

CONCEPTS AND CHARACTERISTICS OF THE NEW MATHEMATICS
PROGRAMS ACCEPTED OR REJECTED BY TEACHERS

by 45

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B.S., University of Bridgeport, 1949

A MASTER'S REPORT

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

College of Education

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1969

Approved by:


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LD
2668
B4
1969
M54

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ACKNOWLEDGMENT

The writer would like to acknowledge the patient and scholarly guidance given him by his advisor, Dr. Floyd Coppedge.

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THE PROBLEM

Introduction

This study was conducted in a school district increasingly committed to the new program since 1960. Mr. George Evans, Supervisor of Mathematics in Broward County, Florida, estimates that in the school year 1966-67, at least 80 per cent of the secondary school teachers had had some training in the new programs. It is the goal of this school district to be virtually 100 per cent committed to the new programs.

In this environment of acceptance, what are the concepts and characteristics of the new programs being accepted by teachers? In covering this question, this report confines itself solely to whether or not teachers in the described school district accept all or part of the new programs. The merits of the overall new programs as compared to the more traditional secondary school mathematics programs and the possible benefits or detriments to the pupil from each program will not be discussed, except where any of these facts may relate to teacher acceptance of the new programs.

Statement of the Problem

The purpose of the study was to determine what concepts or characteristics of the new programs were being accepted or rejected by teachers or certain groups of teachers, and whether or not age, experience, new programs' experience and preparation were determinants in teacher acceptance or rejection of the new programs.

Significance of the Problem

Much has been written about what the new programs are, and what they hope to accomplish, but there has been little research on just what groups

of teachers are accepting which parts of these programs. Since the teacher will probably be effective in purveying the changes associated with the new programs only to the extent he accepts them, these facts are important to know.

Definition of Terms

New Programs. This term as used in this report refers to the new instructional developments which have taken place since the mid-fifties, such as, the MSG (School Mathematics Study Group) and the UICSM (University of Illinois Committee on School Mathematics). Other terms that appear in The Review of Literature that also refer to the same new instructional material are: New math, modern math, modern mathematics, modern programs, new curriculum, modern school program, new concepts and new mathematics.

Positive Statements. Statements contained in the survey instrument (marked with an asterisk) on which a positive response was considered as indicating acceptance by the respondent of that concept or characteristic of the new programs mentioned in the statement.

Negative Statements: Statements contained in the survey instrument on which a negative response was considered as indicating acceptance by the respondent of that concept or characteristic of the new program mentioned in the statement.

Favorable Response. A negative response to a negative statement (see above), or a positive response to a positive statement (see above). Such responses would indicate acceptance of that phase of the new programs by the respondent.

Unfavorable Response. A positive response to a negative statement, or a negative response to a positive statement. Such responses would indicate

rejection of that phase of the new programs by the respondent.

No Response. When a respondent failed to indicate on his survey instrument either a favorable or unfavorable response to any statement. This apparently occurred mostly because the statement did not apply to the respondent and would account for an uneven tabulation for each statement within a category (see below).

Category. A term used to indicate a sorting of all returned survey instruments. There are four categories: age, referring to the age of the respondent; preparation, referring to the number of college credits the respondent received in courses devoted to, or oriented towards preparing teachers to teach the new programs; experience, referring to the numbers of years teaching experience of each respondent; new programs experience, referring to the number of years teaching experience with new instructional material.

Subgroups. This term refers to a specific segment of the population whose responses were tabulated separately and compared, or could be compared, to other specified segments of the population. Each category has three or four subgroups, such as under 40, 40-49, and over 49, referring to a grouping of responses by the age of the teacher; or 0-3, 4-9, 0-1, 2-4, etc., referring to a grouping by either number of credits earned, or years of teaching experience of the teacher.

Combined Totals. An additional category without subgroups that reflects tabulations of responses of all the teachers.

Accepted Statement. A classification designating when the favorable responses of a subgroup totaled enough to meet a predetermined criteria.

Rejected Statement. A classification designating when the unfavorable responses of a subgroup totaled enough to meet a predetermined criteria.

Neutral Statement. A classification created to designate when neither the total of the favorable or the unfavorable responses of a subgroup were sufficient to meet a predetermined criteria.

Population

The population of this study was composed of 262 secondary school mathematics teachers of Broward County, Florida, during the 1966-67 school year. The researcher and his department head who helped criticize the survey were excluded.

Limitations

No attempt was made to qualify for the respondents any terms used in the statements contained in the survey sheet, or the statements themselves. Similarly no attempt was made to qualify any responses made by the teachers.

The survey was limited to secondary school mathematic teachers of Broward County, Florida, and the results were not intended to be representative of any other group.

REVIEW OF THE LITERATURE

A pertinent part of the literature reviewed was an article by Alice Heutlig and John M. Newell. It described a survey conducted among 115 elementary teachers from a suburban school system near Boston. A survey instrument containing 31 statements was used to test teacher reaction toward the new program introduced within the prior two years. Fourteen of the statements were designed as positive statements and seventeen were designed as negative statements. The teachers were requested to agree or disagree with the statements of the survey instrument. Their responses were classified as either favorable or unfavorable towards the new program. The teachers were also requested to give information about their age, their number of years of teaching experience and the amount of preparation they have had in the new programs. This information was used to form subgroups within the individual categories of age, experience and preparation. Statistics were developed comparing the subgroups and subjected to a chi square analysis.

Their survey indicated that teaching experience was a significant factor in teacher acceptance of the new programs, since a chi square analysis indicated that the differences in reaction by the subgroups within this category was significant beyond the .01 level; acceptance decreased as experience increased. Those teachers with less than ten years' experience reacted significantly more favorably towards the new math programs than those with more than ten years' experience.

