum report to the regional elementary science fair chairperson in support of the suggestion to create a transition category at fifth-grade level of the science fair.

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APPENDIX A

RESULTS OF FACULTY QUESTIONNAIRE

Results of Faculty Questionnaire

5 = strongly agree
4 = agree
3 = undecided
2 = disagree
1 = strongly disagree

(1) The science fair is treated as an extension of science class.

Response	Teachers
5 -	
4 - - - - -	2
3 - - - - -	2
2 - - - - -	3
1 - - - - -	1

(2) If students in my class enter the science fair, I give them class time to work on it.

Response	Teachers
5 -	
4 - - - - -	3
3 -	
2 - - - - -	4
1 - - - - -	1

(3) Students' motivation and enthusiasm for the sicence fair can be enhanced by my enthusiasm.

Response	Teachers
5 - - - - -	4
4 - - - - -	2
3 - - - - -	1
2 - - - - -	1
1 -	

(4) Students enter the science fair because of my encouragement.

Response	Teachers
5 -	
4 - - - - -	3
3 - - - - -	3
2 - - - - -	2
1 -	

(5) I consider the science fair as an optional home project.

Response	Teachers
5 - - - -	3
4 - - - -	3
3 -	
2 -	
1 - - - -	2

(6) I think experimenting is a h'gh level cognitive activity.

Reponse	Teachers
5 - - - -	3
4 - - - -	3
3 - - - -	1
2 - - - -	1
1 -	

(7) I have a good understanding of the scientific method and processes for experimenting.

Response	Teachers
5 -	
4 - - - -	6
3 -	
2 - - - -	2
1 -	

(8) I feel confident in assisting students who wish to do an experimental project for the science fair.

Response	Teachers
5 - - - -	1
4 - - - -	4
3 - - - -	1
2 - - - -	2
1 -	

(9) For students to have success with an experimental project, much guidance and direction must be given.

Response	Teachers
5 - - - -	4
4 - - - -	1
3 - - - -	3
2 -	
1 -	

(10) For students to have success with any type project, much guidance and direction must be given.

Response	Teachers
5 - - - -	1
4 - - - -	3
3 - - - -	2
2 - - - -	2
1 -	

(11) Parents can offer quality assistance to their child concerning experimental science fair projects.

Response	Teachers
5 - - - -	1
4 - - - -	4
3 - - - -	1
2 - - - -	2
1 -	

(12) Parents seem confused about how to help their child with science fair projects.

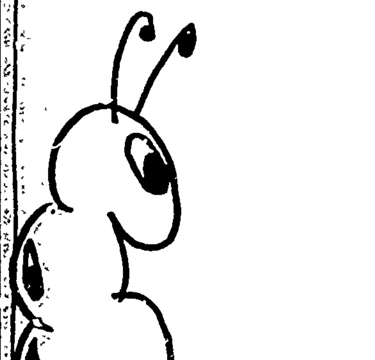
Response	Teachers
5 -	
4 - - - -	2
3 - - - -	3
2 - - - -	1
1 - - - -	1

APPENDIX B

SCIENCE FAIR GUIDE BOOK

THE SCIENCE FAIR WORKBOOK

FOR RESEARCH-TYPE PROJECTS



written &
illustrated by Marcia J. Daab

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THE TIME LINE

Make up a work schedule for yourself. It will keep you on task at a reasonable rate and help eliminate a last minute rush.

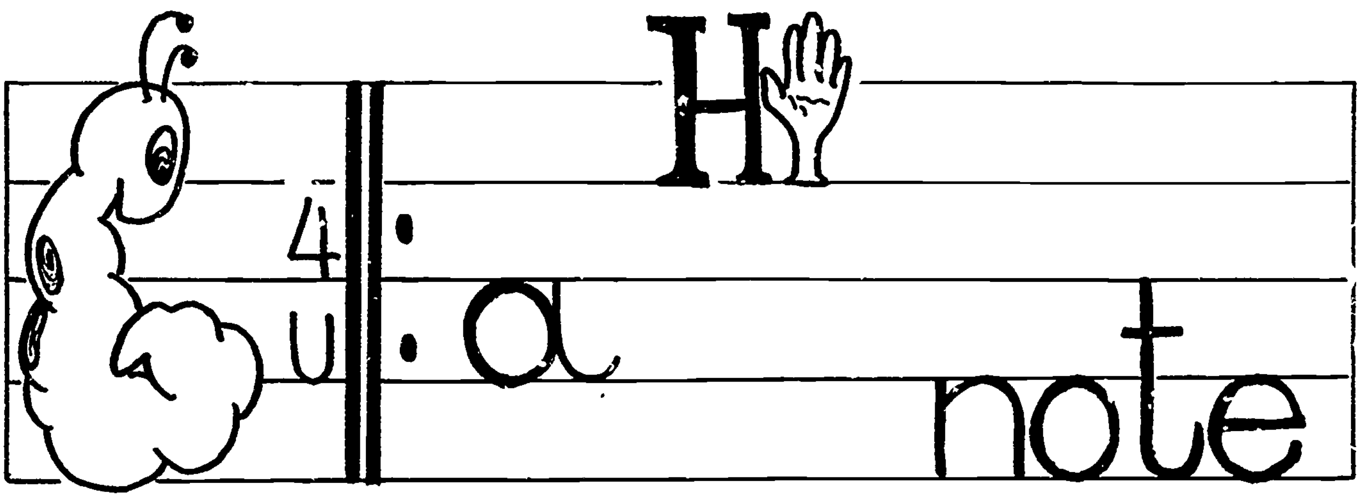
Today's date: ____________

Project Part	Due Dates
Topic	____________
Research & Bibliography	____________
Hypothesis, Materials, Procedure, Variables	____________
	____________
Experimenting & Results	____________
Graphs	____________
Conclusions	____________
Final Report	____________
Exhibit	____________

LOCAL FAIR ____________

DISTRICT FAIR ____________

REGIONAL FAIR ____________



Hi!

