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ABSTRACT

Most of the literature on the instructional effects of operationally defining the objectives of a curriculum before implementation has been based on a logical, rather than an empirical, analysis of the instructional process. A model procedure was developed and used to examine empirically the contribution of the cognitive objectives of an instructional system to the instructional process within an operational middle school setting (grades 5-8). When valid tests were constructed, teachers were taught toward and students mastered the cognitive behaviors stated in the prespecified objectives of the curriculum. Although this relationship held for individual classes, comparison across classes for a grade level indicated that teachers had considerable instructional freedom when implementing the curriculum within the classroom. (Author)

AN EMPIRICAL STUDY OF THE CONTRIBUTION OF BEHAVIORAL OBJECTIVES TO TEACHING AND LEARNING

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BACKGROUND

Whether school curricula should be based on objectives specifying the behavioral changes expected of students in specific content areas has been a topic of continuing controversy. Advocates of behavioral objectives (Bloom, 1956; Mager, 1962; Popham, 1970) claim that such a systematic approach to curriculum design leads to better instruction and maximizes student learning, while opponents (Atkin, 1968; Eisner, 1967a) argue that the precise statement of objectives leads to a mechanistic approach to instruction which hampers the teacher's desire to innovate or pursue unanticipated outcomes, thus, curtailing student learning to some extent. One of the problems in this controversy over the use of behavioral objectives is that most advocates and opponents have formulated their position on the basis of a logical rather than empirical analysis of the instructional process. This evaluation effort was planned in response to Eisner's statement, "that the contribution of educational objectives to the process of curriculum construction, teaching, and learning, is, at base, an empirical problem" (1967b, p. 277).

OBJECTIVES OF THIS STUDY

Recognizing the need to study the impact of educational objectives empirically, the objectives of this study were set as follows:

1. To develop a model procedure for the empirical assessment of the contribution of behavioral objectives to teaching and learning;

2. To use this procedure to empirically assess the contribution of behavioral objectives to teaching and learning within an actual school setting where objective based curricula are being used.

SETTING

The model procedure for assessing the contribution of behavioral objectives to teaching and learning was developed within the context of a suburban Greater Boston middle school encompassing grades five through eight. Within this setting, the systems approach to curriculum development was utilized to design objective-based curricula for all disciplines.

Once the model procedure was developed it was applied in science, since the science curriculum had been implemented more extensively than the curricula in other disciplines. More specifically, this application focused on the unit of the science curriculum entitled, "Physics, Chemistry and Weather". The model procedure was applied to all classes at each grade level. The number of classes at each grade level is reported in Table 1.

TABLE 1

The Number of Classes at Each Grade Level Participating in the Application of the Model Procedure For Assessing the Contribution of Objectives To Teaching and Learning

Grade	Number of Classes
5	10
6	12
7	11
8	10

It is important to note that in developing the science curriculum for grades five through eight, a scope and sequence of the concepts and generalizations essential to the discipline was delineated. Then instructional guides were developed for various units at each grade level on the basis of this scope and sequence of concepts and generalizations. Although a separate instructional guide was prepared for each grade level, the procedure for implementing the science curriculum was such that teachers at all four grade levels taught the same basic unit at the same time. For example, when teaching the "Physics, Chemistry, and Weather" unit, the teachers in grades five through eight used different instructional guides at each grade level, but these instructional guides were all keyed to the scope and sequence of concepts and generalizations related to physics, chemistry and weather. The instructional guide at each grade level contained a listing of the objectives of the unit as well as the pre- and post tests for the unit based on parallel items.

DEVELOPMENT OF A MODEL PROCEDURE FOR EMPIRICALLY ASSESSING THE CONTRIBUTION OF BEHAVIORAL OBJECTIVES TO TEACHING AND LEARNING

The model procedure developed for assessing the contribution of objectives to teaching and learning is based upon two assumptions. First, if cognitive objectives have an impact upon teaching and learning, then teachers will teach toward the behaviors specified in the objectives and students will master these behaviors. Secondly, the behaviors specified in the objectives of a curriculum as well as those behaviors taught by the teacher and mastered by the pupil can be classified according to the Taxonomy (Bloom, 1956). Once classified, these behaviors can be summarized in the form of a cognitive emphasis profile which indicates the percent of emphasis devoted to each taxonomic category. For example, the taxonomic classification of the objectives of a curriculum might produce the following distribution:

Knowledge	-	50 objectives		50%
Comprehension	-	30 objectives		30%
Application	-	6 objectives	Converting to percents	6%
Analysis	-	5 objectives	→	5%
Synthesis	-	5 objectives	yields a cognitive	5%
Evaluation	-	4 objectives	emphasis profile	4%

As noted above, a cognitive emphasis profile for the curriculum can be derived by converting the number of objectives in each taxonomic category to a percent. This conversion assumes that all objectives receive equal weight in the instructional process, regardless of their taxonomic level.

