AN APPLICATION OF NOVAK'S THEORY TO THE DESIGN OF A LEARNING PROGRAM IN NUTRITION FOR CHILDREN OF THE EARLY PRIMARY LEVELS

by

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ABSTRACT

This study investigated an application of Novak's theory for the design of curriculum and instruction as outlined in his book, A Theory of Education (1977)

The theory deals with the development of a curriculum based on a hierarchy of concepts following Ausubel's (1968) notion of cognitive subsumption. Ordering within this hierarchy begins with the most-general, most-inclusive concept and proceeds through a sequence to terminate with the most-specific, least-inclusive ideas. Suitable instructional strategies and devices can then presumably be selected to teach the curriculum.

The particular problem addressed by this study was the application of Novak's theory to the design of an instructional program to teach two specific, nutritional concepts to a group of K/1 children; the role of sugar in dental caries and in obesity. A review of the literature indicated the prevalence of these diseases, their relationship to the dietary habits of children, and the need to begin appropriate instruction in nutrition at an early age. Because the young subjects had limited reading skills, a logo-character, "Sugar Shy," was created and the children were taught how this logo could be used to identify low-sugar foods.

Novak's theory necessitated awareness of the children's concepts relevant to sugar and its dietary effects prior to the planning of the curriculum. A cognitive assessment was made of each child before and after teaching the program. These assessments were based upon pictures drawn by the children and their comments about them. The ability of children to classify low-sugar foods was also assessed.

Results of this study tended to show that Novak's model could be successfully applied to the development of an instructional program. The subjects' knowledge of relevant nutritional concepts, as determined by a post-assessment, increased by approximately 60% and their abilities to classify foods by 40%.

It was argued that the theory should be applicable to any subject at any grade level. The outcomes also suggested a possible role for Novak's work in the pre-service and in-service education of teachers and administrators. Novak's approach was viewed as a potentially valuable bridge between educational theory and classroom practice.

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CHAPTER 1

INTRODUCTION

1.1 GENERAL PROBLEM

> No curriculum theorist in the past has shown the relevance of learning theory in the design of curriculum . . . application of learning theories to curriculum design is ambiguous at best. (Novak, 1977, p. 134)

Joseph Novak, in his book A Theory of Education, addressed the above issue of the lack of relationship between learning theories and curriculum design. He drew predominantly upon the work of two theoretical frameworks, Ausubel's (1968) theory of learning and Johnson's (1967) model for curriculum and instruction. In mapping out a correspondence between the curricular and instructional theories of Johnson and the cognitive learning theory of Ausubel, Novak produced a unique model for designing instructional programs. (Hereafter, this correspondence between Ausubel and Johnson will be referred to as Novak's model).

Novak argued that prior to Johnson's work (1967), the texts produced by pioneers in curriculum theory building, Ralph Tyler (1949), George Beauchamp (1961), and Hilda Taba (1962), failed to clearly distinguish between curriculum and instruction. Johnson stressed the need to separate curriculum from instruction; to select knowledge from the total, available culture and then to order this knowledge into a curriculum. Appropriate instructional strategies were to be matched to this curriculum.

Ausubel stated that if new knowledge is to be learned in a meaningful way then the new knowledge must be anchored to relevant concepts already within the learner's cognitive structure; he called these anchoring concepts "subsumers." According to Ausubel: "The most important single factor influencing learning is what the learner already knows. Ascertain this and teach him accordingly." (Novak, 1977, p. 24) Ausubel's theory of subsumption required that instruction begin with the most general, most inclusive concepts and proceed via a conceptual hierarchy to the most specific, least inclusive concepts.

Novak (1979) indicated that, to the best of his knowledge, no one other than university researchers had applied his model to the design of a learning program; a search of the literature confirmed this statement.

<u>The general problem of this study was to apply Novak's model to the design of an instructional program</u>.

1.2 DEFINITIONS OF TERMS

Concept	An abstract general notion which describes some regularity or relationship within a group of facts. (Ref. Novak, 1977, p. 18)
E.R.I.C.	Educational Resources Information Center. A computerized data-base of references to literature in the field of education.
High-sugar Foods	Foods which taste excessively sweet to children, e.g., candies, pastries, frozen desserts and ordinary soda pop.
K/1	Grades kindergarten and first grade combination; children of ages five to six years.
Low-sugar Foods	Foods which taste moderately sweet (or not sweet) to children, e.g., fresh fruits, unsweetened cereals, sugarless gum, and fresh orange juice.
Natural Sugar	The sugar contained in foods such as fruit, vegetables.
Sugar	The granulated product, either white or brown sold in grocery stores.

1.3 IMPORTANCE OF THE PROBLEM

1.3.1 Background of the Study

Nutrition was chosen in this study as the subject for the design of a short learning program based upon Novak's model. During the 1976-78 school years I supervised nutritional studies with children of the primary grades and their parents. These experiences led to a further interest in the problem of teaching nutritional concepts to young children and, last summer, an extensive review of the literature was undertaken.

This review generally indicated that there were no well-documented studies of teaching/learning programs at the kindergarten and lower primary levels. (Schmidt, 1974, p. 74) Every program uncovered in the literature was based upon the Four Food Groups approach, i.e., bread and cereals, milk products, fruits and vegetables, and meats. (Shapiro, 1974; Johnson, 1974; Warren, 1972)

During a personal interview at the headquarters of the Society for Nutrition Education in Berkeley, California (1978), the director commented that there was virtually nothing to be accomplished by attempting to teach nutrition in schools using programs which are based entirely upon the Four Food Groups approach.

1.3.2 Purpose of the Study

The purpose of this study was to interpret and apply Novak's model to design a program to teach nutritional concepts to children of the kindergarten and first-grade levels.

1.3.3 Significance of the Study

As stated earlier, Novak documented the lack of deliberate application of learning theory to curriculum and instruction. With the publication of A Theory of Education, Novak provided a possible route to connect theory with classroom practice. As with any theory, however, its relationship to reality must be established. This study represented an attempt to illustrate the potential use of Novak's model in the design of a learning program. While the study focused upon a relatively small portion of a teaching program, there appeared to be no compelling reasons why the results could not be applied to the large scale curricular and instructional design suggested by Johnson (1967). The Seattle Times of January 21, 1979, carried two announcements regarding public hearings on what restrictions should be placed on the sale of "junk" food in schools. After a series of sessions were held by the United States Department of Agriculture, the Department proposed a national policy to ban the sale of "competitive foods," such as candy, soda pop, frozen desserts and chewing gum, in schools that participated in the National School Lunch Program. Similar accounts in our own media indicate that problems of childhood nutrition are of equal concern in Canada. "Results of the survey showed that only 1.4% of the schools (0.9% of the children) carried only nutritious foods in their vending machines." (Delaney, 1973)

In view of the almost total lack of effective nutritional programs for the youngest children within our public school system, (the most impressionable years) the choice of nutritional concepts as the subject for a K/1 instructional program seemed timely. It was hoped that the successful completion of this project, with its emphasis upon a limited number of nutritional concepts, might serve as a model for similar programs to teach additional concepts. An instructional program, successfully taught and learned in the early-primary years, might significantly alter our national dietary habits.

1.4 SPECIFIC PROBLEMS TO BE INVESTIGATED

The following specific questions were addressed in this study:

(a) Can Novak's model be used to develop a learning package on nutrition at the K/1 level?

(b) What are the problems associated with the implementation of this learning package?

(c) What subsumers do K/1 children hold regarding the role of sugar in nutrition; specifically with respect to the problems of dental caries and of obesity?

(d) What concepts does a child need to meaningfully learn in order to understand the role of sugar in dental caries and obesity?

(e) Is the conceptual hierarchy, as derived from Novak's model, effective in presenting the concepts identified in (d)?

(f) What instructional strategies, selected according to Novak's model, seem appropriate for the implementation of the curriculum determined in (e)?

(g) What role might an invented character, a logo, play in the development of the instructional program generated in (f)?

1.5 LIMITATIONS OF THE STUDY

This study was subject to the following limitations:

(a) The study was conducted with a small number of children in an upper-middle class district. These children represented a mixture of high-ability first-graders and unclassified kindergarten children.

(b) The learning package consisted of just one section of a larger instructional program in the area of nutrition.

While these limitations should be considered when interpreting the results of this study, theoretically there should be no reason to deny application of the results of this study to any subject at any grade level.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter reviews the literature in four areas. First, a statement of Novak's model and its interpretation; second, references to nutritional educational programs for primary children; third, logo learning and finally the role of sugar in dental caries and obesity.

2.2 NOVAK'S MODEL

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NOVAK'S MODEL FOR CURRICULUM AND INSTRUCTION

Curricular Design	Instructional Design
Selection criteria for knowledge in our culture	Stress on concepts implies need to identify major and minor concepts in a field of study.
Ordering criteria for knowledge selected	Meaningful learning and progressive differentiation require the most general, most inclusive concepts be presented early and subsequent information be provided to clarify meaning and show connections to subordinate concepts. (Recall distinction

Novak's Model for Curriculum and Instruction (continued)

Curricular Design	Instructional Design
	between logical and psychological order in Chapter 4).
	Superordinate learning and integrative reconciliation require that subordinate concepts be presented in a manner that allows association with more inclusive concepts (superordinate concepts), and meanings of apparently disparate concepts will be clarified to show distinctions and relationships between subordinate concepts (integrative reconciliation).
	For young learners, care must be taken to assure that primary abstractions are available in the learners' cognitive structures prior to instruction in concepts requiring secondary abstractions.
Curriculum intended learning outcomes (ILO's)	Although Johnson does not specify the form of ILO's, Ausubel's theory would indicate that these should be concepts to be learned, for with them we effect meaningful learning. In other words, Johnson's "curriculum matrix" produced by the curriculum development system should be a matrix of concepts. To the extent possible, this matrix should suggest hierarchical and subordinate relationships between concepts, although this feature is in part confounded with the sequence in which concepts are taught and the specific examplars used in instruction. Skills, attitudes, and values should be considered especially as they bear on learning of the concepts specified.
Instructional planning system Selection of exemplars (instrumental content)	Ausubel's theory requires that examples used meet the following conditions: (1) necessary motor skills are available or practiced, (2) relevant primary abstractions are available or taught, (3) secondary abstractions presented do not ignore (1) and (2) above, and

Novak's Model for Curriculum and Instruction (continued)

Curricular Design	Instructional Design
	(4) explicit association between new learning and existing cognitive structure is provided (cognitive bridging).
Selection of teaching approaches	Concrete props, when needed, require teaching approaches that introduce these props in proper order. Development of primary and secondary abstractions will be somewhat idiosyncratic, hence teaching approach must allow for varying rates of learning, for alternative exemplars, variation in exposure to concrete props, and adjustment to motivation patterns of students.
Actual learning outcomes	Achievement will be a function of the general cognitive maturation (degree of overall cognitive structure differentiation) but primarily dependent on initial or developed relevant subsumers in learner's cognitive structure. Presence of meaningful learning set will lead to growth in relevant subsumers in contrast to rote learning, and should facilitate problem solving capabilities to the extent that progressive differentiation and integrative reconciliations of relevant concepts has occurred.
Evaluation	Rate of new learning will depend on quality of existing or developed relevant subsumers, and motivation for learning. Transfer of learning to new problem solving situations will be a function of the degree of concept differentiation, superordinate subsumption, and integrative reconciliation achieved. Genic variation in learners will be confounded with achievement of the above.
Feedback to curriculum planning	Concepts selected may require (1) more general cognitive structure development than typically present in the learners, (2) alternative

Novak's Model for Curriculum and Instruction (continued)

Curricular Design	Instructional Design
	sequences of concept presentation, (3) better clarification of relationships between concepts in the matrix and/or better description of salient aspects of the concept(s).
Feedback to instruction	Failure to achieve concept mastery (as evidenced by lack of transfer to novel, relevant problems) may indicate a curriculum problem as above or (1) poor selection of exemplars (not easily or extensively linked to existing cognitive structure of learners), (2) inappropriate pacing leading to role learning or failure to learn (too fast) or boredom and decline in motivation (too slow), (3) necessity for provision for more motor skill development, greater use of concrete props for primary concept development, more extensive development of secondary abstractions and/or relationships among the latter, (4) Selection of alternative instructional strategies to better achieve above items, for example, tutorial assistance where existing relevant cognitive development of learners is highly variable or unusually idiosyncratic.

2.3 INTERPRETATION OF NOVAK'S MODEL

(a) Concept Identification and Selection

Novak's model is brief and explicit on this topic; the only problems presented had to do with identification of major and minor concepts. Novak (p. 142)[1] recommended Gowin's work to assist teachers

[1]All page notations refer to Novak, 1977.

to "unpack" the knowledge of a discipline. Once "unpacked," the researcher is supposedly able to identify major and minor concepts but neither Novak nor Gowin indicated the specific procedures for doing so. In the absence of prescribed criteria to identify major and minor concepts the designer of an instructional program is obliged to make purely arbitrary decisions regarding the relative importance of concepts.

(b) Concept Sequencing

Novak's model (p. 137) suggested that concepts must be considered according to their degree of generability and inclusiveness. Meaningful learning (p. 25) requires new information to be linked with existing concepts or "subsumers" (or, subsuming concepts).