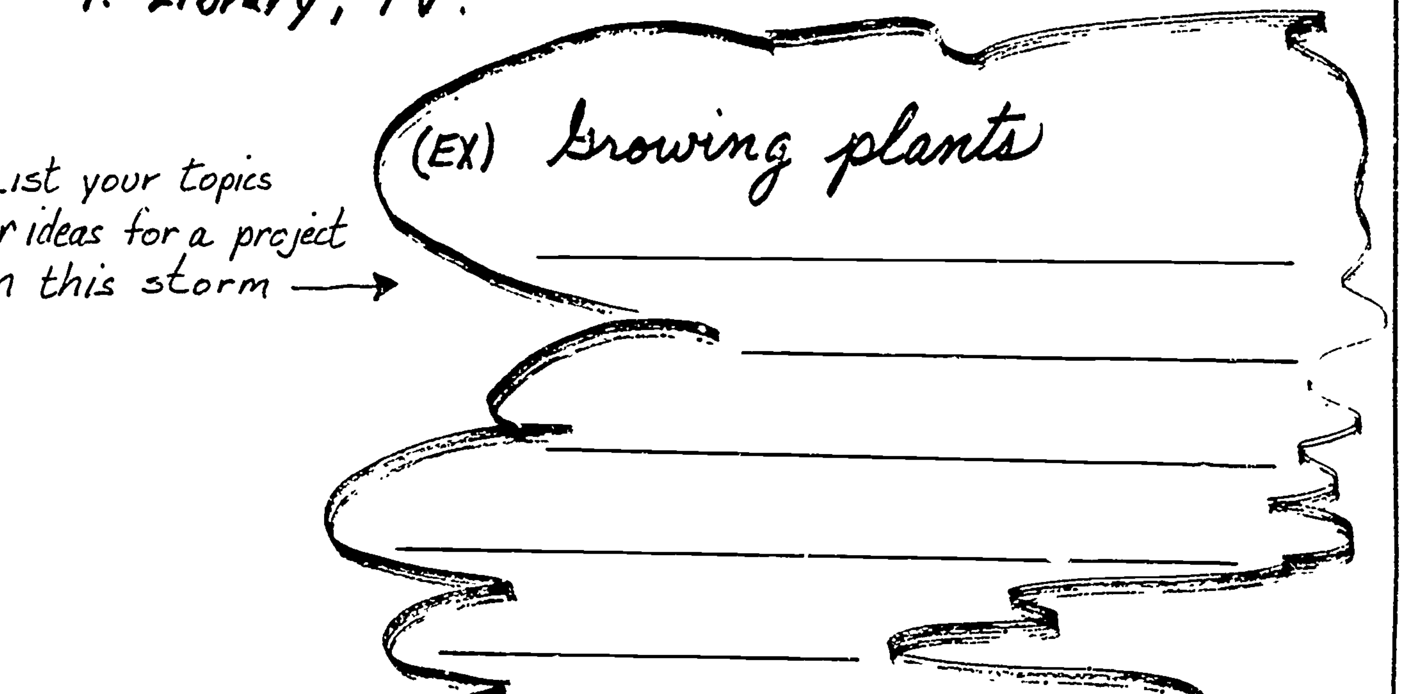
This is a step-by-step guide written and especially made for you, the student-scientist, wanting to do a research-type science fair project. Follow this page-by-page from the very beginning to the end. At the end you will have a project that is totally complete with exhibit and report.

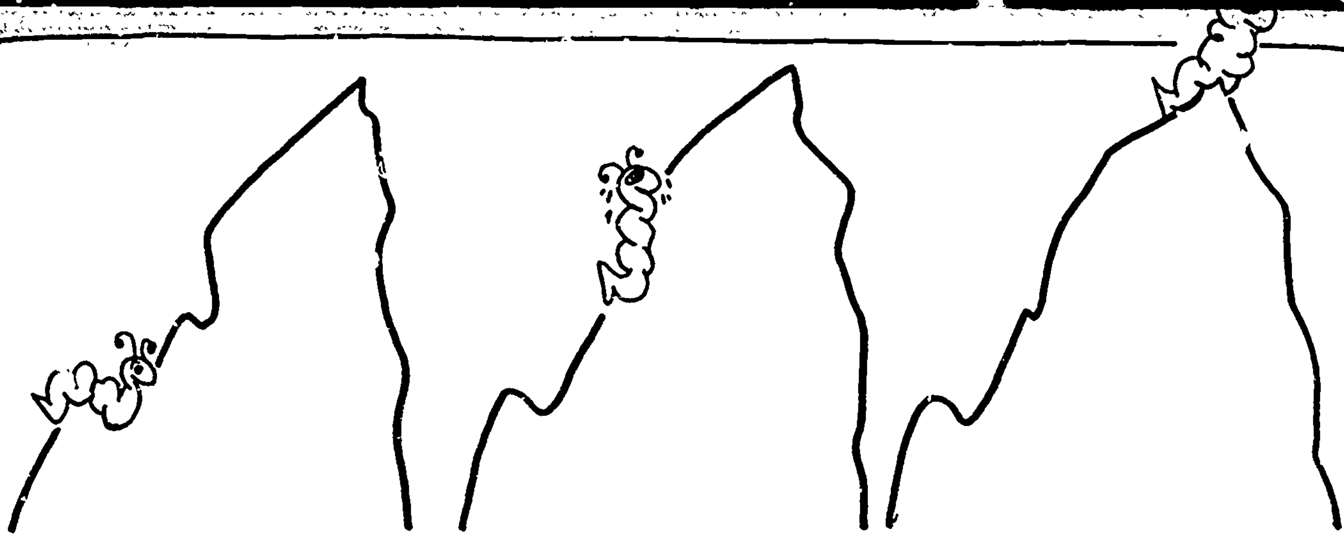
TOP·I·CAL STORM \'täp·i·kəl stôrm\ n 1: a violent outbreak of ideas for your science fair project. 2: this storm occurs in various areas. Its energy blows and whirls your interests and experiences around, creating a blinding list of project topics.

Famous Topical Storm Areas

1. Your interests or hobbies
2. Teacher suggestions / Science class
3. Parents, relatives, or friends
4. Library, TV.

List your topics or ideas for a project in this storm →





THE PURPOSE is GETTING to the POINT

NARROW YOUR TOPIC

FROM PAGE 1, LIST YOUR FAVORITE TOPIC.	MAKE IT MORE SPECIFIC.	WHAT QUESTION COULD YOU ASK ABOUT THIS?
(EX) plants	plants and fertilizers	Which fertilizer 'X' or 'Y' will help petunias grow better?
YOUR TURN ↓		

HINT: Your PURPOSE or QUESTION points out 2 things: (1) WHAT you are testing [FERTILIZERS]; and (2) HOW you will measure the change because of the test [GROWTH OF THE PETUNIAS WITH THE 2 TYPES OF FERTILIZER]

Your bibliography - list all sources alphabetically.

