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ABSTRACT

This checklist is designed to help elementary school principals assess and improve science programs in their schools. The checklist is divided into four major sections, each dealing with an area that has an impact on these programs: (1) administrative aspects, considering the science curriculum plan, provisions for science in the budget, principal's leadership role, and staff development practices; (2) science texts and/or written curriculum materials, focusing on content, process, and several related areas (consistency with curricular goals, accuracy and clarity, compatibility with developmental level of students, relevancy of materials, etc.); (3) classroom visitations, focusing on observations of teacher and student behavior during science classes; and (4) resources and facilities, looking for evidence of science resources/facilities in and beyond the classroom, and determining how resources are acquired. Instructions for converting checklist responses into a matrix format are included. The matrix provides a systematic procedure for comparing what is desirable in the school science program to what is being achieved. It offers a method for diagnosing a program, and identifying both strengths/weaknesses--strengths that can be capitalized upon and weaknesses that can be eliminated. (JN)

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HANDBOOK III

CHARACTERISTICS OF A GOOD ELEMENTARY SCIENCE PROGRAM

Part A: Principal's Checklist of Characteristics

Project for Promoting Science Among Elementary School Principals

National Science Teachers Association
1742 Connecticut Avenue, NW
Washington, DC 20009

KENNETH R. MECHLING and DONNA L. OLIVER

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HANDBOOK III

CHARACTERISTICS OF A GOOD ELEMENTARY SCIENCE PROGRAM

Part A: Principal's Checklist of Characteristics of a Good Elementary Science Program

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The project, Promoting Science Among Elementary School Principals, began as an idea at the meeting of the board of directors of the National Science Teachers Association (NSTA), held in Dayton, Ohio in 1980. It was conceived as a joint effort of NSTA and the Council for Elementary Science International (CESI). We are grateful for the foresight, encouragement, and leadership of Don McCurdy, then president of NSTA.

Many people shared in the development of the project. Their efforts and ideas deserve our sincere appreciation. They include:

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PREFACE

If good elementary science programs were easy to come by, most schools would have one. Needless to say, it isn't easy and most schools don't. Problems abound with science programs; teachers often lack preparation in science, they don't feel confident about teaching it, time is cramped, supplies and equipment are lacking, leadership for science is difficult to find. The list could go on and on. Your school is probably faced with one or more of these problems.

Fortunately, there are many good science programs: programs that get kids excited, programs that teachers enjoy and do a good job of teaching, programs that have the support of the school community, and programs in which children learn science processes, concepts, and attitudes valuable to their lives now and in the future. We can learn from those programs. Through our own observations, through what others have written, and through research we know the characteristics of good elementary science programs. The purpose of this Handbook is to help you to identify some of the characteristics and use them to assess the effectiveness of your own science curriculum.

There are two major, but closely related, parts to <u>Characteristics of a Good Elementary Science Program</u>. Part A is the "Principal's Checklist of Characteristics of a Good Elementary Science Program." It includes selected characteristics of good elementary science programs stated in the form of questions. We urge you to use the Checklist to assess your own science program. Part B, "Elaboration of the Principal's Checklist of Characteristics of a Good Elementary Science Program," is the companion document keyed by number and/or letter to each question on the Checklist. It provides suggestions and specific recommendations to make the Checklist more meaningful and useful to you. We hope you will use both as you seek to improve your science curriculum.

This Handbook is part of a National Science Teachers Association project titled "Promoting Science Among Elementary School Principals." There are four Handbooks in the series: Handbook I, titled Science Teaches Basic Skills; Handbook II, The Principal's Role in Elementary School Science; Handbook III, Characteristics of a Good Elementary Science Program; and Handbook IV, What Research Says About Elementary School Science.

Ken Mechling
Donna Oliver

PURPOSE AND USE OF THE CHECKLIST

Good elementary school science programs don't just happen. They are built with support from the school community, with good science teaching in the classrooms, and with leadership from you, the principal. This checklist is designed to help you assess and improve the science program in your school.