Given the assumptions stated, the procedure for assessing the contribution of objectives to teaching and learning was developed within the context of the descriptive matrix of Stake's paradigm for the classification of evaluative data (Stake, 1967). This paradigm is illustrated in Figure 1. For the purpose of this study the columns and rows of the descriptive matrix can be viewed as follows:

Intents - anticipated events or behaviors,

Observations - events or behaviors which have occured,

Antecedents - events or behaviors preceding the instructional process

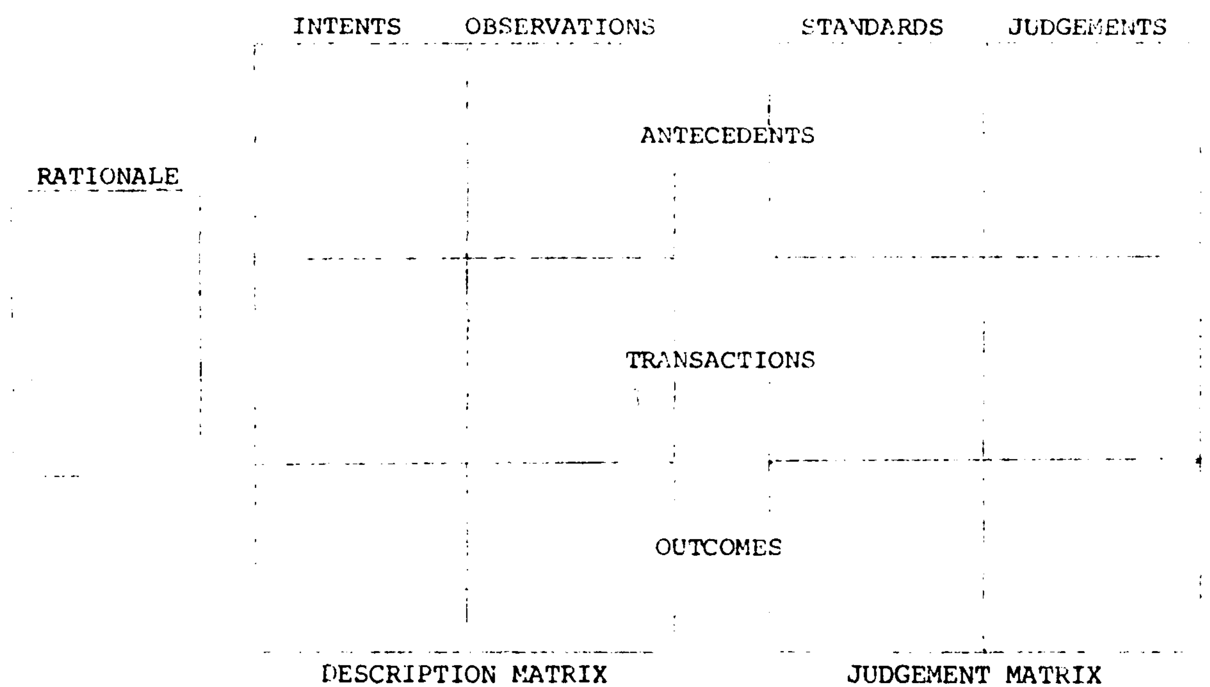
Transactions - events or behaviors dealing with the instructional process

Outcomes - events or behaviors resulting from the instructional process.

The model procedure developed in this study is based on six cognitive emphasis profiles corresponding to the six cells of the descriptive matrix of Stake's framework.

FIGURE 1

Stake's Paradigm for the Classification
Of Evaluative Data



DEFINITION AND DERIVATION OF THE COGNITIVE EMPHASIS PROFILES

1. *Profile based on the objectives of the curriculum*

When utilizing the systems approach to curriculum development (Banathy, 1968), objectives and tests are products of the curriculum development process presented to the teacher when the curriculum is implemented. Since the objectives of a curriculum are developed prior to instruction and may be viewed as a statement of the need which the curriculum is to satisfy (Carter, 1969), it is appropriate to place objectives within the intended antecedents cell of the Stake paradigm.

The cognitive emphasis profile based on objectives was derived by classifying objectives according to the Taxonomy of Intellectual Abilities (TIA) using the procedures developed by Steele (1969).

Steele adapted the TIA from the Taxonomy (Bloom, 1956) in an effort to provide a classification system which could be used readily by teachers and administrators who have not received extensive training in the classification of cognitive behaviors.

The TIA system can be used to classify behavioral objectives and/or measurement items in terms of the following hierarchical listing of cognitive behaviors:

I. Memory
II. Translation
III. Interpretation/Extrapolation
IV. Application
V. Synthesis
VI. Evaluation
VII. Formal Analysis

An operational definition of each of the cognitive behaviors of the TIA is presented in the Appendix. According to Steele (1970, p. 8), "a reliability and validity study was conducted which demonstrated that the Taxonomy of Intellectual Abilities could be used reliably and with precision by untrained teachers and administrators". In addition, Scrinivasan (1971) found that a translation of the TIA could be used reliably with an Indian population.

For this study, the cognitive emphasis profiles based on the objectives of the science unit were derived by employing a panel of seven trained raters to classify the unit objectives at each grade level according to the TIA. Once the objectives at each grade level were classified, the cognitive emphasis profile based on objectives was derived by calculating the percent of objectives within each TIA category. A separate profile was developed for the "Physics, Chemistry, and Weather" unit at each grade level.

To obtain an indication of the interrater reliability of the procedure used to rate the objectives, the intraclass correlation coefficient (Guilford, 1965) was calculated on the basis of the ratings obtained at each grade level. The reliabilities which were obtained are presented in Table 2. The high reliabilities presented in Table 2 indicate that there was considerable agreement among raters as to the taxonomic level of the behaviors reflected in the objectives at each grade level.