You've already done the hard part - getting the topic, narrowing it and researching it. Now the easy part. Make an educated guess about what will happen in your experiment because of your test. This educated guess is called the

HYPOTHESIS

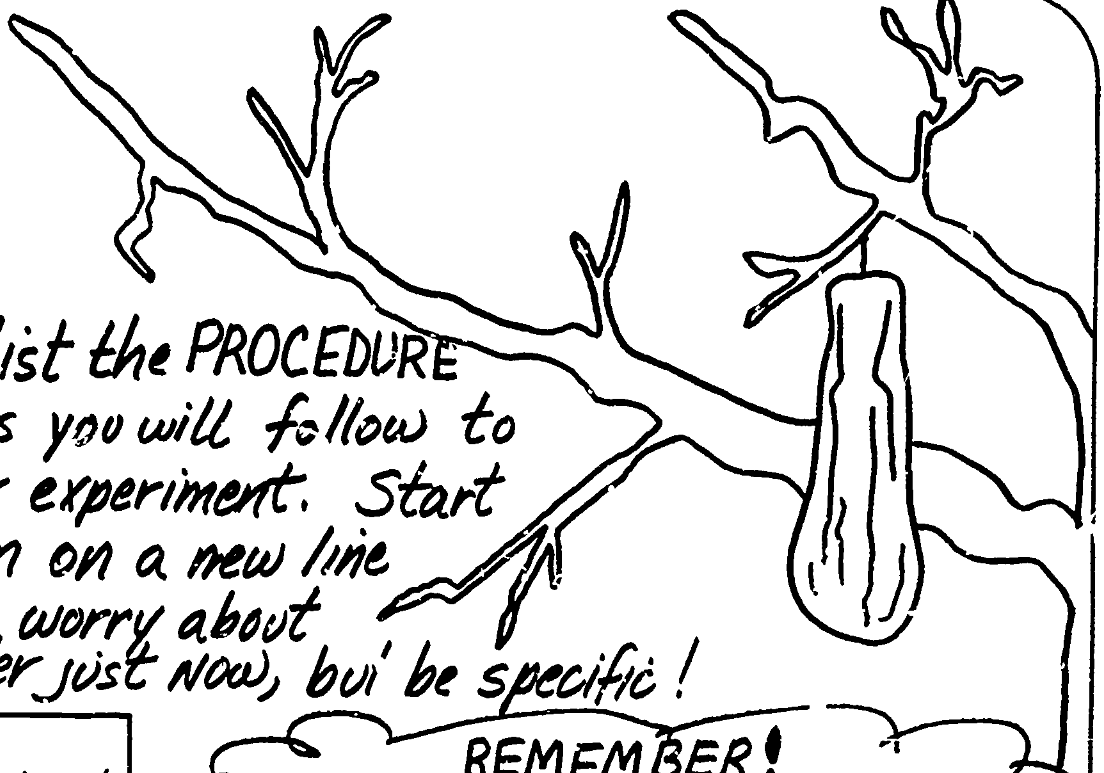
Write your HYPOTHESIS.

Review your question on page 3.

Materials List

What will you need for your experiment?

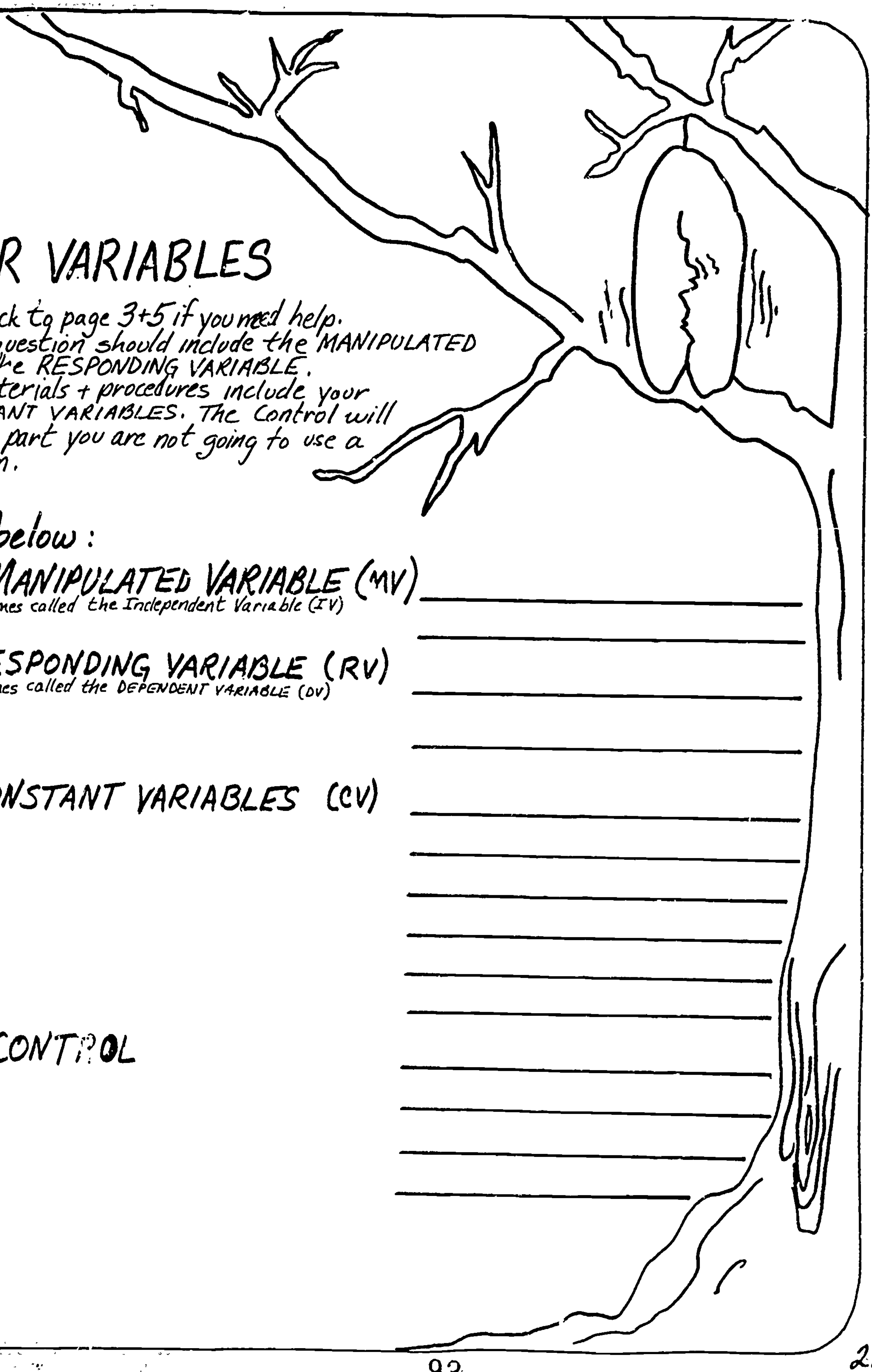
1. ____________________
2. ____________________
3. ____________________
4. ____________________
5. ____________________
6. ____________________
7. ____________________
8. ____________________
9. ____________________



On this page list the PROCEDURE
List the steps you will follow to carry out your experiment. Start each direction on a new line below. Don't worry about the exact order just now, bui be specific!

Sample:
- Fill 12 pots with 100ml of soil each.
- In each pot, plant 3 Petunia seeds – 3 cm. deep.
- Water each pot with 50ml of water on Mondays.
- Give 4 pots 'A', 10g of fertilizer 'X' each week.
- Give 4 pots 'B' 10g of fertilizer 'Y' each week.
- Give 4 pots 'C' no fertilizer

REMEMBER!
- Make sure you use enough test items – (Petunias).
- And/or repeat your experiment at least 3 times.