The checklist is not comprehensive. After reviewing the literature and reflecting on our own experiences with good elementary science programs, we have selected questions which seemed particularly appropriate for consideration by principals. We have tried to limit them so you can evaluate your program with reasonable expenditures of time and effort.

The checklist can be effective only if you, the principal and science curriculum leader in your school, carefully examine your elementary science program. For your convenience we have divided the checklist into four major sections, each dealing with an area of great impact on your science program. They are administrative aspects, science texts and other written materials, classroom visitations, and resources and facilities.

You'll be able to answer some of the questions while sitting at your desk. For others it will be necessary to review your administrative policies, examine samples of science texts and other curriculum materials, visit classrooms when science is being taught, and check your science education—resources and facilities.

keeping in mind that it represents a characteristic of a good elementary science program, and check yes if your school has that characteristic, no if it does not, and no data if you lack information to answer the question. Over a period of time you will undoubtedly be able to whittle down the no data responses to very few, eventually converting them to yes or no as you learn more about your program.

If you are uncertain about the meaning of any items or of how they apply to your school, use your judgment in responding. Keep in mind that these are only guidelines and, consequently, they will be open to some interpretation. If you think of additional characteristics which should be on the list but are not, use the space provided in each subsection to add your own.

After you have completed the checklist, go to the last page which includes spaces for your overall evaluation. Count your yes, no, and no data responses. If you have a lot of responses for no data, it may mean that you have more to learn about your science program. If you have a substantial number of no responses, it may mean that your program offers lots of opportunities for improvement. Keep in mind that a specific analysis of the no responses can enable you to identify where your program needs the most help. Finally, if your responses are predominantly yes, it may mean that your science program is already pretty good.

A principal who answered yes to all or almost all of the questions would have a science program of the very highest quality. If your school falls short of this standard, the checklist provides criteria for improvement. You can decide where to start. The evaluation page requests that you identify the strengths and weaknesses of your science program and select five actions which you can take during the coming year to improve it. With your leadership, initiative, and support, improvement can be achieved. Start now!

NOTE: Some principals have indicated a desire to use a matrix response format rather than the yes, no, no data format. The last section of the Handbook includes easy directions for converting the checklist to a matrix format.

TABLE OF CONTENTS
PART A

PRINCIPAL'S CHECKLIST OF CHARACTERISTICS OF A GOOD ELEMENTARY SCIENCE PROGRAM

Page

PRINCIPAL'S CHECKLIST OF CHARACTERISTICS OF A GOOD ELEMENTARY SCIENCE PROGRAM

I. LEARNING ABOUT YOUR SCIENCE PROGRAM BY REVIEWING ADMINISTRATIVE ASPECTS WHICH AFFECT IT

	Yes	No	No Data
A. <u>REVIEWING YOUR SCIENCE CURRICULUM PLAN</u>			
1. Is there a written statement of goals and objectives which describes what your pupils should be learning in science?	___	___	___
2. Is there a written curriculum plan which describes planned, coordinated, and sequential science experiences for all grade levels, K-6 or K-12?	___	___	___
3. Is your science curriculum plan consistent with the basic goals of education in your state?	___	___	___
4. Did the preparation of the science curriculum plan involve all teachers, administrators, parents, students, and others responsible for implementing and sustaining it?	___	___	___
5. Is there evidence that the science curriculum plan was developed with the intent of making science learning valuable to the lives of the children now and into the 21st century?	___	___	___
6. Has time for teaching science been scheduled on a daily or weekly basis, with <u>minimums</u> of 100 minutes per week for K-3 and 150 minutes per week for 4-6?	___	___	___
7. Do all teachers of science understand the goals, the curriculum plan, and the time allocations for science instruction?	___	___	___