In summary, the cognitive emphasis profile based on objectives is a measure of curriculum intent which conveys those behaviors which should be emphasized when the curriculum is implemented in the school setting.

TABLE 2

Reliabilities By Grade Level For The Classification of the Unit Objectives According to the Taxonomy of Intellectual Abilities

Grade	Number of Objectives Classified	Reliability
5	47	.94
6	28	.93
7	123	.89
8	26	.95

2. *Profile based on measurement items*

Tyler (1950) notes that if the tests developed for a curriculum do not measure the same behaviors as the objectives, then either the tests will not be used or the curriculum will be deflected from its original intents as stated in the objectives. Since teachers are usually required to use the tests provided when implementing an objective-based curriculum, it is safe to assume that instruction will be influenced by the behaviors measured by these tests. Consequently, the measurement items of these tests provide an indication of the behaviors which teachers are encouraged to emphasize during instruction and can be classified according to the Stake paradigm as observed antecedents.

The cognitive emphasis profile based on measurement items was derived by employing a panel of seven raters to classify the measurement item of the post tests for the "Physics, Chemistry, and Weather" unit according to the Taxonomy of Intellectual Abilities. Then a profile based on measurement items for each grade level was obtained by calculating the percent of post test items within each TIA category.

A measure of the reliability of these item ratings was obtained by calculating the intraclass correlation coefficient at each grade level. The reliabilities obtained are presented in Table 3.

TABLE 3

Reliabilities By Grade Level For The Classification Of The Measurement Items Of The Unit According To The Taxonomy of Intellectual Abilities

Grade	Number of Measurement Items Classified	Reliability
5	38	.58
6	24	.78
7	27	.76
8	27	.86

The reliabilities presented in Table 3 were lowered due to the nature of the measurement items being rated. At the fifth grade level 97.37 percent of the items measured memory types of outcomes and 2.63 percent of the items measured translation types of outcomes. Since at the fifth grade level there was a high concentration of measurement items which the raters perceived as obviously measuring one specific outcome (i.e., memory), the variance among items was not large compared to the variance among raters. In the ideal situation, it is expected that there would be considerably more variance among items than among raters. The small variance among items as compared to the variance among raters tends to increase the error variance and decrease the intraclass correlation coefficient. As grade level increased the measurement items tended to measure a wider range of the behaviors described in the Taxonomy of Intellectual Abilities. Thus, the variance among items increased and the intraclass correlation coefficient was not lowered as much.

To summarize, the cognitive emphasis profile based on measurement items is a measure of curriculum practice which reflects those behaviors which will be emphasized when the curriculum is implemented in the school setting.

3. *Profile based on the behaviors the teacher planned to foster in the classroom.*

When a curriculum is implemented in the school setting, the teacher must utilize the curriculum materials which have been developed and his/her personal resources to plan and present an instructional sequence suited to the needs of the class. Jackson (1968) in his book, Life In Classrooms, discusses the distinction between what teachers plan to do in the classroom and what they actually do in the classroom as follows:

> This distinction being made here between two aspects of the teacher's work is so fundamental and has so many implications for educational matters that it deserves some kind of official recognition in the language used to describe the teaching process. The terms 'interactive' and 'preactive' might serve this purpose. What the teacher does vis-a-vis students would be called 'interactive teaching' and what he does at other times - in an empty classroom so to speak - could be called 'preactive teaching'. (Jackson, 1968, pp. 151-152)

In light of Jackson's comments, the cognitive behaviors which the teacher plans to emphasize in the classroom can be viewed as the teacher's pre-active cognitive emphasis. The cognitive behaviors which the teacher does emphasize in the classroom can be viewed as the teacher's interactive cognitive emphasis. Since preactive cognitive emphasis is a measure of the behaviors the teacher plans to foster in the classroom, it can be classified according to the Stake paradigm as an intended transaction.

One approach to deriving a cognitive emphasis profile based on the behaviors the teacher planned to foster in the classroom would be to ask the teacher to complete the cognitive section of the Class Activities Questionnaire (Steele, 1969) on the basis of the behaviors he/she planned to emphasize in the classroom. The cognitive section of the Class Activities Questionnaire (CAQ) consists of fourteen short items which measure the seven cognitive dimens[illegible]s of the Taxonomy of Intellectual Abilities. In the setting wher[illegible] .is model was being developed, the CAQ was not appropriate since it was designed for use at the secondary and post-secondary levels. To facilitate the derivation of the necessary cognitive emphais profiles, the cognitive section of the CAQ was adapted for use at grades five through eight. The resultant adaptation of the CAQ was called the Science Activities Questionnaire (SAQ). The items of the SAQ are presented by cognitive factor in Figure 2. A copy of the SAQ is presented in the Appendix.

Each teacher participating in this study was asked to complete the Science Activities Questionnaire for each of his/her classes on the basis of the behaviors he/she planned to foster during instruction. The responses to the SAQ were weighted as follows:

Response	Weight
Strongly Agree	4
Agree	3
Disagree	2
Strongly Disagree	1

FIGURE 2

Items of the Science Activities Questionnaire (SAQ) Presented by Cognitive Factor

Factor I: Memory

1. The students main job was to remember information.
7. Memorizing information was the students main concern.

Factor II: Translation

6. Putting ideas into your own words was an important activity.
13. It was important for the students to explain and to summarize the information which was presented.

