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ABSTRACT

In an effort to identify the cognitive characteristics of teachers which predispose them to attempt to increase levels of information processing in their classrooms, a theoretical construct--cognitive complexity--was synthesized from the processes of conceptual level, creativity, and categorization. Measures of constructs listed above were administered to 25 preservice teachers. Information processing in the classroom was observed during student teaching using the Florida Taxonomy of Cognitive Behavior as the criterion variable. Stepwise regression was used to extract the significant predictor variables of conceptual level, hypothesis generation, and fluency and flexibility. (Authors/JD)

COGNITIVE COMPLEXITY AND ITS RELATIONSHIP TO THE CLASSROOM COGNITIVE BEHAVIOR OF TEACHERS

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In recent years the classroom behaviors of teachers and the antecedent causes of these behaviors have been studied from many different perspectives. Attitudinal aspects of teacher behavior have come to be studied with increasing intensity (Loree, 1971; Kahn and Weiss, 1973), as have personality factors (Peck, 1960; Veldman and Menaker, 1969) and levels of skill acquisition (Houston, 1968; McDonald and Allen, 1967). The data derived from such studies have suggested partial explanations and/or descriptions of teacher behavior. However, Smith (1971) notes that a primary distinction among researchers in this area lies in the roles and importance assigned to personality and cognitive variables in teaching, with cognition receiving inadequate research attention in attempts to explain teacher behavior.

Getzels and Jackson (1963) briefly reviewed and evaluated the attempts of researchers to relate cognitive abilities of teachers to teaching effectiveness. As early as 1912 (Boyce, 1912) attempts were made to establish such a relationship, but the relatively promising results of this and other early studies soon gave way to more discouraging results (Morsh and Wilder, 1954). A number of studies (Carlile, 1954; Shea, 1955) have attempted to evaluate teaching effectiveness as predicted by standardized tests of general thinking abilities. The results again were inconclusive, prompting Getzels and Jackson (1963) to comment that if such studies were conducted in the future using similar measures, they could probably not add significantly to the research already conducted in the area.

Although the Getzels and Jackson summary would suggest that the use of traditional measures of intelligence or general cognitive ability to predict teaching effectiveness is not a productive line of research, it does not discount other, more particular, cognitive abilities as predictors of teacher effectiveness.

The need to conduct research into cognitive factors which influence teaching behavior continues as the stated outcomes of schooling emphasize, among other things, the development of the intellectual capacities of the student (Williams and Callahan, 1976; Webb, 1970). Since our educational system is committed to cognitive development and achievement, the assumption is being made that teachers can facilitate cognitive growth on the part of their students. The question of how cognitive achievement is most effectively impacted is still an open question. Certain characteristics of teachers continue to be suggested as variables which influence cognitive achievement in students. For example, Fraenkel (1973) suggests that if teachers confront and internalize higher level skills, and implement them in their instruction, cognitive growth in students can be facilitated. Bloom, Hastings, and Madaus (1971) believe teachers can aid students in attaining a fuller range of objectives through their own increased knowledge and practice of higher order teaching behaviors. Experimental studies by Williams (1970, p. 83) indicate that if a teacher increases the range of instruction to include higher levels of thinking processes"... the cognitive behavior of his pupils will similarly increase."

Available evidence, therefore, tends to support the position that teachers, by using a higher level of instruction, can have an impact upon increasing the cognitive abilities of students. Yet very little is known about the factors which predispose some teachers to attempt to increase student cognitive abilities through higher levels of instruction. The present research was designed to ascertain if there might be a specific cognitive characteristic which teachers possess that is related to the level at which they attempt to process information in their classrooms. The characteristic examined will be called cognitive complexity and represents an integration of Bruner's concepts of categorization abilities, Conceptual Systems Theory and Torrance's notion of creativity. In addition, the personality characteristic of openness vs. closedness as described by Rokeach will be considered as closely related to these cognitive abilities and will be examined as a potential contribution to the level of classroom information processing.

Cognitive Complexity Defined

The present study attempted to identify but one of the myriad of cognitive abilities which theoretically could be used to discriminate between teachers, and then use this information in a manner predictive of the level of classroom information processing. In assessing the cognitive abilities of the sample members, this study used as its theoretical basis three apparently different theories of cognitive functioning: Jerome Bruner's (1956, 1960, 1963, 1966) studies in the areas of concept attainment and concept

formation; Harvey, Hunt, and Schroder's (1961) Conceptual Systems Theory; and the work of E. Paul Torrance in the area of creativity. Specific aspects of each of these descriptions of cognitive functioning have been combined into a new construct which we will call cognitive complexity.