YOUR VARIABLES

Go back to page 3+5 if you need help.
Your question should include the MANIPULATED and the RESPONDING VARIABLE.
The materials + procedures include your CONSTANT VARIABLES. The Control will be the part you are not going to use a test on.

List below:

the MANIPULATED VARIABLE (MV)
or sometimes called the Independent Variable (IV)

____

____

the RESPONDING VARIABLE (RV)
or sometimes called the DEPENDENT VARIABLE (DV)

____

____

the CONSTANT VARIABLES (CV)

____

____

____

____

____

____

the CONTROL

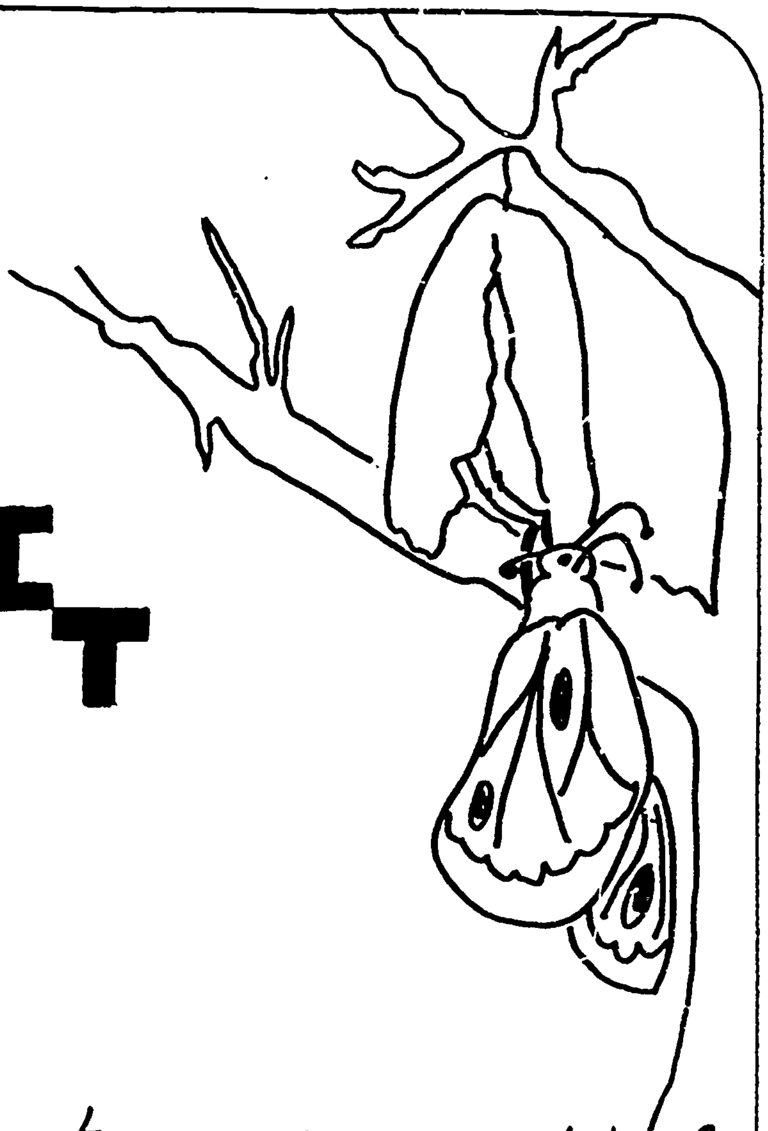
____

____

____

____

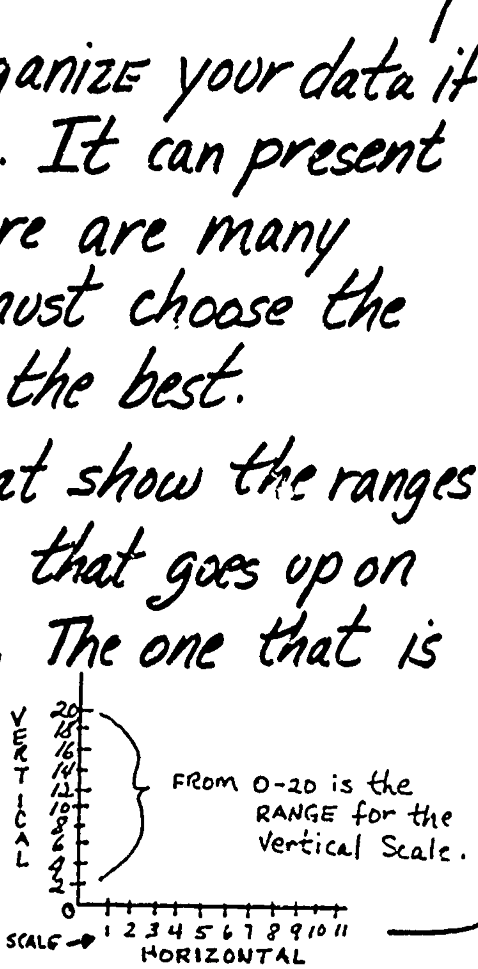
GRAPH IT



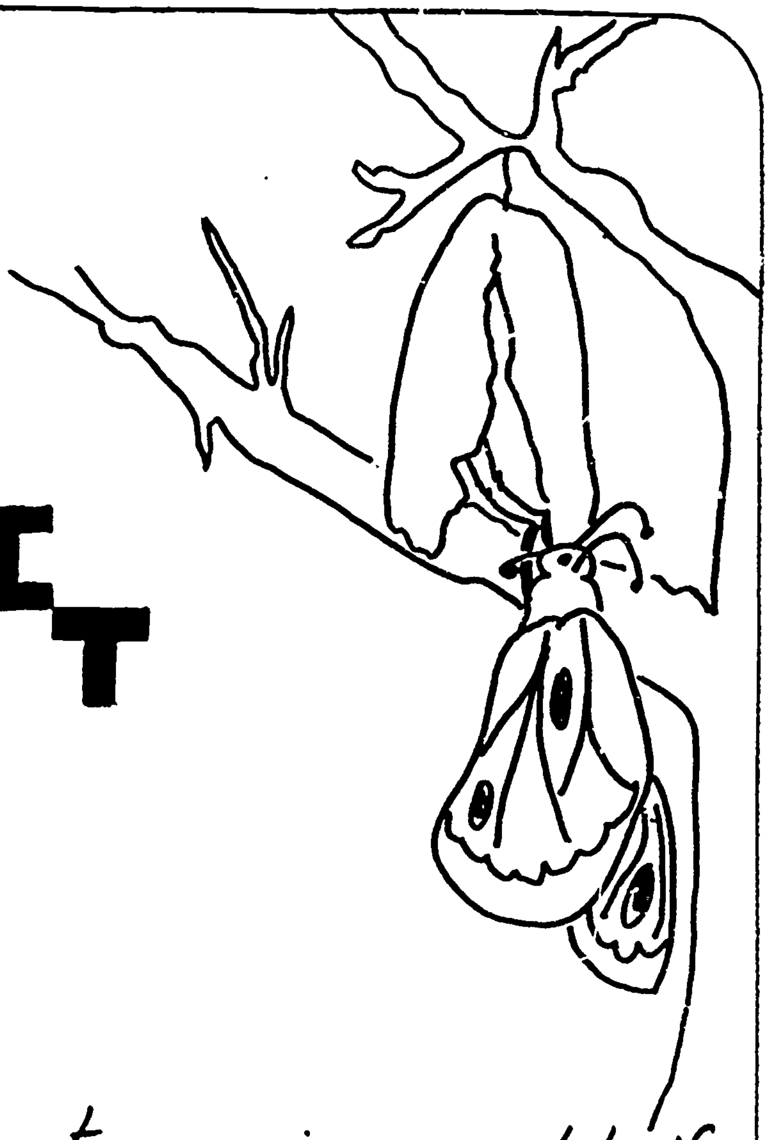
A GRAPH is another way to organize your data if the results are given in numbers. It can present your results more clearly. There are many types of graphs to use. You must choose the one that presents your data the best.