Factor III: Interpretation/Extrapolation

4. Students were expected to come up with ideas or results that were suggested, but not clearly stated, in the information which was given.
11. Students were expected to use the information which was given to figure out how things were related - that is, how things were the same or how things were different.

Factor IV: Application

3. It was important for students to use the knowledge and methods they had already learned to solve new problems by themselves.
10. Students were expected to use the knowledge and the problem solving skills they had learned in science to solve problems in real-life situations.

Factor V: Synthesis

8. Students were urged to produce something brand new by adding new information to what they already knew.
14. Inventing, designing, composing, and creating were important activities.

Factor VI: Evaluation

2. It was important for students to decide whether their answers were right or wrong and to give the reasons for their decision.
12. It was important for the students to decide whether the ideas presented were good or bad.

Factor VII: Formal Analysis

5. Drawing conclusions and examining the difference between facts and hypotheses were important activities.
9. Using the scientific method to think through difficult problems was an important activity.

The teacher's score on each cognitive factor of the SAQ is the mean of the responses to the two items measuring that factor. Thus, the cognitive emphasis profile based on the behaviors the teacher planned to foster in the classroom is the teacher's profile of scores on the seven cognitive factors of the SAQ.

Since paired items are used to measure the cognitive factors of the SAQ, the percent agreement between responses to these paired items was used as an index of the reliability of the SAQ when administered to teachers. The reliabilities obtained are presented in Table 4.

TABLE 4

Reliability of the Science Activities Questionnaire In Terms of the Percent Agreement on the Paired Items Of Each Cognitive Factor

Cognitive Factor	Number of Teachers Responding	Percent Agreement
Memory	44	72.73
Translation	44	90.91
Extrapolation/ Interpretation	44	90.91
Application	44	93.18
Synthesis	30	86.67
Evaluation	29	89.66
Formal Analysis	31	87.10

The reliability of the items related to the memory factor was not as high as anticipated due to some teachers' concept of the memory process. Some teachers felt that reading a definition over and over until it could be recited from memory could be called memorization, but being able to recite a definition from memory because it was heard several times during class discussions was not memorization. These teachers responded to the items related to the memory factor by saying it was important to remember or recognize information but not important to memorize information.

In summary, the cognitive emphasis profile based on the behaviors the teacher planned to foster during instruction may be viewed as a measure of instructional intent.

4. Profile based on the student's perceptions of the behaviors taught in the classroom.

As previously discussed, the cognitive emphasis of the teachers within the instructional setting can be viewed in two ways - 1.) the cognitive behaviors which the teacher plans to emphasize (i.e., preactive cognitive emphasis), 2.) the cognitive behaviors which the teacher actually emphasizes within the instructional setting (i.e., interactive cognitive emphasis). Since interactive cognitive emphasis is a measure of the behaviors actually fostered in the instructional setting, it can be classified according to the Stake paradigm as an observed transaction.

A logical source for information regarding the behaviors the teacher actually emphasized in the classroom is the students. A cognitive emphasis profile based on students' perceptions of the behaviors taught in the classroom was obtained by administering the Science Activities

Questionnaire to the class. When using the SAQ with the class, students were instructed to respond to each item on the basis of what the teacher had stressed during instruction. The item responses of students were weighted just like the item responses of the teacher, and the class score on each cognitive factor of the SAQ is the mean of the responses to the two items measuring that factor. Thus, the cognitive emphasis profile based on students' perceptions of the behaviors taught in the classroom is the class profile of scores on the seven cognitive factors of the SAQ. A separate profile was developed in this manner for each class participating in this study.

If the Science Activities Questionnaire (SAQ) is a reliable instrument for the measurement of cognitive emphasis within a classroom, then it would be expected that there would be more agreement among the SAQ responses of the students in the same class than among the SAQ responses of students from different classes. Horst (1949) has developed a formula which estimates the reliability of an instrument on the basis of the within class and between class variances. According to the Horst formula an instrument is reliable if the within class variance is small as compared to the between class variance. The reliabilities of the cognitive factors of the SAQ obtained in this study as well as the reliabilities of the cognitive factors of the Class Activities Questionnaire (Steele, 1971) are presented in Table 5. According to the data presented in Table 5, there are only minor differences between the overall reliabilities of the cognitive factors of the Science Activities Questionnaire and Steele's Class Activities Questionnaire.

TABLE 5

Reliabilities by Cognitive Factor of the Class Activities Questionnaire Developed by Steele And the Science Activities Questionnaire Used in This Study

Cognitive Factor	Class Activities Questionnaire (N = 131 classes)	Science Activities Questionnaire (N = 44 classes)
Memory	.88	.84
Translation	.65	.83
Interpretation/ Extrapolation	.86	.64
Application	.83	.81
Synthesis	.89	.79
Evaluation	.71	.78
Formal Analysis	.78	.88

To summarize, the cognitive emphasis profile based on students' perceptions of the behaviors taught can be viewed as a measure of the instructional practices of the teacher as perceived by the class.