Bruner's pioneering work in the areas of concept attainment and concept formation was predicated upon his belief that one of the most fundamental cognitive processes is the act of categorization. As Bruner (1956, p. 231) points out "... all cognitive activity depends upon a prior placing of events in terms of their category membership." Thus, the categorization of events and objects is seen as a basic adaptive mechanism of the organism, a mechanism which is essential if man is to handle efficiently the countless stimuli which he receives from his surroundings. This categorization activity involves responding to apparently different stimuli (objects, events, or people) as if they are equivalent and grouping these stimuli into classes. Thus, when an individual responds to events or objects in the environment he does so in terms of their class (category) identity and not in terms of their idiosyncratic characteristics. The predisposition of the human organism to categorize achieves several important outcomes. First, it reduces an immensely complex environment into one which can be handled with a minimum of strain, and a major consequence of this reduction is that it lessens the need for constant re-learning. Second, categorizing enables us to identify objects, events, and

people in the environment. This identification can be seen as the placing of these stimuli into categories or classes. Third, since humans operate not just with singular categories but also with superordinate and subordinate category systems, categorization allows for ordering and relating classes of events (Bruner, 1956).

Categorization behavior also has a prominent role in the Conceptual Systems Theory of Harvey, Hunt, and Schroder (1961). Conceptual Systems Theory is a general theory of cognitive and personality development in which individual development is seen as progress through four distinct, invariant, hierarchically organized stages. Each of these stages has its own cognitive and personality characteristics, and progression through the stages allows the individual to better adapt to a changing environment. As Hunt (1970, p. 35) describes it:

> Since persons at higher stages were more abstract and more capable of tolerating stress, a higher level of conceptual development was regarded as more desirable, at least where the person was required to cope with, or adapt to, a changing environment.

Each of the original authors of the 1961 study have continued research in the general area of Conceptual Systems Theory, and the theory itself has undergone modifications with each author. The author with whom this research is most closely identified is H. M. Schroder, who has taken a more cognitive view of Conceptual Systems Theory than have the other contributors to the original work. He and his co-workers have examined the manner in which the individual combines information derived from the environment for adaptive

purposes (Schroder, Driver, Struefert, 1967). The major cognitive process which serves as a basis for evaluating how an individual combines information is the ability to generate categories and rules for combining these categories.

> It is the ability to generate categories, scales, or dimensions for coding the flow of information and to use selected organizations of these different kinds of information in a flexible manner in decision making that is the psychological foundation of a person's adaptability to change (Schroder, Karlins, Phares, 1973, p. 36).

The ability to generate categories for processing information, and the ability to use combinatory rules for interrelating these categories, is described by Schroder and his associates as being hierarchical in nature. This continuum ranges from a low to a high level of conceptual integration where each level of integration has its own cognitive and personality characteristics. Individuals with a low level of conceptual integration exhibit, among other things, categorical black and white thinking along with the inability to tolerate ambiguity. Individuals who possess a high level of conceptual integration can, when presented with informational stimuli, see complex interrelationships, tend to be more abstract, and are better able to tolerate ambiguity.

The use of the categorization activity as an evaluative tool extends also to the work of E. Paul Torrance in the area of creativity. Torrance and his associates have generated numerous tasks with which to identify creative thinking (Torrance, 1962). These tasks are all based on the subject producing divergent solutions

and multiple possibilities. This work of E. Paul Torrance in the identification of creative thinking abilities has specified the ability to generate a large number of responses over a wide range of categories as a factor in creative thinking. Developing an instrument theoretically based on the divergent component of Guilford's Structure of the Intellect Model, Torrance designated fluency, flexibility, originality and elaboration as characteristics necessary for creative thinking. The fluency and flexibility aspects of this instrument (Torrance, 1966) bear considerable similarity to the ability to generate categories in the process of information search described by Schroder, et al. (1967). Each activity on the Torrance Tests of Creative Thinking is scored on the basis of number of responses offered and the number of categories which the subject's responses can be placed. A high fluency score indicates that the subject has generated a large number of responses, while a high flexibility score indicates that these responses came from a wide range of possible categories of responses. These two abilities have been considered essential for the complex thinking process called creativity to occur. It would thus appear that common characteristics (albeit labeled differently) have been identified by persons working within the field of cognitive processes. It seems justified in light of the interpretation of these various characteristics to label them with one common tag (cognitive complexity) which describes a series of processes involved in complex category generation and labeling.

