THE DEVELOPMENT AND EVALUATION OF THREE PREVENTIVE DENTAL HEALTH EDUCATIONAL PROGRAMMES, UTILIZING DIFFERENT RESOURCE MATERIALS, DESIGNED TO IMPROVE THE SNACK HABITS AND NUTRITION AND DENTAL HEALTH KNOWLEDGE OF GRADE 5 SCHOOL CHILDREN

by

HELEN IRENE HALE

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ABSTRACT

THE DEVELOPMENT AND EVALUATION OF THREE PREVENTIVE DENTAL HEALTH EDUCATIONAL PROGRAMMES, UTILIZING DIFFERENT RESOURCE MATERIALS, DESIGNED TO IMPROVE THE SNACK HABITS AND NUTRITION AND DENTAL HEALTH KNOWLEDGE OF GRADE 5 SCHOOL CHILDREN

Three nutrition and dental health educational programmes were developed with the purpose of evaluating the effectiveness of several resource materials in changing the behaviour of grade 5 children. The objectives of the educational programmes were to: (1) improve knowledge about nutrition and dental health, (2) increase or maintain the consumption of nutritionally and/or dentally acceptable snack foods, (3) decrease the frequency of sucrose-snack consumption between meals, and (4) increase or maintain the selection of nutritionally and/or dentally acceptable snack foods. Grade 5 teachers in Portage la Prairie were trained at a workshop to teach one of the three programmes. The NuDent Programme used resources which actively involved the students (puppets, comic/activity books), the Muncher Programme used a resource which relied on passive involvement (film) and the Basic Programme did not include resource materials. The three educational groups were compared with a Control Group which did not receive any programme. The effectiveness of the programmes/resources were evaluated with a nutrition and dental health knowledge test, a three-day food record and a simulated snack selection activity. Students who participated in an educational programme significantly improved nutrition and dental health knowledge but did not dramatically improve the quality of the snack foods they consumed and did not significantly improve the quality of the snack foods selected in the simulated activity. However, the frequency with which sucrose-snacks were consumed between meals was significantly decreased. The NuDent Programme appeared to be the most effective programme in improving knowledge and was the only programme which had a significant positive effect on the consumption of nutritionally and dentally acceptable snack foods. The success of the NuDent Programme was attributed to the preventive effect it had on those students who already had good snack habits. It was concluded that participation in a nutrition and dental health programme improved knowledge and decreased the frequency with which children consumed sucrose-snacks between meals. Furthermore, improvement in knowledge and maintenance of positive snack food consumption behaviour appeared to be related to the degree with which the resource materials actively involved the children in the programme.

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I. INTRODUCTION

Evaluation is very important in the teaching-learning process in order to assess whether the primary goal of education, that is behavioural change in the "desired directions", has been achieved. Unfortunately, evaluation of the effectiveness of school health programmes is probably one of the most neglected activities in the practice of public health (1,2,3). Many programmes are initiated and continued for years without a critical analysis of effectiveness.

McKenzie and Mumford (4) contend that much of what has been published concerning nutrition education consists of experiments which have been poorly designed and poorly evaluated. Firstly, many studies which report positive results are based on subjective assessments where researchers reported the instructors' impressions of the learning situation. Secondly many of the studies that deal with nutrition teaching of children in schools are evaluated for the immediate results and not for long term effectiveness of change in food habits. Thirdly, there is frequently a lack of adequate control groups, making it difficult to separate the influence of education from that of other environmental factors. Furthermore, Guba (5) maintains that a sign of failure of evaluation is the fact that it is so often incapable of uncovering any significant information. Over and over comparative studies of alternatives in education have ended in a finding of "no significant difference". If proper experimental procedures are followed, it is the contention of this author that "no finding" is a "finding", that is, that there really is no difference.

There could be many reasons for the limited extent of evaluation in nutrition education. One factor may be that most people associated

with nutrition projects usually feel that what they are doing is worthwhile, that the value is clear to all observers, and that the best has been accomplished with the resources at hand (2). Perhaps equally important is the fact that evaluation comes at the end of a programme and unfortunately many programmes never succeed in reaching completion (4). Another likely factor is that evaluation is difficult. A specialized staff is constantly required (2), considerable time is needed (4) and above all, nutritionists are not familiar with accepted varified procedures of evaluation (3). Guba (5) asserts that the blame should not fall entirely on the shoulders of educators since there is a need for professional evaluators to develop a technology of evaluation which practitioners would find operational.

In any educational programme, there are many factors which could be evaluated such as the rapport of the teacher, different teaching techniques and various resource materials. The factor evaluated in this research project was the resource material used in the educational programme.

It is important to evaluate the effectiveness of resource materials not only to improve their quality but also to determine whether the objectives for which they are being used are being fulfilled in the first place. In 1950, Ritchie (6) stated that little systematic work on this subject had been carried out. A review of the current literature indicates that there is still a lack of objective evaluation of teaching aids and educational resources. Such titles as "Puppets are Effective Teachers" (7), "Live Action Drama Teaches Nutrition" (8), and "Comic Book Approach Helps Teach Pupils to Think" (9), are typical of what is in the literature--creative ideas with subjective evaluations. The

question left unanswered is always--"Does the educational resource work?" The comments of Ritchie (6) on evaluation are pertinent to this thesis:

> "In a program of education in nutrition, efforts should be made to assess the results and the effectiveness of methods and teaching materials. The basic criteria are action and changes in behaviour which should be the real aim of any nutrition program..... Commerical companies can evaluate their advertising materials by the effects on sales, but teaching materials do not ring a cash register. To make a really scientific comparison between samples, a specific experiment or series of controlled observations is needed which measures the effects of the different materials on groups of people when all other factors are identical."

Therefore, the purpose of this study was to develop and evaluate several educational programmes, each of which utilizes different resource materials. The focus of the programmes was on the prevention of dental caries through dietary modification.

Dental health education is necessary since dental caries is a major public health problem. It has been estimated that approximately 98% of the population suffers from this disease (10). The problem is magnified by the irreversible and irreparable nature of the carious lesion which limits treatment to the removal of damaged tissue and replacement with metallic, ceramic or plastic substitutes. Furthermore, no other physical condition can profit so directly from preventive behaviour as can dental health (11).

Dental health education should start at an early age since the average child, in the United States, starts school with at least 3 decayed primary teeth (12). With development of permanent dentition, decay attacks the teeth at the rate of about one tooth per year. By age 20, the average young adult has 24 decayed, missing or filled teeth (12). While neglect of diet and oral hygiene during early years takes

a heavy toll in tooth decay, it also sets the stage for an even higher toll from periodontal disease in adulthood. This illustrates vividly the need for effective education of children in methods of preventing decay and gum disease. Since the average dentist and hygienist see a limited number of patients twice a year, the elementary school system is the likely setting for a comprehensive nutrition and dental health educational programme (13).

Dietary modification, as opposed to other approaches to dental caries prevention, was the focus of the educational programmes because this approach has not been exploited by health educators. According to Blinkhorn (14) "an apple a day keeps the dentist away" propaganda should make way for a more scientifically orientated set of simple preventive dietary procedures. In the present study, the educational programmes aimed to decrease the frequency of sucrose-snack food consumption and increase or maintain the consumption of nutritious, non-cariogenic snack foods among grade 5 children. The educational programmes also aimed to improve the students' knowledge about nutrition and dental health.

Active interest in this research was stimulated by the Home Economics Directorate, Manitoba Department of Health and Social Development who employed the author during the summer of 1975 to develop educational resources on the subject of nutrition and dental health for elementary school children. Both the Home Economics Directorate and the author were keenly interested in determining the effectiveness of these resources in changing behaviour.

II. REVIEW OF LITERATURE

A. DIET AND DENTAL CARIES

1. Etiology of Dental Caries

Dental caries, by definition, is a localized progressive process involving the loss of tooth structures such as the enamel, dentin and sometimes cementum (15). The most widely accepted theoretical cause of this process is that bacterial enzymes within the dental plaque ferment dietary carbohydrate which results in the production of organic acids; the organic acids diffuse out of the plaque, attack the enamel tooth surface and initiate demineralization of the hydroxyapatite. This is followed by dissolution of the enamel protein. The cariogenic bacteria then have access to the organic matrix of the dentin and cause its proteolytic degradation; the result is tooth cavitation (16,17,18).

Thus dental caries is fundamentally a dietobacterial disease in which there is an interplay of four principal factors, namely the host (particularly the teeth and saliva), the agent (dental plaque), the substrate (diet) and time (18,19,20). For caries to occur, conditions in each factor must be favourable. In other words, caries requires a susceptible host, a cariogenic flora and a suitable substrate which must be present for a sufficient length of time (20).

The logical approach to caries prevention, therefore, is based upon attempts to 1.) reduce the susceptibility of the tooth to decay through fluoridation of drinking water (21) and more recently by the application of occlusal sealants (22,23), 2.) lower the number of micro-

organisms in contact with the tooth by brushing and flossing (plaque control) (24), 3.) modify the substrate by selecting noncariogenic foodstuffs (19) and 4.) reduce the time the substrate is available in the mouth by limiting the frequency of intake (19). A comprehensive preventive programme should give equal weight to all factors since a hierarchy of importance has never been established. Points #1 and #2 are the realm of the dentist and dental hygienist and points #3 and #4 are the realm of the nutritionist. Having recognized the multifactorial nature of dental caries and that prevention requires a health team approach, this discussion will focus on the dietary component of the disease, culminating in dietary recommendations for prevention on the basis of the research cited.

An abundance of epidemiological and experimental evidence indicates that sucrose is a particularly cariogenic substrate. Evidence for the intimate relationship between sucrose ingestion and dental caries will be discussed under 4 categories:

- Epidemiological surveys of caries prevalence and human diets
- Industrial and consumer use of sucrose
- Studies on humans
- Experimental caries in animals

2. Epidemiological Surveys of Caries Prevalence and Human Diets

Circumstantial evidence linking sucrose consumption and human caries prevalence can be found in several epidemiological surveys. During the 1939-1945 war there was in many European countries, an

enforced change in dietary pattern (18). In general, the total consumption of carbohydrates was altered little but there was a marked reduction in the consumption of sucrose, sweets and manufactured confectionery. In the United Kingdom, these changes were accompanied by a decrease in dental caries experience in young children that continued until the rationing of sugar was eased and finally abolished (25). There was then a greater caries experience in children of the same age as those studied during the war (26). Similar findings were reported from Scandinavia (27) and Japan (28). The most likely reason, and the only common factors in all these studies, was the obligatory reduction in the consumption of easily fermentable carbohydrate, especially in the amount available for eating between meals (29).

Other indirect evidence associating dietary factors with caries experience has come from the study of primitive peoples. Dramatic increases in caries activity have been noted in the Bantus, Eskimos and Maoris when they adopted a "civilized" diet, the major change being an increased sugar consumption (30).

3. Industrial and Consumer Use of Sucrose

There is evidence that the incidence of caries has increased over the past 25 years (31). Surprisingly, there has been no significant change in per capita consumption of refined sugar by Canadians over the past 25 years (TABLE 1). Similarly, in the United States, there has been no appreciable change in per capita sugar consumption during the past 50 years (TABLE 2). However, today the bulk of sugar is used in manufactured foods instead of being used in the home (31,34). Sugar is used in a wide variety of foods, but the amount that is added to carbon-

TABLE 1

Pounds Per Capita Domestic Disappearance of Sugar in Canada, 1948-1973

	AVERAGE OF 5-YEAR PERIODS					
	(1) 1948-1953	(2) 1954-1958	(3) 1959-1963	(4) 1964-1968	(5) 1969-1973	% CHANGE PERIOD (1) TO PERIOD (5)
TOTAL SUGAR	98.63[a]	94.69	91.54	99.55	100.39	1.8%

a average of 6 year period

Statistics Canada, 1976 (32)

TABLE 2

Pounds Per Capita Consumption of Sugar-Containing Foods and Total Sugar in the United States, 1925-1971

	AVERAGE OF 5-YEAR PERIODS					
	(1) 1925-1929	(2) 1935-1939	(3) 1947-1949	(4) 1957-1959	(5) 1971[a]	% CHANGE PERIOD (1) TO PERIOD (5)
Confectionery	8.0	8.2	9.8	9.4	11.0	37.0%
Cereal & Bakery	7.7	9.7	12.9	15.4	17.6	130.0%
Processed Vegetables	4.6	4.4	9.0	9.8	10.4	126.0%
Dairy Products	2.3	2.4	4.6	4.9	5.8	152.0%
Beverages	5.0	5.2	10.6	12.6	22.8	356.0%
Total Processed	28.4	31.1	48.4	50.0	70.2	105.0%
Total Sucrose	100.0	97.1	94.8	95.4	101.5	1.5%

a Data for only 1971

Page, L. and Friend, B., 1972 (33)

ated beverages and snack foods has increased most rapidly (33). Furthermore, Canadians today rely to a far greater extent on ready-to-eat snack foods than did their ancestors several decades ago. The soft-drink market is perhaps the most obvious manifestation of this shift (Figure 1). According to Bibby (31) the increased use of snack foods can contribute to increased caries in two ways. Firstly, the manufacturing and refining processes result in foods which are more cariogenic in form. Secondly, the easy availability and variety of snack foods, along with other social influences, have given rise to habits of more frequent eating of sucrose-foods that contributes to caries. Furthermore, as indicated in TABLE 3, sugar-containing foods are used less frequently with meals when they would be least destructive and more frequently as snacks when they would be most damaging. Therefore, it seems likely that, in the light of today's food habits, the time and form in which sugar is used is more important than the amount eaten.

4. Studies on Humans

A number of studies have been done comparing the frequency and amount of sugar eaten with persons whose carious state is known (37-45). These studies vary in their method of dietary collection as well as what they consider to be high and low caries occurence. However, the investigators all conclude that the frequency of eating sucrose-containing foods is causally related to caries.