Progressive differentiation (p. 86) consists of the development and elaboration of relevant, subsuming, subordinate concepts as a result of the assimilation of new concepts, i.e., as meaningful learning proceeds (p. 26).

Advance organizers are concepts which are "more general, more abstract and more inclusive" (p. 78) than the learning material that is to follow. If relevant subsumers are available, advance organizers act as a cognitive bridge to link these subsumers with new material to be learned. If relevant, subsuming concepts are not available, advance organizers can anchor new learning and lead to the development of a subsuming concept which can function to facilitate subsequent relevant learning (p. 78).

Psychological ordering of concepts (pp. 94-96) requires not only the presentation of concepts from the general to the more specific but also that they be arranged to allow for integrative reconciliation Novak (p. 90) has accepted Ausubel's notion of integrative reconciliation; an explicit exploration of relationships between concepts, noting significant similarities and differences and reconciling real or apparent inconsistencies. An instructional program must explicitly illustrate how new meanings compare and contrast with more restricted earlier meanings, and how higher order concepts take on new meanings. "Integrative reconciliation is best achieved when instruction deals with concepts at all levels of the conceptual hierarchy in a cyclic fashion" (p. 90).

For example, in the learning program developed in this study the most general, most inclusive superordinate concept was, "We are what we eat." One of the most specific, least inclusive subordinate concepts was, "Sugar can cause dental caries." In the process of enabling the children to meaningfully learn the role of sugar regarding dental caries, a number of intervening concepts and exemplars were used. Lesson No. 1 in Appendix I of this report describes a lesson based upon children's experiences during "tricking or treating" on Halloween. A comparison of ways of ordering the concepts found in that lesson follows:

No. 1 We are what we eat.

No. 2 There is a variety of foods.

No. 3 Some foods are sweet

No. 4 We tend to prefer sweet foods.

No. 5 Sweet foods contain sugar.

No. 6 Some foods may harm us.

No. 7 Sugar can cause dental caries

No. 8 Sugar can cause obesity.

The above sequence may be considered as a more or less logical ordering of concepts. What follows is a psychological ordering of the concepts presented in the lesson. (Numbers of the corresponding logically-sequenced concepts appear in parentheses). The lesson was a discussion centred about what the children had received at Halloween and what happened to it.

"We got a lot of stuff." (No. 2)

"We like the sweet things best." (Nos. 3 & 4)

"My mommy would only let me eat one candy at dinnertime." (No. 6)

"Sugar makes things sweet." (No. 5)

"Sugar can give you cavities." (No. 7)

"Sugar can make you fat." (No. 8)

"Too much sugar is not good for us." (No. 1 implied)

In subsequent lessons a number of subordinate concepts were meaningfully learned, cognitively linked, and underwent progressive differentiation: e.g., "Candies are sweet. Sweetness is caused by sugar. Candies contain sugar. Sugar causes cavities in teeth. Candies cause cavities. If you want to avoid cavities avoid candies and sugar." Other exemplars (syrups, frozen desserts, soda pop) were also used. Thus the instruction dealt with concepts at different levels of the conceptual hierarchy in a cyclic fashion. Similar treatment was given to the role of sugar in obesity. During the instructional program the superordinate concept, "We are what we eat," underwent integrative reconciliation. By the end of the program several children had asked about the roles of other foods, e.g., the natural sweetness of apples and oranges. As a result of "cycling up and down the conceptual ladder" (p. 91) and encountering a number of exemplars, some children began to show some indication of a grasp of the need for a variety of foods and for some consideration of the kinds and amounts of foods consumed; the higher order concept had taken on new meaning for them.

Novak's model (p. 138) indicated that primary abstractions must be present in the learner's cognitive structure prior to the introduction of concepts requiring secondary abstractions. He considers primary abstractions (p. 121) as concepts whose meanings derive from specific, concrete, empirical props. The learning of primary concepts usually includes the acquisition of verbal labels, e.g., "sugar." Secondary abstractions (p. 121) are concepts whose meanings are acquired by the learner applying the concept to exemplars rather than using exemplars to acquire the concept. For example, having learned that the presence of the Sugar Shy logo indicates a food with a relatively lower sugar content, and having seen the logo on a variety of fresh fruits, the learner can acquire the secondary abstraction that all fresh fruits contain relatively low levels of sugar.

(c) Intended Learning Outcomes

This topic appeared straightforward in Novak's model (p. 138); learning outcomes are concepts to be learned. Novak (p. 151) pointed out one dilema in curriculum and instructional planning. He warned,

> Any arbitrary curriculum planning decisions pertaining to the sequencing of concepts to be presented might result in undesirable or unmotivating instructional alternatives, and conversely, arbitrary decisions on topics or activities in instructional planning might obviate any chance for concept differentiation or integrative reconciliation.

The above statement was interpreted by this investigator to imply that the achievement of learning outcomes depends upon the hierarchial and subordinate relationships between concepts in the curriculum matrix, the sequence in which the concepts are presented, and the specific exemplars and strategies used in instruction.

(d) Instructional Planning: Selection of Exemplars

Four requisites for examples used in instruction were outlined in Novak's model (p. 138). The only one of these which this researcher considered in need of further interpretation was item No. 2, "relevant primary abstractions are available or taught."

In the process of instructional planning a teacher usually makes some guesses, based upon prior experience, regarding the relevant subsumers likely to be held by the intended learners. This investigator decided to label such guessed-at subsumers as "assumed subsumers." In order to refine the instructional planning process it is necessary to assess the degree to which relevant subsumers are held, i.e., to convert "assumed subsumers" into "confirmed subsumers" (author's term).

Posner (1977) and the Cognitive Structure Group at Cornell University outlined a number of ways of assessing cognitive structure (word association, conceptual map and tree construction, the generation of propositions, clinical interviews, and problem solving tasks). All of these techniques are time-consuming and they pose special problems for K-1 children who are functionally illiterate. Some of these techniques (e.g., clinical interviews) demand highly skilled practitioners as well as time.

(e) Selection of Teaching Approaches

Novak (p. 138) stated. "Concrete props, when needed, require teaching approaches that introduce these props in proper order." By "proper order," Novak (p. 154) indicated that experience with concrete props was required whenever the learner is confronted with new concepts or with concepts that cannot be readily associated with existing concepts in cognitive structure, i.e., with superordinate concepts of a more general, more inclusive nature. He saw the dependence upon concrete props as a function of the degree of relative cognitive structure differentiation (p. 153). Further, he claimed that concept structure differentiation is to a large extent related to age. Around twelve years of age most children enter Piaget's stage of formal operations and can see the relationships between secondary abstractions without concrete props. According to Novak (p. 153) the need for concrete props was indicated whenever (regardless of age) the learner has inadequately differentiated cognitive structure in the subject area.

(f) Actual Learning Outcomes

Novak's model (p. 139) stated that achievement was a function of the general cognitive maturation (degree of overall cognitive structure differentiation) that had occurred. These outcomes were considered to be primarily dependent upon the initial or developed relative subsumers in the learner's cognitive structure. Desired learning outcomes should include an increase in numbers of relative subsumers accompanied by their progressive differentiation and integrative reconciliation The learner's problem-solving capabilities should be enhanced as a result of this learning.

(g) Evaluation

According to Novak (p. 188), "two kinds of evaluation are needed in education." The first type, "summative evaluation" attempts to determine what knowledge and skills an instructional program has imparted to students. The second type, "formative evaluation," is a continuous monitoring of an instructional program as it is being developed to check on how well the instructional program is fulfilling the purposes of the curriculum plan. Formative evaluation compares intended learning outcomes of an instructional program with the actual learning outcomes of individual students.

Novak (p. 189) claimed that, educational evaluation, "is in a shambles." He cited a lack of connection between evaluation and learning theory and curriculum theory or instructional theory. He suggested that if Ausubel's learning theory were used as a base for evaluation theory then test items would measure concept differentiation and integrative reconciliation.

In this investigator's opinion, the work of the Cognitive Assessment Group of Posner (1977) could possibly make a significant contribution to both formative and summative evaluation. This group has investigated a number of ways of assessing cognitive structure, i.e., word association, conceptual mapping, conceptual tree construction, generation of propositions, propositional analysis of clinical interview protocal, and problem solving tasks.

(h) Feedback to Curriculum Planning

Of the three considerations which Novak (p. 139) felt should be applied to curriculum revision as a result of feedback from the outcomes of an instructional program, only the first one, "Concepts selected may require more general cognitive structure development than typically present in the learners," seemed to require interpretation.

If a learning program did not produce the expected outcomes then one possible source of improvement might lie in an examination of the subsumers held by the learners. Novak (p. 78) suggested that if relevant, subsuming concepts were not present in the learner's cognitive structure advance organizers could help develop these subsumers. Again, this investigator was led back to a consideration of Ausubel's statement (Novak, 1977, p. 24) regarding the role of subsumers as the most important single factor influencing learning.

(i) Feedback to Instruction

The most interesting feature of this component of Novak's model (p. 139) was his reference to the assessment of concept mastery as evidenced by transfer to novel, relevant problems.

According to Novak (p. 105), the most salient issue in an exploration of problem solving was how hierarchially arranged cognitive structures (conceptual structures) functioned. He postulated (p. 108) that good problem-solving ability required well-defined concepts relative to the problem to be solved. The person considered good at solving new problems probably had a tendency to develop higher order concepts with great generability and inclusiveness which became relevant to a wide array of problems. Problem-solving ability was also considered contingent upon the adequacy of prior learning. In summary, Novak (p. 108) viewed problem-solving as essentially a special case of meaningful learning. For him, hope for improvement of problem-solving capabilities lay with improvement of the process of meaningful learning and in rewarding successful problem-solvers more than rote memorizers.

This researcher surmised that the placement of concept-mastery, and its links with problem-solving, in this particular (terminal) section of the model indicated problem-solving as a device to be used in formatively assessing an instructional program, i.e., if problem-solving capabilities were not enhanced, the program designer should re-examine the instructional component of the learning program. The remainder of this section of Novak's model (p. 139) indicated specific areas of an instructional program to be considered in such an examination.

2.4 NUTRITION PROGRAMS FOR THE PRIMARY GRADES

Schmidt, in summarizing an exhaustive review of the literature published between 1963 and 1973, stated:

> The literature about nutrition education is voluminous with contributions from educators, nutritionists, psychiatrists, and others. The literature contains substantial discussions about nutrition but no research studies concerned with teaching nutrition to kindergarten children were found. (Schmidt, 1974, p. 29)

A search of the most recent literature which included entries into 1978, produced results that tended to parallel those of Schmidt, i.e., materials and reports were found but evidence of research was lacking. The total number of E.R.I.C. entries dealing in any way with the nutrition of primary children was limited; few of the references available were of value to this study. The following references were considered relevant.

The concept that nutrition education should begin early was supported by the work of Niedermeyer and Moncrief (1975). Johnson reported:

> Results of this phase indicated that children below the fifth grade might be more amenable to changes in dietary habits and attitudes due to nutrition instruction. (1974, p. 12)

Two reports, one by Project Head Start (1976) and the other a submission to the U.S. Federal Trade Commission by the Council on Children, Media and Advertising (1976) also stressed the need to provide nutrition education in the early years.

Shapiro (1974), in a report which evaluated a nutrition series presented via television, indicated that the impact of the program appeared to decline with the age of the student.

The inclusion of multi-sensory activities in nutritional programs for young children was recommended by Warren (1972), Schmidt (1974), and McIntyre (1975). Another report by Project Head Start (1969) also supported this view.

Several references suggested that nutrition-education activities should be integrated with other subject areas, notably the work of Warren (1972), Karsch (1977), and Schmidt (1974). Additional support for this rationale was provided by Perryman (1972) and by McAffee (1974).

McIntyre made one comment which hinted at the possible suitability of an Ausubelian approach to the teaching of nutrition:

> The child's maturation level and previous experiences determine what is meaningful to him. (1975, p. 39)

The idea of using a logo as a teaching device within a nutritional program derived from the proposal made by the Council on Children, Media and Advertising (1976). This report was based upon attempts to use a "Nutrition Computer" (a robot figure) to present nutritional information to children. The Council wanted the robot to appear in T.V. food commercials directed at children under twelve years. Only eight subjects were used in their research. They attempted to use the logo to convey information about calories, proteins, vitamins, and minerals, simultaneously, to four and five year-olds by means of shading and numeric data. The results of this 1976 project were obviously not convincing to federal authorities (no such logo has yet appeared on commercial T.V.).

2.5 LOGO TEACHING AND LEARNING

Since the use of a logo as an instructional device seemed appropriate to this study, a review of the literature on this topic was undertaken. A thorough search of the E.R.I.C. system and other appropriate literature revealed no studies on logo learning.

The results of an E.R.I.C. search and a hand search of the card catalogues at the University of British Columbia revealed no entries on, or related to, this topic.

2.6 DENTAL CARIES

Ample evidence was found in the literature to support the choice of dental caries as a subject for testing Novak's model. Nizel (1977) suggested that the most prevalent health problem in the United States today is "rotten" teeth. He estimated that the annual cost of treating dental caries exceeded four billion dollars: an additional sixteen billion dollars would be required to treat all of the cavities in the United States, in the year 1977. In his advice to paediatricians he made the following recommendation:

> . . . emphasize to the mother the need for teaching and conditioning the child to eat well-balanced, varied, adequate diets of natural foods with no between-meal dental decay producing sugar-rich snacks. (1977, p. 155)

In his work on diet and dental caries, Andlaw stated:

> Although various sugars are readily broken down to acids by oral bacteria, sucrose is considered to be the most important in relation to dental caries.
> (1977, p. 47)

In the conclusions to his research he indicated that the elimination of sucrose from the diet resulted in almost complete arrest of dental caries.