Using as a basis a synthesis of the preceding perspectives concerning cognitive functioning, the present study advances the concept of cognitive complexity as the predictor variable(s) of the level at which pre-service teachers attempt to process information in the classroom. For this study cognitive complexity is defined as:

1. The number of responses an individual may give in any specified cognitive task,

2. The number of categories an individual may generate in any specified cognitive task,

3. The number of categories utilized by an individual in any specified cognitive task, and

4. The evenness of information search across categories which an individual exhibits in any specified cognitive task.

Therefore, the more cognitively complex person will be able to generate more responses, generate and utilize a greater number of categories, and search for information across a larger number of categories than the less complex person.

Abstractness has been mentioned by Schroder and his associates as a characteristic of persons who have a high level of conceptual integration. Abstract thinking ability in logical problems has thus been considered as a predictor variable in this study. Furthermore, the suggestion by Schroder and his associates that low levels of conceptual integration are accompanied by an inability to tolerate ambiguity and categorical black and white thinking serves

as a basis for hypothesizing that the personality variable of openness might also contribute to cognitive complexity and, thus, to the prediction of classroom behavior (Schroder, 1967).

Method

Measurement Instruments

Whenever possible, instruments used to assess the independent variables (cognitive complexity) in this study were those used in the theoretical development of the constructs described previously. Level of conceptual integration was assessed utilizing mean scores from sentence-stem and paragraph-completion techniques (Schroder, Driver, and Streufert, 1967).[1] Evenness of information search across categories was assessed using instruments from Schroder, et al. (1973) and Beyer (1971) and analyzed with Senders' uncertainty statistic, $\hat{H}$ (1958). Scores for number of responses and number of categories utilized were also recorded for these instruments. Similarly, fluency and flexibility scores from the Torrance Tests of Creative Thinking (Verbal Form B) were used as measures of number of responses (Fluency) and category generation (Flexibility).

While the previous measures were used to directly measure number of responses, category use/generation, and evenness of information search, additional measures were used to assess abstract-

[1] In the present study, inter-rater reliability for two raters was .87 (Pearson product-moment correlation).

ness and openness-closedness. Abstractness was measured using the Paulus Conditional Reasoning Test, Form Z (Assessing), and openness-closedness was assessed using the Rokeach Dogmatism Scale (Rokeach, 1960).

The Florida Taxonomy of Cognitive Behavior was used to measure the level at which information was processed in the classroom (criterion variable). The Florida Taxonomy is an observational instrument utilizing Bloom's Taxonomy to record the frequency of teacher and pupil activity across levels of cognitive behavior. The only modification of Bloom made in the Florida Taxonomy is a separation of translation and interpretation into separate categories. These are classified as forms of comprehension in the Bloom Taxonomy. Webb (1970) has reported inter-observer reliability ranging from .80 to .85 for a selected group of observers.[2]

Subjects

The sample was a group of 25 pre-service social studies teachers who participated in student-teaching at the secondary level during the 1974-1975 school year. All of these subjects at the time of their participation in the study were in a program aimed at the acquisition of the Virginia Collegiate Professional Certificate. All were enrolled at the University of Virginia, and all had participated

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[2]The three raters for this study achieved a .89 inter-observer reliability using Kendall's Coefficient of Concordance:W (Siegel, 1956).

in a similar social studies methods course prior to student-teaching. The sample was composed of both graduate and undergraduate students.

Data Collection

The instruments used to collect data fo nt variables (cognitive complexity and personality) w nistered to the pre-service teachers at the second meeting of the methods class which preceded student-teaching. The time allowed to complete each section was consistent with the time allowances used by the authors of the instruments. Data collection for the dependent measure was accomplished by the supervising teachers from the University of Virginia. Each student teacher was observed and rated at least twice during the student-teaching experience. The ratings were done during the second-half of the student-teaching experience, and in individual cases student teachers were encouraged to teach at least one 'unit' on their own. This was done because the organizational framework of the schools in which some of the student-teaching took place put a heavy emphasis on learning centers with a consequent reduction of student and teacher verbal interaction, at least at the large-group level.

Data Analysis

The data was analyzed using descriptive statistics and stepwise multiple regression analysis. Descriptive statistics were utilized where necessary, i.e., the mean of the sentence-stems and the mean level of information processing. For all other appropriate data raw scores were used in the analysis. Stepwise multiple

regression was used to extract the best set of independent variables predictive of the level of classroom information processing.