An example of this type of investigation was that of Duany et al. (37) who analyzed the dietary patterns of 46 caries-free and 40 caries-active students aged 12-14 years by means of a dietary history. Each student was given a weighted dietary score based on the frequency with

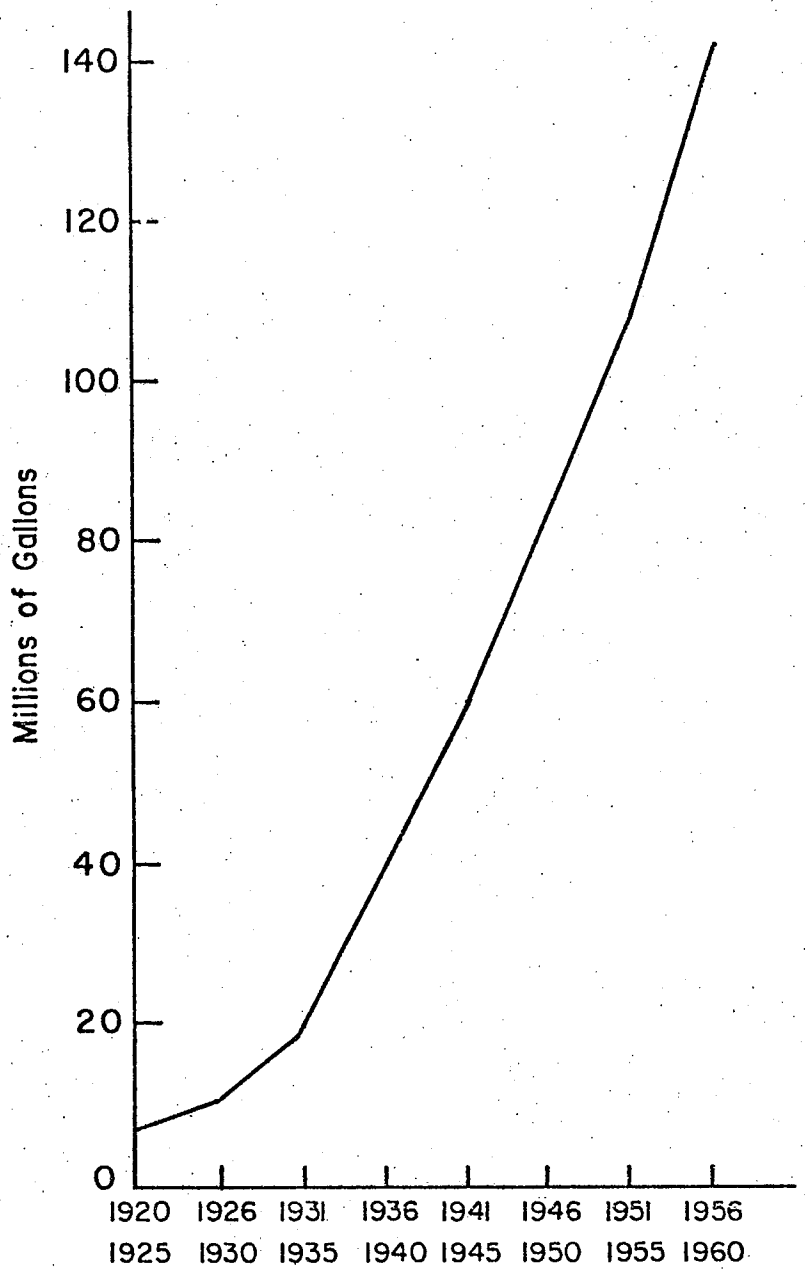

Figure 1 Physical Output of Carbonated Beverages, 1920-1960, Canada

Urquhart, M.C. and Buckley, K.A.H., 1965 (35)

TABLE 3

Changes in Per Capita Servings of Sweet (Dessert) Foods in 4,000 Homes, 1963-1968

FOOD	TOTAL %	DESSERT %	SNACK %
Soft drinks	+32.5	+114.3	+26.3
Cakes	- 9.8	- 32.8	+70.4
Cookies	-11.9	- 42.6	+39.9
Fruit	-10.9	- 38.5	+56.1
Snacks (Chips & so forth)	+28.1	+ 1.0	+63.2
Candy (Chocolate)	+29.2	- 37.2	+46.5
Other candy	+41.0	- 8.3	+48.0

U.S. Department of Commerce, 1969 (36)

which they consumed sucrose-foods. High weighted dietary scores reflected a history of frequent consumption of foods that contain sugar at and between meals and low scores indicated infrequent eating of sucrose-foods. The dietary scores were correlated with the DMF index (decayed, missing, filled surfaces) of the students. The results showed significant differences between the dietary regimes of the two groups. The caries-active group ate more frequently foods which contained a high concentration of sucrose such as candies, chocolates, ice cream and soda pop; their dietary scores ranged from 10 to 35. In the caries-free group, sucrose-containing foods were not often consumed and between-meal and bedtime snacks usually were absent; their dietary scores ranged from 4 to 18. Furthermore, a positive correlation of +0.70 was found between DMF surfaces and the dietary scores. These findings suggest a causal relationship between the frequent ingestion of sucrose-foods and beverages and dental caries.

Based on 24 hour recalls with parents, Weiss and Trithart (38) found that among 783 children, 4 and 5 years of age, there was a direct and consistent relationship between caries experience and the frequency of eating sucrose-snacks (gum, candy, soft drinks, ice cream). Specifically, those who ate 1 snack had a def (decayed, extracted, filled) score of 4.8; 2 snacks, 5.7; 3 snacks, 8.5; and 4 or more, 9.8.

Although these two studies as well as others (39-45) offer evidence for the positive relationship between frequency of sugar consumption and tooth decay, they have limitations since it cannot be inferred that present diets necessarily identify past eating patterns. It would be desirable to collect dental and dietary data at periodic intervals on a longitudinal basis. Investigators would then be able to observe changes

in eating patterns and concomitant caries incidence.

The most ambitious attempt to study the relationship between caries activity and carbohydrate intake was the Vipeholm study, conducted by Gustafsson et al. (46) at the Swedish Mental Institution between 1946 and 1951. The sample consisted of 436 adult inmates (mean age was 32 yrs.) who were placed on specific diets and observed over a 5-year period. The first year constituted an adjustment period during which a baseline caries index was established and all patients consumed a well-balanced diet with no candies or chocolate. The next 4 years constituted the carbohydrate study period during which the subjects were divided into groups in which the subjects were divided into groups in which the amount, form and frequency of sugar was modified.

The findings are summarized graphically in Figure 2. Definite increases in caries resulted from the sugar additions, but these increases were not proportionate to the amount of sugar used. The frequency of eating and the vehicle in which the sugar was contained were of more importance. The next dramatic increases in caries resulted when caramels or toffees were fed between meals. For instance the same 70 gms. of sugar eaten each day in caramels divided into four portions gave rise to almost twice as many caries as when it was divided into two parts. Twenty-four toffees fed ad libitum produced the greatest numbers of new carious surfaces/year. It was found that 30 gms. of sugar eaten in milk chocolate caused a mean of 1.35 carious lesions, whereas 40 gms. contained in toffee caused 3.55 lesions/year. Although the sugar content in toffee (40 gms.) was less than that of caramels (70 gms.) the toffee caused more caries because they were considered to be more rententive. Also, 160 gms. of sugar in bread gave rise to a mean of 1.30 lesions, whereas 330 gms.

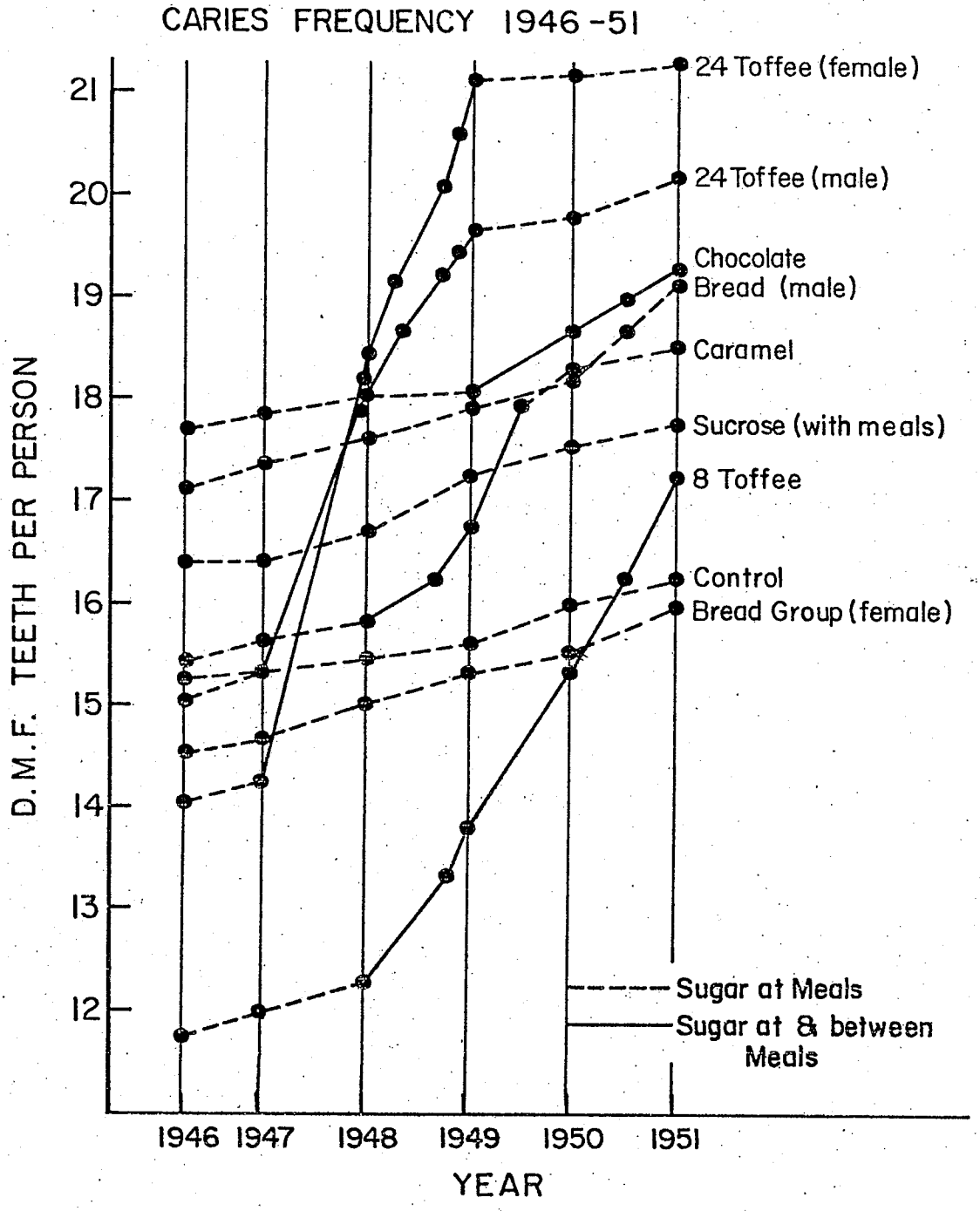

Figure 2: Vipeholm Caries Study Showing the Effect of Between-Meal Eating on Caries Activity.

Gustafsson et al., 1954 (46)

used with the same frequency in tea and coffee caused only 0.43 lesions/ year. In all instances, when the sugar was withdrawn, the caries-attack fell to the pre-test level.

This study has been criticized because young adults were used rather than children who have a higher caries susceptibility and more available surfaces to decay, and also because the data were reported in terms of new carious teeth rather than % of available caries-free surfaces (47). These criticisms have validity; however three important conclusions were drawn from the study which also have been shown in other human studies (37-45) and experimental studies on animals (48-52):

1) consumption of sugar can increase caries activity,
2) the more retentive the sugar the greater the caries activity, and of greatest importance,
3) the more frequently sugar is eaten between meals, the the greater the increase in caries.

5. Experimental Caries in Animals

Although there are differences between rodents and man in the composition of the saliva, morphology of the teeth and eating patterns, there are also pronounced similarities in the caries process as far as cariogenic flora and diet are concerned (20). Therefore parallels can be drawn between animals and man.

Stephan (48) compared the cariogenicity of a wide range of human foods fed to rats ad libitum in addition to their basic diet (dried skim milk powder and dried liver) which was noncariogenic when fed to the rats twice a day for 1 hour each time. Some of the findings are presented in TABLE 4. Foods producing a caries score of greater than

TABLE 4

Comparison of Rat Caries Produced by Different Human Foods Fed Ad Libitum

Food Material Added to Basic Diet	Mean Caries Score
Control	0
Corn chips; popcorn; peanuts; milk; lettuce; cabbage; lemons	0
Potato chips	1.6
Carrots	2.1
White bread + peanut butter	5.2
Graham crackers	8.7
White bread + raspberry jam	10.2
Honey graham crackers	19.2
Apples	19.4
Bananas	21.0
Grapes	24.1
Candy mints	24.7
Cola	29.6
Marshmallows	30.1
Raisins	30.9
Dates	32.7
Milk chocolate	34.1
Sucrose	62.1

Stephan, R.M. 1966 (48)

10.0 were considered significantly cariogenic. Note that sucrose gave by far the highest caries score. Also to be noted is that the apples, bananas and grapes produced carious lesions. They too contain fermentable carbohydrates (2-10% glucose, fructose & 1-9% sucrose) (49). Stephan (48) suggested, as a result of his rat study, that noncariogenic or "safe" food items which include corn chips, pop corn, peanuts, milk, lettuce and cabbage should be kept readily available in the home for children to eat as between-meal snacks.

There have been other animal studies which have compared the cariogenicity of different carbohydrates--starches, sucrose, maltose, lactose, fructose and glucose usually added to the animal diet in a powdered form (50-53). Under such conditions sucrose invariably proves deleterious by inducing smooth surface lesions more than any other carbohydrate while starch appears to be the least cariogenic.

The difference in cariogenicity between sucrose and starch and between sucrose and other sugars has been explained at a molecular level. Firstly, sucrose when compared to starch easily diffused through the plaque layers to the enamel surface where it is fermented to acids which are trapped there and demineralise the enamel. In contrast, the large non-diffusing starch molecules remain on the surface of the metabolically active micro-environment of the tooth--unless they are impacted by masticatory forces (54).

Secondly, sucrose is unique because extra-cellular enzymes preferentially use it to produce extracellular polysaccharides both glucans (from the glucose moiety) and fructans (from the fructose moiety) in the plaque (55). The glucans serve as structural components of the plaque matrix in effect "gluing" certain bacteria to the teeth. Microbes

held on the tooth surface by the polysaccharides build up a sufficient thickness so that the buffering effects of saliva are minimized and the diffusion of acid end-products of bacterial fermentation out of the plaque are reduced. Also, the fructans are degradable by the plaque-flora and may function as transient reserves of fermentable carbohydrate thereby prolonging the duration of acid production.

It should be mentioned that variables other than the sucrose content influence the cariogenicity of foods. Such factors as the acidogenicity of the food, the presence of acid buffers or enamel protective agents in the food, as well as flavour effects and food texture, which have a great effect on salivary response, all contribute to the food's caries potential (31).

However the evidence is fairly conclusive that snacking on fermentable carbohydrates is conducive to caries production especially if the snacks are of a retentive nature. Nizel (19) offers an explanation for this phenomenon. Each time the dental plaque is exposed to sucrose, it produces acid for 20-30 minutes. Thus frequent use of any combination of sucrose-foods could produce continuous acid formation on the tooth surface.