Teacher training in the new programs also appears to be a significant factor in teacher acceptance of the new programs, since a chi-square analysis indicated that the differences in reaction by subgroups within this category

was significant beyond the .01 level; acceptance increased as the amount of training in the new programs increased.

The results of the survey showed that the grade level taught was not a significant factor in teacher acceptance of the new programs.

The responses of all of the teachers, regardless of the category or subgroup, were unfavorable to the new programs for the following statements contained in the survey instrument:

1. The modern math program frequently seems to make the obvious complicated.
2. It is often easier to go back to the old methods when it becomes difficult to get a point across.
3. My pupils would be covering more ground were I still using the traditional program.

The authors of the article recommended that a special program be considered for teachers with more than ten years' experience to meet their particular needs. They stated that there were "some attitudes toward the modern mathematics program that detracted from the most effective implementation of them", and hoped that more experience would create more positive attitudes.¹

While there is a paucity of evidence regarding teachers' reactions to the new programs, there is ample material on the concepts and characteristics of the new programs; and such is reflected in the statements contained in the

¹
Alice Heutlig and John M. Newell, "Attitudes Toward Introduction of Modern Mathematics Program by Teachers with Large and Small Number of Years Experience", The Arithmetic Teacher, 13 (February 1966) pp. 125-30.

survey instrument used in connection with this report.

While curriculum revision was originally begun prior to the first Russian space shot, Sputnik I (1957), this feat paved the way for immediate large-scale introduction of the new programs in the mathematics programs of the secondary schools throughout the country.² Initially, the new programs were adapted to the more able secondary school students only, and training programs for secondary school teachers reflected this. Their training did not expose them to materials or problems related to so-called slow students.³

In fact, even in 1960 there was still discussion among noted educators whether or not the new programs should be introduced into the elementary school, and be extended to all students in all grades regardless of their ability.⁴ There were pleas to public school teachers to accept the change, get into the spirit of the new program, learn and be professional.⁵

Revision of the original new curriculum was already taking place in 1960-61, while programs for the less-talented student and the elementary school were just being prepared for use.⁶

One article appearing in the February, 1966 issue of The Arithmetic

²Howard F. Fehr, "Breakthrough in Mathematical Thought," The Mathematics Teacher, 52 (January, 1959) pp. 15-19.

³The Revolution in School Mathematics, A Report of Regional Orientation Conferences in Mathematics, (Washington D.C., National Council of Teachers of Mathematics, 1961) pp. 13, 45-47.

⁴Harold Fawcett, "Guidelines in Mathematical Education," The Mathematics Teacher, 53 (October, 1960) pp. 418-23.

⁵Howard F. Fehr, "New Thinking in Mathematical Education," The Mathematics Teacher, 53 (October, 1960), pp. 424-29.

⁶The Revolution in School Mathematics, op. cit., pp. 62, 72.

Teacher concerning elementary teachers of one school district indicated that the new math programs were introduced in these schools in 1962.⁷ Another article appearing in the same issue mentions the instability of the elementary programs, and indicated a need for textbooks adapted to the reading and study ability of the pupils, because our democratic society demands a new program for all.⁸

New programs for average or slow learners were acknowledged to have had a late start,⁹ though steady progress has been made.¹⁰ This researcher used the first state-adopted (approved for purchasing) modern math textbook for slow learners in the junior high schools of Broward County in the 1965-66 school year, and the first state-adopted modern math textbook for average students (C grade in junior high school) in the high school in the 1966-67 school year.

A report on the April 1967 NCTM (National Council of Teachers of Mathematics) meeting mentions that Braunfield and Associates have been trying and revising material for slow learners to be as non-verbal as possible.¹¹

⁷Alice Heutlig and John M. Newell, loc. cit.

⁸Howard F. Fehr, "Sense and Nonsense in a Modern School Program," The Arithmetic Teacher, 13 (February, 1966) pp. 83-91.

⁹The Revolution in School Mathematics, op. cit., p. 62.

¹⁰Robert B. Davis, "Recent Activities of the Madison Project", American Mathematics Monthly, 72 (January, 1965) pp. 72-73; F. J. Kelly and H. T. Lerch, "Mathematics Programs for Slow Learners", The Arithmetic Teacher, 13 (March, 1966) pp. 332-36; Sarah Greenholz, "Successful Practices in Teaching Mathematics to Low Achievers", The Mathematics Teacher, 60 (April, 1967) pp. 329-35.

¹¹NCTM Speakers Stress Methodology, Florida Council of Teachers of Mathematics Newsletter, May, 1967.

They began this project in 1964, but do not expect to be able to publish the material until 1968. The claim is that good mathematics is involved.

The literature thus far reviewed placed emphasis upon curriculum revision. The teacher was mentioned primarily in connection with the need for him to change or upgrade his background. Some articles did discuss to a degree, the need for other changes, and in particular, a change in methodology. For example, Ferguson stated that a "change to the new program necessitated a change in new content, a change in the approach to familiar content, a change in teacher preparation, and a change in methodology."¹²

Another source reported that "the new methods of teaching (discovery, emphasis on proof, etc.) do not stand alone, but are to be regarded as essential components of the new content. Conventional courses do not, in general, provide a basis for applying these improved methods."¹³

Kelly noted that, "teachers need training in methodology, associated with a system of inquiry and discovery along with content, better understanding of the desired goals of the program, and development of techniques unique to the program".¹⁴

Another article, though appearing in an elementary school mathematics journal, included the secondary school as also having as its greatest need in modern math a "theory of instruction" coordinating simultaneously curriculum

¹²Eugene D. Ferguson, "Current Reforms in the Mathematics Curricula - A Passing Phase or Progress, The Mathematics Teacher, 57 (March, 1964) pp. 143-48.