Results

Table 1 is a reporting of the stepwise regression analysis. Six predictor variables were entered into the regression equation (sentence-completions; Rokeach Dogmatism; number of responses from Schroder, 1973; number of responses from Beyer, 1971; abstract score, Paulus Conditional Reasoning Test; Fluency score, Torrance Tests of Creative Thinking) and collectively explain 73 percent of the variance in the criterion variable. Three of the six best predictor variables (number of responses from Schroder, 1973; number of responses from Beyer, 1971; Fluency score, Torrance Tests of Creative Thinking) are associated with the number of responses generated on the three measures where responses were included as separate measures.

Insert Table 1 about here

The strongest, and most meaningful, relationship between any of the predictor variables used in this study and the level at which the student teachers attempted to process information in their classrooms was found to be the mean score of the sentence-stem completions. Integration index as measured by the sentence-stem completions (Schroder, et al., 1967) correlated significantly ($r = .61$, $p < .10$) with the criterion measure. The integration index of sample members as measured by this exercise was included in

the regression equation on the first step, thus contributing the single largest amount of variance in the regression equation. Pre-service teachers who possessed higher integration levels tended to process information in their classrooms at a higher level than those who were rated as having a lower integration index.

This result would be consistent with the theoretical basis of the integration index, i.e., persons who are rated as having a higher integration index (relatively) would tend to have more dimensional units at their disposal for combining information in an integrative fashion (Schroder, et al., 1967). Further, in a Brunerian sense, a person with a high index would have a more sophisticated ability to perceive and utilize the building blocks of concepts, namely criterial attributes or dimensions. They would also have a more fully developed system of subordinate and superordinate concepts combined in a fashion to maximize information derived from environmental stimuli.

The most notable attribute of the best set of cognitive characteristics predictive of higher level classroom cognitive behavior is the inclusion in the regression equation of response generation activities. In the stepwise procedure, the number of responses on the construct from Schroder (1973) was included in the equation at step three, the number of responses in the classification activity (from Beyer, 1971) was included at step four, and the Fluency score on the Unusual Uses task was included at step six (see Table 1).

The Rokeach Dogmatism Scale was included as an evaluative

instrument in this study due to its apparent close similarities, at least at a theoretical level, to descriptors of personality correlates of low and high integration index. One would expect that a highly dogmatic person (manifested by a high dogmatism score on the Rokeach instrument) would share many of the attributes ascribed by Schroder, et al. (1967, 1973) to a person evaluated as having a low integration [illegible]ured by their instrument, namely:

A. Having a fixed rule structure,

B. Having a rule structure that is only minimally modifiable,

C. Exhibiting categorical, black-white thinking with the inability to think in terms of relativeness or abstractions, and

D. Anchoring of behavior in external conditions.

The scores on this scale contributed enough variance to be included in the regression equation on the second step. The relationship between scores on the Rokeach and the criterion variable was both inverse and significant ($r = -.26$, $p < .10$). Thus, those sample members who were rated as most dogmatic tended to process information at a lower level than those sample members who were evaluated as less dogmatic.

Bruner (1973), Harvey, et al. (1961), and Schroder, et al. (1973) have all postulated a relationship between abstractness and higher-order cognitive abilities. Bruner (1973) has indicated that a highly concrete person will have difficulty in generalizing information, and the Conceptual Systems theorists have maintained

that the integration index varies along a concreteness-abstractness continuum. An attempt was made in this study to ascertain if concreteness-abstractness characteristics of sample members were related to classroom information processing behavior. As can be seen from Table 1, the abstractness score on the Paulus Conditional Reasoning Test was included in the regression equation on the fifth step.

Due to the nature of the technique of stepwise multiple regression several final observations about the quantitative data analysis of the study should be made here. In the stepwise technique the independent variable contributing the most variance will be included on the first step of the regression equation. Since the independent variables included on subsequent steps are in reality partial correlations, any variable which has a high correlation with an independent variable already in the regression equation will have 'lost' some of its variance and be less likely to be included at the specified significance level. This 'loss' of variance will tend to lessen the likelihood that such variables (those highly correlated with one already included) will contribute sufficient variance for inclusion, even if it is significantly correlated with the dependent measure.