	Yes	No	No Data
8. Does your science program undergo a thorough periodic review, perhaps every five to seven years, in which goals, teaching strategies, and other aspects of the curriculum are reconsidered?	___	___	___
9.	___	___	___

B. REVIEWING PROVISIONS FOR SCIENCE IN YOUR SCHOOL BUDGET

	Yes	No	No Data
1. Does your school budget include an annual allocation of funds for financing the science program?	___	___	___
2. Does the budget include funds for science materials, supplies, equipment and/or books?	___	___	___
3. Do your teachers have ready and easy access to petty cash funds for consumable and perishable science materials which can best be purchased locally?	___	___	___
4. Does the budget include funds for staff development in science; i.e., consultants for local science inservice programs, staff travel to science conferences, and teacher attendance at science conventions?	___	___	___
5. Does the budget include funds for transportation and other costs related to pupil field trips to sites of science learning, such as nature centers, zoos, planetariums, museums, or factories?	___	___	___

	Yes	No	No Data
6.			

C. REVIEWING YOUR LEADERSHIP ROLE IN SCIENCE INSTRUCTION

1. Do you show your leadership in science through actions such as letting your teachers know that you are interested in science, demonstrating a positive attitude toward science, visiting classrooms when science is being taught, and encouraging and supporting science teaching? ___ ___ ___

2. Do you let teachers know that they are expected to teach science for the times indicated in your curriculum plan? ___ ___ ___

3. Do you evaluate teachers during their teaching of science? ___ ___ ___

4. When prospective teachers are being interviewed or considered for employment in your school, do you question them about their preparation, interest, and competence for teaching science? ___ ___ ___

5. During the past two years, has your science program been monitored by curriculum reviews, teacher surveys, pupil interviews, or other means to assess its continuing effectiveness and have these assessments resulted in improvements? ___ ___ ___

6. Do you take the lead in providing inservice programs in science for your teachers?

		Yes	No	No Data
7.	When a committee or group is formed to select a new science curriculum, have you been or will you be an active participant in that group?	___	___	___
8.	Have parents been made aware of your school science program by activities such as parent-teacher meetings which involve parents in science activities and science fairs to which the public has been invited, or by publicity in school or community news media?	___	___	___
9.	If standardized examinations are used, are the science sections valid measurements of the goals, objectives, and experiences of your school's science program?	___	___	___
10.	On the standardized examinations for science, do the children perform as well as or better than the national average and, over time, do they either perform consistently or improve?	___	___	___
11.	Is your school's system for giving grades, reports, or student evaluations consistent with your science programs's objectives and instructional practices?	___	___	___
12.		___	___	___

D. REVIEWING YOUR STAFF DEVELOPMENT PRACTICES

		Yes	No	No Data
1.	Are regular inservice programs provided in accordance with school needs in science?	___	___	___

	Yes	No	No Data
2. Do teachers of science assist in designing inservice programs?	___	___	___
3. Do inservice programs offer teachers specific skills, techniques, and materials that can be immediately useful to them for their science teaching?	___	___	___
4. Do teachers have opportunities to learn new science teaching techniques, try out newly-adopted science curriculum materials, and participate in activities similar to those their pupils will be doing *before* they are expected to use them in their own classroom?	___	___	___
5. Do you, the principal, participate actively in science inservice programs?	___	___	___
6. Have substantial numbers of your teachers participated in science education courses, workshops, meetings, etc., provided by school or regional educational agencies, colleges and universities, and professional science education associations?	___	___	___
7. Does the school provide release time so that teachers can participate in science education programs designed to improve science teaching?	___	___	___
8. Does the professional library in the school include journals such as *Science and Children*, *Science Activities*, newsletters or journals of your state science teachers' association, and other science education reference materials to serve as sources for new ideas, and are teachers encouraged to use them regularly?	___	___	___