¹³Revolution in School Mathematics, op. cit., pp. 78-79.

¹⁴F. J. Kelly and H. T. Lerch, "Mathematics Programs for Slow Learners, The Arithmetic Teacher, 13, (March, 1966) pp. 332-36.

and method.¹⁵

Rapael suggested that:

It is easy to teach the teacher the new mathematics within time; it is not so easy to teach him the real nature of mathematics, or the methodology of the new math. Unless teachers do grasp the new instead of compromising and returning to the apron strings of the old, we may well bring on a return to the old mathematics. Teachers indicate they know what the new mathematics is but not what it is not in the classical response, "Well really, isn't it just the same as before, only with different words?".¹⁶

Adler had much to say on these same ideas. He talked about:

"Guiding Principles" we accept but do not always live by.
 (1) Teach for understanding not merely manipulative skill.
 (2) Provide material that allows discovery. (3) Replace drill for drill's sake by using past understandings to build new meaningful situations. (4) Use the spiral approach of introducing more sophisticated material at higher levels within the framework of the same structural concepts. (5) Use supplementary pamphlets. (6) Logical reasoning should be initiated in grades 4-6.

.....

It is a grave error to assume that what children learn is all they are capable of learning. What they learn today depends to a great extent on what we try to teach them and the methods we use for teaching them.

He also refers to the noted work of Jean Piaget, that in essence indicates two of the three factors involved in learning are subject to cultural rather than genetic control.¹⁷

Others support the concept of the new programs that a certain topic should not be prejudged as too sophisticated for certain students.

¹⁵Vincent J. Glennon, "Research Needs in Elementary School Mathematics," The Arithmetic Teacher, 13 (May, 1966) pp. 363-67.

¹⁶Brother I. Rapael, "The Return of the Old Mathematics," The Mathematics Teacher, 60 (January, 1967) pp. 14-17.

¹⁷Irving Adler, "Cambridge Report: Blueprint or Fantasy," The Mathematics Teacher, (March, 1966) pp. 210-217.

Both Davis¹⁸ and Phillips¹⁹ discuss the Madison Project, in which there is continuous success in presenting topics at still lower and lower grades. Success in reaching culturally-deprived children with so-called sophisticated topics is also part of the Madison Project.²⁰ Phillips also wrote that the liberal use of visual and other learning aids is a concept of the new programs.²¹

An underlying concept of the new programs is teaching for understanding rather than using methodology that relies upon drill to gain momentary results. In his article on evaluation (testing) programs, Hartung suggested that good test construction includes testing for what you teach; consequently, tests used to evaluate student progress in the new programs should include testing for understanding.²² In general it is accepted that a positive attitude toward the new programs by the teacher is important to the eventual success of them.

¹⁸Robert B. Davis, loc. cit.

¹⁹Harry I. Phillips and Marguerite Klutiz, Modern Mathematics and Your Child, U. S. Department of Health, Education and Welfare, Number OE-29047, Washington; Government Printing Office.

²⁰Robert B. Davis, loc. cit.

²¹Harry L. Phillips, loc. cit.

²²Maurice I. Hartung, Evaluation in Mathematics, Twenty-Sixth Year-book, Washington: The National Council of Teachers of Mathematics, 1961.

METHODS AND PROCEDURE

The article by Heutlig and Newell, mentioned in the Review of Literature, formed a basis for the design and procedure of this report. While the survey instrument used by Heutlig and Newell was prepared with elementary teachers in mind, many of the statements also applied to secondary school teachers. It was decided that some of their statements could not be used because they referred to learning situations primarily reserved for the elementary level.

The final survey instrument of this report (see Appendix A) contained twenty-two statements. Thirteen used by Heutlig and Newell were also used in this report, some with slight revision in word, but not in thought. The two statements below, used by Heutlig and Newell, were used in this report after changing words to make the statements more applicable to learning situations in the secondary school level (the number appearing in a parenthesis is the same number used for the statement as it appeared in the final survey instrument).

(6) Students gain a much deeper understanding of mathematics through the new program. (Heutlig and Newell used "number concepts" instead of "mathematics").

(22) Large quantities of visual aids often serve as a distraction to the learning processes. (Heutlig and Newell used "manipulative aids" instead of "visual aids").

Two statements used by Heutlig and Newell were used in this report after additions were made. Both the writer and his department head, who helped criticize the survey statements, felt that these two statements in their original form did not allow much of a choice in responses.

(5) Students learn best by working with a single textbook, rather than being provided supplementary material that might approach the same topic from a somewhat different viewpoint. Do not consider research material. (Heutlig and Newell ended their statement after the word "textbook").

(15) You should always develop the logic behind why a series of mechanical steps work, rather than simply teaching these steps, even with average or below-average students. (Heutlig and Newell ended their statement after the word "steps" which is underlined).

The following statements were not included in the survey of Heutlig and Newell, but were used in this report:

(4) You may teach for understanding, but success can best be evaluated by testing for answers.

(8) The students that have had a substantial modern math background seem to do better in subsequent mathematics courses.

(11) The new math is worthwhile for above-average students only.

(20) Learning and teaching the modern program has made me a better teacher.

(21) The modern program is alright, I suppose, but not for what I teach.

Following the example of Heutlig and Newell, eight statements were designed to be positive statements with respect to the new programs, while the remaining were designed to be negative. The mathematics department head of this researcher, his county mathematics' supervisor and Dr. R. J. Yates²³

²³R. J. Yates, Dr. of Philosophy in Mathematics, Kansas State University, personal interview, June 21, 1967.

were requested to view the final survey statements from the standpoint of these designs. All three individuals cited concurred with them.