Some graphs have 2 scales that show the ranges of what you measured. The scale that goes up on the left is the VERTICAL SCALE. The one that is on the bottom is called the

HORIZONTAL SCALE ⟶



GRAPH IT



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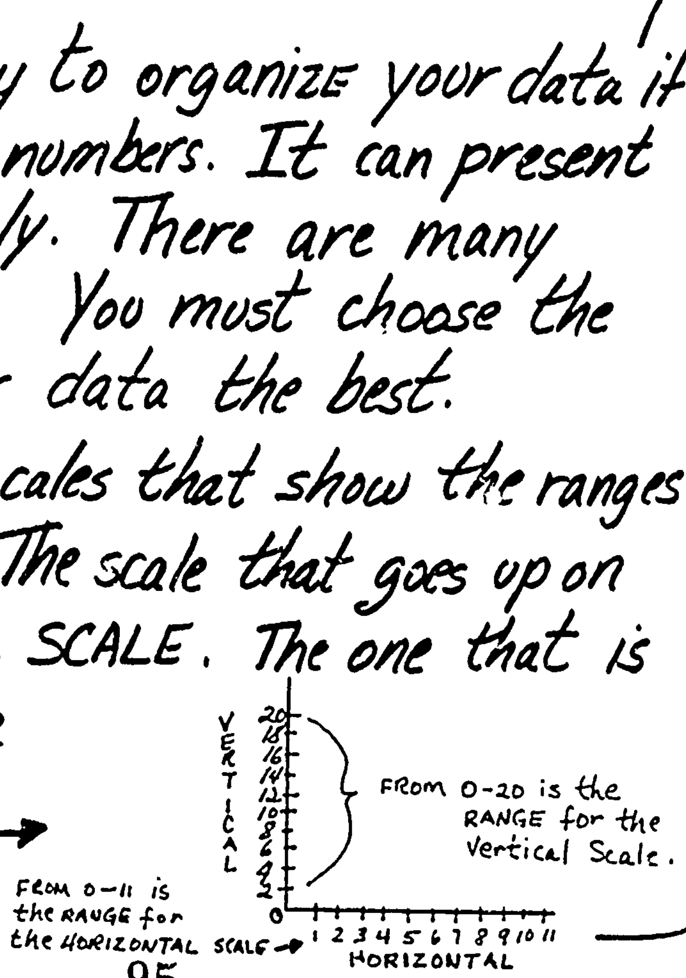
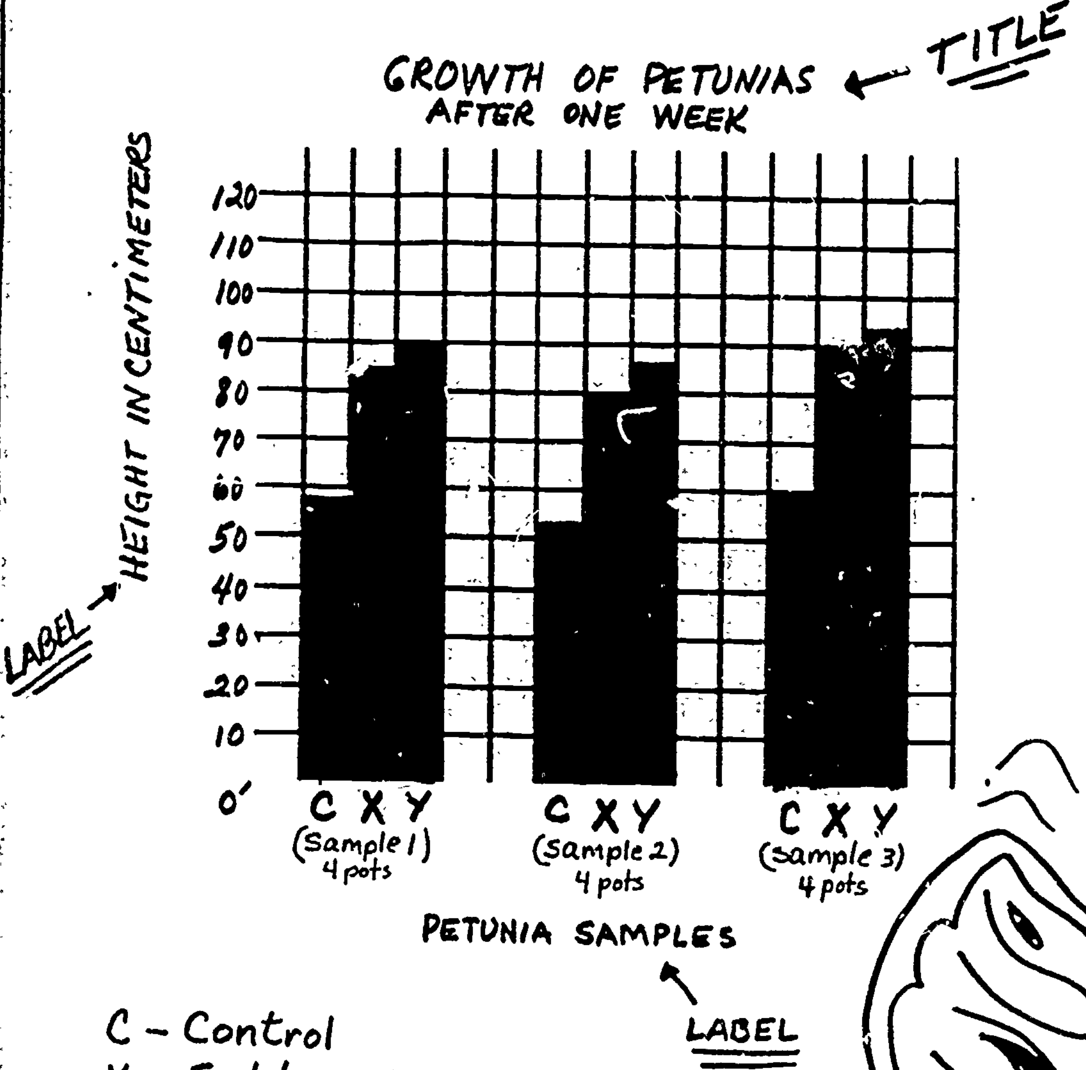
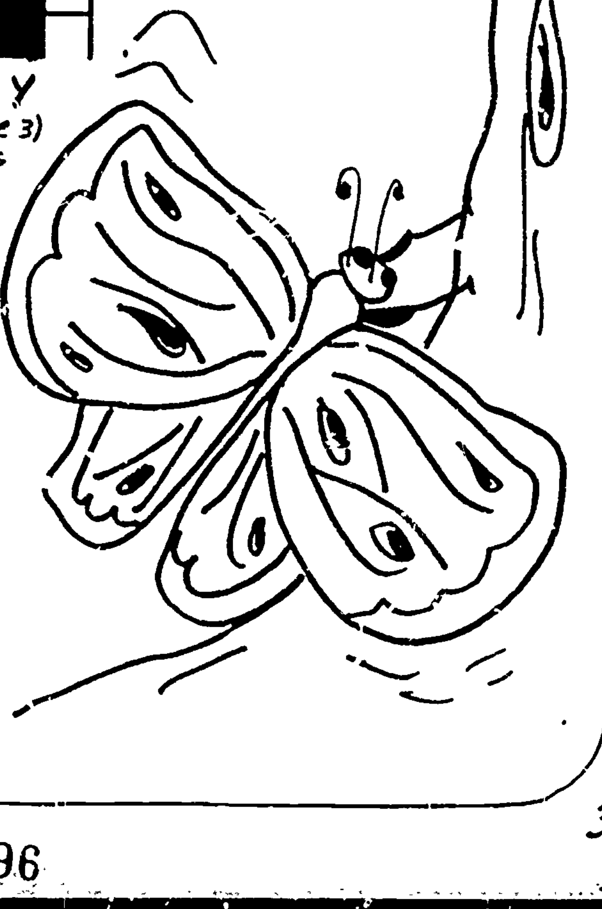
HORIZONTAL SCALE ⟶