Yes No No Data

9. ___ ___ ___

II. LEARNING ABOUT YOUR SCIENCE PROGRAM BY EXAMINING SCIENCE TEXTBOOKS AND/OR WRITTEN CURRICULUM MATERIALS

A. REVIEWING YOUR SCIENCE TEXTBOOKS AND/OR OTHER WRITTEN CURRICULUM MATERIALS FOR SCIENCE CONTENT

1. Is there a balanced emphasis among the life sciences, earth sciences, and physical sciences? ___ ___ ___

2. Do the written materials include a study of problems which are relative to us now and in the future; e.g., acid rain, air and water pollution, effects of spraying areas with poisonous substances, energy production and availability, medical research, and world population and hunger? ___ ___ ___

3. Do the written materials require students to apply major concepts to everyday life situations? ___ ___ ___

4. ___ ___ ___

B. REVIEWING YOUR SCIENCE TEXTBOOKS AND/OR OTHER WRITTEN CURRICULUM MATERIALS FOR SCIENCE PROCESSES

1. Do the written materials include liberal quantities of hands-on investigations and activities which the children can actually do? ___ ___ ___

	Yes	No	No Data
2. Are the scientific processes such as observing, measuring, predicting, inferring, classifying, recording and analyzing data, formulating and testing hypotheses, and designing and conducting experiments an integral and prominent part of the materials children will read?	___	___	___
3. Do the written materials encourage children to explore, discover, and find answers for themselves rather than telling them how things turn out?	___	___	___
4. Do the written materials require students to apply science processes to problem-solving situations?	___	___	___
5.	___	___	___

C. OTHER CONSIDERATIONS AS YOU REVIEW THE SCIENCE TEXTBOOKS AND/OR OTHER WRITTEN CURRICULUM MATERIALS

1. Are the written curriculum materials consistent with the goals of science for your school?	___	___	___
2. Are the written materials clearly written, accurate, and up-to-date?	___	___	___
3. Do the written K-6 materials proceed from the simple to the complex and are they designed for the children's appropriate developmental levels?	___	___	___
4. Is the information that children will read written at suitable grade levels?	___	___	___

	Yes	No	No Data
5. Do the children's reading materials appear interesting and relevant to their levels?	___	___	___
6. Are there opportunities for children to learn about science-related careers?	___	___	___
7. Are valid evaluation materials and techniques; i.e., tests, record sheets, performance demonstrations, and reports, included as an integral part of the program?	___	___	___
8. Does your science program include a functional teachers' guide that teachers actually use and find helpful?	___	___	___
9. Do the written materials include enough application of science content and processes to make science meaningful to students?	___	___	___
10.			
	___	___	___

III. LEARNING ABOUT YOUR SCIENCE PROGRAM BY VISITING CLASSROOMS

A. OBSERVING TEACHER BEHAVIOR IN SCIENCE CLASSES

	Yes	No	No Data
1. Are all teachers who are supposed to teach science actually teaching it for the allotted times?	___	___	___
2. When you discuss science, do your teachers display positive attitudes?	___	___	___

	Yes	No	No Data
3. Do teachers regularly use a variety of teaching methods such as group investigations, discussions, multimedia instruction, reading, role playing, game playing, writing, small group projects, lecturing, and individualized instruction?	___	___	___
4. Are teachers providing learning experiences that teach both science content and science processes and help children apply what they learn to everyday problem situations and science-based societal issues?	___	___	___
5. Do teachers provide many opportunities for children to participate in science activities, investigations, or experiments in which they have hands-on experiences with real objects?	___	___	___
6. During children's investigations do teachers function as guides by means such as assisting individual students, asking questions, suggesting alternate ways of thinking about problems, and providing additional materials?	___	___	___
7. Do teachers allow students to explore science materials <u>before</u> they "invent" concepts to explain them?	___	___	___
8. Do teachers ask open-ended, divergent questions and allow a wait-time of at least three to five seconds for students to respond?	___	___	___
9. Do teachers really listen to what children have to say?	___	___	___