The survey instrument was prepared, together with a data sheet and an instruction sheet, (see Appendix A). In order to use the Broward County mail "pony" system, it was necessary to forward the above three papers stapled together with a self-addressed envelope.

Surveys were sent to all 262 teachers of the Broward County school district. Again, in order to make use of the "pony" system, the surveys were forwarded to the attention of each mathematics' department head, together with a covering letter (see Appendix A). Of the 166 sealed surveys returned, 163 were useable, at least in part. This represents an approximate 63 per cent response, which compares favorably to the about 65 per cent considered reputable.²⁴

Quantitative responses were requested in the data sheet, but similar to Heutlig and Newell, the results were tabulated as being simply a favorable or unfavorable response, without regard to the degree of agreement or disagreement. The information requested on the data sheet was used to place the individual responses in subgroups of four categories of age, preparation, experience and new programs' experience, whereas Heutlig and Newell in their survey compared degree of acceptance of the new programs between subgroups of only three categories - experience, grade taught and preparation. This survey omitted the category of grade taught primarily because the information supplied by the respondents as to the grade level or subject they taught was nebulous. For example: grades 7-12, or grades 10-12, or algebra, geometry, etc.

²⁴George J. Mouly, The Science of Educational Research (New York; American Book Company, 1963) pp. 141-166, 231-263.

The category of age was added, hopefully to determine if longevity in teaching was in itself a factor in rejection of the new programs as the survey results of Heutlig and Newell indicates, or if simply age and its posture of resistance to change was not indeed the determining factor.

The category of teaching experience in the new programs was also added to this survey, primarily because Heutlig and Newell conjectured that experience would create more positive attitudes

The data sheet information requesting the number of overall mathematics credits earned (oriented towards new programs, or otherwise) was not used, since it was decided that subgroups in this category should generally follow the pattern of acceptance or rejection of several other categories.

The tabulated responses were converted to percentages. If at least 60 per cent of a subgroup gave a favorable response to a statement, the statement was considered accepted by that subgroup. (When terminology such as acceptance or rejection of a statement is used in this report, it should be understood that what is actually being accepted or rejected is the meaning of the statement as it relates to the new programs). If at least 60 per cent of a subgroup gave an unfavorable response, then that statement was considered to be rejected by that subgroup. Statements that were neither accepted or rejected by a subgroup were classified as neutral. The number of statements accepted, rejected or considered neutral were tabulated for each subgroup, and a chi-square analysis of this data was used as a test for significance.²⁵

The above-procedure followed the pattern used by Heutlig and Newell, and was copied in order to have a basis for comparing the results of their

²⁵J. P. Guilford, Fundamental Statistics in Psychology and Education, (New York: McGraw-Hill Book Co., 1965) Chapters 1, 2, 3, 6, 11.

survey with those of this report.

Chi-square analysis was then used to establish the significance of the responses made to each statement by each subgroup. This procedure included determining the number of favorable or unfavorable responses necessary to have significance beyond the .05 level. It should be noted that the percentage of responses necessary to have significance varied from 58 per cent when the total responses were 163 as in the combined totals, to 70 per cent when the total responses were only 20, as in the 1-2 subgroup in the experience category.

It should be understood that only the chi-square statistic was used to establish significance levels.

RESULTS

Table I shows the results of tabulating responses as either favorable (F) or unfavorable (U) for every subgroup of every category and also for the combined totals.

Table II shows whether a statement was accepted (A), rejected (R), or was considered neutral (N) for every subgroup, using as a criteria the 60 per cent level of favorable or unfavorable responses explained above. These were totaled, and each category and certain grouping within each category were tested for significance. The results follow.

<u>Preparation Number of Credits</u>	<u>Accepted</u>	<u>Rejected</u>	<u>Neutral</u>
0-3	8	5	9
4-9	13	5	4
10-18	17	3	2
over 18	18	0	4

A chi square analysis of data contained in two different eight cell tables was made. In the first analysis only data classified as accepted and rejected was used, and the analysis revealed a chi square value of 9.501, beyond the .05 level. In the second analysis the neutral statements were added to the rejected statements to comprise one column of four cells, while the accepted column was used unchanged. This data also revealed a chi square value of 10.027, significant beyond the .05 level. It should be noted that the data shows that more statements were accepted and less rejected by teachers as the amount of their preparation increased.