In a comparison of the snack-food eating habits of mothers and children, Clancy (1977) examined the consumption of eighteen foods.

Sucrose was implicated as a major contributor to plaque formation and subsequent tooth decay. Of particular interest were the negative correlations between dental caries and the intake of fruit juices, fruit (apples and oranges), and sugarless gum. Although Clancy considered the role of chewing gum in the causation of dental caries questionable, she noted that the chewing of regular gum may be a good indicator of the total use of sugar-rich foods in snacks.

2.7 OBESITY

As was the case with dental caries, evidence to indicate the need for the inclusion of obesity in a nutritional program for young children was readily obtained.

Gifft (1972) suggested that obesity is the most widespread form of malnutrition in the United States. (Because of similarities in diet there is good reason to suspect that her findings apply equally to Canada.) According to Gifft, it is well documented that obese children will run a great risk of remaining obese all their lives. Unfortunately, the author noted, the notion that a fat child is a healthy child is still widespread. She suggested it was unfair to encourage chubbiness in a toddler and small child and then to suddenly condemn it as he approaches adolescence. Gifft's research indicated that the best hope for controlling obesity lies in finding ways to prevent it.

Knittle (1975) proposed that a critical period of adipose tissue development occurs somewhere between birth and age two and this time period has important consequences for the future development of the size of the fat deposits in the adult. He suggested that a second critical period occurs at the pubescent and adolescent periods. These findings tended to support the need for nutritional education in the primary grades. Indeed, Knittle's data clearly indicated that dietary regimens in childhood-onset obesity should be instituted prior to age six if a lifelong history of obesity is to be avoided.

Yudkin (1972) showed that sugar supplies approximately one-fifth of the average eater's calories; for children, as much as fifty percent. He claimed that the consumption of sugar on top of an ordinary diet not only increased the risk of obesity but also the risk of nutritional deficiencies.

Cleave (1975) contended that "the <u>sole</u> cause of obesity lies in the consumption of refined carbohydrates."

2.8 SUMMARY

The review of the literature indicated:

1. The role of sugar in the nutrition of children is of international concern;
2. Sugar is implicated as a major contributor to the diseases of dental caries and of obesity; and
3. There is a need for nutrition-education programs aimed at the early-primary child.

CHAPTER 3

DESIGN OF THE STUDY

3.1 INTRODUCTION

This study explored an application of Novak's model of curricular and instructional design. Two tasks were completed; the design of a learning program to teach nutritional concepts to K/1 children and, the teaching of this program to a group of these children.

Pre- and post-program cognitive assessments of the subsumers held by the children regarding the role of sugar in dental caries and obesity were made.

The learning program required fourteen school days for its completion, including the two cognitive assessments. The teaching of the instructional program took twelve consecutive, daily lessons of approximately half-hour duration. Each lesson was presented at the same time (1:30 p.m.) each day.

3.2 OUTLINE OF THE LEARNING PROGRAM

An outline of the learning program developed in this study appears as Table 3-1 of this report. The format of this outline is presented in two columns and consists of the conceptual framework

(Novak, 1978, pp. 137-139) on the left and teaching strategies on the right. The adaptation of the conceptual framework to the subject of sugar in foods preceded the selection of appropriate teaching strategies.

3.3 SUBJECTS

The subjects for this study were an intact K/1 class in the researcher's school. There were fourteen kindergarten children with heterogeneous learning capabilities, and ten first-grade children diagnosed in the preceding month of June as having above average learning capacities, as measured on local, district-wide tests.

Most of the children could count up to 100 and some had already completed the grade one reading program at the time the data was collected (January-February).

3.4 PRE- AND POST-PROGRAM COGNITIVE ASSESSMENTS

Identical pre- and post-program assessments of the cognitive structures of the learners was carried out as follows:

(a) Subsumers Relevant to Sugar, Dental Caries, and Obesity

Evidence of these subsumers was gathered pictorially and orally during a modified clinical interview. Each child was brought into the unoccupied health room, seated at a table and a given a blank sheet of paper and a box of crayons. The child was then asked to draw a

TABLE 3.1

OUTLINE OF THE LEARNING PROGRAM

Curricular Design (Ordering of Concepts)	Instructional Design (Teaching Procedures)
Lesson No. 1	
Gathering of subsumers relevant to nutrition	Discussion re Halloween
An overview presentation of concepts (i) to (x)	Cutting out pictures of foods
Lesson No. 2	
Review of Lesson No. 1 Emphasis upon concepts (ii), (iii), (iv) and (v)	Sorting of pictures of sweet foods onto a red paper mat and not-sweet foods onto a green one
2A - Concept of red (stop) and green (go) as used in traffic lights	Discussion
2B - Concept of red (stop eating) and green (go ahead and eat) applied to foods 2C - Concept of natural sweetness* * - Concept introduced by children	Pictures from the red mat placed in an envelope marked with a red sticker and the names of the pupils; those from the green mat into an envelope with a green sticker
Lesson No. 3	
Review of lessons No. 1 and No. 2 Emphasis upon concept 2C	Discussion of all work to date
* - sugar content of composite foods based upon sugar contents of the components (candy apple)	Pupils work in groups of 4: 2 pupils work with the green envelope from lesson No. 2; 2 with the red

Table 3.1 (continued)

Curricular Design (Ordering of Concepts)	Instructional Design (Teaching Procedures)
* - The dentist as a "helper"	Pupils paste pictures onto a poster board of the appropriate color Teacher discussion of work in progress Teacher labels posters, "Sweet" and "Not Sweet"
<u>Lesson No. 4</u> (Optional after 4A)	
Review of Lesson No. 3 (extending back to the salient concepts of Lessons No. 1 and No. 2) Emphasis upon concept 2A	Comparison of numbers of items on red and green posters
4A - Concept of relative numbers of sweet and not-sweet items advertised (more items on the red posters)	Counting of items on posters in modules of 10 Placement of one sticker on bar graph for each module of 10 items
4B - Concept of a bar graph (reviewed)	
4C - Concept of counting by 10's to 100 (review for nearly all students)	
4D - A symbol (sticker) on a graph representative of more than 1 item	
4E - Concept of place values for numbers larger than 10 (review for some)	Discussion of concepts that can be extracted from a bar graph
4F - Qualitative relationships (more than/less than) can be obtained from graphs	

Table 3.1 (continued)

Curricular Design (Ordering of Concepts)	Instructional Design (Teaching Procedures)
Lesson No. 5	
Review of Lesson No. 4 (all nutritional concepts back to Lesson No. 1)	Posters from Lesson No. 3
	Bar graph from Lesson No. 4
Emphasis upon concepts represented by the bar graphs	Discussion
Relationship of the graph to sweetness of foods	
5A - "Sweet" synonymous with "high sugar" and "not-sweet" with "low sugar"	
5B - Meaning and significance of "wink"	Introduction of the "Sugar Shy" puppet
5C - meaning and significance of "shy"	
5D - Configuration of the face of "sugar shy"	Puzzle card No. 1
5E - Sugar Shy is asexual	Introduction of ACT I of "The Drama of Sugar Shy"
Review of concept (vii)	
Lesson No. 6	
Review of Lesson No. 5	Discussion, Posters and Graph
Emphasis upon 5A, 5B, 5C, and 5E	
Special emphasis upon 5D	ACT I of the drama - drill
Review concept (vii)	Review of Puzzle Card No. 1 from Lesson No. 5
Review concept 2D (natural sugars)	Creation of Sugar Shy puppets by children

Table 3.1 (continued)

Curricular Design (Ordering of Concepts)	Instructional Design (Teaching Procedures)
Lesson No. 7	
Review of Lesson No. 6	Posters and Graph
Reinforcement of concepts (vii) and (ix)	Discussion
7A - Meaning of the word "too" as used in ". . . get too fat"	Introduction of the "Sugar Shy Song"
7B - Avoidance of offence to "plump" people	
Lesson No. 8	
Review of salient concepts to date	Posters and Graph
Emphasis upon concepts (viii) and (iv) and 5A	New materials added to postets
	Drill ACT I - chorus
Review of the processes of observation and classification	Drill song with actions and puppets
	Introduce ACT II of the drama
8A - Differentiation and integrative reconciliation of the word "shy" as used with sugar	
Lesson No. 9	
Review of salient concepts to date	Posters and Graph
Emphasis upon concepts (viii), and (ix) and 5A	Discussion
	Review ACT I
9A - Discrimination between Sugar Shy and other faces	Drill ACT II

Table 3.1 (continued)

Curricular Design (Ordering of Concepts)	Instructional Design (Teaching Procedures)
9B - Association of Sugar Shy with the color "green"	Drill song with actions and puppets
9C - Extinction of the color red	Presentation of Puzzle Card No. 2
	Presentation of Puzzle Card No. 3
	(Faces of Sugar Shy colored in green)
Lesson No. 10	
Review of Lesson No. 9 Emphasis on concept 9A and 8A	Discussion, Posters and Graph
	Drill of ACTS I and II
Introduction of concept (x) The Sugar Shy logo can be used to identify low-sugar foods	Review of the song
	Review Puzzle Cards No. 4 and No. 5
10A - Green equates with Sugar Shy who equates with low-sugar foods	Drawing of Sugar Shy logos on the green (low-sugar) posters
	Association of Sugar Shy with the color green
Lesson No. 11	
Review of Lesson No. 10 Emphasis upon concepts, (x), 9C and 10A	Discussion
	Posters with logos drawn on them
	Review of ACTS I and II
	Singing of the song
	Green, logo stickers affixed to a new set of pictures

Table 3.1 (continued)

Curricular Design (Ordering of Concepts)	Instructional Design (Teaching Procedures)
Lesson No. 12	
Review of Lesson No. 11	Posters with drawn logos
Significance of the green, Sugar Shy stickers	Pictures with green, logo stickers from Lesson No. 11
Processes of observation and classification	Discussion
	Sorting of pictures into high and low-sugar piles using the logo to identify the low
Test of concept mastery	
	Affixing Sugar Shy stickers to plain, wrapped packages
	Sorting of these packages
	Song

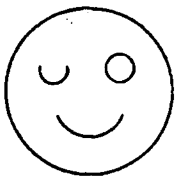
picture to show what might happen to a person who eats "a lot of sugar." Upon completion of the picture they were asked to make a statement regarding the picture; these comments were written on each picture by the researcher and observers. This same task was assigned to the children the day before and the day after the instructional program was presented.

(b) Logo Learning and Food Identification

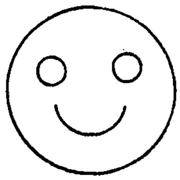
Part of the learning program involved teaching children how to identify an invented logo character, "Sugar Shy," and the application of this logo to identify foods with lower sugar contents. The degree of integrative reconciliation of the concepts relevant to the identification and application of the logo was assessed by an exercise in sorting. Since the subjects had no previous contact or experience with the logo there was no expectation that they would undergo integrative reconciliation of the logo in the pre-assessment. The logo was used in both assessments as a means of duplicating the pre- and post-assessments in an attempt to determine the extent to which any reconciliation might have occurred as a result of instruction.

The subjects were individually confronted with an assortment of twelve different food products, six with relatively high sugar content and six with relatively low levels of sugar. The food items were placed in exactly the same configuration for the start of every sorting exercise, see Appendix A.

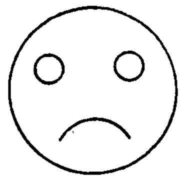
The six low-sugar items each carried the "Sugar Shy" logo on a circular, green sticker, approximately 15 mm in diameter. Three of the high-sugar foods carried identical green "Happy Face" stickers and the remaining three, "Sad Faces."



"Sugar Shy"



"Happy Face"



"Sad Face"

Each child was told that some of the foods on the table had, "a lot of sugar" in them, and others, "only a little bit," of sugar. The subject was then asked to sort the foods into two containers; the, "lot of sugar," pile and the, "little bit of sugar" pile. The time required to complete the task and also, the number of times a child changed his/her mind prior to final placement were recorded. A child who had completed the task was not permitted to associate with those waiting to be tested. A sample of the pre- and post-assessment data sheet can be found in Appendix A.

3.5 THE LEARNING PROGRAM

3.5.1 Curricular Design

The field of human nutrition is so extensive that it was necessary to restrict this study to the early childhood years. As suggested in Novak's model, the major and minor concepts to be taught were identified. A conceptual hierarchy was established which it was hypothesized would result in the meaningful learning of these concepts by the children. This hierarchy, beginning with the most inclusive concept; follows:

(i) We are what we eat.

(ii) There is a variety of foods.

(iii) Some foods are sweet.

(iv) We tend to prefer sweet foods.

(v) Sweet foods contain sugar.

(vi) We cannot live on sweet foods alone.

(vii) Some foods may harm us.

(viii) Sugar can cause dental caries.

(ix) Sugar can cause obesity.