6. Dietary Recommendations for the Prevention of Dental Caries

In most school dental health programmes reported in the literature, the dietary component of preventive dental health has been given minor if any attention compared to oral hygiene performance. For example, in a study conducted by Williford *et al.* (56) it was planned to test the theory that dental health education would influence students to improve their oral health. It was decided that this improvement would

be the result of motivating the students to learn, understand and to practice the "essentials" of good oral health which included "good diet" and "avoidance of snacks". However the evaluation consisted only of a pre- and post-examination of oral debris, calculus and gingivitis. Other studies may evaluate a change in dietary behaviour as a result of dental health education by simply asking one or two questions such as: "Do you eat sweets between meals?" (57) or "Do you frequently drink soft drinks?" (58).

Since snacking has become a way of life, it is unrealistic to tell children to eliminate between-meal foods as a preventive measure for dental caries. Rather it is realistic to recommend snacks within the four food groups which are nutritious and compatible with dental health. However the degree to which different foods contribute to nutritional and dental health varies considerably. Four categories of snacks which consider the sugar and nutrient content have been devised jointly by the Ontario Society of Public Health Dentists, Ontario Society of Community Nutritionists and representatives from the Faculty of Dentistry, University of Toronto and Ontario Ministry of Health (59). The 4 snacking categories are presented in TABLE 5 and are described by these professionals as follows:

1) Good nutritional and good dental foods/snacks

   These foods are high in nutrients and low in sugar and therefore can contribute significantly to the total daily nutrient needs and will not promote dental caries. These foods are beneficial anytime.

2) Good nutritional and poor dental foods/snacks

   These foods are high in nutritional value but are also

TABLE 5

Joint Dental and Nutrition Education Policy on Snack Foods

1.) GOOD DENTAL AND NUTRITIONAL FOODS/SNACKS

Plain milk
Plain yogurt
Cheese

Raw fruits & vegetables
Unsweetened fruit or vegetable juices
Tossed salads or coleslaw

Plain muffins
Plain whole grain or enriched breads & cereals
Crackers

Hard-cooked devilled eggs
Peanuts, pistachios, mixed nuts
Seeds (sunflower, pumpkin, sesame)

Nuts & Bolts
Sandwiches, filled with meat, poultry, fish, eggs, cheese or peanut butter
Hot dogs
Hamburgers
Pizza

2.) POOR DENTAL BUT GOOD NUTRITIONAL FOODS/SNACKS

Milk puddings
Milkshakes
Chocolate milk or drink
Ice cream
Ice cream sodas
Yogurt, sweetened

Raisins & other dried fruit
Sherbet
Sweetened fruits and juices

4.) NUTRITIONALLY & DENTALLY UNACCEPTABLE FOODS/SNACKS

Sugar added to beverages such as tea or coffee
Soft drinks, regular
Honey
Jams
Jellies
Sweet baked goods
Chocolate bars
Cookies
Candies, lozenges, regular gum and breath mints

3.) NUTRITIONALLY POOR BUT DENTALLY ACCEPTABLE FOODS/SNACKS

French-fried potatoes
Popcorn
Potato chips
Pretzels
Soft drinks, sugar-free
Cheese sticks & other similar party snacks

RECOMMENDED BY:

Ontario Society of Public Health Dentists

Ontario Society of Community Nutritionists

Representatives from Faculty of Dentistry, University of Toronto and Ontario Ministry of Health

high in sugar content. It is better to consume them with meals when there is a greatly increased flow of saliva to neutralize the acids formed in the mouth from the sugar.

3) Nutritionally poor but dentally acceptable foods/snacks

Although these foods are relatively harmless to the teeth due to low sugar content, they contribute little toward fulfilling nutrient needs and therefore should be used with discretion.

4) Poor nutritional and poor dental foods/snacks

These foods are high in sugar and are not acceptable as between-meal snacks. They are also low in nutritional value and should not replace the high nutrient foods in the diet.

Children should be advised to avoid the frequent ingestion (nibbling) of foods that contain sucrose. According to Keyes (60) it is not realistic to expect patients to eliminate all sweets from their diet. However "all the sweets you wish once a day or with your meal" is a reasonable compromise.

Furthermore, as nutritionists we are not justified in merely restricting sugars because the teeth are already formed. We also have the responsibility to give nutritional advice that will provide for protection of all body tissues (61). A comprehensive nutrition and dental health educational programme should include the principles of a well-balanced diet as well as "sugar control".

II. B. DIETARY PREVENTION OF DENTAL CARIES THROUGH EDUCATION

1. Who Should Receive the Educational Programme

A review of the literature indicates that the elementary school child should be the target group for education. Firstly, dental caries is primarily a childhood disease and represents the most common of all dietary problems of the elementary school-aged child (14,62). The American Dental Association gives priority to the 6 to 12 year age group for dental health education because this is the age of permanent tooth formation (63).

Secondly, elementary school children frequently consume soft drinks, candy, cookies, cake, ice cream and other sweets between meals (14,38,39,62,64-70). For example, the Nutrition Canada Survey (1970-1972) (70) found that 95% of children 5 to 11 years of age consumed foods which were primarily sugar. The mean daily consumption was 51 gms. with approximately 1/4 eaten during each of the time periods (morning hours, noon hours, afternoon hours and evening hours). Furthermore in the study by Zita et al. (39), who analyzed a week's food intake of 200 children aged 5 to 13 years, it was found that approximately 1/3 of the weekly total sugar intake was in the form of between-meal snacks. Such between-meal food habits contribute to the occurrence of dental caries.

Thirdly, it appears that children generally have money to buy snacks and therefore have some control over their between-meal consumption habits (14,68,71). Blinkhorn (14), in 1972, studied the sweet-eating habits of 132 children, 10 years of age, in England and found that 67% of the sample spent money on sweets each week and only 18%

claimed that gifts such as picture cards influenced their sweet buying habits. A study of 54 San Francisco children, aged 8 to 12 years, in 1974 (71) indicated that all of the children had some money and that about ½ of their weekly allowance was spent on snacks largely consisting of cokes and chocolate bars.

The problem facing children today is that sweet eating has become a social norm (14). Presents of confectionery as a reward for good behaviour, for birthdays, Christmas and Easter presents is a common practice. In Blinkhorn's study (14) it was found that sweets were used as a means of securing friends and gaining prestige in the group. The study in San Francisco (71) indicated that children were influenced primarily by television and their peers in their choice of snacks. The effect of television is not surprising when one considers how children are bombarded with Saturday morning commercials designed to "magnetize" the child's mind to search for the syrupy, sweet taste in life - "Coke--it's the real thing", "Life Savers--just a part of living", "The Pepsi Generation" (72); not to mention the famed Cookie Monster on Sesame Street who devours cookies by the box (73).

Thus a fourth reason to educate elementary school children is to help them understand and deal with the many inducements to buying food and drink. Through education the child can learn the essentials of diet and dental health: what to eat, when, and how it affects his oral status. Theoretically, he will then be in a better position to make wise snack choices.

Fifthly, the establishment of positive nutritional and dental habits, attitudes and behaviour is best accomplished during childhood and thus major educational efforts should be focused on children (74,75)

76). Correct food habits established in childhood will benefit the child throughout his life and the children of today form the community values of tomorrow. Furthermore, food habits can be changed later only with difficulty and at much psychological cost. In a four-year study by Robinson et al. (77) designed to determine the effectiveness of dental health education given to 392 high school students, it was concluded that dental health facts may be learned after childhood, but that the knowledge does little to motivate the alteration of preformed habits.

2. Who Should Teach the Educational Programme

According to Mutter, Health Consultant with the Ottawa Board of Education, the classroom teacher can be the most effective dental health educator (78). A combination of training in childhood education, daily pupil contact and a close rapport with a "captive" audience enables the teacher to have a more lasting effect on the dental habits of young people than the dentist. Furthermore, it is suggested that employment of an outsider such as a hygienist or nutritionist to teach nutrition and dental health is not as practical because he/she would only have limited time for each school (79).

According to Mutter (78) teachers have not assumed this role or been successful in this role in the past due to 3 "lacks":

1.) Lack of teacher training in this aspect of health education.

Meier (80) indicates that most teachers know nothing of the new concepts of preventive dentistry and feel they have educated their students if they have shown dental films and have given the children fill-in sheets of a tooth and its parts. In addition, studies have indicated a somewhat limited understanding of

nutrition by elementary teachers (81,82). In a study of nutrition knowledge and attitudes of 910 early elementary teachers in Nebraska (82), it was found that the overall nutrition knowledge scores were low. For example, concentrated sweets were thought to be essential for energy needs by approximately 80% of the teachers.

Nutrition and dental health education workshops appear to be the solution to this problem. The Ontario Milk Marketing Board conducted a workshop with 7800 elementary teachers in 1974 (83). The results were encouraging as 70% of the teachers who participated in the workshops taught nutrition to their classes; their students showed improvement in nutrition knowledge and there was improvement in claimed eating behaviour. A review of the dental health literature suggests that teachers could be taught new dental health concepts and techniques in a relatively short time and could, in turn, teach children to implement practices which would reduce dental decay (84-88). However, the success of any educational programme is highly dependent upon the motivation and enthusiasm of the classroom teacher as well as the adequacy of the training.

2.) Lack of attractive and effective teaching materials made readily available.

The daily schedule of the average teacher is an extremely heavy one, and if we are to burden her/him with teaching nutrition and dental health and expect her to be motivated in doing so, then it is our responsibility to supply her with resource materials (82, 89). According to Spitze (90), the availability of visual aids

including attractive and interesting materials, pamphlets, games and activities designed to help the teacher create an imaginative learning situation may be the decisive factor in a teacher's success with nutrition education. Masters (88) indicated the need for a simplified dental health education manual or guide which provides lesson plans for the teacher to follow.

3.) Lack of individual pupil supplies so that the children can "learn by doing"

For increased interest of the student, the pupil supplies should be interesting as well as instructional.

3. How to Teach the Educational Programme

The ultimate objective of nutrition education is to establish good food habits on a daily basis. Unfortunately, as nutrition educators we often lose sight of this purpose in our eagerness to disseminate information (91). We like to assume that individuals who have gained a basic knowledge of the concepts and principles of nutrition will be motivated to apply this knowledge in their food choices (92).

To succeed in nutrition education we must understand and apply the five principles of learning as outlined by Fleming in 1957 (93). Firstly, learning takes place more readily when emphasis is placed on the individual. The learner needs to feel that nutrition has meaning for him and the learning should be geared to his level of ability and his interests. Secondly, learning is facilitated as emphasis is placed on human relation factors; when the learner feels secure and that he belongs. Thirdly, learning tends to occur when the learner perceives what is to be accomplished, that is when the purpose is clear; when there is some

way of evaluating progress. The fourth learning principle of active involvement and the fifth principle dealing with the use of educational resources will be discussed separately.

Learning is facilitated when the learner is actively involved. The more the learner becomes involved by seeing, hearing and doing, the more he learns (94). Studies (94) have shown that of what people learn, they retain:

10% of what they read
20% of what they hear
30% of what they see
50% of what they see and hear
70% of what they say
90% of what they do

According to Gifft et al. (95) it is relatively easy to achieve physical involvement when learning subjects which require manual competence such as cooking or the proper way to brush teeth. Involving the student's mind is more difficult. These authors suggest several teaching methods which tend to build learner involvement.

One of the teaching methods which is suggested by Gifft et al. is the encouragement of verbal response. Questions posed throughout the class can induce the learner to do his own thinking, or can test understanding and relevance of the material. Albertini et al. (96) elicited a response technique in a dental health education programme by talking to 8 and 9 year old children informally about their feelings toward dentistry, dentists and dental health in general. In this way they determined what basic values, fears, misconceptions and interests existed and dealt with them accordingly. These researchers also used a problem-created technique in their programme. They asked the children to help them solve a problem, namely, "How do we get kids like you to

brush their teeth for the rest of their lives?" These two techniques as well as a few other child-created and participatory educational approaches resulted in a significant improvement in the students' oral hygiene behaviour.

Another teaching technique which builds learner involvement is guiding the learner to discover information for himself. Guided discovery improves understanding, retention and application of knowledge (95). Often quite simple activities will promote learning. The children in the study of Albertini et al. (96) discovered the role of acid demineralization in tooth decay by putting eggs in vinegar for 24 hours, then squeezing eggs into small openings of milk bottles. Hatcher (97) in 1941 showed quite conclusively that teachers who guided pupils to analyze their diets, to decide what they needed to do to improve them and to check on their progress, were able to obtain rather striking improvements. In contrast, Hatcher reported that when the teaching was of the traditional type in which the teacher decided what should be studied, how it should be done and made the evaluation, there was no significant improvement in the diets of the pupils at the end of a period of food instruction.

Utilizing peer influence is another successful method, suggested by Gifft et al. (95) to draw the audience into the learning process. Three reasons are given for the success of this method:

> "Firstly, an accepted peer has credibility with the learner because he is perceived as one who has been through similar problems, understands the obstacles, and has successfully coped with them.
> Secondly, peers can interpret clearly to each other because they share similar living patterns and ways of expressing themselves.
> Thirdly, peers tend to talk with each other more freely and more candidly than with those whom they perceive as occupying a different position in the social order."

Peer interaction can be accomplished in several ways. Perhaps the most commonly used method is group discussion. Lewin, in 1943, (98) compared group discussion-decision methods with lecture methods on changing the attitudes of 120 women to the consumption of kidney, brain and heart. In the group discussion-decision method there was a free exchange of ideas among the group leading to the setting up of definite goals for action, whereas in the lecture method the nutritionist did all the talking. The results showed that 32% of women who attended a group discussion began to serve one of the meats after 7 days, compared with only 3% of women who attended a lecture. Other studies (99,100) have also shown that food habits could be changed more effectively by group discussion than by lecture. Similarly, passive informational programmes on dental health have produced only minor oral hygiene improvement in children, aged 8 to 12 years (101,102).

Peers can also function as teachers of their classmates. The surest method to learn something well is to teach it. Mills (103) advocates that every student should have built into his programme at least one experience with teaching others. In the study by Albertini et al. (96) on the effect of dental health education on oral hygiene behaviour, children who showed positive inclinations toward behaviour change were given the responsibility to motivate their friends toward better hygiene and were successful in their attempts.

Role playing and dramatization techniques are useful methods to create interaction among the learners. Gifft et al. (95) suggest that attitudes may change if the actors assume a role which induces them to verbalize statements that are contrary to their privately held opinions.