This is a BAR GRAPH of the petunia experiment. The RESPONDING VARIABLE is the VERTICAL SCALE. Notice all graphs must have a title and both scales labeled.

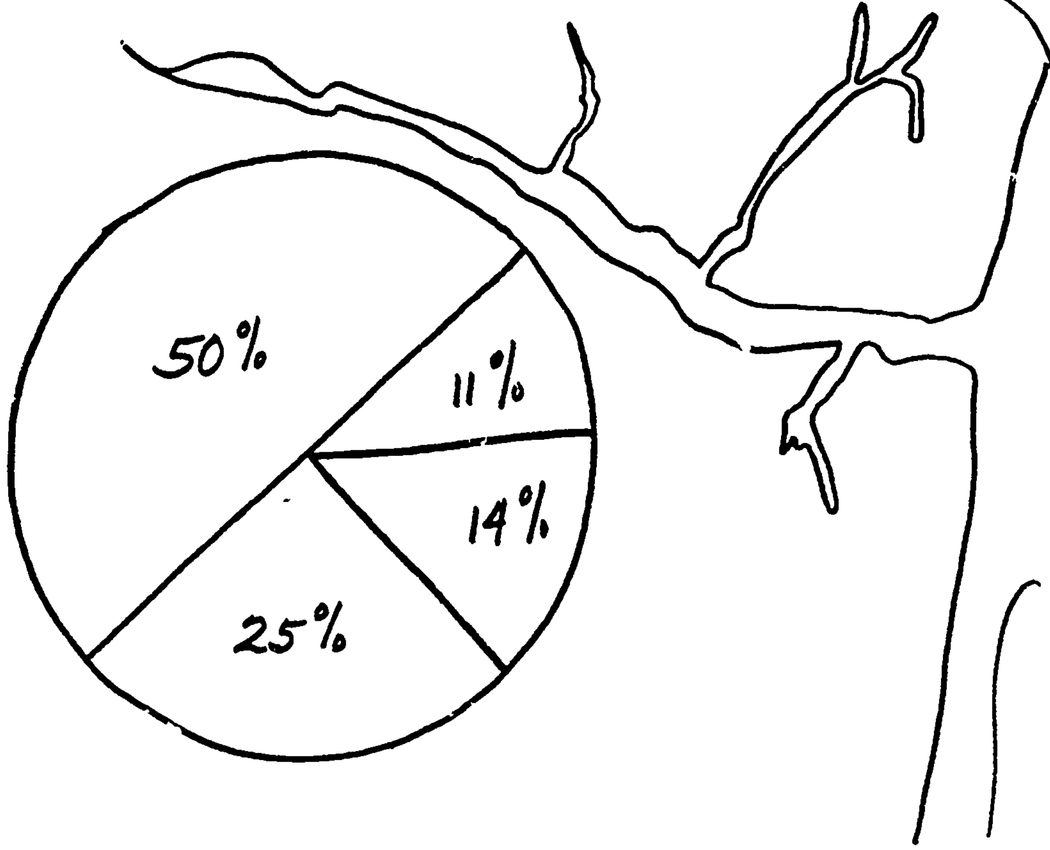


C - Control
X - Fertilizer X
Y - Fertilizer Y



Look at the PIE GRAPH on the next page, then decide which graph shows your results in the most understandable way.