(x) A logo can be used to identify foods with lower sugar contents.

A set of lesson plans based upon this hierarchy was developed prior to the start of the instructional program but modifications were made to these plans as the program was presented, in response to pupil in-put and reaction. The final sequence of presentation of concepts within the learning program appears in Appendix B.

The Intended Learning Outcomes of Novak's Model as applied to this program were restricted to the learning of only two concepts, i.e., the role of sugar in obesity and in dental caries. An ancilliary concept to be learned was the application of a logo to the identification of low-sugar foods.

3.5.2 Instructional Design

The instructional planning for the program used in this study followed the recommendations of Novak's model. The researcher was aware of the motor skills possessed by the subjects and all manipulative tasks assigned were considered within their capabilities. A variety of physical props, e.g., pictures, charts, graphs, puppets and games, was used throughout the program and these were introduced at appropriate times. Integration with other subject areas, e.g., language arts, arts and crafts, music and mathematics, were deliberately built into the program. An outline of the instructional techniques used in each lesson parallels the cognitive hierarchy and is presented in Table 3.1.

3.5.3 Format of the Instructional Program

The twelve lessons of the instructional program followed a common design.

(a) Learning Objectives

This section listed the principal learning objectives of each lesson.

(b) Instruction

Items in this section provided direction to the researcher regarding the sequencing of the concepts to be presented and the teaching strategies and devices to be used.

(c) Notes

In general, items under this heading provided the rationale for the instructional format of each lesson. The relationships between items in the lesson plan to Novak's model were indicated in this section.

(d) Observer's Comments

This researcher was fortunate in that the presentation of each lesson was critically observed by at least two (sometimes more) adult observers who made notes on the progress and events of the lesson. This degree of observation occurred because the K/1 class was assigned two student-teachers, in addition to the classroom teacher, for the entire time of the learning program. Immediately following each lesson the observers de-briefed the researcher and together their observations were discussed; additional observations were frequently added by the researcher. As a result of these sessions the modifications were made in the program as it progressed.

(e) Researcher's Comments

This section contains the salient outcomes of each lesson as perceived by the researcher. When possible, these outcomes were expressed in terms of Novak's model. Many of these comments were suggestions and recommendations for the improvement of any successive attempts to teach the program.

3.5.4 Learning Centre

A learning centre was established within the K/1 classroom following the introduction of Sugar Shy in Lesson No. 5. A total of six game-like activities were created for use by children at the centre. Access to the centre for the K/1 group was provided with the cooperation of the classroom teacher. The researcher's duties as principal of the school did not allow more than the half-hour per day of instructional time but the creation of the learning centre provided children with opportunities to review and to learn at their own pace using a variety of exemplars and instructional devices, in keeping with the recommendations of Novak's model. In addition, the classroom teacher developed much of her own program about a nutritional theme to reinforce the work of this program and maintain the integration with other subject areas. A description of the learning centre and its activities is included in Appendix B.

CHAPTER 4

OUTCOMES OF THE STUDY

4.1 INTRODUCTION

The general problem of this study was to apply Novak's model to the design of an instructional program. A number of specific problems as identified in Chapter 1 were investigated.

Novak's model was used to develop a learning program on nutrition at the K/1 level. A number of the subjects were initially familiar with the role of sugar as a causative agent in dental caries but only six of the twenty-two subjects mentioned obesity in the pre-program assessment; for others, an array of requisite subsumers was devised to permit cognitive bridging. A conceptual hierarchy was derived from Novak's model to present the requisite concepts to those children who did not hold them initially. Once the necessary conceptual hierarchy had been established, instructional strategies deemed appropriate for the implementation of the curriculum were devised. A logo character was created in accordance with Novak's recommendation of providing a variety of exemplars and concrete props.

4.2 RESULTS OF PRE- AND POST-PROGRAM COGNITIVE ASSESSMENTS

4.2.1 Pictorial Assessment of Subsumers

Children were instructed to draw a picture to show the effects of eating too much sugar and then to comment upon their drawings. Comments made by children to the interviewer about each picture were analyzed to ascertain references to obesity and dental caries. A remark such as, "Suzy was eating too much sugar. She got a hole in her tooth," was considered as evidence of a subsuming concept regarding sugar and dental caries. "Pooh floated up to space with honey. He is fat," was accepted as an awareness of a relationship between the consumption of sweets and obesity. A comment such as, "I had a little bit of sugar in my feet," was interpreted as indication of a lack of confirmed subsumers regarding the role of sugar in dental caries and obesity. The results of the assessment of the comments which accompanied the pictures are summarized in Table 4.1.

While the pre- and post-assessments were not considered as strong evidence of the effectiveness of the program, it did provide some indication of change in the subsumers held by the children.

The most obvious difference between the two assessments was the increase in the numbers of children who mentioned both dental caries and obesity from 0% (0/23) in the pre-assessment to approximately 60% (15/23) in the post. There was a decline in the number of students who mentioned neither disease from 9 of the 23 (approximately 40%) to zero in the post-assessment. Only 3 pupils, No. 8, No. 9 and No. 11 failed to show any difference in their subsumers following the teaching of the program. Subject No. 22 was absent for the pre-assessment but present for the post-evaluation; her remarks were not included in this report.

Some differences between the results of kindergarten children and first-graders were noted. In the first assessment only 36% (5/14) of the kindergarten subjects showed confirmation of relevant subsumers and all of these were restricted to dental caries. However, 90% (9/10) of the first-graders demonstrated awareness of some relationship between sugar and dental caries or obesity in this same assessment.

One of the concepts presented in the hierarchy had to do with the unsuitability of sweet foods as the only items of diet. Although this transitional concept was not designed to be assessed, it was noted with interest that the comment, "getting sick" appeared only once in the initial assessment but six times in the final.

4.2.2 Identification of Low-Sugar Foods

The results of identical pre- and post-program sorting tasks were assessed for the degree to which the subjects had meaningfully learned the concept of the logo character "Sugar Shy" as an identifier of low-sugar foods. The results of these assessments are summarized in Table 4.2

The data of Table 4.2 indicated several features of interest to this researcher.

TABLE 4.1

PICTORIAL ASSESSMENTS AND COMMENTS

Subject	PRE-PROGRAM ASSESSMENT: Concepts Mentioned: Dental Caries (only)	Obesity (only)	Both	Neither	POST-PROGRAM ASSESSMENT: Concepts Mentioned: Dental Caries (only)	Obesity (only)	Both	Neither
				GRADE ONE				
1	x						x	
2		x					x	
3		x					x	
4	x					x		
5	x						x	
6		x					x	
7				x			x	
8		x				x		
9		x				x		
10		x					x	
Sub-Totals	3	6	0	1	0	3	7	0
				KINDERGARTEN				
11	x				x			
12				x			x	
13	x						x	
14				x			x	
15	x						x	
16				x	x			
17				x	x			
18				x			x	
19	x						x	

Table 4.1 (continued)

Subject	Dental Caries (only)	Obesity (only)	Both	Neither	Caries (only)	Obesity (only)	Both	Neither
20	x						x	
21				x			x	
22	Absent for pre-evaluation - data excluded							
23				x		x		
24				x	x			
Sub-Totals	5	0	0	8	4	1	8	0
Group Totals	8	6	0	9	4	4	15	0

TABLE 4.2

ASSESSMENT OF FOOD SORTING TASKS

Subject	PRE-PROGRAM ASSESSMENT			POST-PROGRAM ASSESSMENT		
	Incorrect Placements	Alterations of Placements	Sorting Time (min)	Incorrect Placements	Alterations of Placements	Sorting Time (min)
			GRADE ONE			
1	2	0	2	0	0	1
2	4	0	5	0	0	3
3	2	0	3	0	0	2
4	6	1	3	0	0	1
5	5	1	3	0	0	3
6	3	0	2	0	0	1
7	4	0	2	0	0	1
8	6	0	2	9	0	2
9	6	0	2	5	0	2
10	1	0	4	0	0	2
Averages	3.9	0.2	2.8	1.4	0.0	1.8
			KINDERGARTEN			
11	2	1	1	0	0	1
12	6	0	2	0	0	1
13	3	0	1	6	0	1
14	9	0	3	0	0	2
15	7	0	2	2	0	2
16	5	0	1	6	0	1
17	3	0	1	3	0	1
18	8	1	3	5	0	3
19	4	0	2	3	0	2
20	3	0	2	0	2	2

Table 4.2 (continued)

Subject	PRE-PROGRAM ASSESSMENT			POST-PROGRAM ASSESSMENT		
	Incorrect Placements	Alterations of Placements	Sorting Time (min)	Incorrect Placements	Alterations of Placements	Sorting Time (min)
21	9	3	3	6	0	3
22	Absent for pre-evaluation - data excluded					
23	3	0	2	3	0	2
24	9	4	3	8	2	4
Averages	5.5	0.7	2.0	3.2	0.3	1.5
Group Averages	4.8	0.5	2.4	2.4	0.2	1.9

(a) Incorrect Placements

In the pre-assessment, none of the subjects classified all of the food items correctly. In the post-assessment twelve of the twenty-three subjects managed to sort all items correctly. The average number of errors in placement committed by the group in the pre-assessment (4.8) was double that of the post (2.4). The average numbers of errors committed by the kindergarten children (5.5 in pre; 3.2 in post) were considerably larger than those of the first-graders (3.9 in pre; 1.4 in post). Three subjects, No. 8, No. 13 and No. 16, showed an increase in the number of incorrect placements in the post-assessment; two remained constant, No. 17 and No. 23; the remaining eighteen subjects demonstrated a decline.

(b) Alterations of Placements

Most children showed little evidence of indecision regarding placement, once they had made their initial selections. The first-graders showed no vacillations in the post-assessment.

During the second assessment it seemed to the researcher that some children made positive choices but may have then been confused in trying to remember which pile was for high-sugar and which for low-sugar items. No assistance was offered these subjects.

(c) Sorting Times

Sorting times were taken only to the nearest minute. There appeared to be virtually no difference between the times taken by both groups in either assessment. The average times for the whole group may be considered as identical (pre, 2.4 min; post, 1.9 min).

4.3 OUTCOMES OF INDIVIDUAL LESSONS

For convenience, these outcomes were placed within the comments for each individual lesson as it appears in Appendix B. Since the researcher was unable to be present in the classroom while children were working at the learning centres, no outcomes have been reported.

4.4 OUTCOMES OF DESIGNING THE INSTRUCTIONAL PROGRAM

The task of designing the instructional program yielded several outcomes of potential value to the design process. As previously indicated, the instructional program was developed by following Novak's recommendations as closely as possible, particularly in regard to the development of a conceptual hierarchy. The researcher found that this procedure resulted in clearer and more precise statements of objectives and once these had been defined the task of selecting suitable instructional strategies was readily accomplished.

Although a set of detailed lesson plans was created by these procedures the researcher's experience in teaching K/1 children tempered the presentation of each lesson. In prior teaching, recognition had always been given to the contributions of children to the teaching/learning situation, but from the start of this program the researcher was acutely perceptive and receptive to expressions of relevant subsumers. As a result of the input of children, the conceptual hierarchy, while keeping its general format, was modified to accommodate the perceived needs of children.

In summary, the specific problems posed in Chapter 1 contributed to the outcomes relevant to program design as follows:

(a) The outcomes of the pre- and post-assessments indicated that the design was successful.

(b) The researcher also taught concurrently, other subject material, e.g., science and literature to children of the intermediate grades. Almost reflexively she found herself employing Novak's model to the design of lessons. Novak's theory was, in fact, discussed with a small group of children in an enrichment class; considerable understanding of the importance of subsumers was revealed in conversation by these children.

(c) The design of the pre- and post-assessments pointed up the need for more sophisticated instruments for these purposes. For example, at times there were discrepancies between the observers' interpretations of a diagram and the child's dictated message about the diagram.

(d) In the researcher's opinion, the originally-planned concepts supplemented by additions suggested by the children e.g., "natural sugar," contributed to the program's success. Novak's theory would suggest that a restricted array of concepts could lead to extensive rote-reception learning. The effects of any variation in the number and/or sequence of concepts would require separate studies.

(e) The enthusiastic response of the children to the logo, "Sugar Shy," contrary to the findings cited in the literature review, indicated the suitability and desirability of incorporating such devices into instructional programs for the K/1 level.

4.5 OTHER OUTCOMES

4.5.1 Student Teachers

The two student teachers, who worked in the K/1 classroom during the development of the instructional program, received several unanticipated benefits. They observed an experienced teacher preparing and presenting the lessons and then contributed to the on-going processes of assessment and modification of the program. These young teachers were impressed by the controls built into the project and the need to keep accurate and complete records. One of them repeated one of the lessons and her performance was videotaped by her colleague and later evaluated by both students and their sponsor.

4.5.2 Other Teachers

As previously indicated, the K/1 teacher developed much of her own classroom work around a nutritional theme. A second-grade teacher also introduced the topic of nutrition into her program. Both of these teachers provided "nutritional" parties on St. Valentine's day with low-sugar foods in place of the traditional sweets. Several colleagues throughout the district expressed interest in the instructional program and the outcomes of this study.

4.5.3 Parents

No attempts were made to involve parents directly in this study. The only communication with the home occurred incidentally when the children talked about what they were doing in school. Parents who had occasion to visit the school did mention the nutritional studies and appeared highly supportive.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

The following conclusions were drawn from the experiences of designing and presenting the learning program used in this study.