In summary, the educator should use teaching methods which actively

involve the learner. Such techniques as encouraging verbal response to problem-solving questions, guiding the learner to discover information for himself and creating purposeful interaction among peers can enhance the learning process.

The fifth and final learning principle discussed by Fleming (93) is that learning is facilitated by the wise use of teaching aids. A nutrition teaching aid is any resource or device used as a "tool" to make nutrition education more effective (104). Resources vary in nature from films, slides and posters to games, puppets, comics and real life objects. Depending on how they are chosen and used, resources can reinforce and vitalize nutrition teaching and motivate the learner.

Crucial to the successful use of educational resources is an understanding of their relationship to the learning process as a whole. Dale (105) outlines the interrelationships of various types of audio-visual materials as well as their individual "positions" in the learning process in his theoretical Cone of Experiences (Figure 3). The audio-visual materials are arranged in the order of increasing abstractness as one proceeds from direct experiences at the base of the cone to verbal symbols at the pinnacle of the cone. The closer to the base the educational resource is positioned, the more it involves the student in the educational process and, theoretically, the greater is the extent of learning.

The direct, purposeful experiences at the base of the cone are those that can be seen, handled, tasted, touched, felt and smelled, that is direct reality as we experience it first hand. Preparing a meal is a direct purposeful experience. If the learning situation is a part of "real life" or seems real to the student, he will perceive the

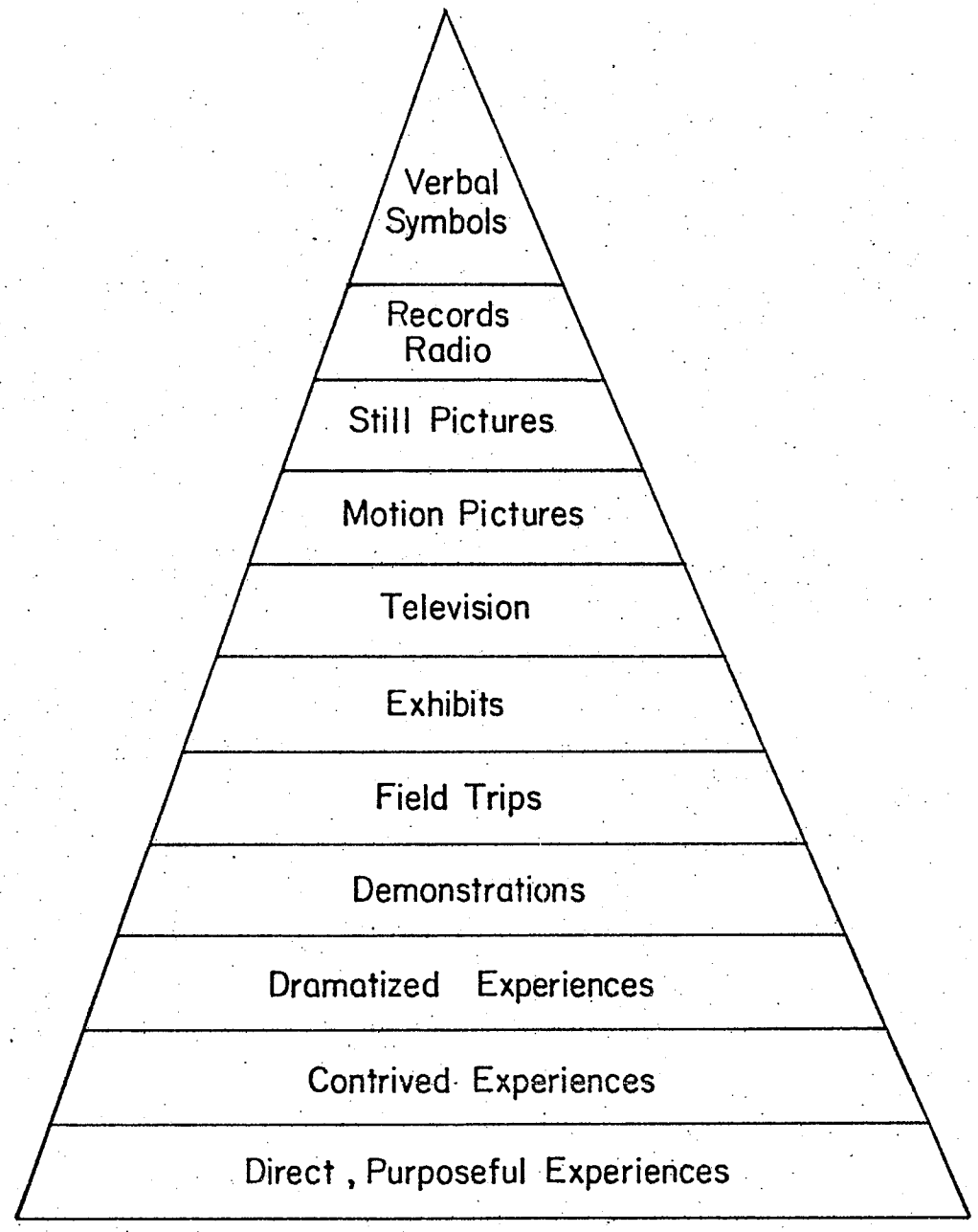

Figure 3 Cone of Experiences

Dale, E., 1954 (105)

relevance and be more eager to learn (90).

The second stage in the development of increasing abstractness are contrived experiences. A contrived experience differs from the original in size, in complexity, or in both. It is an "editing" of reality in situations where the real thing cannot be perceived directly: when it is too big or too minute, confused or concealed. For example, a model of a tooth covered in visible plaque is a contrived experience and helps in the study of oral hygiene.

The third band on the "Cone of Experience" is dramatized experience which includes plays, puppetry and role-playing. A teaching advantage of dramatization over real-life situation, according to Dale (105), is that it can eliminate many insignificant elements that merely distract attention and can sharpen and stress the truly important ideas. Furthermore, the subject matter of a dramatization is usually stirring and attention-compelling; and as such, it is not easily forgotten. Nutrition education can be easily integrated into the dramatic arts (10,106). Puppets have been reported in the literature to be an effective learning tool (9,107,108). Holder (108) suggested that the reason for their success is that they involve peer group pressure. The group feels a responsibility for producing a successful programme, and group pressure often is used to penalize the guilty one for interrupting orderly procedures.

The three cone bands discussed thus far all involve doing. In the next 7 stages on the "cone", the student is primarily an observer. He can do little to change the experiences which confront him. Although audio-visual materials of the "observing" type do not require the active physical participation of the students they can involve the students

mentally and emotionally if used properly (105).

Films, the eighth stage in the cone, are widely used in teaching nutrition to children (104). Good films can be used effectively to introduce a subject, to stimulate an activity, to demonstrate techniques and to review a subject when it is completed. However, they can rarely be used effectively as the sole educational medium unsupported by other teaching methods (109). Jenkins et al. (110) found that 6 films shown at one-week intervals with a half hour of supplementary activity after each film improved the knowledge of 4th grade students.

Classroom teachers who continually compete with or confiscate comic books, which are at the 9th and 11th stage of the cone, readily admit that these magazines have a hold on child audiences (111). Rather than reject the use of comics in the classroom, we ought to recognize their strong appeal to young readers (112). As Berger (113) concludes, "Any medium that has the continued attention of hundreds of millions of people deserves serious attention and study." Carruth and Foree (114) found that a cartoon approach to programmed instruction units was effective in improving high school students' knowledge about food buymanship. Overall, the students felt less pressured to learn "facts" and were more inclined to read and react with enthusiasm to a new approach. Another study (115) looked at the reactions of teachers and 8 to 14 year olds to a comic book entitled "Gulp". The majority of all youth were able to select the intended message of the three comic book episodes about body image, soft drinks and fad dieting. Most teachers felt "Gulp" was original, informative and thought-provoking and could be used effectively as a nutrition teaching tool with some simplification of vocabulary and page design.

A final educational resource which is not found on the cone, but deserves mention, is the use of educational games. Spitze (90) advocates that games are an effective learning tool because they require active participation, the students are mentally and emotionally involved, the situations are real or reasonable simulations of reality and the students are required to make decisions. Techniques of this type encourage cognitive involvement and thus further the chance for learning (95).

To varying degrees, all educational resources can enrich classroom learning when they are systematically used. However, when any teaching aid is used as an end in itself, without being integrated into a series of learning activities, its educational value is seriously limited (116).

4. Evaluation and the Teaching-Learning Process

Methods, techniques and aids used in a nutrition educational programme should be evaluated for their effectiveness (109). According to Gronlund (117), an educational psychologist, teaching, learning and evaluation are interdependent facets of education which are clearly recognizable in the following steps of the educational process:

1.) Identifying and defining objectives in terms of desired changes in pupil behaviour.

The first step in both teaching and evaluation is that of determining the learning outcomes to be expected from classroom instruction. What specific behavioural changes are we striving for, and what are pupils like when we have succeeded in bringing about those changes? Only by identifying objectives and stating them clearly can we provide direction to the teaching process and set the stage for ready evaluation of specific learning outcomes (118).

2.) Planning and directing learning experiences in harmony with stated behavoural objectives.

This is the point at which course content, teaching methods and educational resources are integrated into planned learning experiences so that pupil behaviour will change, we hope, in the desired direction. Unless the planning and directing of learning experiences is preceded by a clear statement of objectives and followed by an evaluation of pupil progress, it is impossible to to determine the effectiveness of the learning experiences.

3.) Determining pupil progress toward stated educational objectives.

While the first step in the educational process-defining objectives - answers the question what to evaluate, this step is concerned with the "how" of evaluation. How do we evaluate a change in knowledge or a change in dietary behaviour?

4.) Using the results of evaluation to improve learning and instruction.

Evaluation of pupil progress is of benefit to teachers, administrators and pupils. Information from carefully developed evaluation techniques can provide the teacher with clues to the effectiveness of the course content, teaching methods and resources employed. Furthermore, evaluation procedures help clarify for the pupil what it is we wish him to learn, how he is progressing, as well as the particular areas of learning difficulty.

In the present study the preceding 4 steps in the educational process were used as a guide in the development and evaluation of three educational programmes for grade 5 students. The primary purposes of the educational programmes were to decrease the frequency of sucrose-snack food consumption and to increase or maintain the consumption of nutritious, non-

cariogenic snack foods of these children. A secondary aim was to improve the students' knowledge about nutrition and dental health. The educational programmes, which were delivered by the classroom teachers, differed only in the supplementary resource materials used. The author was interested in determining which educational resources were most effective in improving the students' dietary behaviour and knowledge.

III. OBJECTIVES AND HYPOTHESES OF RESEARCH

Before the objectives were determined for this study, 4 assumptions were delineated:

1.) Children consume snacks, many of which are nutritionally and/or dentally unacceptable as defined in Section IIA.6.

2.) Teachers can be trained by a nutritionist to teach their students about nutrition and dental health.

3.) The teacher's attitude and enthusiasm about teaching nutrition and dental health is an uncontrollable variable.

4.) There is a random distribution of parents who have favourable or unfavourable attitudes about nutrition and dental health.

A. OBJECTIVES

The objectives of this research were as follows:

1.) To develop several nutrition and dental health educational programmes which utilize different teaching resources, with all other components of the educational programmes identical.

2.) To train grade 5 teachers to teach the subject of nutrition and dental health using the educational programmes and resources.

3.) To assess a change in the students' knowledge about nutrition and dental health using a knowledge test before and after education for each educational programme/resource used.

4.) To assess a change in the nutritional and dental health quality of snack foods consumed by the students using a 3-day food record before and after education for each educational programme/resource used.

5.) To assess a change in the frequency with which the students consume sucrose-containing snacks using a three-day food record before and after education for each educational programme/resource used.

6.) To assess a change in the nutritional and dental health quality of snack foods selected by the students using a simulated snack activity before and after education for each educational programme/ resource used.

7.) To determine which educational resources produced the most desirable changes in knowledge and behaviour by comparing the results of the different educational programmes.

III. B. HYPOTHESES

In order to carry out the objectives of the study, the following hypotheses were formulated:

1.) All children who receive a nutrition and dental health educational programme will:

(1) improve their knowledge about nutrition and dental health

(2) increase or maintain the consumption of snack foods which are nutritionally and/or dentally acceptable

(3) decrease the frequency with which they consume sucrose-containing snacks

(4) increase or maintain the selection of snack foods which are nutritionally and/or dentally acceptable.

2.) The degree to which the major educational resources in each educational programme requires the active involvement of the children will be:

(1) positively related to their knowledge about nutrition and dental health

(2) positively related to the consumption of nutritionally and/or dentally acceptable snack foods

(3) inversely related to the frequency with which they consume sucrose-containing snacks

(4) positively related to the selection of nutritionally and/or dentally acceptable snack foods.

IV. METHODOLOGY

A. DEVELOPMENT OF EDUCATIONAL PROGRAMMES

Three educational programmes, suitable for grades 4 to 6, were developed using the resources prepared by the author in the summer of 1975 as well as others available from the Home Economics Resource Centre, Manitoba Department of Health and Social Development. Each educational programme had the same behavioural objectives, teaching concepts, activities* and experiments. They differed only in the major supplementary resource materials.

The major resources used in each programme are shown in TABLE 6. The puppets and comic/activity book of the NuDent Programme can be classified as using primarily participation-based resources since their use requires active student involvement and peer influence. In contrast, the film of the Muncher Programme is primarily an observer-based, conventional resource since it relies on passive student involvement. The Basic Educational Programme, which did not include the expensive resources (films, puppets, comic/activity book), used in the other two programmes was added as a basis for comparison.

The programmes were designed to be taught by the classroom teacher and to be incorporated into other subjects such as Reading, Science and

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* Activities included making nutritious non-cariogenic snacks and having a snacking party, making posters, evaluating individual diet diaries, playing food bingo and various other instructional games.

TABLE 6

Major Resources[1] Used in the Educational Programmes

Major Resources	Educational Programme		
	NuDent	Muncher	Basic
Comic/Activity Book[2]	✓	—	—
Puppets[3]	✓	—	—
Film[4]	—	✓	—
Flip Chart[5]	✓	✓	✓
Activities and Experiments	✓	✓	✓

1 All resources are available from the Home Economics Resource Centre, Manitoba Department Health & Social Development.

2 "Join the NuDent Gang to Learn About Good NUtrition and DENTal Health"

3 The NuDents were designed after the characters in the comic book.

4 "The Munchers" (produced by the American Dental Association).

5 "Between You and Me is Your Smile"

Art. Each educational programme was presented in a teacher's manual.* The manuals indicated the week and the day that each lesson was to be taught during a one-month period. An example of the format of the teacher's manual for each educational programme is presented in Appendix A_1 to A_3.

