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## The Role of the Elementary School Principal in Administration of Cuisenaire Materials

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THE ROLE OF THE ELEMENTARY SCHOOL PRINCIPAL IN  
ADMINISTRATION OF CUISENAIRE MATERIALS

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A Research Paper  
Presented to  
the Graduate Faculty  
Central Washington State College

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In Partial Fulfillment  
of the Requirements for the Degree  
Master of Education

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by  
Vernon John Harkness  
August 1963

THIS PAPER IS APPROVED AS MEETING THE  
PLAN 2 REQUIREMENT FOR THE COMPLETION  
OF A RESEARCH PAPER.

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Ernest L. Muzzall  
FOR THE GRADUATE FACULTY

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## CHAPTER I

### INTRODUCTION

Recent years have seen a reconsideration of the arithmetic curriculum in the primary grades. Many school systems are taking a critical look at the entire elementary arithmetic program, re-examining goals, content, and method in relation to children's abilities and needs.

The Cuisenaire materials have been rapidly introduced to children in many elementary schools in the Highline School District #401, where the writer is employed as an elementary principal. The Cuisenaire materials, sets of colored rods made of wood, consist of two hundred and ninety-one pieces. Manuals and other instructional aids accompany the rods.

Information for presentation of the Cuisenaire materials in the classroom is available to teachers, but little evidence has been presented concerning the role of the elementary principal in administrating and implementing these materials.

There is a distinct community interest in this area of the curriculum in the Highline School District. Educators, too, have shown considerable interest in using the Cuisenaire materials as a supplement in the arithmetic

curriculum. However, educators need to be more adequately prepared and informed in order to introduce these materials to children.

## I. THE PROBLEM

Statement of the problem. It was the purpose of this study (1) to review literature regarding new trends in the elementary arithmetic program; (2) to investigate the role of the elementary school principal in administration of Cuisenaire materials; and (3) to investigate the current elementary arithmetic programs in the Highline School District #401 and, where evidence was available, in other school districts using Cuisenaire materials.

The program in the Highline School District was investigated to determine the curricular goals and content of schools using Cuisenaire materials and of schools not using such. Other school districts using Cuisenaire materials were investigated to obtain further results of the program as well as information concerning the administrator's role.

The writer found it necessary to interview principals in the Highline School District to obtain evidence.

Importance of the study. The writer finds it imperative to be adequately prepared to administrate an



arithmetic program in the elementary school today.

According to Battle:

The supervisor is concerned with improving the quality of instruction through work with the staff, teaching aids, facilities, community resources, and other available means. The effectiveness of his work depends largely on the degree to which he can keep informed on developments and resources (2:308).

The intrinsic and real worth of informed leadership to the community, the children, and the teachers should not be underestimated in the expanding and changing curricula of space-age education. As Wagner said, "All help possible must be provided teachers . . . to teach" (32:455).

Limitations of the study. No attempt was made to explore the method of instruction with the Cuisenaire materials as this information is available in teacher's manuals. The writer was concerned with the role of the administrator.

The study of other school districts using Cuisenaire materials was limited to the writer's review of literature and to original investigation already mentioned.

## II. DEFINITIONS OF TERMS USED

The Cuisenaire rods or materials. These are described by Gattegno:

Cuisenaire constructed sets of rods comprising two hundred and ninety-one pieces. These are cut from lengths ranging in centimetres from 1 cm. to 10 cm. Thus the smallest unit is a centimetre cube, and the longest is a rod 10 cm. long. Each of the ten rods has a characteristic colour according to its length, and experiments in varying the colour system in an attempt to improve upon it have led to no advance. They fall into three families based upon the primary colours, yellow, red and blue, together with white and black. The smallest rod, namely, the 1 cm. cube, is a sub-multiple of all the numbers, and is white. The 7 cm. rod is black. The 5 cm. and 10 cm. rods are respectively light green, dark green and blue. The series 2, 4, and 8, are red, purple and brown (14:9).

Administration or administrator. These terms shall be construed to mean an elementary school principal carrying out his assignment as supervisor of instruction in the school.

Cuisenaire. This refers to Georges Cuisenaire of Thuin, Belgium, who invented the materials.