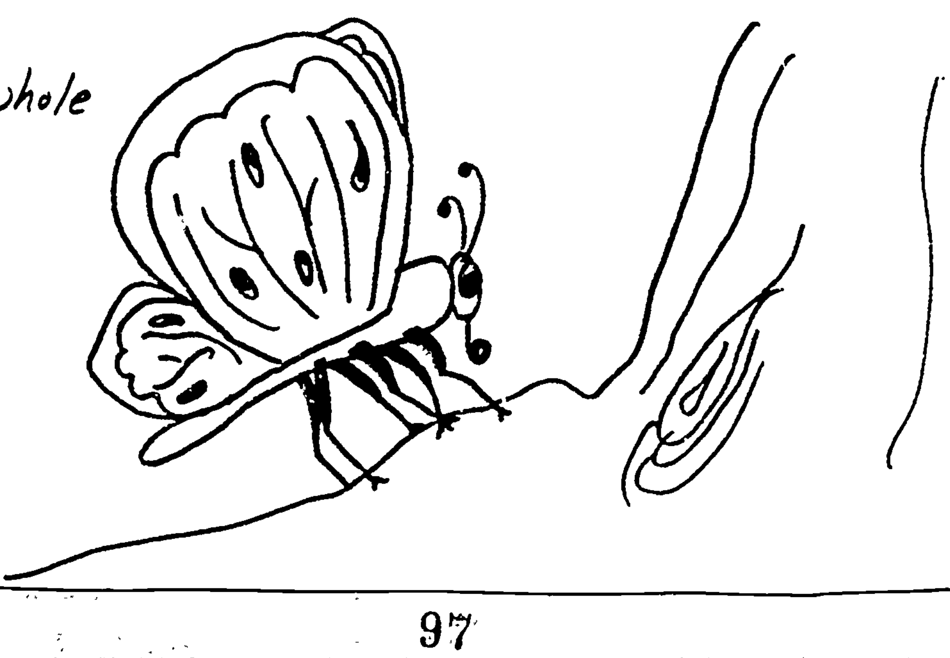
The Pie Graph



This is a PIE GRAPH. It is used to show how parts are compared to a whole. The petunia experiment results would not have been presented very clearly using this type of graph. Remember to label your graph.

50% - 1/2
25% - 1/4
11%
14% > 1/4
} parts

100% - 1 - whole



CONCLUSIONS

Conclusions are the ending to your story. Without conclusions your experiment is incomplete. Conclusions tell in words exactly what happened during the experiment, they tell whether your results supported your HYPOTHESIS and answer questions that may have come up during the experiment.

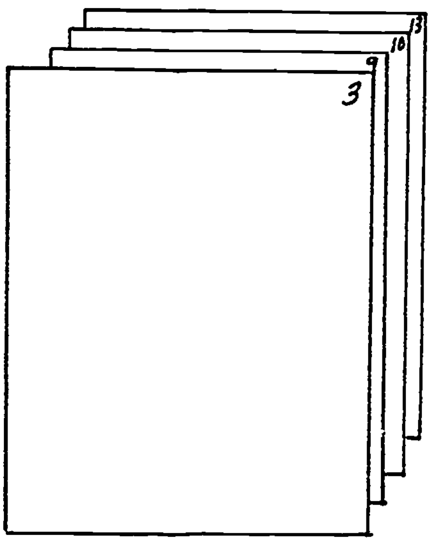
A sample conclusion from the petunia experiment:

The petunias fertilized with 'Y' grew to 110 cm in 11 days. The petunias fertilized with 'X' grew to 96 cm in 11 days. The control, with no fertilizer, grew to 76 cm. This data supports my hypothesis that the petunias would grow better with fertilizer 'Y'. It also shows that fertilizer 'X' is better than no fertilizer at all.

This information would (continued on next page)

THE WRITTEN REPORT

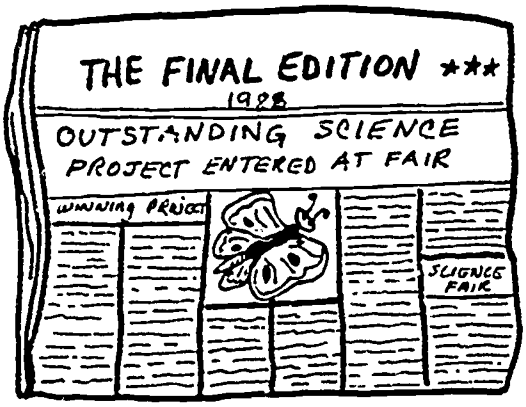
Tear out the following pages of this guide and put them in this order: page 3, 9, 10, 13, 14, 18, 19, 21; your results from 26, 27, 28; your best graph(s) from 33-37; 39, and 12,



This is a rough copy of your completed project report. PROOFREAD it for:

1. correct spelling + grammar
2. good sentences + paragraphs
3. accurate calculations

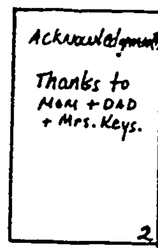
The FINAL COPY should be rewritten in ink very neatly or typed by someone. Remember to acknowledge the typist if you use one. As you rewrite the report, title each page. See examples on next page.



1st page of FINAL REPORT ----- Title Page

2nd page of FINAL REPORT ---- Acknowledgements

Ackn wledge all persons who helped you... Mom, dad, typist, etc.



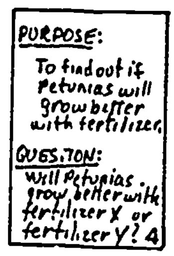
3rd page of FINAL REPORT ---- Table of Contents

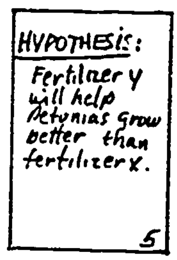
(Look at the one in this guidebook on page i)

4th page -- PURPOSE + QUESTION --(rewrite-page 3+5)

5th page -- HYPOTHESIS -(rewrite-page 13)

6th page -- BACKGROUND INFORMATION -- (rewrite research report-pages 6-10)





Next NEW page -- MATERIALS LIST -- (rewrite page 14)

Next the PROCEDURES --(rewrite-pages 18+19)

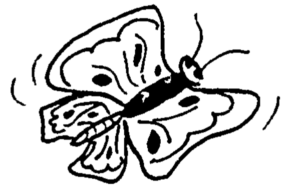
Next the VARIABLES -- (rewrite-page 21)

Next the RESULTS --(rewrite the best tables - page 26-28)