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* Following the study, the author modified the NuDent Manual for use in all Manitoba schools. This manual can be obtained from the Home Economics Resource Centre, Manitoba Department of Health and Social Development.

IV. B. EVALUATION OF EDUCATIONAL PROGRAMMES

1. Experimental Design

A pre-post experimental design using three experimental groups and one control group was employed where:

Experimental Group I - received the NuDent Educational Programme

Experimental Group II - received the Muncher Educational Programme

Experimental Group III - received the Basic Educational Programme

Control Group IV - received no educational programme

Pre-Test		Post-Test
Time 1		Time 2
E_I	- - - - Education - - - -	E_I
E_{II}	- - - Education - - - -	E_{II}
E_{III}	- - - Education - - - -	E_{III}
C_{IV}	- - - - - - - - - - - -	C_{IV}

The rationale for this design is as follows. The application of both pre- and post-measurements to the experimental groups, and their comparison enables an assessment of the change in knowledge and behaviour

after education. The control group provides the standard against which change observed in the experimental groups is compared. If the control group shows the same kind and degree of change in knowledge and behaviour as that of the experimental groups, it is impossible to argue that education may have caused the change. On the other hand, if the control group shows little or no change relative to the experimental groups, it can be argued that education was most likely the causal agent. Similarly, if the 3 experimental groups show the same degree of change, it is impossible to argue that the resources used have caused the change. However, if the degree of change in knowledge and behaviour in the NuDent Group > the Muncher Group > the Basic Group, it can be argued that the type of resource used in each programme is an important factor in producing the change.

2. The Sample

a. Selection of the Grade

The sample comprised children in grade 5 for the following reasons:

i. a readability test on the comic/activity book showed that it was at the grade 4 to 5 level.

ii. a pre-test of all resources indicated that they were enjoyed by this age group.

iii. a review of the literature (Section IVB3.b.) suggested that children in this grade could provide information on their food consumption behaviour and could answer multiple-choice questions.

b. Selection of the Schools

The sample of children was drawn from schools outside Winnipeg because elementary schools in Winnipeg were receiving nutrition education through the School Nutrition Programme* and the Big Ideas Programme.** Portage la Prairie was chosen because of its proximity to Winnipeg and because it had 6 elementary schools which provided a fairly large sample. Furthermore, the author had received encouragement and enthusiasm from Dental Services, Manitoba Department of Health and Social Development in Portage la Prairie for the development of the resource materials. Dental Services had also expressed a desire that the educational materials be tested in Portage la Prairie schools.

Accordingly, the author met with the Superintendent of Portage la Prairie School Division No. 24, Mr. V. E. Holmes, and obtained his permission to conduct the study in Portage la Prairie. Subsequently, the author met with the principals and vice-principals to discuss the project and two weeks later received notice that all 6 elementary schools wished to participate in the study.

c. Selection of the Students

The names and addresses of all grade 5 students were obtained from the teachers. Subsequently, a letter was sent to the parents of each student informing them about the study. A consent slip was attached for the parents to sign and return (Appendix B). For those parents who did not respond, the teachers and principals either sent home another consent form or telephoned until all parents had responded. Of 262 possible

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* Sponsored by the Home Economics Directorate, Manitoba Department of Health and Social Development

** Sponsored by Manitoba Milk Marketing Board

children, 5 could not participate in the study because 4 parents did not give their consent and one child did not speak English. Therefore 257 children were eligible to participate in the study.

d. Allocation of Schools to Study Groups

The schools were randomly assigned to the 4 study groups with the stipulation that there would be only one experimental group in each school to avoid contamination between classes. TABLE 7 shows the distribution of students by study group and school, and the number of classes per school.

3. Research Instruments

Three instruments were employed in the study:

a. Knowledge Test

b. Three Day Food Record

c. Simulated Snack Selection Activity

a. Knowledge Test

One of the goals of nutrition education is to improve knowledge. Accordingly, a test to assess knowledge about nutrition and dental health was developed by the author in accordance with the educational objectives. Revisions were made on the knowledge test following a critical analysis by four academic members in the Faculty of Home Economics and a pre-test on 30 grade 5 students from a Winnipeg school.

The revised knowledge test (Appendix C) consisted of 2 parts:

Part I - included 4 checklists on classification of foods into the 4 food groups

Part II - included a series of 40 multiple choice questions covering

TABLE 7

Distribution of Students by Study Group and School, and Number of Classes/School

Study Group	School	No. Classes/ School	No. Students
NuDent	A	2	51
	B	1	32
Muncher	C	1	40
	D	1	28
Basic	E	2	55
Control	F	2	51
	TOTALS	9	257

various aspects of nutrition and dental health such as balanced diet; food classification; recommended number of servings from the 4 food groups; sources and functions of nutrients; cause, treatment and prevention of tooth decay; definition of plaque; and quality of snack foods from a nutritional and dental health standpoint

b. Food Record

Food records were used to assess a change in:

1.) the nutritional and dental health quality of each snack food consumed during each snack period

2.) the frequency of sucrose consumption between meals.

In a review of the purposes and methods of individual dietary surveys, Marr (119) concluded, "there is no generally accepted method of measuring the dietary intake of free-living individuals". All methods of dietary collection have limitations: the direct measurement of food intake is feasible only for small groups; food diaries may cause the subject to change his normal eating habits; general histories are subject to problems of memory and 24 hour recalls suffer because only one day is measured and this day may be atypical (120,121,122).

Inevitably two methodological decisions must be made: What is the best way to obtain the information wanted? How long a period is needed? Answers have been sought by many investigators (121-135). From these investigations it has been learned that the objectives of the study must be clearly defined because, above all, they determine the appropriate method to be employed in collecting, processing and interpreting dietary data (127,128,129). The choice of method also depends on the size of sample needed and the funds and personnel available (122,127). The

effective investigator uses only one interview method with full recognition of its limitations as well as advantages (128,130,131).

The most widely used method of dietary collection is the dietary record, which consists of a detailed written diary of all food and beverage consumed by an individual during a given time (121,132). Of concern is the minimum number of days a record must be kept to give an adequate picture of normal dietary intake (119,127,132,133,134). Many authorities feel that a dietary record of seven consecutive days or twenty consecutive meals is the shortest length feasible from the standpoint of validity (132). Using 252 seven-day food records kept by 10 to 12 year olds in two schools, Trulson (131) studied the variability in intake for one-three-(Tuesday, Wednesday and Thursday) and seven-day periods by means of the standard deviation. The standard deviation decreased as the number of days studied increased up to seven. The extent of these reductions depended on the nutrient or food under investigation and thus the author concluded that the duration of the survey should depend on this also.

On the other hand, shorter record-keeping periods have the advantage that a greater number of subjects may be studied and subjects may be more willing to participate since less is required of them (128,133). Eads and Meredith (135) feel that the accuracy of record-keeping is better on a short-time than a long-time basis. These investigators made the point that people make a real effort to keep an accurate record for one day; however, they tend to lose interest and become careless when they attempt to keep records for several days. It is the experience of Young and Trulson (127) that the individuals who are careful in keeping dietary records are careful throughout.

Nutrition field units which operated under the direction of U.S. Public Health Service obtained dietary information by one-day dietary records (136). They believed that the extra time necessary to obtain an accurate 7-day diet record would be impossible for the large sample and limited staff. A larger number of accurately-taken one-day records was preferred to a smaller number of 7-day records. Several researchers have concluded that the shorter, more expedient 24 hour recall or one-day record can be substituted for the more time-consuming 7-day records when an estimate of the mean intake of the group is necessary (122,127,132,137). Tinsley (130) as a result of the study of a one-week dietary records of school children recommended that if a week of record-keeping is not practical due to dwindling interest on the part of participants, 3 days probably represented the minimum length of time that might give a fairly satisfactory picture of food intake.

The quality of data from a dietary study depends on the ability of both participants and interviewers and the understanding and care with which they perform their duties (139). It has been shown that children can give accurate information on their past food intake provided that they know the names of foods, have developed a sense of time, have a good memory and are willing to cooperate (140). Bransby et al. (141) investigated the accuracy with which fifty 10 to 15 year old children recalled all foods and beverages consumed in the previous 24-hour period. All foods consumed by the children were weighed or recorded in household measures. It was found that the children's estimated quantities of foods were as accurate as the weighed or measured intake. Similar results have been reported by a Swedish study of 46 children 8 years of age and 43 children 13 years of age (142) and a British study of 155 school children

aged 8 to 15 years (143).

A study (144) designed to assess the accuracy with which 9 to 18 year old students recall foods and beverages in the school lunch, reported that foods most commonly omitted were bread, margarine and celery. Also the names of fruit juices were sometimes confused and there was a tendency to under-report the quantity of juice consumed. Because the age range of the children was large, the ability of the children to perform in the study must have varied considerably. However, on a group basis, the errors of estimation cancelled out in such a way that a fairly accurate representation of the average nutrient intake was obtained.

In a more recent study (140) the accuracy of 24 hour recalls by children aged 6 to 12 years was checked by comparing them with their mothers' reports of foods eaten at home and records of school lunches for the same day. The results suggested that young children can provide information on their diet as accurately, or more accurately than their mothers. In another study designed to compare the results when records of the same day's diet were kept by the mothers and the children, there was no significant difference in the final evaluation in terms of food groups (129).

Most researchers agree that 9 to 11 year old children are able to recall easily the foods eaten over a 24 hour period (135,140,145). Bosley (145) indicated that below 9 years, children have some difficulty in remembering what they ate for supper on the preceding day. Above 11 years of age, children may have acquired information about the foods they should eat which would bias their reports but would not influence their food habits. Also, there is a well-known tendency of children beyond 11 years to seek the approval of adults (145).

Considering the conclusions of the methodology studies on the most effective techniques to obtain dietary data when the sample is large and the personnel limited, and bearing in mind that the dietary record should cover a sufficient period of time to portray a normal food intake, but not too long to lose the children's interest, a three-day food record was chosen for this study (Appendix D).

The question of which days to record food intake was considered next. Three-day food records have typically been kept on Tuesday, Wednesday, and Thursday (129,131). Chalmers (132) investigated the question of which days should be used in a dietary record of junior high school students, college students, pregnant women and male industrial workers. On the average, it was immaterial which day was chosen since no "day effect" was found with the exception of the college group. However, it was recommended before surveying any particular group that this conclusion not be assumed without investigation.

Conceivably, "week-end food consumption may consist of larger and more varied meals because the family is together, the homemaker spends more time in food preparation, guests are entertained and weekly grocery shopping is done. For some persons, week-end eating patterns may include more snacks and a difference in the types and amounts of foods consumed, due to less time spent at home, attendance at various types of entertainment and the practice of sleeping longer hours" (146). Several studies have shown that week-end diets differ from those consumed on week-days (129,132,134,147,148). Tinsley (138) suggested the use of Sunday, Monday, and Tuesday for school children. Jenkins et al. (110) chose Thursday, Friday and Saturday for the three-day food records kept by 4th grade students.

On the basis of the foregoing the author chose to collect dietary information on Wednesday, Thursday, Friday and Saturday. Saturday was chosen in preference to Sunday because there was concern that the children would not be able to remember instructions on the Friday to bring Sunday's record to school on Monday. Wednesday was included as a practice day and would be substituted for Thursday's record if necessary.

c. Simulated Snack Selection Activity.

This activity was designed to determine whether or not the students would apply their knowledge about nutrition and dental health in the selection of a snack food.

On the final day of the pre- and post-dietary collection period, the interviewer told the class that in gratitude for their participation in her survey she would like to offer them a TREAT. She displayed 8 treats (TABLE 8) that were available for selection. These particular snacks were chosen for this activity because they were typical of what could be obtained at a corner store. It was stressed that all the treats were worth the same amount of money.

Treat Tokens (Figure 4) were distributed for the students to fill out quietly and independently so that the students would make a choice without the influence of their peers. The dietary interviewer explained that the tokens were needed for her record as she had to go out and buy all the treats (of course all treats had been purchased previously in quantity for the entire study). A master sheet including all the students' choices was prepared so that the teachers could distribute the treats accordingly.

TABLE 8

Type and Quality of Snack Foods Available for the Simulated Snack Selection Activity

TYPE OF SNACK FOOD	NUTRITIONAL & DENTAL HEALTH QUALITY OF SNACK FOOD
Dairy Milk Chocolate Bar	Nutritionally and Dentally POOR (ND)
Wunderbar Chocolate Bar	ND
Ice Cream	Nutritionally ACCEPTABLE but Dentally POOR (ND)
Raisins	ND
Potato Chips	Nutritionally POOR but Dentally ACCEPTABLE (ND)
Cheez Corn	ND
Peanuts	Nutritionally and Dentally ACCEPTABLE (ND)
Sunflower seeds	ND

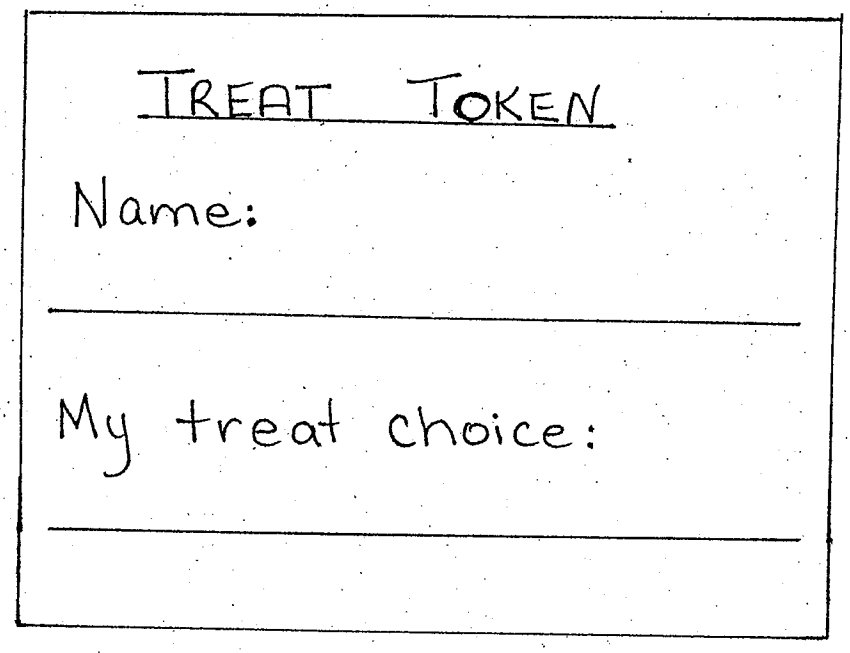

Figure 4 Treat Token for Simulated Snack Selection Activity

4. Implementation of the Study

a. Teacher Training

The author conducted a teacher training workshop in Portage la Prairie the evening of October 6, 1976. A second session was held on October 7th for those who could not attend the first meeting.