Gattegno. This refers to Caleb Gattegno, who developed Cuisenaire's material into a system of teaching mathematics.

Primary grades. This refers to grades one, two, and three in an elementary school.

## CHAPTER II

### CONSIDERATION OF THE ARITHMETIC CURRICULUM

#### I. CURRENT TRENDS

Experimental programs. Arithmetic today is in many respects an entirely different discipline from what it was at the turn of the century. New developments have been extensive; new concepts have been revolutionary.

Many groups and individuals are at work modernizing the arithmetic curriculum and experimenting with new content and methods at the elementary level. Some of these experimental programs were discussed by Crawford:

The University of Illinois Arithmetic Project directed by Dr. David Page . . . aims to improve the content and instruction of elementary school mathematics by introducing new systems and settings which can support a continuing exploration by children . . . of new approaches to communicating, organizing, and illustrating mathematical content so that often more advanced ideas can be treated at earlier grade levels.

The Syracuse University Madison Project originated in 1957 as an experimental mathematics curriculum for weaker students, but moved on from there to take as its main objective the study of the best possible mathematical instruction for children of various ages.

The School Mathematics Study Group, a conference on elementary school mathematics, was held in February, 1959, with the result that a program for grades 4, 5, and 6 consisting of some 25 units was written and tested empirically under the supervision of a special panel in the summer of 1960 (8:5-7).

Mention has already been made of the Cuisenaire materials as one of the current trends or experimental programs in use in many parts of the world today. A more thorough treatment and examination of these materials follows later in the study.

Regarding new thinking in elementary mathematics education, Deans states that "The time is ripe for a reconsideration of arithmetic in the primary grades" (11:424). Wagner commented on the objectives and activities of the School Mathematics Study Group:

The world of today demands more mathematical knowledge on the part of more people than the world of yesterday, and the world of tomorrow will make still greater demands (32:454).

Fehr (12:424) indicated that school people must make recommendations for modification, additions, deletions and improvements of existing programs so that responsible authorities and mathematicians can influence change as they see the need for it.

Availability of funds. The availability of funds for mathematics programs under Title III of the National Defense Education Act has been a factor in the investigation of elementary school projects. Burgess (6:9) reports that a total of 77 school districts and offices of county superintendents of schools in California made applications

for projects planned to improve instruction at the elementary level and to explore different ideas and approaches. He further indicated that many classrooms were being supplied with concrete and manipulative devices and audio-visual aids to supplement instruction in these projects.

Implications for teacher education. Teachers can help each other to find new ways of working with children. More efficient ways are surely sought by all. Elementary arithmetic workshops for the past two years in the Seattle-King County area have been crowded. Many teachers have been turned away or forced to postpone receiving instruction. Priority systems based upon immediate need have been implemented to determine who might attend a workshop. This is an indication of the interest educators in this particular geographical area have in the new programs and how they assess the need for improvement of instruction in this area of the curriculum.

McSwain and Cooke state: "Time, resource materials, and professional guidance are essential in helping pupils to develop meaningful understanding of arithmetic" (22:14).

The many projects concerned with revision in mathematics education indicate that the provision of new curricula and/or methods and materials without teachers able to

communicate them is sterile. The many and varied efforts to improve elementary school mathematics programs have focused a major attention on teacher education (5:421-425). Teacher education, then, is an integral and vital part of reform in mathematics education.

## II. IMPLICATIONS FOR EDUCATION

Since the reconsideration of the arithmetic curriculum in the elementary school in recent years, there have been conflicting views concerning the need for change. Some sources indicate that education must offer more difficult material at an earlier age in larger quantities. Others maintain that the traditional approach is adequate.

### Sources implying change. Foster states that:

One of the avowed aims of the elementary school program is to teach children how to think. The ability to take a set of conditions and deduce logical conclusions is an essential skill in our modern society. Arithmetic instruction as an integral part of our total elementary program should make a contribution to the development of deductive reasoning.

Many schools have delayed the introduction of materials stressing the use of deductive reasoning until the intermediate arithmetic program. New programs in arithmetic for primary grade children verify that these children have a greater mathematical capacity than we had previously supposed. These mathematical experiences will certainly lead to better mathematics students and contribute toward teaching children how to think in a more effective manner (13:20).