This phenomenon appears to have taken place in this study in the area of category generation/use and its relationship to the level at which sample members were processing information in their classrooms. Earlier in this paper the case was made for using the

categorization behavior as an independent measure in this study. Two of the instruments used to assess the number of categories utilized in specific tasks (Schroder, 1973; from Beyer, 1971) were not included in the regression equation at the specified level of significance, yet they were significantly ($p < .10$) correlated with the criterion measure. It is quite probable that their exclusion from the regression equation was the result of their high correlation with variables already in the equation. For example, the number of categories used by sample members on the Schroder (1973) construct (which was significantly related to level of information processing in the classroom, $r = .32$, $p < .10$) was not included in the regression equation. It is probable that its exclusion was the result of its significant correlation with variables already in the equation, i.e., with the number of responses on the Schroder (1973) construct ($r = .85$, $p < .10$), and with the scores on the sentence-stem completions ($r = .32$, $p < .10$). Similarly, the number of categories generated by the sample members on the classification (from Beyer, 1971) exercise (which was significantly related to the level of information processing in the classroom, $r = .33$, $p < .10$) was not included in the regression equation. The number of categories generated on the classification exercise had a significant correlation with the following variables already in the regression equation; the number of responses on the Schroder (1973) construct ($r = .42$, $p < .10$), the Fluency score on the Unusual Uses activity ($r = .26$, $p < .10$), the number of responses on the classification exercise ($r = .60$, $p < .10$),

and with the scores on the sentence-stem completions ($r = .47$, $p < .10$). These observations further illustrate the relationship between response generation and category generation/use which was discussed earlier. They would also tend to support indications that have been derived from this study that there is some relationship between response/category generation and the level at which information is processed in the classroom, at least in the sample members' classrooms.

The major purpose of this study has been to begin to identify the cognitive characteristics (and their personality correlates) of pre-service teachers and explore their relationships to the level at which these teac ers processed information in their classrooms. Results of the data analysis performed upon the variables in the study would indicate that some relationship does exist between an individual's cognitive characteristics and the level at which they process information in their classrooms. That is, there are preliminary indications that the theoretical construct of cognitive complexity does have a relationship to the predilections certain individuals have vis-a-vis levels of information processing. While this study does seem to indicate that relationships between the variables do exist, it makes no assumptions about the magnitude of the relationships.

The development of higher order cognitive skills will continue to be an important function of our public school systems. Because of this fact, it is exceedingly important that the professional

personnel employed by our schools have at their disposal the ability to aid students to develop cognitively. Thus, the question of whether or not this ability is enhanced or hindered by the cognitive characteristics of the instructional personnel themselves becomes of crucial importance.

Traditional pre-service teacher education has attempted to impart a wide variety of skills and knowledge to those who are preparing to teach. This preparation has made the tacit assumption that if these skills and knowledge are successfully internalized by the pre-service teacher then one of the outcomes of their own instructional efforts will be the facilitation of cognitive development on the part of their students. The present study would suggest that this assumption should undergo further investigation in terms of:

1. An intensified investigation, to this point not sufficiently addressed, of the cognitive characteristics of those persons charged with facilitating student cognitive growth, and how these characteristics may enhance or impede this charge. Improving instruction through better technical preparation and improving instruction by an increased knowledge of learner characteristics have been emphasized in prior research; however, neither of these emphases addresses adequately the vehicle by which these improvements are to take place, the teacher.

2. Smith's (1971) call for an analysis of pre-service course work as it relates to in-service classroom performance. The

influence of pre-service training on the cognitive complexity of students and resultant affect on teaching behavior is suggested, and

3. Glaser's (1976) call for a "linking science" between the psychology of learning and classroom instruction, what he calls a psychology of instruction.

TABLE

Predictor Variables of Level of Classroom Information Processing: Stepwise Multiple Regression[a]

Step	Variable Entered	Multiple r	r^2
1	Sentence Completions (Schroder, et. al., 1967)	.61	.37
2	Rokeach Dogmatism Scale (Rokeach, 1960)	.68	.46
3	Number of Responses (Schroder, et. al., 1973)	.74	.55
4	Number of Responses (Derived from Beyer, 1971)	.78	.61
5	Abstract Score, Paulus Conditional Reasoning Test	.83	.68
6	Fluency Score (TTCT, 1966)	.85	.73

[a] $p < .10$

Note. n = 25

REFERENCES

Beyer, Barry K. Inquiry in the Social Studies Classroom: A Strategy for Teaching. Columbus: Charles E. Merrill Publishing Co., 1971.

Bloom, B., Hastings, T., and Madaus, G. Handbook on Formative and Summative Evaluation of Student Learning. New York: McGraw-Hill Book Co., 1971.