TABLE I

FREQUENCY OF FAVORABLE (F) AND UNFAVORABLE (U) RESPONSES
FOR EACH STATEMENT IN EACH SUBGROUP

STATEMENT		NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
COMBINED TOTALS																								
	F	154	67	76	66	97	135	48	121	111	118	94	105	124	98	61	95	142	121	141	113			
	U	9	96	86	96	64	28	115	25	51	42	68	56	37	63	101	66	19	31	19	44			
AGE																								
UNDER 40	F	87	44	50	39	59	77	29	72	69	68	56	58	71	56	30	53	83	67	84	73			
	U	2	45	39	49	30	12	60	9	20	19	33	30	18	32	58	35	6	16	4	15			
40-49	F	36	11	14	16	22	30	11	27	20	26	21	28	29	23	14	20	31	29	30	24			
	U	5	30	26	25	17	11	30	9	20	14	19	12	10	17	27	20	9	9	9	15			
OVER 49	F	31	12	12	11	16	28	11	22	22	24	17	19	24	19	13	22	28	25	27	16			
	U	2	21	21	22	17	5	22	7	11	9	16	14	9	14	20	11	4	6	6	15			
PREPARATION																								
0-3	F	20	10	12	6	14	20	3	15	12	14	8	13	13	13	4	9	18	15	19	15			
	U	4	14	12	18	10	4	21	6	12	10	16	10	11	14	20	12	6	7	5	7			
4-9	F	50	19	17	22	31	45	17	41	33	36	32	35	44	35	15	27	48	42	45	41			
	U	4	35	36	32	23	9	37	5	20	17	21	18	9	19	39	27	5	10	7	11			
10-18	F	46	18	23	21	28	39	13	33	37	35	29	34	37	28	16	32	42	33	41	32			
	U	1	29	24	25	19	8	34	10	10	11	18	13	9	17	30	15	4	8	5	14			
OVER 18	F	36	18	22	17	23	32	14	30	28	32	24	23	29	24	22	26	33	30	34	24			
	U	0	18	14	19	13	4	22	4	8	3	12	13	7	12	14	10	3	5	2	11			
NEW PROGRAMS EXPERIENCE																								
0-1	F	22	6	13	9	12	18	5	17	16	15	12	16	16	11	3	11	22	12	22	20			
	U	3	19	12	16	13	7	20	4	8	9	13	8	9	14	22	13	2	9	3	5			
2-4	F	81	33	40	35	55	72	26	66	58	60	52	52	69	52	27	51	76	66	74	64			
	U	5	53	46	51	31	14	60	10	28	25	34	33	17	33	58	34	10	15	9	18			
OVER 4	F	48	25	22	20	28	43	15	35	38	40	27	35	39	33	24	32	41	40	42	31			
	U	1	24	26	27	21	6	34	11	11	8	21	14	8	15	25	17	7	7	7	16			

<u>EXPERIENCE</u>		19	8	11	8	14	16	5	17	16	13	11	14	12	8	12	11	2	13	18	12	20	17
1-2	F	1	12	9	12	6	4	15	2	4	6	9	5	1	9	8	9	17	7	2	5	0	3
	U	28	11	16	11	21	24	7	24	24	22	17	20	22	18	27	17	8	16	29	21	26	24
3-4	F	2	19	14	19	9	6	23	2	6	7	13	10	3	10	3	12	22	13	1	5	1	3
	U	35	18	20	16	22	31	10	28	26	26	22	22	30	23	27	25	12	21	32	29	32	29
5-9	F	0	17	15	17	12	4	25	5	9	9	13	12	4	12	7	9	23	14	3	5	3	6
	U	82	37	47	35	57	71	22	69	66	61	50	56	64	49	66	53	22	50	79	62	78	70
UNDER 10	F	3	48	38	48	27	14	63	9	19	22	35	27	8	31	18	30	62	34	6	15	4	12
	U	57	20	21	23	33	51	21	40	33	42	35	41	45	37	46	35	25	34	50	47	50	34
OVER 9	F	6	43	41	40	30	12	42	13	29	20	27	21	14	24	16	28	38	28	11	13	13	26
	U																						

TABLE II

Classification of Each Statement For Each Subgroup as Accepted (A), Rejected (R), or Neutral (N)
 Criterion Used, 60 Percent of Responses Being Favorable (Accepted), or, Unfavorable (Rejected)

Statement Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Combined Statement	A	R	N	R	A	A	R	A	A	A	N	A	A	A	A	A	R	N	A	A	A	A
Age																						
Under 40	A	N	N	N	A	A	R	A	A	A	A	A	A	A	A	A	R	A	A	A	A	A
40-49	A	R	R	R	N	A	R	A	N	A	N	A	A	A	A	N	R	N	A	A	A	A
Over 49	A	R	R	R	N	A	R	A	A	A	N	A	A	N	A	N	N	A	A	A	A	N
Preparation																						
0 - 3	A	R	N	R	N	A	R	A	N	N	R	N	A	N	N	N	R	N	A	A	A	A
4 - 9	A	R	R	R	N	A	R	A	A	A	N	A	A	N	A	A	R	N	A	A	A	A
10 - 18	A	R	N	N	A	A	R	A	A	A	A	A	A	A	R	A	R	A	A	A	A	A
Over 18	A	N	A	N	A	A	N	A	A	A	A	A	A	N	A	A	A	A	A	A	A	A
New Programs Experience																						
0 - 1	A	R	N	R	N	A	R	A	A	A	N	A	A	N	A	N	R	N	A	N	A	A
2 - 4	A	R	N	R	A	A	R	A	A	A	A	A	A	N	A	A	R	A	A	A	A	A
Over 4	A	N	N	N	N	A	R	A	A	A	A	A	A	A	A	A	N	A	A	A	A	A
Experience																						
1 - 2	A	R	N	N	A	A	R	A	A	A	N	A	A	N	A	N	R	A	A	A	A	A
3 - 4	A	R	N	R	A	A	R	A	A	A	N	A	A	A	A	A	R	A	A	A	A	A
5 - 9	A	N	N	N	A	A	R	A	A	A	A	A	A	A	A	A	R	A	A	A	A	A
Under 10	A	M	N	N	A	A	R	A	A	A	A	A	A	A	A	A	R	A	A	A	A	A
Over 9	A	R	R	R	N	A	R	A	N	A	N	A	A	N	A	N	R	N	A	A	A	A

<u>Age</u> <u>Number of Years</u>	<u>Accepted</u>	<u>Rejected</u>	<u>Neutral</u>
under 40	17	2	3
40-49	13	5	4
over 49	12	4	6

A chi square analysis of data contained in two, six cell tables was made, the data being set up in cells similar to the method used in the preparation category. The data excluding neutral statements revealed a chi square value of 2.039, while including neutral statements revealed a chi square value of 2.750. Neither value is significant at the .05 level.

<u>New Programs Experience</u> <u>Number of Years</u>	<u>Accepted</u>	<u>Rejected</u>	<u>Neutral</u>
0-1	12	4	6
2-4	16	4	2
over 4	15	1	6

A chi square analysis of data contained in two, six cell tables was made similar to above, and revealed a chi square value of 2.121 excluding the neutral statements, and 1.728 including them. Neither value is significant at the .05 level.