Neuriter and Wozencraft (25:252-255) indicated that many children can thrive intellectually in second grade under a regimen of accelerated arithmetic instruction combined with enriched teaching in other subjects. The reactions from children seemed to show that they had more fun with arithmetic than had other classes in previous years. A casual follow-up of the same children in the first few months of the third grade indicated that the gains were retained, permitting more rapid progress in third grade arithmetic.

According to Brownell:

1. Much of the traditional content of arithmetic will be taught sooner.
2. Greater prominence will be given to the mathematical aspects of the subject.
3. Practicable means will be found to accommodate effectively differences in learning ability.
4. The program in the higher grades will include much that is new.
5. We have seriously underestimated the attention span of school beginners.
6. Likewise, we have seriously underrated the "readiness" of school beginners for systematic work in arithmetic.
7. We can safely ask children in the lower grades to learn more in arithmetic than we are now asking them to learn (3:42; 4:173).

The Twenty-Fifth Yearbook of The National Council of Teachers of Mathematics criticizes the arithmetic curriculum in kindergarten and grades one and two in the following respects:

1. Limiting experiences to the numbers 1 through 10 holds the students to a starvation diet.
2. It is not likely to generate much enthusiasm for the study of numbers.
3. It may be a bar to good learning situations.
4. Although many children can do some adding and subtracting before entering school, some second grade programs still devote pages to adding numbers 1 through 9. This is boring to students who already know these facts.
5. There is overemphasis on counting objects in pictures to get answers. This deprives pupils of the opportunity to do the kind of thinking essential to arithmetic.
6. The telling, showing, explaining type of introduction to facts that is typical of current practices may be questionable.
7. Heavy reliance on the numeral form of addition exercises may not be good learning procedure.
8. More use should be made of work problems (19:100).

Hull, who has participated for two years in an experimental program using Cuisenaire materials, states:

While the program which becomes possible may sound ambitious in the relation to expectations which we usually have had for children in the primary grades, we are finding that these things can be accomplished normally, without a great deal of strain, and that the student's growing awareness of the relatedness of ideas and his enthusiasm for mathematics provide a good basis for future learning (18:3).



Sources not implying change. Although there are many proponents of new programs of content and method in the elementary mathematics curriculum, there are an equal number of opponents who imply that this may not be the wisest approach to teaching arithmetic. Others take the viewpoint that caution is the better part of valor, or that educators should apply the principle of prudence when reconsidering the arithmetic curriculum.

Sage states:

It is evident that children in the first grade can learn to multiply, those in the second grade can learn much geometry . . . but what child needs to know geometry at the second grade level, or how to multiply at the first grade level. The depressing of upper level fields of mathematical specialization further into the elementary curriculum must be stopped (29:188).

Read contends that educators must be alert to use new materials in new ways, but he indicates some cautions to observe:

I think there is relatively little disagreement with the premise that the continual development of mathematics calls for new objectives, new curricula, new texts, new methods of teaching, and new methods of teacher training.

One danger of pushing algebra into the 5th or 6th grade or calculus into the secondary school is the possibility that the pressure of time may result in superficial coverage.

Select what seems feasible . . . for your school. Do not be afraid to experiment; but do not make changes merely to be different, and do not discard the old merely because it is old (28:163-174).

Swenson continues this line of thought:

Some teachers complain bitterly that there is not enough content in primary-grade arithmetic books. What often seems to be a limited coverage is at times limited because of the teacher's narrow view of the meanings involved. Teachers in the primary grades have the responsibility to teach much more than the oral and written forms (31:3).

Others have indicated that the only reason we are giving any consideration at all to the arithmetic curriculum is because of the critics demanding an up-grading of the program.

Meder sums this by stating:

Critics have cried that more be done. They have demanded more mathematics for more pupils and more traditional mathematics for whom it is demonstrably inappropriate; in some cases more difficult mathematics, just because it is difficult (23:434).

Other sources indicate that we will be using the current or traditional curriculum for many years to come. Hannon (16:614) believes that traditional materials will form the basic core of the curriculum; new materials and new ideas for presenting traditional material should follow a process of evolution rather than revolution. Hull (18:3), in his experimental program with Cuisenaire materials, pointed out that the materials did not, by themselves, constitute a system of teaching mathematics different from the traditional curriculum but made it possible to go more deeply into mathematics at an earlier level, with children

learning the traditional subject matter of the early grades in different ways than before.