	Yes	No	No Data
10. Do teachers encourage scientific attitudes such as open-mindedness, critical thinking, persistence, and responsibility?	___	___	___
11. Do handicapped children have adequate opportunities to become actively involved in science experiences?	___	___	___
12. Do teachers regularly combine science with other curricular areas such as reading, writing, mathematics, social sciences, health, art, music, and physical education?	___	___	___
13. Are children regularly evaluated to determine if they are acquiring competency in the science processes, knowledge, and attitudes specified in the statement of goals and objectives?	___	___	___
14.	___	___	___

B. OBSERVING STUDENT BEHAVIOR IN SCIENCE CLASSES

	Yes	No	No Data
1. Do the children appear to like science?	___	___	___
2. When you talk with children about science, do they display positive attitudes?	___	___	___
3. Is a substantial portion of the children's class time spent in science experiences other than in reading or listening?	___	___	___

Yes No No Data

4. Do students participate freely in discussions of science-related activities and topics, often expressing detailed descriptions of their observations and ideas? ___ ___ ___

5. Can children with limited reading ability succeed in the science program? ___ ___ ___

6. Are there opportunities for pupils to do individualized or specialized work in science; e.g., self-paced study, independent study, individual projects, and peer-group tutoring? ___ ___ ___

7. Are there opportunities for children to explore and find answers to questions they have in science? ___ ___ ___

8. ___ ___ ___

IV. LEARNING ABOUT YOUR SCIENCE PROGRAM BY ASSESSING THE AVAILABILITY OF SCIENCE RESOURCES AND FACILITIES

A. LOOKING FOR EVIDENCE OF SCIENCE RESOURCES AND FACILITIES

1. Are science materials (i.e., thermometers, dry cells, seeds, aquaria) available in sufficient quantities to enable all students to have hands-on experiences with them? ___ ___ ___

2. Does it appear that science supplies and materials are refurbished or replaced on a regular basis? ___ ___ ___

	Yes	No	No Data
3. Is there adequate storage space for science supplies, equipment, and materials?	___	___	___
4. Do the classrooms include running water, sinks, and electrical outlets?	___	___	___
5. Can you see evidence of continuing science experiences in classrooms; i.e., science displays on tables, cages of live animals such as gerbils or hamsters, shelves of science-related books, plants planted and/or cared for by children, science question boxes, mobiles, and science bulletin boards?	___	___	___
6. Are there classroom displays of the children's written essays, graphs, reports, poetry, or art projects that incorporate science-related content and processes?	___	___	___
7. Are there science-related library books readily available in the classroom to help students extend concepts learned?	___	___	___
8.	___	___	___

B. LOOKING FOR EVIDENCE OF SCIENCE RESOURCES BEYOND THE CLASSROOM

1. Do children's science experiences extend beyond the classrooms to the neighborhood of the school or further afield to nature centers, museums, zoos, airports, or factories?	___	___	___

	Yes	No	No Data
2. Does your school library include a reasonable collection of children's books which are science-related?	___	___	___
3.	___	___	___

C. HOW ARE SCIENCE RESOURCES ACQUIRED?

	Yes	No	No Data
1. Are materials for science education readily available to teachers who want and need them?	___	___	___
2. Are teachers of science involved in the selection and purchase of materials, books, supplies, and equipment used in science instruction and for science references?	___	___	___
3. Are procedures for requesting and ordering supplies and equipment reasonable, simple, and efficient?	___	___	___
4. Do teachers participate in inventorying, ordering, storing, and safe use of science materials?	___	___	___
5.	___	___	___

PRINCIPAL'S EVALUATION

1. Checklist Response Totals: Total Responses________

   YES____ NO____ NO DATA_____

2. Overall, I rate my science program as:

3. The major strengths of my science program are:

4. The areas most in need of improvement in my school's science program are:

5. During the coming year I will try to take the following five (5) actions to achieve maximum improvement in my school's science program:

   Now look over your list of five (5) actions which you have selected as starting points for improving your science program and place the numbers 1 through 5 beside them to indicate your priorities for action. One (1) is your top priority, 5 is your lowest.