5. *Profile based on the objectives taught by the teacher*

Although teachers usually focus on the objectives of the curriculum they are implementing, circumstances sometimes prevent them from directing their instruction toward all of these objectives. In some cases the teacher may not cover a series of objectives since he/she feels the students have already mastered the objectives, or conversely, the objectives may be too complex given the ability level of the class. In other instances, the teacher may find that there is not sufficient time to emphasize all the objectives. In most school settings it is realistic to make the distinction between the objectives of the curriculum and the objectives taught by the teacher. The objectives taught by the teacher can be viewed according to the Stake framework as intended outcomes since these are the behaviors which one can realistically expect the students to exhibit.

A measure of cognitive emphasis based on the objectives taught was obtained by asking the teacher to keep a record of the objectives actually covered. Since all objectives were classified according to the Taxonomy of Intellectual Abilities in order to develop the cognitive emphasis profile based on the objectives of the curriculum, the cognitive emphasis profile based on the objectives taught by the teacher was derived by simply calculating the percent of objectives taught by the teacher within each TIA category. This profile reflects those behaviors which students are expected to exhibit due to instruction.

6. *Profile based on student achievement*

Since student achievement is based on observed behavioral change, it can be classified as an observed outcome in terms of the Stake paradigm. In order to exhibit a positive behavioral change, the student must respond correctly to post test items which were answered incorrectly on the pretest. Given that the measurement items of the post test have been already classified according to the Taxonomy of Intellectual Abilities to derive the cognitive emphasis profile based on measurement items, the cognitive emphasis profile based on student achievement was derived by 1.) keeping a tally of the students exhibiting a positive behavioral change on each item of the post test, 2.) summing the tallies for all items within the same TIA category to obtain the total number of behavioral changes within each TIA category and then, 3.) calculating the percent of behavioral changes within each TIA category. In summary, the cognitive emphasis profile based on student achievement is the profile of the percent of observed behavioral changes within each TIA category.

Summary

Each of the cognitive emphasis profiles discussed is listed in Table 6 along with its classification recording to the descriptive matrix of Stake's paradigm and the general method used to derive the profile. These six cognitive emphasis profiles are the basic components of the model procedure for assessing the contribution of behavioral objectives to teaching and learning. These profiles provide a measure of cognitive intent and practice at the curricular, instructional and student outcome levels. The reliability information reported indicates that the cognitive emphasis profiles can be derived within a school setting with a good degree of consistency.

Now that the definition and derivation of the basic components of this model procedure have been discussed, it is appropriate to move on to a discussion of the relationships between these profiles which can be examined.

RELATIONSHIPS BETWEEN COGNITIVE EMPHASIS PROFILES

This model procedure for assessing the contribution of behavioral objectives to teaching and learning focuses on an examination of the relationships between the cognitive emphasis profiles which have been derived,

TABLE 6

Summary of the Cognitive Emphasis Profiles
Comprising the Model Procedure for Assessing
The Contribution of Behavioral Objectives
To Teaching and Learning

Profile	Classification According to the Stake Paradigm	Method for Deriving The Profile
Profile based on the objectives of the curriculum	Intended Antecedent	Classify Curriculum Objectives According to the TIA
Profile based on the measurement items of the post tests	Observed Antecedent	Classify Post Test Items According to the TIA
Profile based on the behaviors the teacher planned to foster in the classroom	Intended Transaction	Teacher Response to SAQ
Profile based on the students' perceptions of the behaviors taught in the classroom	Observed Transaction	Students' Response To SAQ
Profile based on the objectives taught by the teacher	Intended Outcome	Classify Objectives Taught According to the TIA
Profile based on student achievement	Observed Outcome	Classify Behavioral Change According to the TIA

more specifically, the relationships between the profiles based on objectives and each of the other profiles. If objectives do contribute to teaching and learning, there should be considerable similarity between the profile of cognitive behaviors based on the curriculum objectives and each of the other five profiles.

The easiest way to discuss the relationships examined in this model procedure is in terms of an exemplary classroom situation. Using the techniques discussed in the previous section, six cognitive emphasis profiles were developed for each science class within the middle school setting on the basis of the "Physics, Chemistry, and Weather" unit. In viewing one of these science classes through its cognitive emphasis profiles, the first question of interest is "should objectives contribute to teaching and learning within this classroom setting?" Insights into this question can be obtained by examining the relationship between the profile based on the curriculum objectives and the profiles based on the measurement items of the post test. As previously mentioned, if the curriculum objectives and measurement items do not focus on the same behaviors, then the instruction of the teacher will tend to be guided by the behaviors reflected in the measurement item, thus, reducing the probability that the curriculum objective will contribute to teaching and learning.

The next question of importance is "Do objectives contribute to teaching within the classroom setting?" Insights into this question can be obtained by examining the following relationships between cognitive emphasis profiles:

1. Profiles based on the curriculum objective vs. the profile based on the behaviors the teacher planned to foster in the classroom.

2. Profile based on the curriculum objectives vs. the profile based on the class perception of the behaviors taught in the classroom.

2. Profile based on the curriculum objectives vs. the profile based on the objectives the teacher actually taught toward during instruction.

For the relationships where there is similarity between the cognitive emphasis profiles being compared, one can conclude that objectives are making a contribution to that component of the teaching process.