(a) Novak's model of curricular and instructional design was successfully used to design a learning program on nutrition at the K/1 level.

(b) The overall outcomes of this study tended to support the contention that this theory can be applied to any subject at any grade level.

(c) The learning program was implemented with few problems. The only problems of concern tended to be logistic, e.g., the restriction of the researcher's time to one-half an hour per day. Any minor problems associated with the teaching of individual lessons have been detailed in Appendix C.

(d) The K/1 subjects in this study held some initial, relevant subsumers regarding sugar, dental caries and obesity.

First-grade pupils appeared to hold more of these subsumers and these tended to be concerned with both diseases. The kindergarten children seemed aware of the role of sugar in dental caries only.

(e) All of the concepts presented in the learning program appeared to be of value in the meaningful learning of the two prime concepts. Those concepts incorporated into the curricular design appeared to be both requisite and minimal.

(f) The conceptual hierarchy was effective in presenting the concepts. The outcomes suggested that not all concepts were meaningfully learned by all children. However, the fact that none of the subjects initially mentioned <u>both</u> obesity <u>and</u> dental caries but approximately 60% did so on the post-program assessment, was taken as positive indication of the program's effectiveness. Further support was offered by data which showed a decline in the number of students who mentioned neither disease from an initial 40% to zero in the post-program assessment.

(g) The instructional strategies, selected according to Novak's model and detailed in Appendix C, appeared well-suited to the curriculum.

(h) The "Sugar Shy" logo played a significant role in the instructional program. The name and design of the logo appealed to children. It served as a thematic prop which aided the bridging of concepts and facilitated the introduction of other teaching devices and strategies. The effectiveness of the logo as an aid to the identification of low-sugar foods was attested to by the fact that the food-sorting capabilities of the group increased by 40%.

5.2 RECOMMENDATIONS

Specific recommendations related to individual lessons within the instructional program appear in Appendix C. The following broad recommendations were based upon the total experience of this project.

1. Replicate the study with different sized groups of K/1 children from a variety of socio-economic strata.

2. Improve the design of instruments to assess the subsumers held by children. Such instruments should be simple to administrate and provide immediate feed-back.

3. Replicate the learning program in classrooms where teachers are available to children during the entire school day.

4. Investigate the effects of teaching the program over various periods of time.

5. Investigate, over time, the retention of concepts learned via the program.

6. Investigate and develop other nutritional programs applicable to the primary grades, e.g., the possible role of sugar in hyperactivity.

7. Explore ways of increasing parent involvement in any nutritional program, e.g., send assignment sheets to be completed at home; invite parents to a nutritional "open house" at the beginning and the end of an instructional program.

8. Produce publications to educate teachers and administrators about Novak's model.

5.3 SUMMARY

The benefits which the researcher derived from this study are numerous. As a result of this study the researcher developed an improved understanding and appreciation of the work of Dr. Novak.

In addition to designing and teaching a learning program this principal has applied Novak's theory to the observation and evaluation of classroom teachers. It has proved an effective device for analyzing the progress and outcomes of a lesson. In follow-up discussions the appraisal was explained to the teachers and constructive suggestions were readily understood and well-received. The researcher has also applied the theory to evaluate scope and sequence charts for textbook series. Novak's theory is a potentially valuable tool for school administrators.

In this researcher's opinion, Novak's theory of education could provide teachers with a new mode of evaluating and improving current classroom practices. During this study, Novak's theory was explained to teachers and other colleagues and it was favourably, and often, enthusiastically received. The interest expressed by these educators suggests that Novak's theory of curricular and instructional design could profitably form part of any teacher-education program, both pre- and in-service.

Novak's work has already offered much to help bridge the gap between educational theory and the design of learning programs. The positive responses of classroom teachers to even a limited awareness of Novak's theory suggested to this researcher what could be its most significant implication; a bridge between educational theorists and classroom practitioners.

APPENDIX A

INSTRUCTIONAL PROGRAM

Lesson No. 1

Objectives:

To gather children's subsumers relative to the role of sugar in nutrition.

Instruction:

1. "How many of you went out on Halloween?"
2. "What kinds of things did you get?"
3. "Which things were you allowed to eat?"
4. "When were you allowed to eat them?"
5. "What might happen to us if we had only Halloween things to eat all the time?"

Seatwork:

Supply children with magazines, papers, etc. Instruct them to cut out pictures of things similar to (not necessarily identical) with what they received on Halloween. Children work in groups of four. Group places cut-outs in an envelope.

Notes:

This lesson plan follows Novak's model in the following ways:

1. The order of questioning is psychological in that it begins with a general experience that is likely common to all of the children. It is an experience enjoyable to practically every child.

2. Discussions arising from the questions provide some evidence of the subsumers held by the children relative to sugar and nutrition.

3. Question 5 either reviews or introduces the broadest concept of this program, i.e., we are what we eat.

4. The questions also follow a logical progression.

Observer's Comments:

1. Some children experienced difficulty in:
   (a) finding pictures in the magazines
   (b) cutting out pictures, (pictures often too small for the degree of muscular coordination, e.g., one walnut)

2. Answers to question No. 5 dealt exclusively with cavities (their term) and sickness. (No reference to obesity). The first set of drawings made by the children as part of the pre-assessment did indicate some references to obesity (approximately 30%).

Teaching time approximately 10 minutes.

Activity time approximately 20 minutes.

Researcher's Comments:

1. The children held many subsumers relative to sugar in the diet. The subordinate concept of sugar and dental caries was most evident. The superordinate concept, "We are what we eat," was indicated to some degree by their remarks regarding "getting sick," a result of eating too many sweets.

2. The need for an extensive collection of magazines containing suitable pictures was indicated.

3. For those children with poor muscular coordination a kit of pre-cut, suitable pictures could be prepared for sorting instead of cutting out. Novak's model indicated, "necessary motor skills must be available or practiced." (p. 138)

4. If this activity were extended over two or three sessions more subsumers might be elicited and some concept differentiation might take place.

Lesson No. 2

Objectives:

1. To review Lesson No. 1.
2. To classify pictures into sweet (sugared) and not-sweet (not-sugared) categories.

Instruction:

1. Talk about the pictures that the children cut out at the end of Lesson No. 1. Identify examples of things that are sweet (sugared) and those that are not. Demonstrate and drill.

2. Instruct children to sort their pictures into two piles. Things that they think are sweet go onto the red paper mat; pictures of things that are not sweet are placed on a green paper mat.
   Children work in groups of four as before.

3. Teacher circulates and assists with classification, where necessary.

4. Each group placed items from red mat into red color-coded envelopes, items from green mat into green color-coded envelope.

Seatwork:

Children place their sorted pictures into the red (sweet) envelope and the green (not sweet) envelope.

Notes:

1. The primary abstraction that sweetness is due to sugar is one of the subsumers needed for this lesson. (This

subsuming concept appeared to be held by all of the children after the completion of Lesson No. 1 and the review of it at the start of Lesson No. 2). Other assumed subsumers were the concepts of the colors red and green. (Check for color blindness).

2. It is essential that children understand the instructions, hence the demonstrations and drill in item 1.

3. The colours red and green of the mats and envelopes correspond to the colors of traffic lights, with which most children are familiar. The reinforcing concept being developed is, green for "go" (go ahead and eat) and red for "stop" (stop eating). An exciting example of integrative reconciliation occurred when the children applied the subordinate concept of red, "stop," green, "go," to begin building the superordinate concept in which the colors were applied to the classification of foods.

4. Cognitive bridging is provided in the review of the previous lesson. (This bridging by review is characteristic of the start of each lesson in this program; no further mention is made of this feature).

5. The broad, most-inclusive concept, "we are what we eat" is narrowed in this lesson to include the more subordinate concept that foods can be classified as sweet or not-sweet.

The review of Lesson No. 1 further differentiated the concept that we tend to like sweet foods but we cannot live on these alone.

6. The classification of foods as sweet or not sweet is an arbitrary one. In this lesson children are taught to apply the "more or less" principle in their deliberations. In the event of a stalemate, the teacher decides, high, low, or discard.

Observer's Comments

1. Children easily recalled material of Lesson No. 1.

2. Little difficulty in sorting and in placing pictures on the appropriately colored mats.

3. Teacher's help was required by only four or five pupils.

4. Children cooperated well in group work.

5. Children appeared highly interested, animated and responsive.

6. Much enthusiasm was generated with the correlation between the red and green mats and traffic signals.

7. Development lead to introduction of term "natural" sugar. (Children's question regarding sweetness of apples).

Researcher's Comments

The ready recall of Lesson No. 1 was due in part to rote-reception learning but meaningful learning and concept differentiation were also taking place as evidenced by the fact that they were able to classify the pictures on the basis of previous discussions.

Lesson No. 3

Objective:

To review Lessons No. 1 and No. 2.

Instruction:

1. Informal discussion of all work to date.

2. Stress the scheme for classifying foods as sweet or not-sweet. Refer to pictures that have been cut out.

Seatwork:

1. Each group of four pupils has a red and a green envelope containing cut-out pictures (Lesson No. 2). Assign two pupils to work with the red envelope and two with the green.

2. Provide two poster-sized pieces of Bristol board, one red and one green. Each group pastes its pictures on the appropriate poster.

3. Teacher circulates; discusses the task with the children; labels each poster with a felt pen (sweet, not-sweet).

Notes:

1. Nothing new is introduced in this lesson; progressive concept differentiation takes place.

2. Item 5 provides a Language Experience approach to the teaching of reading and writing.

3. The pause in instruction allows for explicit association between new learning and existing cognitive structures i.e., cognitive bridging. Novak's model recommends consideration of pacing on the way to achieving concept mastery. Capable students can assist the less capable (under teacher's direction) until concept mastery is achieved. Enrichment for capable students may be provided by asking them to cut out other sweet things not necessarily present at Halloween.

Observer's Comments

1. Review procedures appeared to offer no problems in understanding green/go, red/stop as it applied to sugar in foods; well understood by most children.

2. One child asked if a candied apple would be considered sweet or not-sweet. Much discussion followed--concensus was that the apple itself was naturally sweet (low sugar) but the candied coating would be high sugar. Many expressed a reluctance to eat candied apples in future.

3. Children raised the importance of dental visits to control and correct cavities. Teacher led discussion around to the helpful role played by dentists. (Dentist not to be feared).

4. When asked, 10 of the 24 children indicated that they had a sugar bowl on the table at home.

5. When asked if they could use as much sugar from the bowl as they wanted one child replied, "Yes, but I'm going to quit."

Researcher's Comments

1. The ready acceptance of the significance of the red and green coding colors indicated further assimilation of this concept and increased integrative reconciliation.

2. The candied apple episode indicated the development of a secondary abstraction which suggested that composite foods should be considered on the basis of the sugar levels of

the components. Other examples were chocolate-covered raisins and peanuts.

3. The concept of the role of the dentist as a helper was spontaneously introduced by the children. The researcher capitalized on this interest and exploited the "teachable moment" and provided cognitive bridging between this new learning and existing subsumers relating sugar to cavities.

4. The "sugar bowl" question was not in the lesson plan but again the researcher allowed the introduction of this topic and knowingly went "off task." It was hoped that by so doing children would begin to consider the application of the concepts presented in the learning program to the home environment.

5. The one child's comment, "I'm going to quit," implied support for integrative reconciliation of the superordinate concept, "We are what we eat."

Lesson No. 4

Objectives:

1. Review Lesson No. 3.
2. Introduce bar graphing.

Instruction:

1. Pin up all charts made by the children.

2. Teacher reviews and drills the words "sweet" and "not-sweet" and the sorting exercise.

3. Teacher counts with children the numbers of sweet and not-sweet items.

4. Item for item, the teacher uses red and green stickers to incorporate the foods represented on the charts into a large bar graph. Red (sweet) items tend to predominate. Stickers may be grouped into bunches of ten on the graph.

Notes:

1. The review indicated in items 1 and 2 teach the children some of the sources of sweet (sugared) and not-sweet (not sugared) foods. Assimilation and integrative reconciliation of previous concepts took place.

2. Integration with mathematics began in items 3 and 4. The concept of one-to-one correspondence may be new to many children.

3. The concept of getting a mathematical (more than, less than), qualitative relationship from a graph was also likely new

to many children. This topic was ancillary to the overall objectives of the program and was not labored at that time. It was considered as merely an introduction to graphs.

Observer's Comments:

1. When questioned about the high-sugar items and what they might do, all children mentioned cavities or holes in teeth and in addition some pupils suggested they might "get fat."

2. The review discussion cycled back to Halloween and the words used to describe the high and low-sugar foods. The researcher stressed examples of foods containing natural sugar.

3. Little difficulty was encountered by most children in creating the two bar graphs based upon modules of ten items. Children were actively involved in counting, putting on stickers, answering questions.

4. Researcher introduced (ad hoc) the concept of place value, e.g., "2 groups of 10 and 1 left over = 21 and now we already have 1 in the 3rd group of ten. Therefore, we must begin counting at 22 for the next child who adds his total to the graph." Place value concept was apparently readily understood by many of the grade-one children.