<u>Experience</u> <u>Number of Years</u>	<u>Accepted</u>	<u>Rejected</u>	<u>Neutral</u>
1-2	14	3	5
3-4	16	4	2
5-9	17	2	3
over 9	10	5	7

A chi square analysis of data contained in two, eight cell tables was made as above, and revealed a chi square value of 2.827 excluding the neutral statements, and 5.564 including them. Neither value is significant at the .05 level.

Data for two special subgroups in the experience and age categories was prepared using the same procedures as previously outlined.

<u>Age</u>	<u>Accepted</u>	<u>Rejected</u>	<u>Neutral</u>
Under 40	17	2	3
40 and over	10	5	7
<u>Experience</u>			
Under 10	17	2	3
Over 9	10	5	7

It should be noted that the data for the subgroups "under 40" years of age and "under 10" years experience is identical, as is the data for the subgroups "40 and over" years of age and "over 9" years experience. A chi square analysis of this data revealed a value of 2.933 with the neutral statements excluded and 3.452 with the neutral statements included. Neither value is significant at the .05 level.

Summarizing the results analyzed above, only preparation is clearly a determinant in teacher acceptance of concepts and characteristics of the new programs, and there is evidence to indicate that acceptance increases as preparation increases.

The categories of age, new programs' experience and experience are less reliable as determinants in teacher acceptance of the concepts and characteristics of the new programs, except that there is some indication

that teachers under 40 years of age, or with less than ten years experience, are somewhat more accepting of concepts and characteristics of the new programs than teachers 40 years or older, or with ten or more years experience, respectively. The results of the survey also appear to indicate that the more experienced teachers are generally less accepting of the new programs than teachers with less experience, because of their age differential, and not because of their difference in experience.

The first part of the problem was to determine those concepts and characteristics of the new programs that were accepted or rejected by teachers. The data from the combined totals category (the only grouping that considers responses of all of the teachers together) was used to make this determination. Table III shows the classification of each statement with significance beyond the .05 level. As can be seen in this table, the following five statements were rejected by teachers:

- (2) The new math often contains terminology and concepts too advanced for the age level at which it is presented.
- (4) You may teach for understanding, but success can best be evaluated by testing for answers.
- (7) The modern program frequently seems to make the obvious complicated.
- (17) It is often easier to go back to the old method when it becomes difficult to get a point across.
- (18) The new program often approaches the same concept from too many angles.

This statement was classified as neutral:

- (3) The new program covers too much material too quickly.

TABLE III

Classification of Each Statement for Each Subgroup
 As Accepted (A), Rejected (R), or Neutral (N), Criterion Used .05 Level of Significance

Statement Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Combined Statement	A	R	N	R	A	A	R	A	A	A	A	A	A	A	A	A	R	R	A	A	A	A
Age																						
Under 40	A	N	N	N	A	A	R	A	A	A	A	A	A	N	A	A	R	N	A	A	A	A
40 - 49	A	R	N	N	N	A	R	A	N	N	N	A	A	N	A	N	R	N	A	A	A	A
Over 49	A	N	N	R	R	A	R	A	A	A	N	N	A	N	A	N	N	A	A	A	A	A
Preparation																						
0 - 3	A	N	N	R	N	A	R	N	N	N	N	N	N	N	N	N	R	N	A	N	A	N
4 - 9	A	N	R	N	N	A	R	A	N	A	N	A	A	N	A	A	R	N	A	A	A	A
10 - 18	A	N	N	N	N	A	R	A	A	A	N	A	A	A	A	N	R	A	A	A	A	A
Over 18	A	N	N	N	N	A	N	A	A	A	N	A	N	A	A	A	N	A	A	A	A	A
New Programs Experience																						
0 - 1	A	R	N	N	N	A	R	A	N	N	N	N	N	N	N	N	R	N	A	N	A	A
2 - 4	A	N	N	N	A	A	R	A	A	A	A	A	A	N	A	A	R	N	A	A	A	A
Over 4	A	N	N	N	N	A	R	A	A	A	N	A	A	A	A	A	N	A	A	A	A	A
Experience																						
1 - 2	A	N	N	N	A	A	R	A	A	N	N	N	A	N	N	N	R	N	A	N	A	A
3 - 4	A	N	N	N	A	A	R	A	A	A	N	N	A	N	A	N	R	N	A	A	A	A
5 - 9	A	N	N	N	M	A	R	A	A	A	M	M	A	A	A	A	R	N	A	A	A	A
Over 9	A	R	R	R	N	A	R	A	N	A	N	A	A	N	A	N	N	N	A	A	A	N

All other concepts and characteristics of the new programs were accepted by the teachers.

The over 18 subgroup of preparation shows itself to be more accepting of the concepts and characteristics of the new programs than any other subgroup. It also represents the most advanced grouping as far as exposure to the new programs. In time it is possible for teachers from other groups to attain the status of this group. Consequently, the responses of the over 18 group could be considered the responses of all future teachers, and as such its results are important. The results in Table III for this subgroup were studied.

Five of the statements, numbers (3), (5), (12), (14) and (17), classified as neutral, need only a change of five responses to be accepted by this group, but there would still remain these statements in the neutral classification:

- (2) The new math often contains terminology and concepts too advanced for the age level at which it is presented.
- (4) You may teach for understanding, but success can best be evaluated by testing for answers.
- (7) The modern program frequently seems to make the obvious complicated.