The final question which can be addressed when applying this model procedure is "Do objectives contribute to learning within the classroom?" The answer to this question can be obtained by examining the relationship between the profile based on curriculum objectives and the profile based on student achievement. If the profile of behaviors achieved by the students is similar to the profile of behaviors reflected in the curriculum objectives, this is an indication that objectives are making a contribution to learning within the classroom setting.

Although such an examination of the contribution of objectives to teaching and learning within one classroom setting is of interest, a topic of greater interest is the contribution of objectives to teaching and learning across classes within the school setting. This more generalizeable information can be obtained by conducting an examination of the contribution of objectives to teaching and learning within each of the classes within the school setting, summarizing these findings by grade level, and then inspecting such findings to see if any overall trends emerge.

Given this model procedure and the cognitive emphasis profiles derived for the classes within the middle school setting, it is timely to move on to a discussion of the actual analysis of these profiles and the general findings which emerged regarding the contribution of objectives to teaching and learning.

APPLICATION OF THE MODEL PROCEDURE FOR ASSESSING THE CONTRIBUTION OF BEHAVIORAL OBJECTIVES TO TEACHING AND LEARNING WITHIN AN OPERATIONAL SCHOOL SETTING

Analysis of the Relationships Between Cognitive Emphasis Profiles

Correlational techniques were used to examine the relationships between the cognitive emphasis profiles for each classroom. The Pearson product moment correlation coefficient (Hays, 1963) was used to assess the similarity between cognitive emphasis profiles where both profiles were expressed in the same units of measurement. When the cognitive emphasis profiles being compared were expressed in different units of measurement they were converted to ranks and their similarity determined using the Spearman rank correlation coefficient (Siegel, 1956). The Spearman rank correlation coefficient was used where one profile was expressed in terms of percentages and the other profile was expressed in terms of mean scores. Table 7 contains a listing of the relationships which were examined when applying the model procedure developed in this study to a classroom setting as well as the correlational technique employed to assess each relationship.

It is important to discuss how the results of the analyses of the relationships between cognitive emphasis profiles were interpreted. First of all, this study should be viewed as an evaluation rather than an experimental study. In his duscussion of the differences in methodology between evaluations and experimental studies, Guba (1965) cautions against

TABLE 7

Correlation Techniques Used to Assess the Relationships Between the Cognitive Emphasis Profiles Derived in This Study

Relationship	Correlational Technique Used
Profile based on curriculum objectives vs. Profile based on measurement items	Pearson r
Profile based on curriculum objectives vs. Profile based on behaviors the teacher planned to foster in the classroom	Spearman r_s
Profile based on curriculum objectives vs. Profile based on class perception of the behaviors taught in the classroom	Spearman r_s
Profile based on curriculum objectives vs. Profile based on the objectives taught by the teacher	Pearson r
Profile based on curriculum objectives vs. Profile based on student achievement	Pearson r

the use of the classical experimental design approach to the analysis and interpretation of the data collected in an evaluation study. Instead, "special techniques of analysis and interpretation need to be developed which are especially suited to the data produced" (Guba, 1965, p. 32).

When applying correlational techniques to the comparison of cognitive emphasis profiles, the sample sizes were small (i.e., 7). Due to small sample sizes, the procedure used to determine whether a significant relationship exists between the two profiles must take into account the low power of the statistical tests employed. For example, if the decision is made that there is a significant relationship between two profiles, there should be as little doubt as possible that this decision is accurate. To maximize the validity of the results of this study, each relationship between cognitive emphasis profiles was evaluated in terms of the traditional decision rules (McNemar, 1962) plus a second decision rule included to compensate for the low power of the statistical procedures used. The decision rules used are as follows:

1. A relationship between cognitive emphasis profiles significant at the .05 level, was viewed as significant for the purposes of this study.

2. A relationship between cognitive emphasis profiles not significant at the .05 level, but significant at the .10 level, was viewed as questionable for the purposes of this study.

3. A relationship between cognitive emphasis profiles not significant at the .10 level, was viewed as not significant for the purposes of this study.

This approach to interpreting the results of the correlational analyses conducted is consistent with the intended use of the findings of this study. The findings of this evaluation based on the relationships tested should be viewed as indicators which must be substantiated through further replications before generalizations can be made.

Study Findings

Upon analyzing the relationships between the cognitive emphasis profiles based on the objectives of the curriculum and each of the other five cognitive emphasis profiles derived in this study, the results were summarized by grade level to identify overall trends. In order to identify trends in these relationships across classes, the findings for classes at each grade level were weighted as follows:

> Each significant relationship was assigned a weight of 1.00.
>
> Each questionable relationship was assigned a weight of 0.50.
>
> Each nonsignificant relationship was assigned a weight of 0.00.

These weights were then summed for each relationship and a mean was calculated. The resultant mean serves as an index of the strength of the trend for the relationship across classes at a particular grade level.

The range of the index of strength corresponding to each of the general trends for the relationships of this study is presented in Table 8.