Researcher's Comments:

1. It was noted with interest that although the subsuming concept of sugar causing obesity was evident in some of the pre-assessment drawings this lesson marked the first time that it was raised orally.

2. The concept differentiation of high and low sugar foods was enhanced by the introduction of additional exemplars.

3. The solving of the bar graphing problem obviously involved a high level of concept differentiation and well integrated secondary abstractions, i.e., the ability to group pictures into modules of ten and relate each module of ten to a colored sticker on the graph. Concept mastery was identified in those children who were able to translate the graph data back into foods.

It appeared to this researcher that five of the children lacked the cognitive development to handle this sophisticated concept. The researcher suspected these children were learning much of the material by rote-reception only.

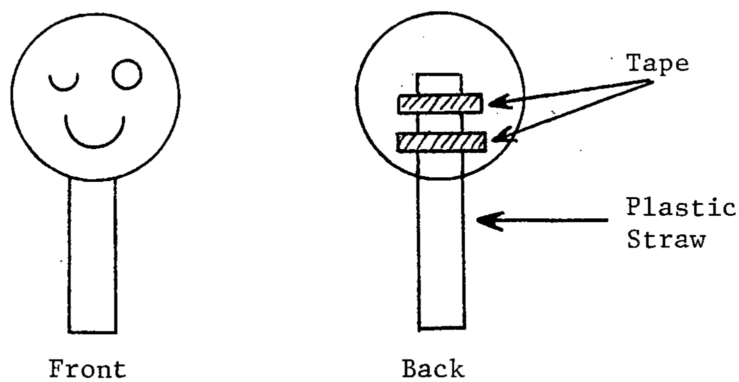
Lesson No. 5

Objectives:

1. Review Lesson No. 4.
2. Introduce the hand-puppet, "Sugar Shy."

Instruction:

1. Review the posters and the graph prepared in Lesson No. 4. Stress the terms, sweet and not-sweet.
2. Introduce the children to "Sugar Shy." Sugar Shy is constructed as follows: (Using a 10 cm, cardboard disc)



3. Teach and drill the meanings of, "wink" and "shy."
4. Introduce Act I of, "The Drama of Sugar-Shy"

   Teacher plays both roles as follows:

The Drama of SUGAR SHY

ACT I

T. What's your name?

C. I'm Sugar Shy!

T. That's a funny name. What does it mean?

C. It means I don't eat too much sugar.

T. How much sugar should you eat?

C. Very little.

T. What did you say your name was?

C. I'm Sugar Shy!

(Ordinarily, T. will be spoken by the teacher, and C. by the children.)

Seatwork:

5. Have the children complete Card No. 1. Explain the assignment by demonstration. Permit abler students to assist those needing help.

Notes:

1. The work to date followed the Novak model by offering a variety of concrete props, introduced at the appropriate times. Thus far the children have dealt with pictures, cut-and-paste posters, bar graphs, puppets and stencils.

2. Pupils have many relevant subsumers at this point, some initial and some learned. A conceptual hierarchy is

being created which includes at this time: "We are what we eat;" foods can be classified as sweet and not-sweet; there are many sources of sweet foods available; and the beginning of the concept that too many sweets may be unfavorable.

3. Enrichment could be offered in item 5. Those who finish the assignment early can try drawing a body for Sugar Shy.

Observer's Comments:

1. Review extended once again back to Halloween (Lesson No. 1).

2. Concepts represented by the graph appeared to be understood by most children.

3. The definitions and spellings of the words "wink" and "shy," were taught by role playing, e.g., "A new student is sometimes shy--show us how you might act as a shy new student." All children practiced winking.

4. Sugar Shy puppet was introduced by researcher saying, "I have a new friend I would like you to meet. My friend's name is Sugar Shy."

Researcher's Comments

1. The classroom teacher extended the introduction of graphing into the mathematics program of this class.

2. Primary abstractions were developed for the words "shy" and "wink." Even though these words may have already existed as subsumers, the role playing probably served to assimilate them into a functional primary concept; and perhaps to advance them toward secondary abstraction status, e.g., role playing a shy student.

3. The phrasing of the introduction of Sugar Shy was deliberately chosen to avoid any sexual designation.

Lesson No. 6

Objectives:

1. To review Lesson No. 5.

2. To have children create their own Sugar Shy puppets.

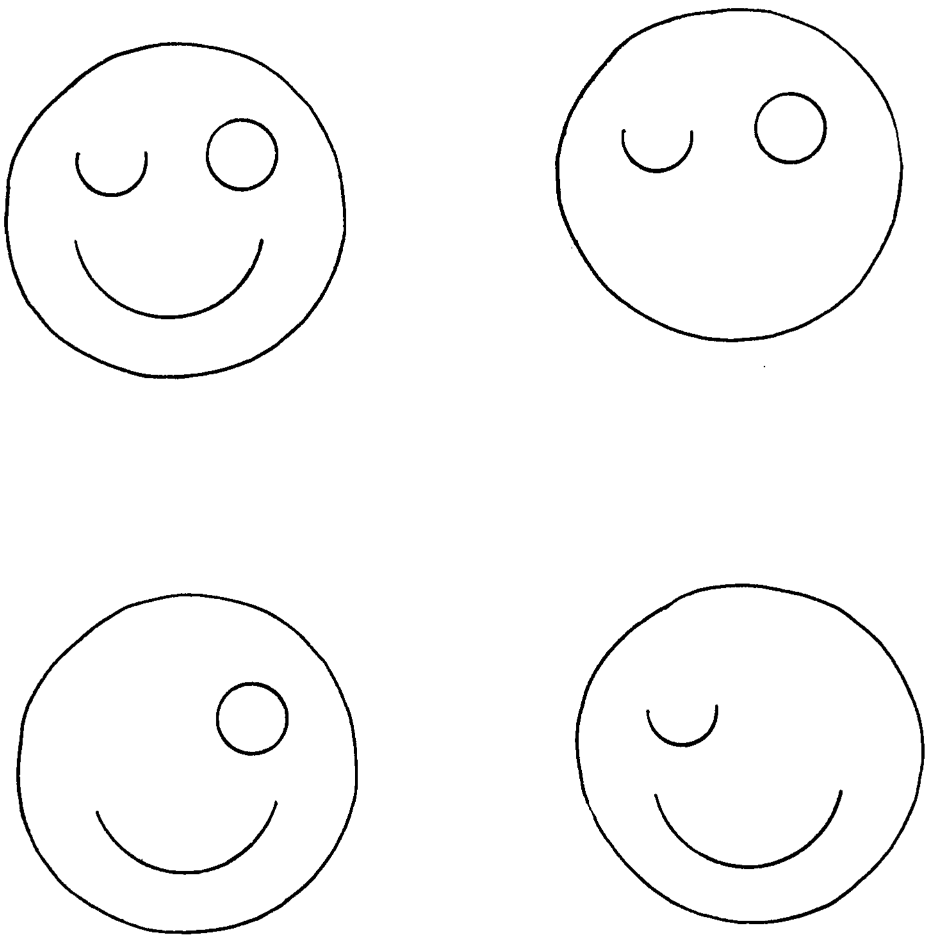
Instruction:

1. Re-teach ACT I of the drama.

   Review the meanings of the words, "shy" and "wink."

2. Review the stencil used in Lesson No. 5.

CARD NO. 1



Seatwork:

3. Use individual diagrams of sketches No. 2, No. 3, and No. 4 of the stencil to test the ability of individual students to correctly draw the face of Sugar Shy.

4. Give pupils green (go ahead and eat) circles of Bristol board, about 10 cm. in diameter. Students who can do so should be encouraged to cut out their own circles.

5. Have the children draw the faces for their own Sugar Shy puppets and attach the plastic straw to the back with tape.

6. Go through ACT I of the drama with the children using their hand-puppets and beginning to respond to the teacher's lines.

Notes:

No new concepts are introduced in this lesson; repetition, drill and reinforcement of concepts already presented.

<u>Observer's Comments</u>:

1. Students again expressed an interest in talking about natural sugars. The list of examples was expanded to include common vegetables, e.g., carrots.

2. Researcher asked "What might happen if Sugar Shy ate too much sugar?" Typical answers; "He might get too fat," and, "He would get holes in his teeth."

3. One pupil directed the class in the recitation of Act I of the Sugar Shy Drama.

4. Children were given a green circle (already cut out, to save time) and drew in the Sugar Shy face.

Researcher's Comments:

1. The puppet Sugar Shy was introduced at what this researcher considered to be an appropriate time according to the suggestion made in Novak's model regarding the introduction of concrete props.

Lesson No. 7

Objectives:

1. To review Lesson No. 6.

2. To introduce and teach the Sugar Shy song.

Instruction:

1. Repeat the instruction of ACT I of the drama using the hand-puppets created in Lesson No. 6.

2. Introduce the Sugar Shy song by singing it to the children with the accompanying hand gestures.

THE SUGAR SHY SONG

(To the tune of "Mary Had A Little Lamb")

Sugar Shy is what I am
What I am
What I am
Sugar Shy is what I am
I am Sugar Shy
I don't want holes in my teeth
In my teeth
I don't want holes in my teeth
I am Sugar Shy
I don't want to get too fat
Get too fat
Get too fat
I don't want to get too fat
I am Sugar Shy

Refrain: 1st verse

3. Teach and drill the meaning of the word "shy" as used in the song.

Notes:

1. Do not embarrass pupils who are already over-weight. Point out that the song says not to get <u>too</u> fat, (to respond to any taunts).

2. Music is now incorporated into the program. The tune is familiar and the words simple and repetitive.

<u>Observer's Comments</u>

1. Children grasped concept of the Sugar Shy Drama Act I. They used the puppet theatre and worked in pairs to re-create the drama.

2. Researcher introduced Sugar Shy Song by humming tune first and then adding the words. Children soon joined in. They appeared to enjoy the repetition.

<u>Researcher's Comments</u>

1. The introduction of music obviously motivated children to learn the words and thereby extend the progressive differentiation and integrative reconciliation of previously learned relevant concepts. According to Novak's model, motivation for learning can enhance the rate of new learning.

Lesson No. 8

Objectives:

1. To reinforce the role of sugar regarding cavities and obesity.

2. Drill ACT I.

3. Drill the song.

4. Introduce ACT II.

Instruction:

1. Discuss the effects of too much sugar upon the teeth and body weight, use the charts.

2. Drill ACT I in chorus, using puppets and gestures.

3. Sing the song, using the actions and puppets. Suggest one pupil as the choir leader (teacher gets them started and then withdraws).

4. Introduce ACT II in the same way that ACT I was handled, i.e., teacher plays both roles and uses a puppet.

ACT II: The Drama of Sugar Shy

T. "What's your name?"

C. I'm Sugar Shy!

T. That's a funny name. What does it mean?

C. It means I don't eat too much sugar.

T. What happens if you eat too much sugar? (a lot of sugar)

C. I may get fat.

T. What else may happen if you eat (a lot of) too much sugar?

C. I may get holes in my teeth

T. Do you want to get fat and have holes in your teeth?

C. No!

T. What did you say your name was?

C. I'm Sugar Shy!

Notes:

1. A review of the processes of observation and classification can be carried on during the use of the charts; e.g., "What have I added to your green charts?"

2. Encourage children to begin bringing pictures of other foods that they think could go onto the charts both red (HI) and green (LO).

3. It may seem that the pace is slow; it is. Children at this age like and need to make progress by a form of incremental repetition.

4. At about this time the teacher begins to use the comparison, "Sweet or sugared" and Sugar Shy," in addition to the already

established, "Sweet" and "Not sweet," classification labels. This comparison differentiates the meaning of the word, "shy," as used with sugar.

Observer's Comments:

Lesson proceeded well according to plan. Enthusiasm of pupils continued high.

Researcher's Comments:

1. Differentiation of previously learned concepts continued.

2. Genic variation appeared to cause no problems in the learning of the words of the song and drama.

3. In addition to rote-reception learning, opportunities were provided for discussions which enhanced concept differentiation.

Lesson No. 9

Objectives:

1. Review ACT I.

2. Drill ACT II.

3. Evaluate the ability of the children to identify the Sugar Shy logo.

4. Review the song.

Instruction:

1. Choral treatment of ACTS I and II with puppets. Teacher and children initially. Student leader appointed for ACT II; another to review both acts.

Seatwork:

2. Assign worksheets similar to the Creature Cards of the E.S.S. unit, "Attribute Games and Problems," (1975).

   (a) Card No. 1

   "Color Sugar Shy green."

   (Card contains three faces, Sad, Happy and Sugar Shy)

   (b) Card No. 3

   A row of three faces of Sugar Shy.

   "Each of these is Sugar Shy." Trace them in green.

   next, A row of three Sad faces.

   "None of these is Sugar Shy."

   next, A row of three faces, 2 Sad and 1 Sugar Shy.

   "Which of these is a Sugar Shy?"

   Trace Sugar Shy in green.

Notes:

1. Children are now being asked to discriminate between Sugar Shy and other faces. This use of the processes of observation and classification will assist the children to differentiate the features of Sugar Shy. The visual product enables the teacher to tell which children have mastered the learning of the logo.