Heutlig and Newell also found statements (7), (14) and (17) rejected by the teachers they surveyed.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The results lead directly to two conclusions. The first is that if more and more acceptance by teachers of more and more concepts and characteristics of the new programs is desired, then administrators should create more opportunities for more teacher preparation in the new programs. There is little evidence that other categories, such as age or experience are serious factors either in promoting or retarding teacher acceptance of the new programs. The first conclusion, therefore, is that all teachers, regardless of age or experience become more accepting of the new programs as they receive more preparation in them, with the possibility that the degree of acceptance by older, more experienced teachers is not as great as with younger, less experienced teachers.

The second conclusion is that teachers, including adequately-prepared teachers, have some doubt that all concepts and characteristics of the new programs are desirable. The natural question to ask is, "Why do teachers reject, or at best, seem confused about accepting certain concepts and characteristics of the new programs?" Is it because they lack understanding of the aims and goals, or techniques (methodology), or the history of the new programs? There was some evidence in the Review of Literature that this could become a problem. Or are the concepts and characteristics themselves unrealistic?

Recommendations

Recommendations for solving the first conclusion are rather easy to make; provide more and unlimited opportunities to better prepare teachers in

the new programs. The efforts to upgrade the background of teachers in institute and in-service programs spearheaded by the National Science Foundation has been effective. These programs should be continued and increased.

State and local school boards should also help. These agencies are better able to provide for training to solve problems unique to their locale. They can arrange for workshops of limited duration to take place at convenient times and places during the school year.

Since so much in the overall program appears to depend upon the readiness of the pupil, local school boards might consider utilizing their qualified master secondary school teachers as consultants, one for each elementary school unit.

Recommendations for resolving the second conclusion are not at first easily definable. The problem here is to determine why teachers are not accepting some of the concepts and characteristics of the new programs. Does the fault lie in the background of the teacher, or, or the particular concept or characteristic of the new program?

Before labeling the concept or characteristic as unrealistic, it is suggested that the backgrounds of the teachers be questioned. Teachers who question the soundness of exposing younger and less-able students to apparently more-advanced concepts and terminology (see statements (2) and (7), should read about the successes attained in the Madison Project and other references.²⁶ Those who agree that testing for answers (see statement

²⁶Robert B. Davis, loc. cit.; F. J. Kelly and H. T. Lerch, loc. cit.; Sarah Greenholz, loc. cit.; Harry I. Phillips and Marguerite Klutiz, loc. cit.; Irving Adler, loc. cit.

(4)) is correct procedure, should read Hartung.²⁷ Perhaps reading Rapael and other references would help defeat the rationale of returning to the old methods when the going gets tough (see statement (17))²⁸.

Secondary school teachers should also be familiar with history of the new programs as it relates to the slow learner and the elementary students. These programs were started late, and the need for curriculum revision to meet the needs of all students has been acknowledged and is being corrected.²⁹ Knowledge of these facts could perhaps lessen the frustrations now confronting secondary school teachers of trying to make compatible the ability of the student and the level of the instructional material available.

If the teacher has been exposed to reading such as those contained in the Review of Literature, and if the teacher still rejects certain characteristics and concepts of the new program, then these rejections should be very carefully considered by administrators and others involved in curriculum construction.

The need for resolving just what should or should not be a part of the new programs appears to be a sound afterthought to sufficient experience with the new programs. Those school districts that have not yet attempted to provide teachers with sufficient understanding of the concepts and characteristics of the new programs, and subsequently resolve any differences, could be doing the new programs a disservice. For example, the

²⁷Maurice I. Hartung, loc. cit.

²⁸Brother I. Rapael, loc. cit.; Irving Adler, loc. cit.; Eugene D. Ferguson, loc. cit.

²⁹The Revolution in School Mathematics, op. cit., pp. 62, 72; Howard F. Fehr, loc. cit.; NCTM Speakers Stress Methodology, loc. cit.

fact that some teachers felt the new programs cover too much material (statement (3)), or that they could cover more ground using the traditional program (statement (4)), could easily be construed more as an age-old curriculum problem of having to cover so many pages or topics per school year, rather than an indictment against the new programs.

Therefore, the second recommendation is to determine whether the concepts and characteristics of the new programs reviewed above as not being accepted by the teachers, are unrealistic, or, if provision should be made in institutes, in-service programs or workshops to include some course designed to explore and discuss the concepts and characteristics of the new programs and why they are part of the program. The course could well be labelled Understanding the Concepts and Characteristics of the New Programs.

Finally, it is recommended that future surveys similar to this should seek qualifying data from respondents to determine the extent they read mathematics' periodicals from which they could have gained more exposure to the concepts and characteristics of the new programs. This survey instrument should have included statements similar to these:

1. On an overall basis, I prefer the traditional program over the new program.
2. There isn't too much difference in the concepts and characteristics of the new programs as compared to the traditional.
3. My method of teaching has not changed since using the new instructional materials.
4. The greatest drawback to the new programs is (check one).
 - (a) The textbooks are beyond the students, except

for the best students.

(b) The students lack background except for the best students.

(c) The programs are simply too difficult except for the best students.

(d) I am not sufficiently prepared to teach it.

(e) Other (complete).

5. The most serious flaw in the new programs is indicated in statement number _____ (if none, write "none").

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APPENDIX A

Covering Letter to the Department Head

Dear (name of department head):

I would appreciate your cooperation in seeing that each member of your department receives a copy of the attached survey.

Maintaining anonymity, imposing upon you and your fellow teachers as little as possible, and expediting the distribution and collection of my survey all helped motivate the procedures outlined in the first page of the survey.

When you have received the number of completed surveys that you expected to be returned, please forward them to me.

If any question comes to mind, please don't hesitate to call me.

Thank very much.

Sincerely yours,

Charles R. Milone

Instructional Sheet

To: Mathematics teachers of Broward County

From: Charles R. Milone, teacher, Stranahan High School

I have attached a survey that I would appreciate your completing. This is done with the approval of both Mr. Evans and Mr. Marshall. To maintain anonymity and still be able to use the Pony, I was advised to provide you with an envelope in which you should seal your completed survey. Then you could return the envelope to your department head, and he or she can forward all of the completed surveys from your school to me together, via the Pony.