_____, et. al. Taxonomy of Educational Objectives, Handbook I: Cognitive Domain. New York: David McKay Co., Inc., 1956.

Boyce, A. C. Qualities of Merit in Secondary School Teachers. Journal of Educational Psychology, 3, 1912.

Bruner, Jerome S., Goodnow, J. J., and Austin, G. A. A Study of Thinking. New York: Wiley and Sons, 1956.

_____. The Process of Education. Cambridge: Harvard University Press, 1961.

_____, and Olner, R. R. Development of Equivalence Transformations in Children. Monograph of the Society for Research in Child Development, 28, 1963.

_____. Toward A Theory of Instruction. Cambridge: Harvard University Press, 1967.

_____. Beyond the Information Given. New York: W. W. Norton & Co., Inc., 1973.

Carlile, A. B. Predicting Performance in the Teaching Profession. Journal of Educational Research, 47, 1954.

Fraenkel, Jack R. Helping Students Think and Value: Strategies for Teaching the Social Studies. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1973.

Getzels, J. W. and Jackson, P. W. The Teacher's Personality and Characteristics. In N. L. Gage (Ed.) Handbook of Research on Teaching. Chicago: Rand McNally and Company, 1963.

Glaser, Robert. Components of a Psychology of Instruction: Toward a Science of Design. Review of Educational Research. Vol. 46, No. 1, 1976.

Harvey, O. J., Hunt, D. E., and Schroder, H. M. Conceptual Systems and Personality Organization. New York: John Wiley and Sons, 1961.

Houston, W. R. Behavioral Science Elementary Teacher Education Program. Washington, D. C.: USOE Bureau of Research, U. S. Government Printing Office, FS5.258.58024.

Hunt, D. E. A Conceptual Level Matching Model for Coordinating Learner Characteristics with Educational Approaches. Interchange. Vol. 1, No. 3, 1970.

Kahn, S. B., and Weiss, Joel. The Teaching of Affective Responses. In R. M. W. Travers (Ed.) Second Handbook of Research on Teaching. Chicago: Rand McNally and Company, 1973.

Loree, M. Ray. Shaping Teachers' Attitudes. In B. O. Smith (Ed.) Research in Teacher Education: A Symposium. Englewood Cliffs, New Jersey: Prentice-Hall, 1971.

Morsh, J. E., and Wilder, Eleanor W. Identifying the Effective Instructor: A Review of the Quantitative Studies, 1900-1952. USAF Train Res. Cent. (Res. Bull., 1954, No. AFPTRC-TR-54-44).

Paulus, Dieter. The Paulus Conditional Reasoning Test, Form Z (Assessing). Unpublished Test, University of Conn., 1967.

Peck, R. F. Personality Patterns of Prospective Teachers. Journal of Experimental Education. 29: 1960.

Schroder, H. M., Driver, M. J., and Streufert, S. Human Information Processing. New York: Holt, Rinehart and Winston, Inc., 1967.

_____, Karlins, M., and Phares, J. O. Education for Freedom. New York: John Wiley and Sons, Inc., 1973.

Senders, Virginia L. Measurement and Statistics. New York: Oxford University Press, 1958.

Shea, J. A. The Predictive Value of Various Combinations of Standardized Tests and Sub-Tests for Prognosis of Teaching Efficiency. Catholic Univ. of Amer. Educ. Res. Monogr. 19: No. 6, 1955.

Siegel, S. Nonparametric Statistics for the Behavioral Sciences. New York: McGraw-Hill Book Co., Inc., 1956.

Smith, B. Othanel (Ed.). Research in Teacher Education: A Symposium. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1971.

Torrance, E. Paul. Guiding Creative Talent. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1962.

_____. Torrance Tests of Creative Thinking. Princeton, New Jersey: Personnel Press, 1966.

Veldman, D. J., and Menaker, S. L. The Directed Imagination Method for Projective Assessment of Teacher Candidates. Journal of Educational Psychology. 60: 1969.

Webb, J. N. Taxonomy of Cognitive Behavior: A System for the Analysis of Intellectual Processes. Journal of Research and Development in Education. Vol. 4, No. 1; Fall, 1970.

Williams, Paul L., and Callahan, Carolyn M. Teacher Perceptions of the Usefulness of Particular Item Types to Assess Selected Cognitive Outcomes. Unpublished Manuscript, 1976.

Williams, T. L. The Effect of Cognitive Instructions on Secondary Student Teachers and Their Pupils. Journal of Research and Development in Education. Vol. 4, No. 1; Fall, 1970.