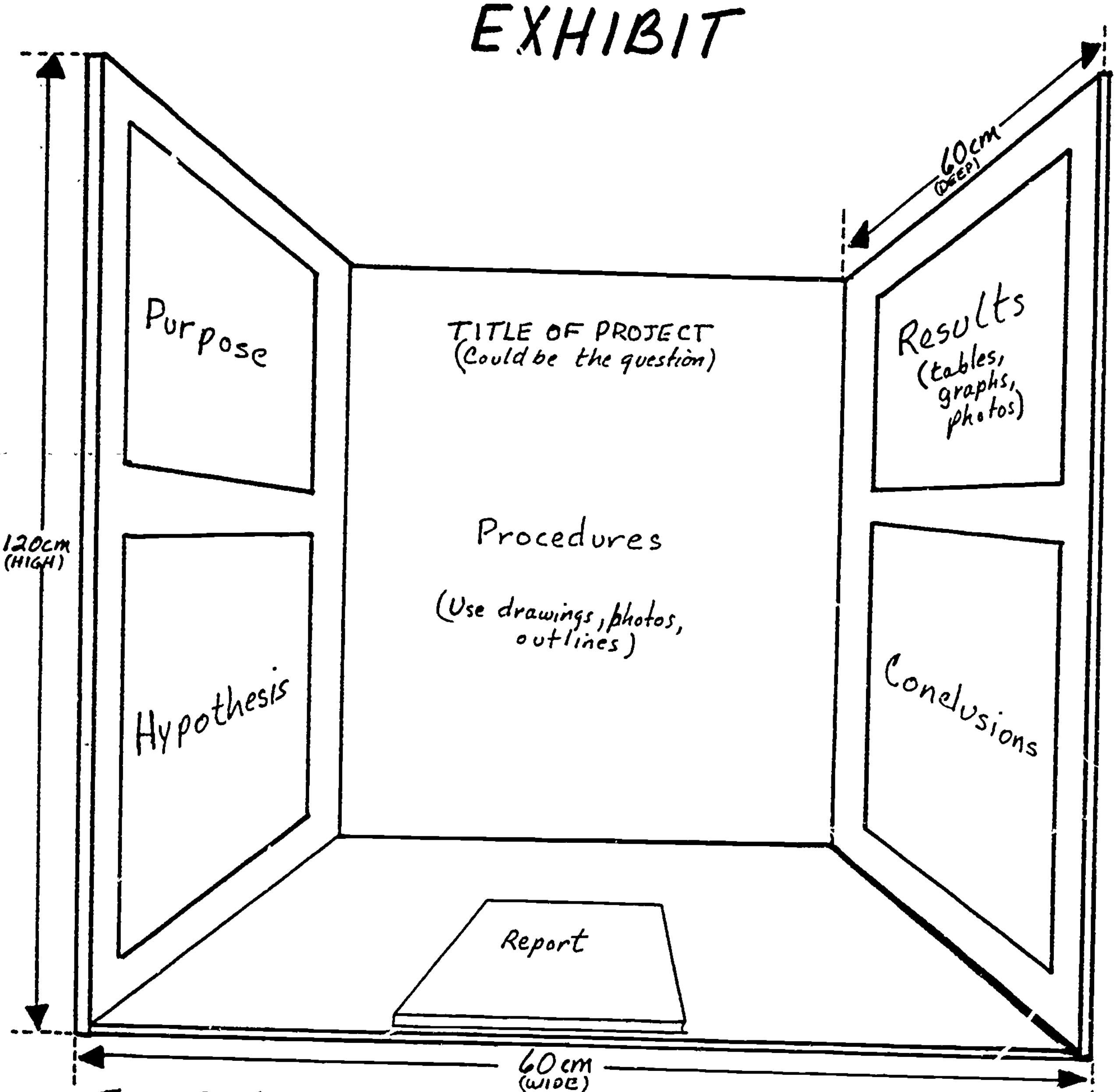
Next the GRAPHS -- choose your best -(rewrite 33-37)

Next the CONCLUSIONS --(rewrite page 39)

Last the BIBLIOGRAPHY -- (rewrite - page 12)



YOUR EXHIBIT



The exhibit may be designed in various ways. This is a very common design above. All exhibits must be NO LARGER than 60cm deep + wide and 120cm high. Use materials that are light weight, but sturdy for self-support. Use attractive lettering and arrange in a clear, simple way.

APPENDIX C

WEEKLY LOG

Log

WEEK__January 11-15______________

SUCCESSFUL METHODS

Individual help - a must!
Time line - good for me and students

UNSUCCESSFUL METHODS

Too many students in class - reduce size next year.
Get more encyclopedias - put in different areas of room.
Too much congestion in some areas.

STUDENT CONCERNS (questions, comments)

Some students going on their own at home - need activities for them.
Questions about where to get materials -- plants etc.
Next year have a list

TEACHER CONCERNS (questions, comments about fair)

(questions, comments about guide book)

Run more copies - teachers positive about book.

PARENTS CONCERNS (questions, comments)

phone call _X_ Mrs. Iyer - needed info about Cor-foam

note __________

direct contact_____

fair only _____

guide only ____

APPENDIX D

WORKSHOP EVALUATION RESULTS

Workshop Evaluation Results

5 = strongly agree
4 = agree
3 = undecided
2 = disagree
1 = strongly disagree

Figures rounded off

1. Was the time of day convenient?

ADULTS

Mean Score - 4.521

Response	Adults
5	12
4	11
3	
2	
1	

STUDENTS

Mean Score - 4.285

Response	Students
5	8
4	11
3	2
2	
1	

2. Was the presenter prepared?

ADULTS

Mean Score - 4.956

Response	Adults
5	22
4	1
3	
2	
1	

STUDENTS

Mean Score - 4.857

Response	Students
5	18
4	3
3	
2	
1	

3. Do you think the workshop was necessary?

ADULTS

Mean Score - 4.608

Response	Adults
5	17
4	4
3	1
2	1
1	

STUDENTS

Mean Score - 4.476

Response	Students
5	12
4	8
3	
2	1
1	

4. Was the length of presentation adequate?

ADULTS

Mean Score - 4.478

Response	Adults
5	16
4	5
3	
2	1
1	1

STUDENTS

Mean Score - 4.285

Response	Students
5	10
4	7
3	4
2	
1	

5. Will the guide be useful?

ADULTS

Mean Score - 4.782

Response	Adults
5	19
4	3
3	1
2	
1	

STUDENTS

Mean Score - 4.857

Response	Students
5	18
4	3
3	
2	
1	

6. Would you suggest this workshop to others next year?

ADULTS

Mean Score - 4.608

Response	Adults
5	16
4	5
3	2
2	
1	

STUDENTS

Mean Score - 4.666

Response	Students
5	14
4	7
3	
2	
1	

7. Would you come to this workshop again if your child enters the fair next year?

ADULTS

Mean Score - 4.043

Response	Adults
5	13
4	3
3	4
2	1
1	2

STUDENTS

Mean Score - 4.047

Response	Students
5	9
4	9
3	1
2	
1	1

APPENDIX E

STUDENT ATTITUDE SURVEY RESULTS

Student Attitude Survey Results

The mean scores of the 27-student Science Fair class based on a 1 to 5-point scale.

1. I have enjoyed participating in the science fair before.

Pre-Implementation	Post-Implementation
4.388	2.85

2. If I am helped with my science fair project at school and home, I will have a better chance of being a winner at the science fair.

Pre-Implementation	Post-Implementation
3.722	4.45

3. I know how to do a science fair project.

Pre-Implementation	Post-Implementation
4.305	4.15

4. I know how to set up an experiment.

Pre-Implementation	Post-Implementation
4.083	4.35

5. I like science.

Pre-Implementation	Post-Implementation
4.388	4.50

6. I like to enter the science fair.

Pre-Implementation	Post-Implementation
3.638	4.30

7. When using a guide to help me, my science fair project is easier and more fun to do.

Pre-Implementation	Post-Implementation
4.111	3.90

8. I will enter the science fair again.

Pre-Implementation	Post-Implementation
3.722	3.55