Morton advises further cautions for the use of certain experiences and devices:

The teacher should always be alert for opportunities to use concrete and semiconcrete experiences. The wise teacher will be equally alert to the mis-use of these so-called manipulative materials. Until we have scientific studies which evaluate the use of these materials . . . the teacher should permit their use as long . . . as they aid the pupil to discover meaning (24:54).

Deans implies that the conflicting views might be joined if her set of purposes for a primary arithmetic program was followed:

1. To guide the child as he uses arithmetic to solve his day-by-day problems both in and out of school.
2. To help children learn that arithmetic is interesting and fascinating, that they can discover how it works, its systematic quality, its relationships, its laws, its possibilities.
3. To help every child learn as much arithmetic as he is capable of learning at the time it can be learned most economically and efficiently (11:22).

## CHAPTER III

### THE CUISENAIRE MATERIAL

#### I. GENERAL DESCRIPTION

The colored rods. The colored rods were described earlier in this study, in Chapter I (14:9).

The cardboard materials. According to Gattegno (14:10-11), Cuisenaire devised three cardboard aids which can be used to gain practice in rapid mental calculation to ensure that products and factors become second nature to the child. They are comprised of a wall chart, product cards, and a lotto game to accomplish these goals.

The film and filmstrip. A film and filmstrip are available that give a general description and condensed introduction to the various uses of the Cuisenaire materials. The teacher or administrator should have some background or training in the use of Cuisenaire materials before attempting to use these visual aids. The introduction of Cuisenaire materials to any group is a very important step (14:25).

Pupil's books. A series of eight pupil textbooks is available with material ranging in difficulty from numbers

under 100 to a study of length, area, and volume (14:75).

Teacher's manuals. Three books or manuals are helpful to the teacher: A Teacher's Introduction to the Cuisenaire-Gattegno Method of Teaching Arithmetic (14:1-75); Modern Mathematics With Numbers in Color (15:1-91); and Numbers in Colour (9:1-96). These manuals contain information concerning the use of the material, stages of mathematical study, the contributions of Cuisenaire and Gattegno, and self-instruction for the teacher in the algebra, arithmetic, and geometry of the Cuisenaire materials.

## II. HISTORY AND INCEPTION

History. Georges Cuisenaire of Thuin, Belgium, over many years developed the use of the rods in teaching mathematics. The credit for this contribution belongs to him in all respects (14:75).

After thirty years of experimentation and practice, the ability of Thuin's students in mathematics finally attracted attention and came to the notice of Gattegno about ten years ago. Recognizing the possibilities of Cuisenaire's materials, he used the rods to develop, project, and propagate his own system of teaching mathematics. However, he does credit Cuisenaire with inventing the materials that stimulated him to do this (15:1-2).

Inception. Gattegno (15:7) implied that the beginning and widespread use of the Cuisenaire materials was probably due to his travel on several continents for the past seven years lecturing to and demonstrating before groups of educators. The writer believes, too, that the current transition and thinking in the arithmetic curriculum has aided and abetted the use of this material, especially in the United States.

### III. CURRENT USE

World-wide. The earliest uses of the rods appear to have been in countries comprising the United Kingdom, but Gattegno indicates that European countries have for many years been experimenting with new methods and content in mathematics (15:7-8). He cites the use in all countries of the United Kingdom, the United States, Europe, Africa, Asia, and South America. He also indicates beginnings in private and parochial schools. It is further indicated that the material is used at all grade levels from pre-school and kindergarten through high school.

#### Specific studies, observations, and conclusions.

In an experiment in Buenos Aires, Argentina, one of several conclusions was, "The enthusiasm for learning of these pupils knew no bounds" (26:8).

Carpenter (7:7) reported that children enjoyed using the rods, discovering relative values, and arriving at correct conclusions themselves.

Lucow (21:18) compared the Cuisenaire method with current traditional methods of teaching multiplication and division in grade three. He concluded that children still needed to learn the combinations to make their responses accurate and automatic.