The workshop covered the following items in the order shown:

i. an explanation of the purpose and organization of the research project.

ii. a discussion of the research instruments and the administrative procedures as outlined in the Time Plan (Appendix E).

iii. a discussion of the importance of the control group. The teachers assigned to the control group were encouraged not to discuss nutrition and dental health with their students during the period of the study. These teachers left after this point of the workshop.

iv. the assignment of the educational programmes to the teacher in the experimental groups and a thorough discussion of the corresponding teacher manuals. The importance of strict adherence to the manual was emphasized. The author demonstrated all the activities and experiments outlined in the manual according to the procedure to be used in the classroom setting and illustrated the use of the assigned educational resources.

b. Training and Role of the Dietary Interviewers

Prior to data collection, the author selected and trained three

nutritionists and the home economist and nutrition advisor in Portage la Prairie to act as dietary interviewers. It has been demonstrated that dietary interviewers of similar backgrounds and training can obtain comparable data (149,150). In this role, each interviewer explained the instructions attached to the diet diaries to the students both before and during the data collection period. It has been shown that personal contact in this manner helps greatly in obtaining the desired cooperation (128). The teachers distributed the dietary records at the end of the day and reminded the students to bring them back the next day. The dietary interviewers checked the records, as they were returned, for completeness and accuracy and questioned the children individually when necessary. This procedure has been shown to be advisable to improve the validity of food intake information (151). If a student forgot his record at home for Wednesday or Thursday, a 24-hour recall was conducted, since a one-day record can be substituted by a 24-hour recall if taken by a trained interviewer (132).

c. Data Collection Period

Baseline data were obtained from Wednesday, October 13 to Wednesday, October 27 as outlined in the Time Plan (Appendix E). The educational programmes were conducted from Monday, November 1 to Wednesday, November 24. Post-evaluation data were collected from Wednesday, December 1 to Monday, December 13.

5. Data Analysis

The final data were obtained from eight grade 5 classes with two classes per study group. One class in the NuDent Group was eliminated

because the teacher did not use the Resources assigned to her. Also six students were eliminated from the study because they refused to cooperate in the dietary collection. The final sample available for study comprised 219 children.

With respect to the statistical analyses, the critical region of .05 was accepted in all cases as being indicative of a change over the time of the study.

a. Knowledge Test

Results of the knowledge test were computed from 213 students who completed both a pre- and post-test. The four checklist questions in Part A were scored on a right minus wrong basis (maximum possible score = 33) and the 40 multiple choice questions of Part B were scored as test items with each correct response receiving one point. The maximum possible score for the total test was 73.

In the computation of the raw data, a noticeable difference was detected between the post-test scores of the two classes of the Basic Group. This difference suggested that a "class effect" might be present. For this reason, statistical analysis was performed on the eight classes instead of the four study groups.

To check the baseline data for homogeneity, a one-way analysis of variance (ANOVA) was performed on the pre-test scores of the eight classes.

Using the pre- and post-test scores of each student in a class, a pre- and post-test CLASS mean score was determined for each of the eight classes.

One-tailed, paired t-tests were used to determine if there was a significant difference between the pre- and post-test scores of each class.

The pre-test scores were subtracted from the post-test scores to give a pre-post change score for every student. Subsequently, a mean of the pre-post change scores* was determined for each class.

To test the null hypothesis of equal change scores between the eight classes, the data were subjected to a one-way ANOVA. Then to determine if there was a "class effect" operating in any of the study groups, the "mean changes" of the two classes within each study group were compared using a 2-tailed, Least Significant Difference (LSD) test (152). Classes within study groups which had equal "mean changes" were pooled and treated as one study group. These group "mean changes" were then compared using a 1-tailed, LSD test to determine which educational programme was most effective in improving knowledge.

b. Three-Day Food Records

Completed three-day food records for the pre- and post-evaluation were received from 146 students. Records kept on Wednesday were analyzed instead of those on Thursday for ten students. Data from five 24-hour recalls were substituted for forgotten food records that were kept on Thursday. Students who forgot their records for Friday or Saturday were not included in the diet record analysis.

i. Quality of Snack Foods Consumed

Each snack food consumed during a snack period on pre- and post-food records was classified into one of the following four snack food categories on the basis of their nutrient and sugar

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* This value will be designated as "mean change".

content (TABLE 9):

(1) Nutritionally and dentally ACCEPTABLE (ND)

(2) Nutritionally ACCEPTABLE, but dentally POOR (NØ)

(3) Nutritionally POOR, but dentally ACCEPTABLE (ØD)

(4) Nutritionally and dentally POOR (ØØ)

An example of the classification of snack foods from a "diet diary" is shown in Appendix F.

Each student was then classified into one of these four snack food categories in the pre- and post-evaluation on the basis of which type of snack food he/she consumed the most frequently over the three days. For example, in the post-evaluation, Subject #104 consumed:

on Thursday	3-ND	0-ØD	0-NØ	5-ØØ
on Friday	4-ND	1-ØD	2-NØ	6-ØØ
on Saturday	2-ND	2-ØD	1-NØ	5-ØØ
TOTALS:	9-ND	3-ØD	3-NØ	16-ØØ

Thus, Subject #104 was classified into the nutritionally and dentally poor snack food category in the post-evaluation. If there were any ties between the snack food categories, the author referred to the fourth food record to break the tie.

To facilitate analysis all snack foods in the ND category were considered to be qualitatively "good" and all snack foods in the ØØ, NØ and ØD snack food categories were rated as qualitatively "poor". Chi square analysis was performed on the percentage of students consuming snack foods in the "good" (ND) snack food category and "poor" (ØØ, NØ, ØD) snack food category in the pre-test period in order to check the baseline data across the four study groups.

TABLE 9

Snack Food Categories Based on Nutrient and Sugar Content*

1. Nutritionally & Dentally ACCEPTABLE Snack Foods

Plain milk
Plain yogurt
Cheese

Raw fruits & vegetables
Unsweetened fruit or vegetable juices
Tossed salads or coleslaw
French-fried potatoes

Plain whole grain or enriched bread & cereals
Crackers

Hard-cooked devilled eggs
All nuts
Seeds (sunflower, pumpkin, sesame)

Nuts & Bolts
Sandwiches, filled with meat, poultry, fish, eggs, cheese or peanut butter
Hot dogs
Hamburgers
Pizza

2. Nutritionally ACCEPTABLE but Dentally POOR Snack Foods

Milk puddings
Milkshakes
Chocolate milk or drink
Ice cream
Ice cream sodas
Yogurt, sweetened (fresh or frozen)
Sherbet

Muffins
Raisin bread & other sweetened breads

Raisins & other dried fruit
Sweetened fruits & juices

3. Nutritionally POOR but Dentally ACCEPTABLE Snack Foods

Popcorn
Potato chips
Cheez corn
Pretzels, Bugles, corn chips, tacos & other party snacks
Soft drinks, sugar-free
Gum, sugar-free

4. Nutritionally and Dentally POOR Snack Foods

Sugar added to beverages such as tea or coffee
Soft drinks, regular
Honey, jams, jellies, syrups
Sweet baked goods
Chocolate bars
Cookies
Candies, lozenges, regular gum, breath mints
Popsicles, fudgsicles

*Adapted from TABLE 5

The change in the quality of the snack food consumed was assessed for each student. Those students who changed were classified as either positive or negative "changers". Based on the classification by snack food category, there were five changes possible in the positive direction:

$\not{N}\not{D} \longrightarrow ND$

$\not{N}\not{D} \longrightarrow \not{N}D$

$\not{N}\not{D} \longrightarrow N\not{D}$

$N\not{D} \longrightarrow ND$

$\not{N}D \longrightarrow ND$

and five changes possible in the negative direction"

$ND \longrightarrow \not{N}\not{D}$

$\not{N}D \longrightarrow \not{N}\not{D}$

$N\not{D} \longrightarrow \not{N}\not{D}$

$ND \longrightarrow N\not{D}$

$ND \longrightarrow \not{N}D$

Students who did not change the quality of snack foods they consumed could either:

1.) maintain good habits (ND) or

2.) maintain poor habits ($\not{N}\not{D}$, $N\not{D}$, $\not{N}D$).

There were eight students across the four study groups who changed from ND snack foods to no snack foods or vice versa who were eliminated from the qualitative analysis because a qualitative value could not be placed on these changes.

The percentage of students in each study group who changed or did not change the type of snack food they consumed was determined. McNemar's Test for the significance of changes between pre- and post-

data (153) was performed to test the effectiveness of each educational programme. When warranted, the effectiveness of an educational programme was assessed by a comparison with the control group using Chi square analysis. Bartholomew's Test for qualitatively ordered proportions (154) was used to test for differences in the percentage of students who maintained good habits across the four study groups.

ii. Frequency of Sucrose Consumption Between Meals

Frequency of sucrose consumption between meals was expressed both as a three-day mean number of sucrose exposures between meals as well as a sucrose ratio for each student.

(1) Mean Number of Sucrose Exposures Between Meals

A three-day total number of sucrose exposures between meals was determined for each student from both the pre- and post-food records. One sucrose exposure was considered to be equal to the consumption of one or more sucrose-foods during one snack time period. For example, subject #104 (Appendix F) consumed two sucrose foods at 5:00 p.m. which was counted as one sucrose exposure. The consumption of toffee at 10:00 a.m., candies at 4:30 p.m. and 9:00 p.m. were counted as three more sucrose exposures, for a total of four sucrose exposures that day.

To check the homogeneity of the baseline data, the Kruskal Wallis Test (155) was performed on the three-day total number of sucrose exposures for each student, in the pre-evaluation, across the four study groups.

A three-day mean number of sucrose exposures was calculated

for each student from both the pre- and post-food records. Using these three-day mean number of sucrose exposures of each student in a study group, a pre- and post-test GROUP mean number of sucrose exposures was determined for each of the four study groups.

A pre-post change in sucrose exposures was assessed for each student by subtracting the post-test three-day mean number of sucrose exposures from the pre-test mean. Subsequently, a GROUP mean of the pre-post changes in the three-day mean number of sucrose exposures* was determined for each of the four study groups, based on the pre-post change in three-day mean sucrose exposures of students in each study group.

To determine whether or not education was effective in decreasing the frequency of sugar consumption, the pre- and post-test three-day mean sucrose exposures of the students in each study group were subjected to the Wilcoxon Matched-Pairs Signed Ranks Test (156,157). Jonckheere's Test for Ordered Alternatives (158) was used to assess which educational programme was most effective in decreasing the frequency of sucrose exposures between meals.

(2) Mean Sucrose Ratios

A pre- and post-test sucrose ratio was calculated for every student by dividing the three-day total number of sucrose

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* This value will be designated as "mean change" in the number of sucrose exposures.

exposures between meals by the three-day total numbers of snack-time periods. For example, Subject #104 (Appendix F) had:

on Thursday: 4 sucrose exposures between meals and 4 snack-time periods
on Friday : 5 sucrose exposures between meals and 7 snack-time periods
on Saturday: 3 sucrose exposures between meals and 4 snack-time periods
TOTAL :12 sucrose exposures between meals and 15 snack-time periods

Thus Subuect #104 had a sucrose ratio of 12/15 or .80; that is, she consumed a sucrose-snack food in 80% of her snack time periods.

Homogeneity of the pre-test sucrose ratios of the students in the four study groups was assessed by the Kruskal Wallis Test.

Using the pre- and post-test sucrose ratios of each student in a study group, a pre- and post-test GROUP mean sucrose ratio was determined for each of the four study groups.

The pre-post change in sucrose ratios was assessed for each student by subtracting the post-test sucrose ratio from the pre-test sucrose ratio. Subsequently, a GROUP mean of the pre-post changes in sucrose ratios* was determined for each of the four study groups, based on the pre-post changes in sucrose ratios of students in each study group.

To determine whether or not education was effective in decreasing sucrose ratios, the pre- and post-test sucrose

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* This value will be designated as "mean change" in sucrose ratio.

ratios of the students in each study group were subjected to the Wilcoxon Matched-Pairs Signed Ranks Test. A Mann-Whitney Test (158) was used to compare the effectiveness of two educational programmes.

c. Simulated Snack Selection Activity

Data for the pre- and post-simulated snack activity were obtained from 214 students. Each student was classified into one of the four snack food categories (TABLE 8), in the pre- and post-evaluation, on the basis of which snack food he/she selected.

To check the baseline data for homogeneity, a Chi square analysis was performed on the percentage of students selecting a snack food from the qualitatively good (ND) snack food category and from the qualitatively poor ($\not{N}\not{D}$, $N\not{D}$, $\not{N}D$) snack food category in the pre-test period across the four study groups.

The change in the quality of the snack food selected was assessed for each student. As discussed previously in Section IV B5.b.i there were five changes possible in the positive direction and five changes possible in the negative direction. Students who did not change the quality of snacks they selected could either:

(1) maintain good choices (ND) or

(2) maintain poor choices ($\not{N}\not{D}$, $N\not{D}$, $\not{N}D$ or $N\not{D} \rightleftarrows \not{N}D$)

The percentage of students in each study group who changed or did not change the type of snacks they selected was determined. McNemar's Test for the significance of changes was used to test the effectiveness of each educational programme.

The snack food choices made by the students also were ranked in order of popularity for both the pre- and post-evaluation.

V. DISCUSSION OF RESULTS

The results will be discussed in the light of the two major objectives of this research project which were:

1.) to evaluate the effectiveness of each educational programme in improving knowledge and behaviour, and

2.) to determine which of the three educational programmes was most effective in producing the desired changes.

A. CHANGE IN KNOWLEDGE SCORES

The knowledge test mean scores appear in TABLE 10. Homogeneity of the baseline data was established as the analysis of variance showed no significant differences between the pre-test knowledge test scores of the eight classes (Appendix G, TABLE I).

The three educational programmes were effective in improving the students' knowledge about nutrition and dental health since a significant difference was shown between the pre- and post-test scores in each class in the three experimental groups ($p < .00001$) but not in the control group (TABLE 10). These results are in agreement with other researchers who have tested the effect of nutrition and/or dental health education on the knowledge of their subjects (110,160-170).

Analysis of variance (TABLE 11) demonstrated that there was a significant difference ($p < .0005$) between the eight classes in the degree with which knowledge improved. This difference could be explained by the effect of the teacher, the effect of the resource materials used in the educational programmes or both the teachers and the resources.