6. One long-range goal for improving my science program is:

CONVERTING THE CHECKLIST TO A MATRIX

Many principals have found a matrix format helpful in assessing their science programs. Rather than responding *yes*, *no*, or *no data* to a checklist of science curriculum characteristics, they compare the characteristics of their current science programs to what they would like them to be. A matrix format provides a systematic procedure for comparing what is desirable to what is being achieved. It offers a method for diagnosing a program, identifying both strengths and weaknesses--strengths that can be capitalized upon and weaknesses that can be eliminated. Following are directions for converting the checklist to a matrix.

This is what a matrix looks like.

DESIRABILITY

4					
3					
2					
1					
−1					
	−1	1	2	3	4

ACHIEVEMENT

Note that the vertical axis is for *desirability* and the horizontal axis is for *achievement*. The numbers refer to the degree of desirability or achievement. Higher numbers correspond to greater desirability or achievement, lower numbers to lesser desirability or achievement. The rating scales* are as follows:

DESIRABILITY for Our Science Program

4 - very desirable; of utmost value
3 - desirable; of significant value
2 - moderately desirable; of medium value
1 - unimportant; of insignificant value
-1 - undesirable; of negative value

ACHIEVEMENT in Our Science Program

4 - excellent; extremely high level
3 - very good; above average
2 - moderate; about average
1 - low; below average
-1 - non-existent or avoided

The items in the Checklist can easily be converted to the matrix format. Start with any item on the checklist. Rewrite it by changing it from a question to a positive statement. For example, item I.A.1. reads like this in the Checklist:

		Yes	No	No Data
I.A.1.	Is there a written statement of goals and objectives which describes what your pupils should be learning in science?	___	___	___

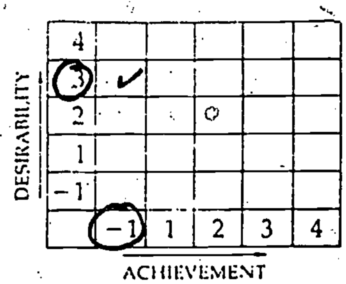
For use with a matrix it can be rewritten into a statement like this:

I.A.1.	Our school has a written statement of goals and objectives which describes what children should learn in science.	D. 4 3 2 1 -1 A. 4 3 2 1 -1

*Adapted from Guidelines for Self-Assessment of Secondary-

To the right of the statement circle the rating you wish to give to the desirability (D) of having a written statement of goals and objectives. Circle the rating for your current level of achievement (A). Let's say you circled a 3 for desirability, which means you believe written goals and objectives are desirable, and a -1 for achievement, which means your school doesn't have written statements of goals and objectives for science.

Transfer these numbers to the matrix by circling 3 for desirability and -1 for achievement.



Now place a check in the place where the ratings intersect. An analysis of this item shows that you believe goal statements are important but your school has none. This identifies a weakness that you may wish to eliminate. You could begin your improvement program by preparing a written statement of science goals and objectives for your school. The same procedure can be applied to any or all items on the checklist, one matrix per statement.

The matrix system offers a systematic method for diagnosing your school's science program, identifying areas of strength and weakness. You may also wish to utilize the system with your teachers to collectively analyze science curriculum strengths and weaknesses. A page of matrices is provided should you wish to duplicate copies for use with your professional staff. Additionally, a large matrix* is provided should you wish to make a transparency for visually displaying a group's analysis.

*Adapted from Guidelines for Self-Assessment of Secondary-School ~~Science Programs~~, Washington, DC: National Science Teachers Association, 1978, pp. 6 and 27.