TABLE 8

Range of the Index of Strength Corresponding
To Each of the General Trends for
The Relationships of this Study

General Trend	Range of the Index of Strength
Significant (+)	0.56 - 1.00
Questionable (?)	0.45 - 0.55
Not Significant (-)	0.00 - 0.44

Grade level findings for the relationships examined in this application of the model procedure for assessing the contribution of behavioral objectives to teaching and learning are summarized by grade level in Table 9. The index of strength as well as the general disposition of each relationship is provided. When interpreting the index of strength it should be noted that the general trend across classes moves toward significant as the index of strength increases and toward not significant as the index of strength decreases.

On the basis of the results presented in Table 9. objectives made their greater contribution to teaching and learning at those grade levels where the objectives and measurement items focused on the same cognitive behaviors. At grades five and seven where the behaviors of the objectives were similar to those of the measurement items, teachers tended to teach toward these behaviors and students tended to master these behaviors. At grades six and eight where the objectives and measurement items did not focus on the same behaviors, teachers taught toward those behaviors reflected in the curriculum objectives, but students did not master these behaviors.

Concerning the relationship between the behaviors reflected in the curriculum objectives and the behaviors emphasized during instruction, the results indicate that with the exception of grade eight, there is no consistency between the behaviors of the curriculum objectives and the behaviors which the teacher planned to emphasize in the classroom. At grade eight, there was no definite trend for this relationship. Relative to the relationship between the behaviors of the curriculum objectives and the behaviors which the class perceived as being emphasized during instruction, no definite trend emerged at any of the grade levels. This observation of no definite trend indicates that some classes perceived the behaviors of the curriculum objectives to be emphasized in the classroom while other classes did not.

TABLE 9

Summary of the Class Level Findings for the Relationships Between Cognitive Emphasis Profiles Examined in this Study

Relationship Examined	Trend for the Disposition of The relationship by grade level			
	5	6	7	8
*Profile based on curriculum objectives vs. profile based on measurement items.	+ (1.00)	- (0.00)	+ (1.00)	- (0.00)
Profile based on curriculum objectives vs. profile based on behaviors the teacher planned to foster in the classroom.	- (0.30)	- (0.04)	- (0.23)	? (0.50)
Profile based on curriculum objectives vs. profile based on class perception of the behaviors taught in the classroom.	? (0.55)	? (0.54)	? (0.50)	? (0.50)
*Profile based on curriculum objectives vs. profile based on the objectives taught by the teacher.	+ (0.90)	+ (1.00)	+ (1.00)	+ (1.00)
*Profile based on curriculum objectives vs. profile based on student achievement.	+ (1.00)	- (0.00)	+ (1.00)	- (0.00)

*See discussion of findings, page

Discussion of the Findings

An extended discussion of these findings and how they may have been biased by the procedures utilized to derive the cognitive emphasis profiles is beyond the scope of this presentation. Persons interested in such a discussion may refer to Iwanicki (1972).

It should be noted at this time that in reassessing this model procedure which has been developed, the findings reported concerning the relationships in Table 9 which have been asterisked (*) tend to be unbiased by the procedures employed and representative of the contribution of objectives to teaching and learning in the setting where the model was applied. The other relationships involved cognitive emphasis profiles based on ponses to the Science Activities Questionnaire which posed some serious validity problems.

CONCLUSION

Through this study, a model procedure has been developed which can be used in an operational school setting to empirically assess the contribution of cognitive behavioral objectives to teaching and learning. It is the intent of the authors that this rationale will be continuously refined and replicated in other school settings. Although the actual findings of this study cannot be generalized to other settings, the empirical evidence accumulated through subsequent replications will lead to the formulation of generalizations about the contribution of cognitive behavioral objectives to teaching and learning. This approach to establishing the generalizeability of a phenomenon is best described as follows:

> Because of the probabalistic nature of field data, and the impressionistic way that these are gathered, constant replication and recycling are necessary to build confidence in conclusions. This tactic might be called the tactic of accumulative evidence. (Guba, 1965, p. 26)

APPENDIX

Operational Definitions of Each of the Categories of the TIA as Adapted from Bloom's Taxonomy by Steele (1970, p. 7).

I. MEMORY

Recall, recognition, bringing to mind of any kind of information. Some alteration of the material may be required, but this is a minor part of the task. Memory involves the ability to reproduce or recognize information as it was presented.

II. TRANSLATION

Changing information into a different symbolic form to express the same idea, such as the use of paraphrasing, pictures, graphs, summaries, outlines, or statements in technical or layman's language. It also includes the use of metaphor, symbolism, and other non-literal statements. Translation involves the ability to comprehend information including recasting or altering it in various ways.

III. INTERPRETATION/EXTRAPOLATION

Discovering and exploring the interrelationships among ideas (on a common-sense level). Comparing, contrasting, and explaining information based on the new view the perceived relationships provide. The task may require going beyond the given data in making inferences, predicting trends, and determining implications and consequences. Interpretation involves the ability to extend and manipulate information to clarify relationships suggested by the data or to project trends based on patterns apparent in the data.

IV. APPLICATION

Utilizing abstractions (generalizations, rules, skills) in concrete situations. Selecting and applying rules or methods to solve a specific problem, usually with a minimum of direction or prompting as to which abstractions apply or how to use them. This kind of task gives practice in the independent use of knowledge and skills, requiring the identification of the issue as well as selection and use of the correct abstractions to solve problems in practical settings. Application involves the ability to select the methods or generalizations called for by specific problem situations and perform the operations required to solve the problem.