Observer's Comments:

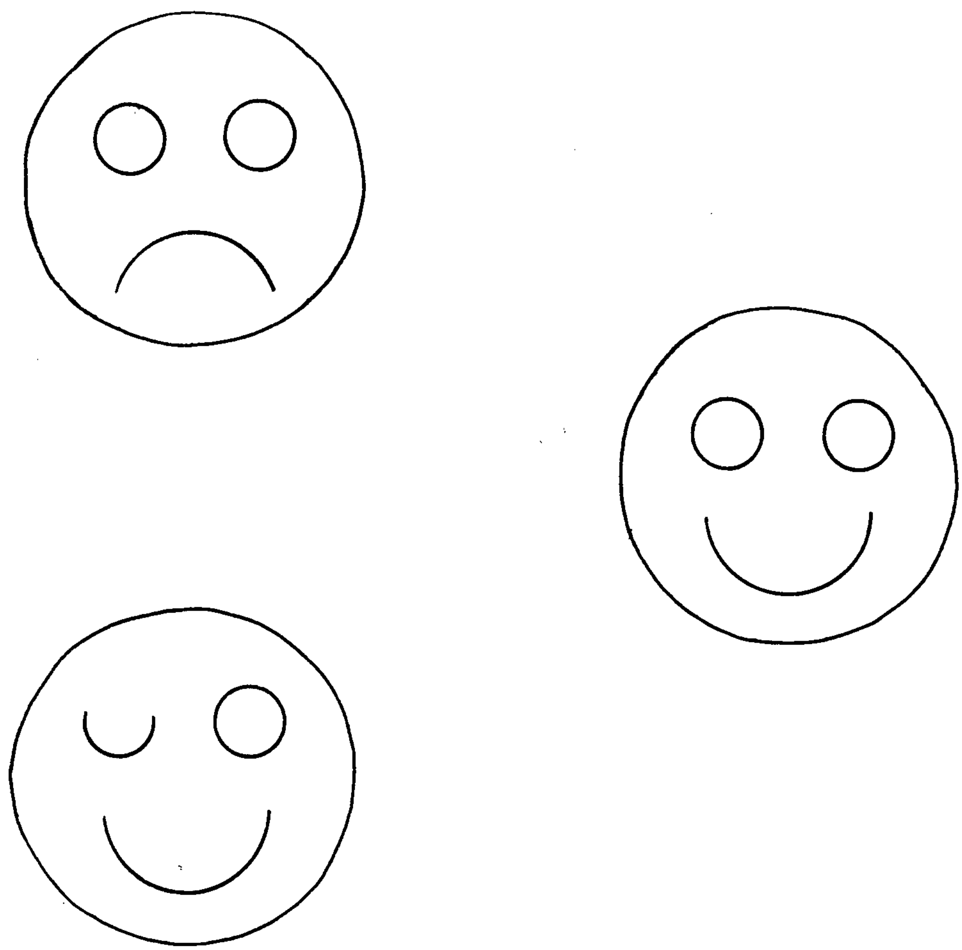
1. Every child in the class successfully colored Sugar Shy green - Card No. 1.

2. Three pupils failed to color the last row correctly by marking the first figure in the row green - Card No. 2. All other faces were correctly colored.

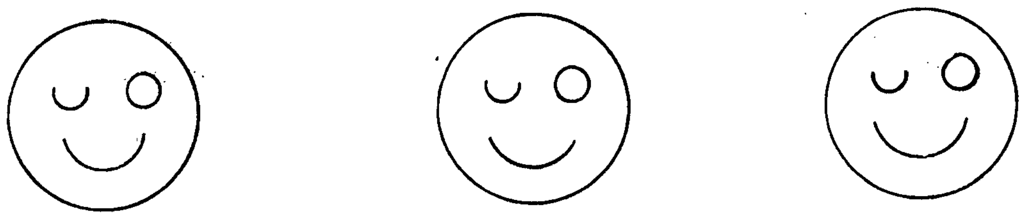
Researcher's Comments

1. The visual presentations of the children permitted the researcher to quickly identify those children who had not yet developed the primary abstraction of the configuration of the Sugar Shy logo.

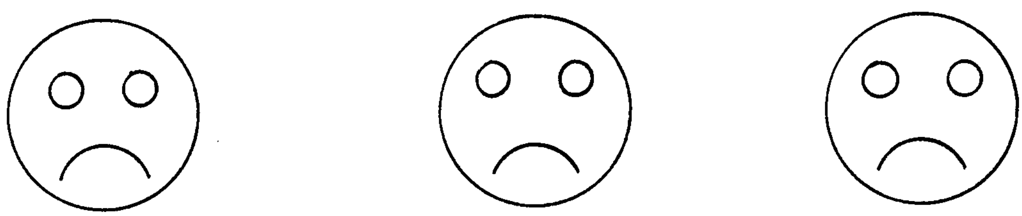
C A R D   N O. 2



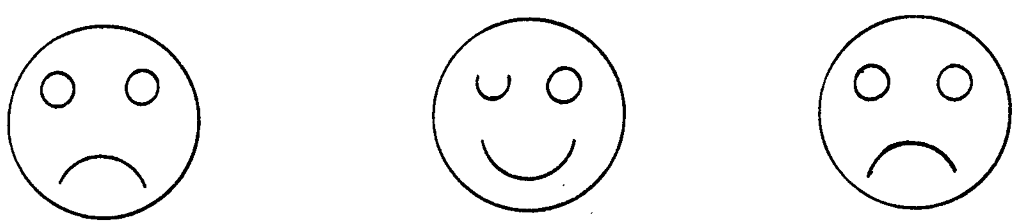
Card No. 3 SUGAR SHY



Trace them in green.



None of these is Sugar Shy.



Which of these is Sugar Shy?

Trace Sugar Shy in green.

Lesson No. 10

Objectives:

1. Review of Lesson 9.
2. Drill ACTS I and II.
3. Review the song.
4. Review foods low in sugar.

Instruction:

1. Choral work on song and ACTS as before. New student leaders selected.

2. Review the green charts to stress foods that are of low sugar content. Use the term "Sugar Shy" to help describe these. Draw attention to the Sugar Shy logos drawn on the charts. Review the meaning or message that this logo conveys.

Seatwork:

3. Review the previous day's work with the classification cards (stencils).

   Assign two new cards as follows:

   (a) Card No. 4. A row of Sugar Shy (3)
   "Each of these is a Sugar Shy." Trace in green.

A row of three Happy Faces.

"None of these is a Sugar Shy."

A row of two Sugar Shys and one Happy Face.

"Trace every Sugar Shy in green."

(b) Card No. 5. Same, except second row has 2 Sad and one Happy. Last row has 1 of each kind of face.

Notes:

1. If children cannot read, the directions for the cards can (successfully) be given orally.

2. Tracing Sugar Shy in green reinforces the use of green as the background color for the low-sugar (sugar shy) charts. i.e., they are learning to associate green with Sugar Shy and Sugar Shy with sugar-shy foods.

3. Let those who have finished early offer assistance if needed.

<u>Observer's Comments</u>:

1. Researcher reviewed Happy, Sad and Sugar Shy faces with board work prior to assigning Card No. 3. After Card No. 3 was completed the outcomes were discussed. A mini lesson took place with children who appeared to need help (5); others proceeded to Card No. 4. All children com-

pleted both cards during the alloted lesson time. Abler students willingly assisted the slower pupils.

Researcher's Comments

1. Once again the pictorial work aided the researcher in determining the levels of concept differentiation of the children.

2. It appeared that five children were experiencing difficulty. However, working with them on a one-to-one basis and offering a few cues improved their performance. (Refer back to comments in Lesson No. 4).

3. Children asked if they could color non-sugar shy faces red. This indicated that they might be using the red/green, stop/go color-coding concept to sort foods.

Lesson No. 11

Objectives:

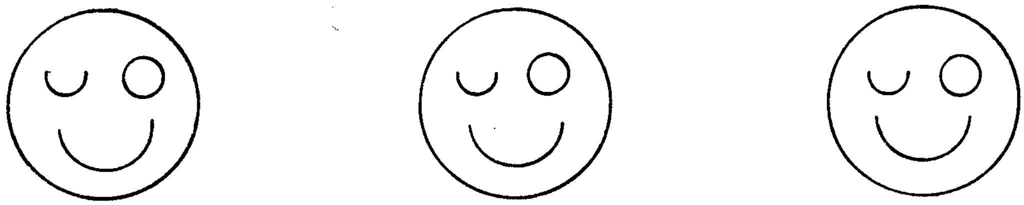
1. Review of Lesson No. 10.

2. Review ACTS I and II.

3. Review the song.

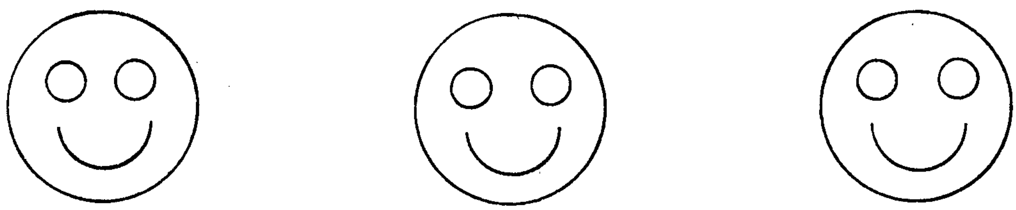
4. Introduce the Sugar Shy stickers on pictures.

Card No. 4

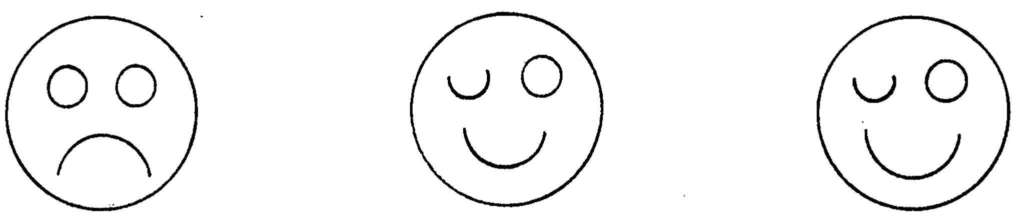


Each of these Sugar Shy.

Trace in green.



None of these is Sugar Shy.



Trace every Sugar Shy in green.

Instruction:

1. Choral work on ACTS I and II as before.

2. Class presented with pictures and containers of foods not previously discussed. Teacher discusses the materials with the children and affixes a green, Sugar Shy sticker on the sugar-shy foods with the lower sugar levels. Children take turns sticking them on. Pictures and products are left available to children between lessons.

3. Close as usual with the song.

Notes:

1. The introduction of the stickers reinforces the concept that a <u>green</u>, Sugar Shy logo can serve as an indicator of food with a lower sugar level.

2. Stress upon the color green and the extinguishing of the color red is a deliberate attempt to overcome the color-code dependency detected in Lesson No. 10, i.e., at this stage the program is only concerned with the identification of low-sugar foods by means of a green logo.

<u>Observer's Comments</u>

1. Researcher asked during review:

   (a) "If I had a food with only a little bit of sugar added to it would I put a sugar shy sticker on it?" Response: "Yes!"

(b) "What kind of a sticker do we put on any that has only a little bit of sugar in it?" Response: "Sugar Shy."

(c) "Would you put a Sugar Shy sticker on a chocolate bar?" Response: "No!"

(d) "How can you be sure that a food has a low-sugar level?" Response: "If it had a Sugar Shy sticker on it!"

(e) "What color is a Sugar Shy sticker?" Response: "Green."

2. Few errors were committed in sorting and affixing stickers. (Same five children needed extra help).

Researcher's Comments

1. The ease with which most children sorted and applied the stickers was evidence to this researcher of concept mastery, i.e., the ability to solve a novel problem. This mastery indicated well-differentiated primary abstractions and a high level of integrative reconciliation of secondary abstractions.

Lesson No. 12

Objectives:

1. Review of Lesson No. 11.

2. Test of concept mastery.

Instruction:

1. Review the products and pictures which were labelled with the Sugar Shy stickers in Lesson No. 11. Drill the significance of the sticker as an indicator of sugar-shy foods.

2. Children required to assign Sugar Shy stickers to one-half of the unmarked boxes and then sort out those which contain (supposedly) low sugar foods.

3. Provide additional pictures and products for the children to label with Sugar Shy stickers.

Seatwork:

4. Children sort products and pictures into two piles; those with Sugar Shy stickers and those without. Teacher circulates to check on the ability of the class to do this sorting. Assistance, as needed, by teacher and those who have completed the task.

5. Close with the song.

Notes:

1. Teacher checks to make sure that the sorting is not being done merely on the basis of the presence or absence of the logo. The significance of the logo relative to sugar content should be checked.

2. During the discussions as to which foods should be labelled with the stickers, the children are learning the names of items of food which are in both the high and low-sugar groups. This is not one of the objectives of the program; if it happens, consider it a bonus! Do not drill or test for it at this time.

Observer's Comments

1. Researcher presented children with an assortment of twelve various sized packages wrapped in plain paper.

   Sample Questions:

   (a) "We don't know what is in this box. Suppose I tell you that it contains a low-sugar food. Which sticker would you put on the box?"

   Response: "I'd put on a Sugar Shy sticker."

   Teacher invited child to do so. Next item was said to contain a high-sugar food. Children agreed that it would not receive a Sugar Shy sticker. Procedure repeated until half of the items carried the Sugar Shy logo.