TABLE 10

Knowledge Test Mean Scores[1] By Study Group and Class

Study Group	Class	Knowledge Test Mean Scores			t value
		Pre-Test Mean ±S.D.	Post-Test Mean ±S.D.	Mean Change[2] ±S.D.	
NUDENT (N=27)	A	39.48 ±6.55	51.78 ±5.25	12.30 ±3.72	t=17.08 p<.00001
NUDENT (N=22)	B	41.09 ±7.18	53.82 ±5.14	12.73 ±6.22	t= 9.57 p<.00001
MUNCHER (N=38)	A	36.84 ±7.59	46.18 ±8.73	9.34 ±5.54	t=10.38 p<.00001
MUNCHER (N=28)	B	39.36 ±5.97	48.54 ±6.81	9.18 ±6.01	t= 8.05 p<.00001
BASIC (N=26)	A	40.54 ±5.11	54.54 ±6.89	14.00 ±5.69	t=12.50 p<.00001
BASIC (N=23)	B	37.91 ±5.60	47.74 ±6.51	9.83 ±5.44	t= 8.70 p<.00001
CONTROL (N=24)	A	37.75 ±6.17	39.29 ±5.74	1.54 ±5.34	t= 1.41 n.s.
CONTROL (N=24)	B	38.44 ±5.06	39.24 ±5.71	0.80 ±4.65	t= 0.86 n.s.

1 Maximum possible score = 73

2 $$\text{Mean Change} = \frac{\sum (\text{Pre-Test Scores} - \text{Post-Test Scores})}{\text{No. Students in Class}}$$

TABLE 11

ANOVA of the Change in Knowledge Test Scores of the 8 Classes

Source of Variation	df	SS	MS	F
Among classes	7	4276.16	610.88	21.15
Within classes	205	5919.91	28.88	$p < .0005$

The results of the Least Significant Difference (LSD) analysis (TABLE 12) indicated that a "class effect" may have been operating in the experimental group receiving the Basic Educational Programme. This was the only study group where there was a significant difference ($p < .05$) between the pre-post mean change in knowledge test scores of the two classes. This was no surprise as the teacher of class A in the Basic Group demonstrated incomparable enthusiasm about the educational programmes at the teacher training workshop. Since this teacher expressed disappointment in not being selected to participate in the NuDent Educational Programme and expressed determination that her students would perform well in the Basic Educational Programme, the researcher was concerned at the time of the workshop that a "halo effect" would be apparent in the results. This concern may have been valid. Furthermore, the literature indicates that when an individual teacher is interested in and committed to nutrition, there is more success in changing nutrition-related behaviour in her class than there is in another class where the teacher feels compelled to teach nutrition (163,166,171).

To facilitate comparative analysis of the pre-post mean changes in knowledge test scores between the different study groups, data from the two classes which had equal mean changes in test scores within study groups were combined. The combined data for the knowledge test scores

TABLE 12

Comparison[1] of Pre-Post "Mean Changes" in Knowledge Test Scores Between Classes Within Each Study Group

Study Group	Pre-Post Mean Change ± S.D.		t value
	Class A	Class B	
NUDENT	12.30 ±3.72	12.73 ±6.22	t = 0.43 n.s.
MUNCHER	9.34 ±5.54	9.18 ±6.01	t = 0.16 n.s.
BASIC	14.00 ±5.69	9.83 ±5.44	t = 4.17 $p < .05$
CONTROL	1.54 ±5.34	0.80 ±4.65	t = 0.74 n.s.

1 "Mean changes" were compared using a 2-tailed LSD test (152) with the formula:

$$\bar{x}_i - \bar{x}_j > t\left(\frac{\alpha}{2}, \gamma\right) S \sqrt{\frac{1}{n_i} + \frac{1}{n_j}},$$

where $\alpha = .05$
$\gamma = 205$
$S^2 = 28.88$

are presented in TABLE 13.

The results of the multiple comparisons of the pre-post mean changes in knowledge test scores between the study groups are shown in TABLE 14. The three experimental groups receiving educational programmes demonstrated a significantly greater ($p < .05$) mean change in knowledge test score than the control group. Furthermore, the NuDent Programme (Prog.) was more effective in improving knowledge ($p < .05$) than either the Muncher Prog. or the Basic Prog. in the case of Class B. However, the effect on knowledge of the Basic Prog. in Class A, which had the "keen" teacher, was comparable to that of the NuDent Prog. and was therefore more effective than the Muncher Prog. There was no significant difference between the effect of the Muncher Prog. and the Basic Prog., Class B, on knowledge.

Ignoring the "class effect", these results suggest a trend in which educational resources that involve active participation of the students (puppets and comic/activity books) are more likely to improve knowledge than those resources which require only a passive involvement (films). Considering the "class effect", however, it is possible that a highly motivated teacher can change students' knowledge without the aid of expensive resources.

TABLE 13

Knowledge Test Mean Scores By Study Group

Study Group	Knowledge Test Mean Scores		
	Pre-Test Mean ±S.D.	Post-Test Mean ±S.D.	Mean Change[3] ±S.D.
NUDENT (N=49)	40.20 ±6.81	52.69 ±5.25	12.49 ±4.95
MUNCHER (N=66)	37.91 ±7.01	47.18 ±7.69	9.27 ±5.70
$BASIC_A$[1] (N =26)	40.54 ±5.11	54.54 ±6.89	14.00 ±5.69
$BASIC_B$[2] (N =23)	37.91 ±5.60	47.74 ±6.51	9.83 ±5.44
CONTROL (N=49)	38.10 ±5.58	39.27 ±5.66	1.16 ±4.96

1 Class A of Basic Study Group

2 Class B of Basic Study Group

3 Mean Change = $\frac{\sum (\text{Pre-Test Scores} - \text{Post-Test Scores})}{\text{No. Students in Study Group (or class)}}$

TABLE 14

Multiple Comparisons[1] of the "Mean Changes" in Knowledge Test Scores Between Study Groups

Hypotheses	Results
NUDENT > CONTROL	t = 11.33 p < .05
MUNCHER > CONTROL	t = 8.11 p < .05
$BASIC_A$[2] > CONTROL	t = 12.84 p < .05
$BASIC_B$[3] > CONTROL	t = 8.67 p < .05
NUDENT > MUNCHER	t = 3.22 p < .05
NUDENT > $BASIC_B$	t = 2.66 p < .05
NUDENT > $BASIC_A$	t = 1.51 n.s.
$BASIC_A$ > MUNCHER	t = 4.73 p < .05
$BASIC_B$ > MUNCHER	t = 0.56 n.s.

1 "Mean changes" were compared using a one-tailed LSD test (152) with the formula:

$$\bar{x}_i - \bar{x}_j > t(\alpha, \gamma) S \sqrt{\frac{1}{n_i} + \frac{1}{n_j}},$$

where $\alpha = .05$
$\gamma = 205$
$S^2 = 28.88$

2 Class A of Basic Study Group

3 Class B of Basic Study Group

V. B. CHANGE IN THE QUALITY OF SNACK FOODS CONSUMED --ASSESSED BY THREE-DAY FOOD RECORD

Homogeneity of the baseline data was established as the chi square analysis showed that the percentage of students consuming snack foods in the "good" (ND) and "poor" ($\not{N}\not{D}$, $N\not{D}$, $\not{N}D$) snack food categories, during the pre-test period was equal among the four study groups (Appendix G, TABLE II).

The percentage of students in each study group who either changed or did not change the quality of snack food they consumed in the post-test period, is presented in TABLE 15. It can be seen that after education, 46.2%, 61.9% and 60.7% of the students in the NuDent, Muncher and Basic Groups, respectively, changed the quality of the snacks they consumed. In the Control Group, which received no educational programme, 48.3% of the students changed their snacking habits in the post-evaluation period.

The results of the McNemar Test for significance of change between the pre- and post-quality of snack foods consumed for each study group (TABLES 16 - 19) demonstrated that a significant effect ($p < .01$) was produced by only the NuDent Educational Programme. However, since the McNemar Test is sensitive to changes in both the positive and negative direction, the direction of change which contributed to the significant effect of the NuDent Programme required further study.

Observation of TABLE 15 suggests that the reason for the significance of the NuDent Programme may be the fact that comparatively fewer students in the NuDent Group changed their consumption of snack foods in the negative direction than students in the Muncher, Basic and Control Groups (7.7% vs. 21.4%, 28.6% and 24.1%, respectively).

TABLE 15

Percentage of Students in Each Study Group Who Changed or Did Not Change the Quality of Snack Food Consumed in the Post-Test Period

STUDY GROUP	% of Students in Each Study Group who Changed			% of Students in Each Study Group Who Did Not Change			GRAND TOTAL
	Positive Direction	Negative Direction	TOTAL CHANGE	Maintained Good Snacks	Maintained Poor Snacks	TOTAL NO CHANGE	
NUDENT (N=39)	38.5% (15)	7.7% (3)	46.2% (18)	23.1% (9)	30.8% (12)	53.8% (21)	100% (39)
MUNCHER (N=42)	40.5% (17)	21.4% (9)	61.9% (26)	11.9% (5)	26.2% (11)	38.1% (16)	100% (42)
BASIC (N=28)	32.1% (9)	28.6% (8)	60.7% (17)	7.1% (2)	32.1% (9)	39.3% (11)	100% (28)
CONTROL (N=29)	24.1% (7)	24.1% (7)	48.3% (14)	6.9% (2)	44.8% (13)	51.7% (15)	100% (29)

TABLE 16

Comparison of Pre- and Post-Test Quality of Snack Foods Consumed by NuDent Group (N=39)

Pre-Test Quality	Post-Test Quality: Poor	Post-Test Quality: Good
Good[1]	3	9
Poor[2]	12	15

$X^2 = 6.72$ 1df $p < .01$

1 Good to poor are those changes in the negative direction.

2 Poor to good are those changes in the positive direction.

TABLE 17

Comparison of Pre- and Post-Test Quality of Snack Foods Consumed by Muncher Group (N=42)

Pre-Test Quality	Post-Test Quality: Poor	Post-Test Quality: Good
Good	9	5
Poor	11	17

$X^2 = 1.88$ 1df n.s.

TABLE 18

Comparison of Pre- and Post-Test Quality of Snack Foods Consumed by Basic Group (N=28)

Pre-Test Quality	Post-Test Quality: Poor	Post-Test Quality: Good
Good	8	2
Poor	9	9

$X^2 = 0$ 1df n.s.

TABLE 19

Comparison of Pre- and Post-Test Quality of Snack Foods Consumed by Control Group (N=29)

	Post-Test Quality: Poor	Post-Test Quality: Good
Good	7	2
Poor	13	7

$X^2 = 0$ 1df n.s.

In addition, a comparison of the percentage of students in the NuDent Group and Control Group who changed in the positive or negative direction (TABLE 20) indicated that there were significantly more students who changed positively and/or significantly fewer who changed negatively ($p < .025$) in the NuDent Group. Thus when compared to a group of students receiving no educational programme, the NuDent Programme had a significantly favourable effect on the quality of snack foods consumed.

Furthermore, the educational programmes appeared to have a differential effect on the percentage of students in each study group who maintained the consumption of "good" snack foods since Bartholomew's Test (Appendix G, TABLE III) showed that the four study groups were qualitatively ordered ($p < .05$) with the NuDent Group (23.1%) > Muncher Group (11.9%) > Basic Group (7.1%) > Control Group (6.9%). These data suggest that all three educational programmes had a "preventive effect" on the students who were consuming "good" snack foods in the pre-test period since a greater percentage of students who received education maintained "good" habits than students who had no education (23.1%, 11.9% and 7.1% vs. 6.9%, respectively). However, the comparative numbers who maintained "good" snack habits were small (9, 5 and 2 in the NuDent, Muncher and Basic Groups vs. 2 in the Control Group). Therefore, although statistically significant, the overall effect of the educational programmes was little.

It can be concluded that the NuDent Programme had the greatest "preventive effect" since a significantly greater percentage of students in the NuDent Group maintained "good" snacking habits than in the Muncher, Basic and Control Groups (23.1% vs. 11.9%, 7.1% and 6.9%, respectively)

TABLE 20

Percentage of Students in NuDent and Control Groups
Who Changed the Quality of Snack Foods Consumed
In the Positive or Negative Direction

Study Group	Direction of Change		TOTAL CHANGE
	Positive	Negative	
NUDENT (N=39)	38.5% (15)	7.7% (3)	46.2% (18)
CONTROL (N=29)	24.1% (7)	24.1% (7)	48.3% (14)

$X^2 = 5.145$ 1df $p < .025$

and fewer students in the NuDent Group changed in the negative direction (77% vs. 21.4%, 28.6% and 24.1%, respectively). This "preventive effect" contributed greatly to the success of the NuDent Programme.

Of descriptive interest are the specific qualitative changes made by the 75 "changers"* in the total sample. The percentage of the total number of "changers" in each study group who changed the quality of snack foods they consumed in specific positive ways is presented in TABLE 21. TABLE 22 presents the qualitative changes in the negative direction. It should be noted that 72.2% of those students who changed their snacking habits in the NuDent Group changed to the greatest extent in the positive direction; that is, from foods such as candy bars and soft drinks to foods such as raw fruits and vegetables (N$\not$D → ND). By comparison, less than 40% of the "changers" in each of the other three study groups changed from N$\not$D to ND snack foods.

In the post-evaluation, more students in the four study groups appeared to consume snack foods which were only nutritionally acceptable (N$\not$D) such as ice cream and sweetened fruit juices, than snack foods which were only dentally acceptable ($\not$ND) such as potato chips and popcorn. It is interesting to observe that the Control Group which received no education was split with 50% of the students changing positively and 50% changing negatively.

With respect to education as a whole, the results show that the attainment of nutrition and dental health knowledge did not lead to a dramatic improvement in snacking behaviour. As Martha Poolton (172)

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* Those students who changed.