Howard (17:191-195) held interviews with thirty-one British teachers regarding their reactions to the Cuisenaire-Gattegno materials. He concluded that the approach was valuable and held promise for future development; the average and brighter pupils seemed to benefit particularly; mathematical concepts were facilitated considerably; and that the approach should be used as a supplement to current methods.

After a two-year study using control and experimental groups with Cuisenaire materials, the Saskatchewan Teachers' Federation Summary of Results (30:2) indicated that one experimental second grade group scored approximately 25 per cent higher than the control group on a power test. The third grade experimental group scored approximately 50 per cent higher than the control group.

In 1959 the results of the second year of the Vancouver, B. C., experiment led to the following conclusions:

Children who have been taught with Cuisenaire materials in Grade 1 and 2 gain remarkable facility in the complex manipulation of whole numbers and fractions and, at the same time, they make progress in the prescribed course of number work that is at least as good as that made by those pupils who are taught by traditional methods.

Cuisenaire materials appear to be no more effective with bright children than with slow children.

Both on a standardized test and on a special Cuisenaire test, children who have used these materials for two years surpass those pupils who have had only one year of this instruction; and they, in turn, do better than those who have had none.

There is some indication that greater benefit may accrue from the use of Cuisenaire materials in Grade 1 than in Grade 2 (20:2).

Highline School District. Some experimentation with Cuisenaire materials has been done for the past three years on an incidental basis. No statistical conclusions or data have been compiled as yet, but interest in expanded use of the material is growing. Mr. Ralph Peters, Director of Elementary Curriculum, commented to the staff of elementary principals on January 26, 1962:

The success of our initial efforts in this field seem largely due to highly interested teachers being willing to study, visit, take classes, etc., to prepare themselves to get the most from this approach and these materials.<sup>1</sup>

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<sup>1</sup>Ralph Peters, Elementary Curriculum Director, in comments to the staff of elementary principals, January 26, 1962. Permission to quote secured.



## CHAPTER IV

### THE ARITHMETIC CURRICULUM OF THE HIGHLINE SCHOOL DISTRICT ELEMENTARY SCHOOLS

#### I. SCHOOLS NOT USING CUISENAIRE MATERIALS

Curriculum guides. The Washington State Curriculum Guide (10:1-114) and the "King County Guide" (1:1-23) are used as a basis for scope, sequence, and further development of the curriculum.

Grade level goals. Grade level goals are stated in the Highline Public Schools "Progress Reports--Grades One, Two, and Three" (27:1-8). These goals were established by teachers and administrators and approved by the Superintendent and Board of Education. These should not be considered the only goals but the basic and sequential learnings stressed at these grade levels.

The goals for Grade One are to develop (1) an awareness of use of numbers in daily living; (2) an understanding of the number symbols 0-9; (3) the ability to count, read, and write neatly the numbers 1-100, by 1's, 5's, 10's and 2's to 20; (4) the ability to recognize coins; and (5) an understanding and recognition of such terms as more-less.

The goals for Grade Two are to understand and learn

(1) to write and count by 1's to 200 and by 2's, 5's, 10's to 100; (2) to add and subtract numbers forming combinations to 12; and (3) simple measurement, time, and arithmetical vocabulary.

The goals for Grade Three are to master the addition and subtraction facts and to develop (1) an understanding of addition with carrying and subtraction by the borrowing method; (2) an arithmetical vocabulary; (3) a practical understanding of the monetary system, liquid measure, linear measure, time, and weight; and (4) accuracy, neatness, and speed.

## II. SCHOOLS USING CUISENAIRE MATERIALS

Several schools in the Highline School District are using Cuisenaire materials as a supplement to existing grade level goals already stated.

The writer interviewed five elementary school principals of schools in the District who were using Cuisenaire materials and had used them for at least one year. The five principals and the schools were Mrs. Katheryn White, Maywood; Mr. Clifford Wilcox, Cedarhurst; Mr. Donald Weeks, Des Moines; Mr. Ferry Fischer, White Center; and Mr. Richard Valentine, Marvista. The principals were asked to respond to four questions in terms of their knowledge of the

use of the Cuisenaire materials in their schools. The four questions and a tabulation of the varied responses follow:

1. In your opinion do the Cuisenaire materials supplement or supplant the present curriculum?

(5) supplement

(1) will never supplant

(1) might supplant eventually

2. What is your observation as to the success of this program in your school?

(4) high motivational factor for learning

(3) teacher enthusiasm was high

(2) stimulated slow learners to do better

(2) pupils grasped concepts quickly and easily

(2) teachers need training for greater results

(1) good students did better than before

(1) it is just another tactile aid

(1) present district goals were exceeded

3. What implications do you see for future use of the material?

(3) a real need for teacher education, especially upper grade teachers

(2) it is only a tool or technique

(2) some change in curriculum, but the basic curriculum is highly important, too

- (1) rapidly expanding use depending upon enthusiasm and support of staff
- (1) a large, over-all change in curriculum is coming soon

4. What implications are present for the principal if these materials are used?

- (4) need in-service training for teachers
- (3) principal needs training and knowledge or background in the materials
- (2) some difficulty in motivating teachers to learn about it
- (1) if you begin the program, plan to use it, but the community may not want it
- (1) teacher turnover might create a problem
- (1) some teachers might not use it wisely
- (1) teachers should not be forced to use it

## CHAPTER V

### SUMMARY AND CONCLUSIONS

#### I. SUMMARY

The current trends in the elementary school arithmetic curriculum indicate an entirely different approach to what has been a more traditional area of the curriculum. Experimental programs and projects are coming to the attention of educators as rapidly as the educators can understand them. New methods, content, and manipulative tools are being explored by these projects and, in turn, schools are experimenting with them.

In the midst of these current trends, authorities and educators alike are either praising the new programs, casting doubts upon them, or urging that the schools be prudent and cautious if they incorporate the programs into the curriculum. This implied a real need for teacher and administrator-education and understanding of new developments.

An investigation of the Cuisenaire materials revealed a system of teaching arithmetic with colored rods and other materials. The system implied that children from kindergarten through high school could learn about numbers in different ways than before by using methods and content

that had been reserved for the secondary schools. Although the results of studies is limited, they indicate that there had been more success than failure in experimental programs using this material.

The Highline School District had sets of stated grade level goals for the primary grades determined by guides and other sources. Schools that either did or did not use Cuisenaire materials strived for pupil achievement of these grade level goals. Schools that used the Cuisenaire materials used them as a supplement to the basic, stated goals.

The interviews with five elementary school principals in the Highline School District indicated primarily that the Cuisenaire materials (1) probably supplement the curriculum; (2) influence motivation for learning by stimulating pupils to achieve the stated arithmetic goals more rapidly and easily and by stimulating teacher enthusiasm for teaching arithmetic (as observed by these principals); and (3) need well prepared teachers and administrators to use the materials wisely and efficiently.

## II. CONCLUSIONS

The role of the elementary school principal in administration of Cuisenaire materials was not clearly defined

by this study. However, some guidelines implied can be clearly understood by the prospective or present elementary school principal.

This study concluded that:

1. The administrator must keep abreast of all new or recent developments, thinking, and research in the arithmetic curriculum. It is imperative that he be informed in order to interpret the curriculum wisely.
2. The administrator must not be too quick to praise or condemn new developments in the arithmetic curriculum. Thoughtful consideration must be given to the fact, in the writer's opinion, that the present arithmetic curriculum is in a state of transition. The review of literature in this study revealed this fact, but even more important, there does not seem to be a majority of research or opinion to encourage or discourage new programs. The administrator would be more prudent to weigh all information carefully before launching into a new program or staying with the established program.
3. The administrator should not begin a new program involving new methods, content, or materials,

such as the Cuisenaire-Gattegno method of instruction entails, without:

- a. teacher interest, cooperation, and understanding of the program.
  - b. adequate teacher training.
  - c. setting up a program for in-service training of staff using all resources available.
  - d. the full cooperation of his immediate superior.
  - e. community interest or education.
  - f. adequate funds to secure and administer the program.
  - g. knowing what the goals and objectives are and continuously evaluating the program systematically.
  - h. giving it a fair trial.
4. The administrator must consider the needs of the children in the school. All other things are of little consequence if these needs are not identified and met. This does not imply that the administrator should be fearful of implementing new ideas and methods into the curriculum. It does imply that the administrator realize that the curriculum is a means of meeting these needs in the most economic and efficient manner.



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