As you know, the success of any survey depends a great deal upon the number of valid returns. I should hate to begin another study because of an insufficient number of returns. Consequently, I sincerely request that you complete and return your question sheet, now before year-end duties are upon us.

Unfortunately I cannot offer you much in return except my deepest gratitude. However I would gladly furnish any of you results of this survey. Complete the statement below and return this form to me, separated from your question sheet, using the same procedure as outlined above for your completed survey sheet.

I _____
(name and school)
would like a copy of the results of this survey.

Data Sheet

As part of the requirements for a Master's Degree at Kansas State University, I am interested in surveying the reactions of Broward County, Florida, mathematic teachers toward the new mathematics' program.

It will not be necessary for you to attach your name to the question sheet, but I will need to know the following facts about yourself:

1. What grade(s) or subject(s) are you teaching now? _____
2. Your age (check one) 20-29 _____; 30-39 _____; 40-49 _____; 50-59 _____; over 59 _____.
3. Number of years teaching _____.
4. Number of years teaching modern math program _____.
5. Total number of all math credits you have earned (check one) less than 21 _____; 21-27 _____; 28-34 _____; 35-44 _____; 45-55 _____; over 55 _____.
6. Number of credits earned in contemporary programs (check one): 0-3 _____; 4-9 _____; 10-18 _____; 19-28 _____; over 28 _____.

I have covered several different viewpoints in the statements following. I seek your personal opinion on each statement, whether you agree or disagree with it. Please do not be influenced by how you feel others may answer any question, though you may be sure you will have company in all your answers.

Mark each statement in the left margin according to how much you agree or disagree with it. Write in +1, +2, +3, -1, -2, -3, depending upon how you feel in each case.

- +1 - I agree only slightly.
- +2 - I agree.
- +3 - I agree strongly.
- 1 - I disagree only slightly.
- 2 - I disagree
- 3 - I disagree strongly.

Return to: Charles R. Milone
Teacher
Stranahan High

Statements of the Survey

- * 1. The new math program gives more meaning to mathematics than traditional mathematics.
- 2. The new math often contains terminology and concepts too advanced for the age level at which it is presented.
- 3. The new program covers too much material too quickly.
- 4. You may teach for understanding, but success can best be evaluated by testing for answers.
- 5. Students learn best by working with a single textbook, rather than being provided supplementary material that might approach the same topic from a somewhat different viewpoint. (Do not consider research material).
- * 6. Students gain a much deeper understanding of mathematics through the new program.
- 7. The modern program frequently seems to make the obvious complicated.
- * 8. The students that have had a substantial modern math background seem to do better in subsequent math courses.
- 9. Mathematics is a series of facts, and should be taught as such until the facts stick.
- 10. I feel my students would be retaining more of their learning were I using the traditional math.
- 11. The new math is worthwhile for above-average students only.
- * 12. True meaning comes only with self-discovery.
- * 13. I enjoy teaching more now that I am using the new mathematics' program.
- 14. I could cover more ground were I still using the traditional program.
- * 15. You should always develop the logic behind why a series of mechanical steps work, rather than simply teaching these steps, even with average or below-average students.
- * 16. The new mathematics program is exciting in every way.
- 17. It is often easier to go back to the old methods when it becomes difficult to get a point across.
- 18. The new program often approaches the same concept from too many angles.
- 19. The modern mathematics' program is just a passing fad.
- * 20. Learning and teaching the modern program has made me a better teacher.
- 21. The modern program is alright I suppose, but not for what I teach.
- 22. Large quantities of visual aids often serve as a distraction to the learning processes.

Return to: Charles R. Milone
Teacher
Stranahan High School

CONCEPTS AND CHARACTERISTICS OF THE NEW MATHEMATICS
PROGRAMS ACCEPTED OR REJECTED BY TEACHERS

by

CHARLES RICHARD MILONE

B.S., University of Bridgeport, 1949

AN ABSTRACT OF A MASTER'S REPORT

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

College of Education

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1969

The purpose of this study was to determine what concepts or characteristics of the new programs were being accepted by teachers, and if age, preparation, experience or new programs' experience were determinants in teacher acceptance or rejection of them.

A survey instrument which contained twenty-two items was used to determine acceptance or rejection of new math programs. Eight of the statements were positive statements, on which a positive response was considered as being favorable to the new programs; while the remaining fourteen statements were negative statements, on which a negative response was considered as being favorable. Additional information obtained included: age, the amount of preparation in the new programs, experience in teaching the new programs, and overall teaching experience. This information was used to form subgroups within the individual categories of age, experience and preparation. Statistics were developed comparing the subgroups and subjected to a chi square analysis. The results of this study supported only preparation as being a significant factor. No other categories were determinants in teacher acceptance or rejection of the new programs.

This report included a further analysis of the data in which the chi square statistic was used to determine if the total favorable (unfavorable) responses of all the teachers for each statement sufficiently outnumbered the unfavorable (favorable) responses to classify the statement as being accepted (or rejected) with significance beyond the .05 level. Statements not able to be classified as either accepted or rejected were classified as neutral. On this basis five statements were classified as rejected, one as neutral, and the remaining as accepted. In most of the rejected statements the teachers appeared to be saying that the new programs contain unnecessary,

complicated, terminology and concepts and that teaching the old method is easier.

It was recommended that local, state and federal educational agencies, including the National Science Foundation, continue and increase opportunities for teachers to become better prepared in the new programs.

Further, local school boards should determine why teachers were rejecting certain concepts and characteristics of the new programs.