V. SYNTHESIS

Recombining parts of previous experience with new material into a new integrated whole, pattern, or structure not clearly there before. Synthesis implies a new product requiring original, creative thinking. This can take the form of a unique communication involving skill in writing or speaking; a proposed set of operations, such as ways of testing hypotheses, or developing an effective plan to solve a complex problem; or the derivation of abstract relations, as in making generalizations or mathematical discoveries. Synthesis involves the ability to generate new ideas and solutions: inventing, designing, composing, creating.

VI. EVALUATION

Clarifying and using a standard of appraisal in making judgments about the value of materials or methods for given purposes. In making judgments of good or bad, right or wrong, the standards or criteria used should be made explicit. This category forms a major link with the affective domain where values, liking, and enjoying are central processes. Evaluation is always somewhat subjective because either the standard cannot be proven to be correct or the idea to be judged cannot be proven to violate or illustrate the standard. Evaluation involves the ability to develop and apply a set of standards for judging worth, and to support the judgments with a justification or rationale based on the criteria used.

VII. FORMAL ANALYSIS

Conducting a searching inquiry into the true nature of interrelationships and testing the validity of arguments according to appropriate rules of reasoning, with conscious knowledge of the intellectual processes being performed. Analysis includes the ability to recognize unstated assumptions, distinguish facts from hypotheses and normative statements, recognize conclusions and purposes of the material, and check consistency and relationships. Formal Analysis involves the ability to consciously apply appropriate rules of reasoning in testing the validity of statements, arguments, and conclusions.

SCIENCE ACTIVITIES QUESTIONNAIRE

Science Teacher's Name ______________________________

Science Section Number ________________

Directions

Each sentence in the Science Activities Questionnaire will be read to you and explained by your teacher. After the sentence is explained, decide how well the sentence describes what was done in science during the last unit. When deciding, think of what was done in science both in class and outside of class.

If you are very sure that the sentence describes what was done in science, circle the words - STRONGLY AGREE.

If you think that the sentence describes what was done in science, circle the word - AGREE.

If you think that the sentence DOES NOT describe what was done in science, circle the word - DISAGREE.

If you are very sure that the sentence DOES NOT describe what was done in science, circle the words - STRONGLY DISAGREE.

Please look at the examples below.

Example A

The students' main job was to remember information.

STRONGLY AGREE   AGREE   DISAGREE   STRONGLY DISAGREE

In Example A, the student answering was very sure that the sentence described what was done in science during the last unit, so he circled - STRONGLY AGREE.

Example B

Inventing, designing, composing, and creating are important activities.

STRONGLY AGREE   AGREE   DISAGREE   STRONGLY DISAGREE

In Example B, the student answering thought that the sentence DID NOT describe what was done in science during the last unit, so he circled - DISAGREE.

Remember to base your answer on how well each sentence describes what your science teacher had you do in science class and outside of science class during the last unit. Circle only one answer for each sentence. Use pencil only. If you change an answer, erase the first answer completely. PLEASE DO NOT SELECT AN ANSWER UNTIL THE SENTENCE [illegible] READ TO YOU AND EXPLAINED BY YOUR TEACHER.

1. The students' main job was to remember information.

STRONGLY AGREE AGREE DISAGREE STRONGLY DISAGREE

2. It was important for students to decide whether their answers were right or wrong and to give the reasons for their decision.

STRONGLY AGREE AGREE DISAGREE STRONGLY DISAGREE

3. It was important for students to use the knowledge and methods they had already learned to solve new problems by themselves.

STRONGLY AGREE AGREE DISAGREE STRONGLY DISAGREE

4. Students were expected to come up with ideas or results that were suggested, but not clearly stated, in the information which was given.

STRONGLY AGREE AGREE DISAGREE STRONGLY DISAGREE

5. Drawing conclusions and examining the differences between facts and hypotheses were important activities.

STRONGLY AGREE AGREE DISAGREE STRONGLY DISAGREE

6. Putting ideas into your own words was an important activity.

STRONGLY AGREE AGREE DISAGREE STRONGLY DISAGREE

7. Memorizing information was the students' main concern.

STRONGLY AGREE AGREE DISAGREE STRONGLY DISAGREE

8. Students were urged to produce something brand new by adding new information to what they already knew.

STRONGLY AGREE AGREE DISAGREE STRONGLY DISAGREE

9. Using the scientific method to think through difficult problems was an important activity.

STRONGLY AGREE AGREE DISAGREE STRONGLY DISAGREE

10. Students were expected to use the knowledge and the problem solving skills they had learned in science to solve problems in real-life situations.

STRONGLY AGREE AGREE DISAGREE STRONGLY DISAGREE

11. Students were expected to use the information which was given to figure out how things were related - that is, how things were the same or how things were different.

STRONGLY AGREE AGREE DISAGREE STRONGLY DISAGREE

12. It was important for the students to decide whether the ideas presented were good or bad.

STRONGLY AGREE AGREE DISAGREE STRONGLY DISAGREE

13. It was important for the students to explain and to summarize the information which was presented.

STRONGLY AGREE AGREE DISAGREE STRONGLY DISAGREE

14. Inventing, designing, composing, and creating were important activities.

STRONGLY AGREE AGREE DISAGREE STRONGLY DISAGREE

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