DESIRABILITY

4					
3					
2					
1					
−1					
	−1	1	2	3	4

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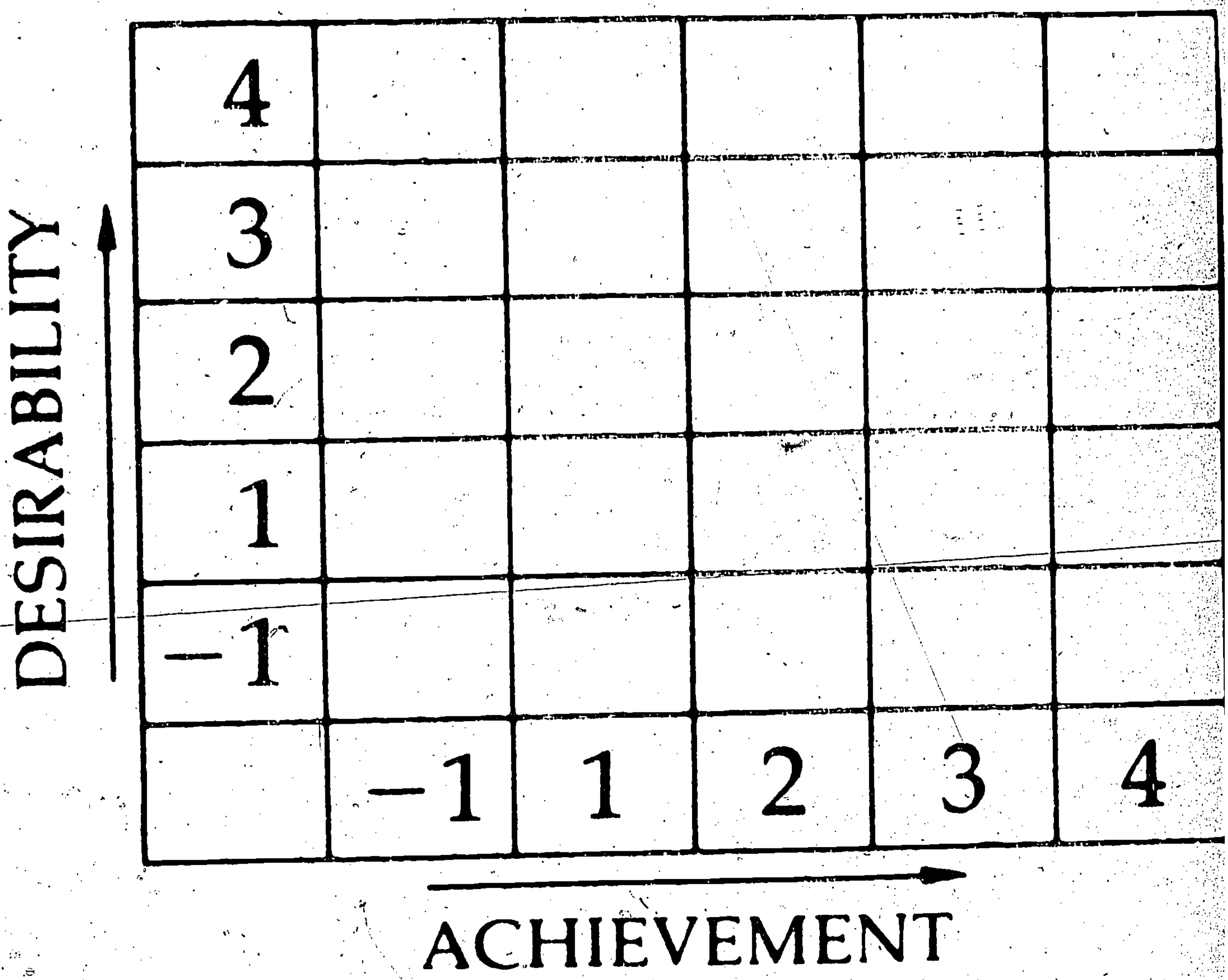
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