   (b) Researcher asked, "Suppose you went into a store and found all of these packages on the shelf. Which of these packages would contain low-sugar foods?"

   Response: "All the ones with Sugar Shy stickers."

2. One child said that he could eat anything that was in the family freezer because his mother had put a Sugar Shy sticker on it.

3. Most children appeared to have mastered the concept of the identification of the logo and its significance as an identifier of low-sugar foods.

Researcher's Comments

1. This researcher was pleased with the apparent levels of success displayed by the children during this summative exercise.

2. It appeared that most children understood that excess sugar consumption could contribute to dental caries and to obesity. Further, they seemed to appreciate the role that the Sugar Shy logo could play in assisting them to identify low-sugar foods.

3. This researcher felt the children were now ready for the post-program assessment of their cognitive structure vis-a-vis sugar and nutrition.

LEARNING CENTRE

During the instructional program a learning centre was set up for the children to use on their own. The materials at the centre were changed from time to time.

The backdrop for the centre consisted of a white, central portion containing a large, green Sugar Shy logo, flanked by a red poster of higher-sugar foods and a green poster of lower-sugar foods. The green poster also carried several Sugar Shy faces as part of the background.

The station was introduced after the children had encountered Sugar Shy in the program, i.e., soon after Lesson No. 5.

Activities and materials for the centre are presented as follows:

Activity No. 1

"FIND SUGAR SHY"

This activity is designed to teach children to discriminate between the Sugar Shy logo and other similar faces, thereby imprinting and reinforcing the attributes of the logo.

Form (a):

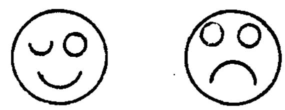
1. Children are presented a bundle of eight envelopes, numbered from one to eight.
2. Each envelope contains a pair of cards. One card carries the Sugar Shy logo, the other a face which is similar but not identical.

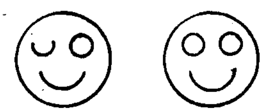
3. Children compare the sketches with the large logo of Sugar Shy on the backdrop and decide which two drawings correspond.

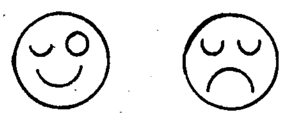
4. A child in doubt is instructed to seek the aid of a classmate. If these two cannot resolve the problem then a third child is invited to assist. If these three are unsuccessful then the teacher's help is sought.

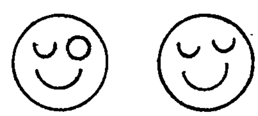
5. Sketches are returned to the Numbered envelope. (cards carry numbers which correspond to the envelope).

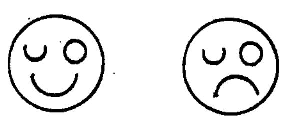
Envelope No. Sketches

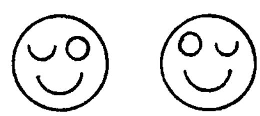
1 

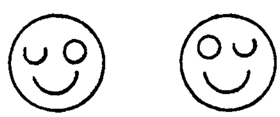
2 

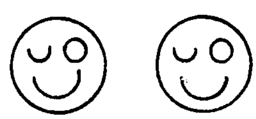
3 

4 

5 

6 

7 

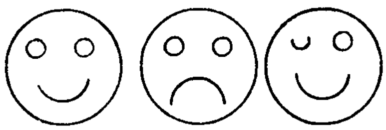
8 

Form (b) of Activity No. 1:

1. Faces presented three at a time.

2. Faces are drawn on flaps of green cloth (felt) pasted by the top edge to a card (minimum size of card is 5" x 7").

3. Child looks at all three faces at once, - decides, - lifts flap to check. If correct a Sugar Shy sticker is found under the flap.

Card No. 1 

Card No. 2 

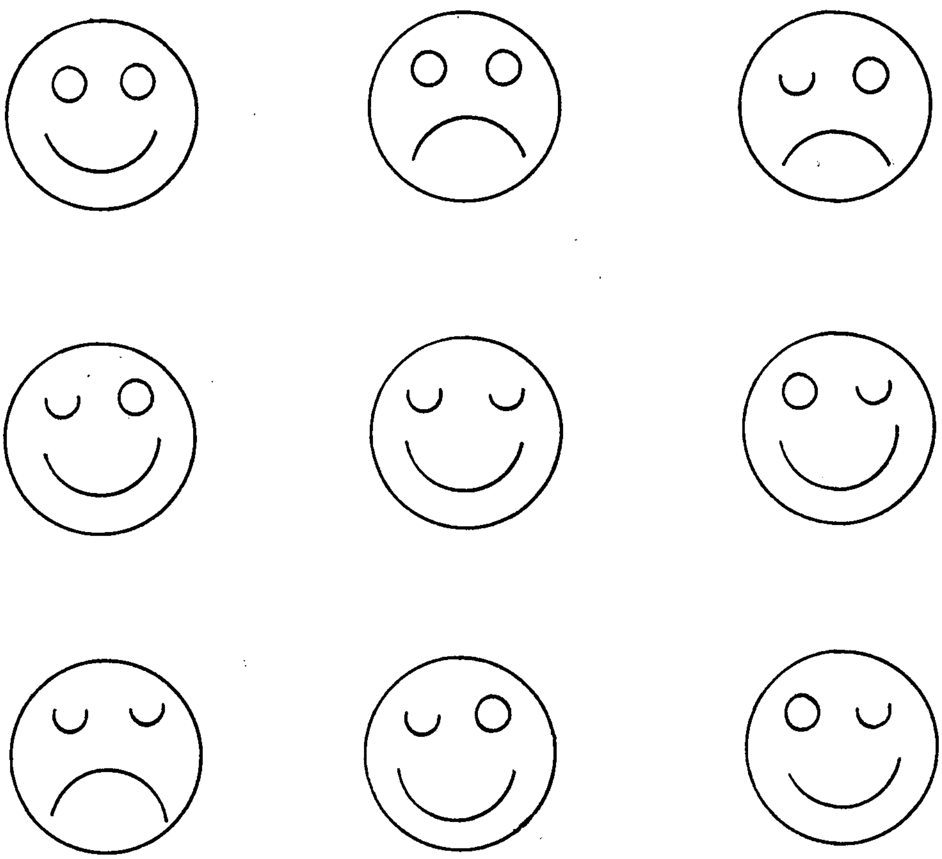
Card No. 3 

Card No. 4 

Form (c) of Activity No. 1:

1. Child examines 9 faces at once.

2. Child decides which face(s) are Sugar Shy and lifts the flat to confirm by the presence of the Sugar Shy sticker.



5. Sketches are returned to the numbered envelope.
(Cards carry numbers which correspond to the envelope).

Envelope No. Sketches

1

2

3

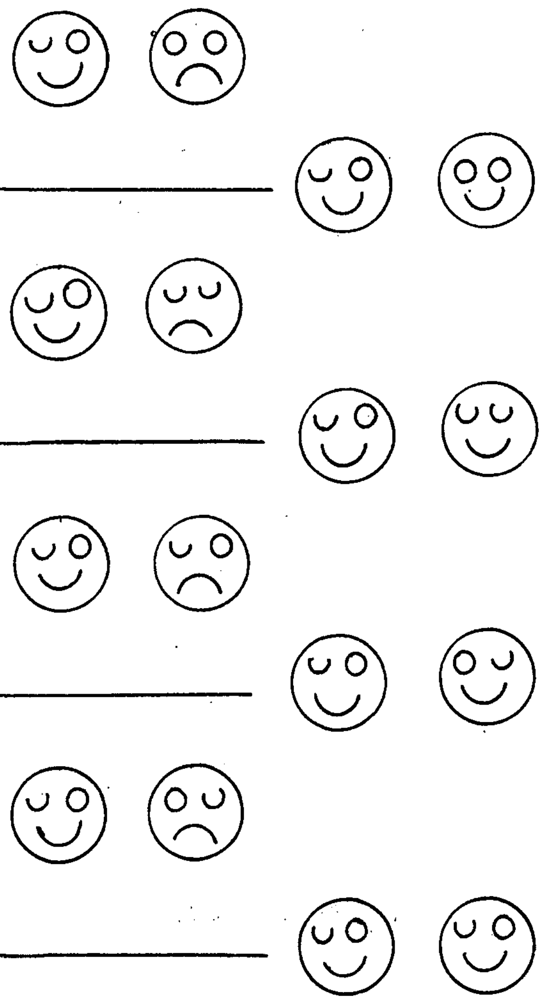
4

5

6

7

8



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Card No. 1

Card No. 2

Card No. 3

Card No. 4

Form (c) of Activity No. 1:

1. Child examines 9 faces at once.

2. Child decides which face(s) are Sugar Shy and lifts the flap to confirm by the presence of the sugar Shy sticker.

Activity No. 2:

"SUGAR SHY IN THE DARK"

1. Children are confronted by an empty cardboard carton lying on its side, the bottom toward them.

2. Two hand-holes are cut in the bottom of the box and covered by a cloth or paper flap pasted to the bottom of the box.

3. A partner places two cards flat, inside the box, and a child places both hands through the holes and feels the surfaces of the cards.

   The cards have been prepared (by children) by drawing a face, pouring glue on the outline and then sprinkling sand into the glue before it dries. This results in a raised and roughened outline of each face.

4. Cards are prepared with a Happy Face, a Sad Face and a Sugar Shy logo, (two of each).

5. Any two cards are presented at any one time.

6. Begin with one Sugar Shy and one of the others (e.g., sad). Next, Sugar Shy and a Happy Face (If children encounter difficulties).

7. Child is required to identify the faces by touch.

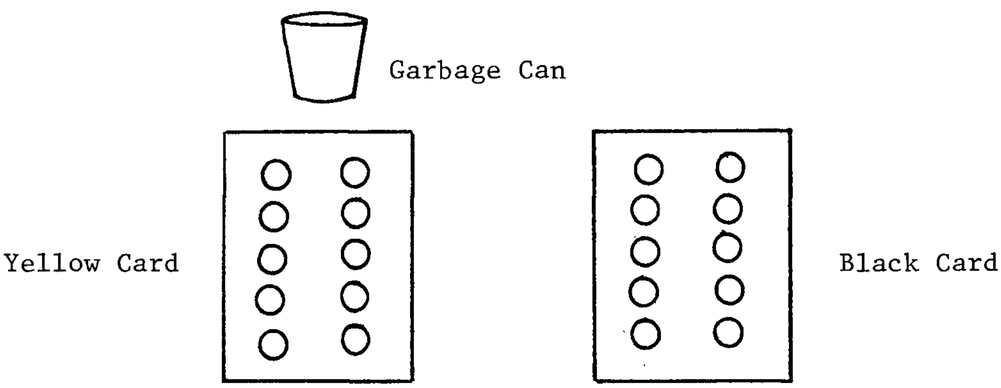
Activity No. 3:

"I'M ALL SUGAR SHY!"

Form (a) of Activity No. 3:

Materials: 10 sugar cubes daubed with yellow (1 color)
10 sugar cubes daubed with black (another color).
(Do not use red or green for these colors, they are coded for higher and lower sugar levels.)
1 paper or styrofoam cup as a "garbage can."
1 pair of dice, made from sugar cubes, with opposite faces daubed with opposite colors (e.g., a yellow face always opposes a black face).

Each player has a card outlined in one of the colors.
Each card has 10 numbered, Sugar Shy logos on it.
The game is set up on the floor as follows:



Each of the Sugar Shy logos on the yellow card is covered by one of the yellow sugar cubes. Similarly, for the black.

Rules of Play:

1. One player picks up the dice, one in each hand, while the other looks away.

2. Player who looked away has to guess which hand has the color of dice corresponding to his card. If successful he wins first toss of the dice.

3. The object of the game is to get rid of your sugar cubes by putting them in the "garbage can" and thereby expose ALL of your Sugar Shy logos and become ALL Sugar Shy. Winner declares, "I'm ALL Sugar Shy!"

4. Dice are rolled.

   If the player rolls and get <u>two</u> faces of his color up, then he places one of his sugar cubes (No. 1) in the "garbage can." If one of each color of face comes up he gets another turn. If two of his opponents colors come up he loses his turn and the dice go to the opponent.

Form (b) of Activity No. 3 "I'M ALL SUGAR SHY!"

Equipment as before, except:

Each die is marked with <u>one</u> color.

One face of each cube is marked with a single dot, the face opposite with two dots.

One player becomes "odd" or "even" for the game (decided by the first throw of the dice).

Rules of Play:

1. To discard a sugar cube the "odd" player must roll an odd number <u>in his color</u>. Similarly for the "even" player.

The following rules apply to the outcome of a throw:

2. color correct, odd or even correct, discard a sugar cube;
3. color correct, odd or even incorrect, take another turn;
4. color incorrect, odd or even correct, take another turn;
5. color incorrect, odd or even incorrect, lose a turn.

Form (c) of Activity No. 3 "I'M ALL SUGAR SHY"

(For children who can count up to 12)

1. Use regular dice or sugar cubes so marked (no color coding necessary).
2. Each player becomes, "over 7" or "under 7" for the game (decided by the first throw of the dice).
3. To win the privilege of discarding a sugar cube into the "garbage can" you must roll over or under 7, whichever.
4. Roll 7 and the player gets another turn.
5. Roll incorrectly and lose the dice to the opponent.

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