TABLE 21

Percentage of "Changers" in Each Study Group Who Changed the Quality of Snack Food Consumed in a Positive Direction

STUDY GROUP & No. of "Changers"	Changes in a Positive Direction					TOTAL POSITIVE CHANGE
	∅ND → ND	∅ND → ∅D	∅ND → N∅	N∅ → ND	ND → ND	
NUDENT (N=18)	72.2% (13)		11.1% (2)			83.3% (15)
MUNCHER (N=26)	34.6% (9)	11.5% (3)	3.8% (1)	11.5% (3)	3.8% (1)	65.4% (17)
BASIC (N=17)	35.3% (6)	5.9% (1)	11.8% (2)			52.9% (9)
CONTROL (N=14)	28.6% (4)		21.4% (3)			50.0% (7)

TABLE 22

Percentage of "Changers" in Each Study Group Who Changed the Quality of Snack Food Consumed in a Negative Direction

STUDY GROUP & No. of "Changers"	Changes in a Negative Direction					TOTAL POSITIVE CHANGE
	ND → ∅ND	∅D → ∅ND	N∅ → ∅ND	ND → N∅	ND → ∅D	
NUDENT (N=18)	11.1% (2)			3.3% (1)		16.7% (3)
MUNCHER (N=26)	11.5% (3)		7.7% (2)	11.5% (3)	3.8% (1)	34.6% (9)
BASIC (N=17)	17.6% (3)			5.9% (1)	11.8% (2)	47.1% (8)
CONTROL (N=14)	28.6% (4)		14.3% (2)		7.1% (1)	50.0% (7)

stated "They do well on their tests, but they do not apply it." Other nutrition education researchers have also found a lack of application of nutrition knowledge gained in the classroom (161,164,165,173).

The success of the NuDent Programme, in comparison to the other educational programmes was greatly attributed to the "preventive effect" it had on the students who already had good snacking habits. Reinforcing good food practices is a positive effect of education. It could be conjectured that the students' mental and emotional involvement in the puppet shows and activities of the comic book as well as the interaction among the students were the contingent factors for success in maintaining good behavioural practises. Gifft et al. (95) reviewed an unpublished study by Devine et al. which found that students who were actively involved in the learning process increased their consumption of fruits and vegetables. Although another group of students, in the same study, who were taught by traditional lecture methods improved their knowledge, they did not improve their dietary behaviour.

Other research has shown that definite improvements in food habits can be obtained when methods of instruction were designed with the improvement of food habits as an objective (97,163,166,169,170,174-179). With the exception of the studies by Dunkley and Beardall (166) and by Alford and Tibbets (179) the nutrition educational programmes were run for two months to two years. Although Dunkley and Beardall (166) found a 25% decrease in the number of poor "snackers" following four weeks of education, they did not include a control group for comparison and did not mention whether this result was statistically significant. Alford's and Tibbets' (179) educational programme at a diabetic camp, which was run for only three weeks, resulted in a significant increase in the

consumption of low carbohydrate vegetables by the diabetic children in the experimental group. Rosentock's (180) theory may explain this result. He states that health action will occur only if the person perceives a threat to health and believes in the efficacy of the dietary change. Since diabetic children are aware of their disease and the immediate consequences of poor food habits on their health status, they may be motivated to change their food practices.

On the basis of these studies, which demonstrated improvement in food habits, it could be speculated that in the present study:

(1) four weeks was not a sufficient length of time to run the nutrition-dental health educational programmes for significant positive changes in snacking behaviour to occur. In fact, the teachers did indicate that they were rushed to complete all the lessons and that there was no time for reinforcement.

(2) the students may not have believed dental caries to be a personal health problem, and if they did, they may not have perceived that dietary modification would be dramatically effective. Knowing that a food tastes good may have had more influence on dietary behaviour than knowing that a food would not promote dental caries, especially when a pleasant taste probably has more immediate personal influence.

Further research is needed to confirm these two speculations.

V.C. CHANGE IN FREQUENCY OF SUCROSE CONSUMPTION BETWEEN MEALS --ASSESSED BY THREE-DAY FOOD RECORD

1. Change in Frequency of Sucrose Exposures Between Meals

The mean number of sucrose exposures between meals per day of each study group for the pre- and post-tests as well as the "mean changes" for each group appear in TABLE 23. Homogeneity of the pre-test data was established as the Kruskal Wallis Test showed that the three-day total number of sucrose exposures between meals of each student was equal across the four study groups in the pre-test period (Appendix G, TABLE IV).

The three educational programmes were effective in decreasing the number of sucrose exposures between meals since the Wilcoxon Matched-Pairs Signed Ranks Test showed that there was a significant difference between the pre- and post-test data in the NuDent ($p < .001$), Muncher ($p < .01$) and Basic ($p < .05$) Groups but not in the Control Group (TABLE 23). Similar findings, based on three-day food records were reported by Shank and Guthrie (160) who studied the effect of a nutrition counselling technique in teaching adolescents the principles of a balanced diet and caries prevention. Before counselling, the adolescents had a mean sucrose exposure of 8.97 (based on three-day totals of sucrose exposures at meals as well as between meals) and after counselling the mean exposure dropped to 7.55. This reduction of 1.42 was significant at the .05 level. However, Shank and Guthrie (160) did not compare these results to a Control Group. Several other studies have suggested, but not tested statistically, that there was a decreased intake of sweet foods as a result of education in the classroom (174,181).

Visual observation of the mean change in the number of sucrose

TABLE 23

Mean Sucrose Exposures Between Meals Per Day of Each Study Group[1]

Study Group	Mean Sucrose Exposures			T value
	Pre-Test Mean ±S.D.	Post-Test Mean ±S.D.	Mean Change[2] ±S.D.	
NUDENT (N=41)	1.49 ±0.88	0.93 ±0.78	0.55 ±0.89	T=610.50 $p < .001$
MUNCHER (N=42)	1.60 ±1.02	1.16 ±0.88	0.44 ±1.02	T=448.50 $p < .01$
BASIC (N=31)	1.56 ±1.04	1.19 ±0.85	0.36 ±0.95	T=282.00 $p < .05$
CONTROL (N=32)	1.21 ±0.67	0.99 ±0.61	0.22 ±0.70	T=225.50 n.s.

1 Group means are based on 3-day mean sucrose exposures of the students.

2 Mean Change=

$$\frac{\sum (\text{Pre-Test 3-day mean sucrose exposures} - \text{Post-Test 3-day mean sucrose exposures})}{\text{Number of students in Study Group}}$$

exposures per day of each of the four study groups (TABLE 23) suggests that the effectiveness of the three educational programmes could be placed on a continuum of change where:

NUDENT > MUNCHER > BASIC > CONTROL

However, Jonckheere's Test for Ordered Alternatives (Appendix G, Procedure I) demonstrated that on the basis of ranks, there was no significant difference ($p < .078$) between the four study groups in the amount of change in the number of sucrose exposures which occurred. It should be noted, however, that the potential for change is a function of the magnitude of the baseline data. For example, there was little room to decrease the frequency of sugar exposures in the present study because the mean number of sucrose exposures in the pre-test was less than 2 for all study groups. Furthermore it is difficult to obtain significant differences between groups when the changes that are being compared are so small. If the students had consumed sucrose-snacks more frequently in the pre-test period, the potential for change would have been more apparent and consequently differences between educational programmes also may have been more apparent.

Since the frequency of sugar consumption is a major food practice that influences dental caries (19,38,39-46), the effectiveness of the three educational programmes on motivating the students to decrease their sucrose exposures between meals is a very positive result. It could be speculated that the children were modifying their sweet-snacking habits in one or more of three ways as a result of education:

(1) They may have consumed sweets at meal-time rather than between meals.

(2) They may have consumed the majority of their sucrose-foods during one snack time period. For example, instead of consuming a piece of cake at 7:00 p.m. and a soft drink at 8:00 p.m., the child may have consumed both at 7:00 p.m.

(3) They may have substituted non-sucrose foods for sucrose-foods during snack periods. For example, a child may have substituted potato chips for chocolate bars or substituted fresh fruit for ice cream, et cetera.

It should not be overlooked, however, that the validity of this data were based on the accuracy of the children's food records. The possibility that the children associated the educational programme with the dietary evaluation and thus knew the desired outcome may have contributed to the significance of these results.

2. Change in Sucrose Ratios

The mean sucrose ratios for the pre- and post-test periods of each study group together with the "mean changes" in the sucrose ratios for each group appear in TABLE 24. The pre-test data were found to be homogeneous as the Kruskal Wallis Analysis demonstrated that the sucrose ratios of the students were equal across the four study groups in the pre-test period (Appendix G, TABLE V). Considering the entire sample N=146), it was calculated that approximately 72% of all snack time periods contained sucrose-foods. Shank and Guthrie (160) similarly observed that, before nutrition and dental health counselling, 72% of all snacks consumed

by the adolescents in their study contained sucrose-foods.

Analysis of the differences between the pre- and post-data showed that the sucrose ratios decreased significantly in only the NuDent Group ($p < .05$) and the Muncher Group ($p < .001$) (TABLE 24). The Basic Educational Programme, which did not use supplementary resources, was not effective in decreasing the sucrose ratios.

A comparison of the "mean change" in sucrose ratios of the NuDent Group with that of the Muncher Group by the Mann Whitney Test (TABLE 25) showed that there was no significant difference in the effectiveness of the NuDent and Muncher Educational Programmes. However, TABLE 26 shows that only the Muncher Educational Programme was significantly more effective than no educational programme ($p < .05$) in decreasing sucrose ratios. It must be reiterated, however, that the significance of change is a function of the magnitude of the pre-test data. The Muncher Group had greater potential for change, that is, more "room for improvement", than either the NuDent or the Control Group (pre-test means were 0.79 vs. 0.68 and 0.69, respectively).

TABLE 24

Mean Sucrose Ratios[1] of Each Study Group

Study Group	Mean Sucrose Ratios			T value
	Pre-Test Mean ±S.D.	Post-Test Mean ±S.D.	Mean Change[2] ±S.D.	
NUDENT (N=41)	0.68 ±0.28	0.54 ±0.30	0.14 ±0.36	T=512.00 $p < .05$
MUNCHER (N=42)	0.79 ±0.30	0.58 ±0.26	0.21 ±0.37	T=612.50 $p < .001$
BASIC (N=31)	0.72 ±0.27	0.63 ±0.29	0.09 ±0.36	T=222.00 n.s.
CONTROL (N=32)	0.69 ±0.32	0.67 ±0.33	0.02 ±0.37	T=206.58 n.s.

1

Mean Sucrose Ratio=

$$\sum \left(\frac{\text{3-day total number of between-meal sucrose exposures}}{\text{3-day total number of snack-time periods}} \right)$$

Number of students in Study Group

2

Mean Change=

$$\frac{\sum \text{(Pre-Test sucrose ratio - Post-Test sucrose ratio)}}{\text{Number of students in Study Group}}$$

TABLE 25

Comparison of "Mean Changes" in Sucrose Ratios of the NuDent and Muncher Groups

Mean Change in Sucrose Ratio of NuDent Group (±S.D.)	Mean Change Sucrose Ratio of Muncher Group (±S.D.)	Mann-Whitney T Value
0.14 (±0.36)	0.21 (±0.37)	T=735.00 n.s.

TABLE 26

Comparison of "Mean Changes" in Sucrose Ratios of the NuDent and Muncher Groups With the Control Group

Mean Change in Sucrose Ratio of 2 Educational Groups (±S.D.)	Mean Change in Sucrose Ratio of Control Group (±S.D.)	Mann-Whitney T Value
NUDENT GROUP 0.14 (±0.36)	0.02 (±0.37)	T=720.00 n.s.
MUNCHER GROUP 0.21 (±0.37)		T=855.00 $p < .05$

V D. CHANGE IN QUALITY OF SNACK FOOD SELECTED --ASSESSED BY SIMULATED SNACK ACTIVITY

The pre-test data were found to be heterogeneous since the chi square analysis showed that the percentage of students selecting snack foods from the "good" (ND) and "poor" ($\not{N}\not{D}$, $N\not{D}$, $\not{N}D$) snack food categories in the pre-test period was significantly different ($p < .05$) across the four study groups (TABLE 27). It appears that in the pre-test period a greater percentage of students in the three educational groups selected qualitatively good snack foods than in the Control Group (22.4%, 15.2% and 10.2% vs. 4.0%, respectively). Moreover, there appears to be differences in the pre-test selection behaviour of the three educational groups. However, considering the entire sample (N=214), the percentage of students who selected "good" snack foods was very small (13.1%), thus leaving "lots of room" for improvement.

The percentage of students in each study group who, in the post-test period, either changed the quality of the snack food they selected in the positive or negative direction or maintained "good" or "poor" snack food selection is presented in TABLE 28. With the exception of the NuDent Group, the percentage of students in each study group who changed the quality of snack food they selected was comparatively lower than the percentage who did not change. It can also be observed from TABLE 28 that the percentages of students who changed in the positive direction are relatively low in comparison with the percentages of students who maintained poor selections in the post-test period.

All three educational programmes were ineffective in motivating the students to change the quality of the snack foods they selected in the classroom setting since the McNemar Tests showed that there was no

TABLE 27

Percentage of Students in Each Study Group That Selected "Good" and "Poor" Snack Foods in the Pre-Test Period

Study Group	Quality of Snack Selected		Total
	Good	Poor	
NuDent	% 22.4 (11)	% 77.6 (38)	% 100 (49)
Muncher	15.2 (10)	84.8 (56)	100 (66)
Basic	10.2 (5)	89.8 (44)	100 (49)
Control	4.0 (2)	96.0 (48)	100 (50)
Total	13.1 (28)	86.9 (186)	100 (214)

$X^2 = 8.013$ df = 3 $p < .05$

TABLE 28

Percentage of Students in Each Study Group Who Changed and Did Not Change the Quality of Snack Food Selected in the Post-Test Period

STUDY GROUP	% of Students in Each Study Group Who Changed			% of Students in Each Study Group Who Did Not Change			GRAND TOTAL
	Positive Direction	Negative Direction	TOTAL CHANGE	Maintained Good Selection	Maintained Poor Selection	TOTAL NO CHANGE	
NUDENT (N=49)	30.6% (15)	24.5% (12)	55.1% (27)	6.1% (3)	38.8% (19)	44.9% (22)	100% (49)
MUNCHER (N=66)	15.2% (10)	21.2% (14)	36.4% (24)	7.6% (5)	56.1% (37)	63.6% (42)	100% (66)
BASIC (N=49)	28.6% (14)	16.3% (8)	44.9% (22)	2.0% (1)	53.1% (26)	55.1% (27)	100% (49)
CONTROL (N=50)	18.0% (9)	24.0% (12)	42.0% (21)	0.0% (0)	58.0% (29)	58.0% (29)	100% (50)

significant differences between the pre- and post-qualitative data of either the NuDent, Muncher and Basic Groups (TABLES 29-31) or the Control Group (TABLE 32).

The results of the McNemar's Tests for the two indices of snacking behaviour (consumption and selection) do not agree. Furthermore, the results from the food records compared to the simulated snack activity indicate that more students in each educational group consumed "good" snack foods than selected "good" snack foods after education (61.6%, 52.4% and 39.2% vs. 36.7%, 22.8% and 30.6% of the NuDent, Muncher and Basic Groups, respectively).* However more students consumed "good" snack foods than selected "good" snack foods before education (29.0% vs. 13.1%).

Many factors could contribute to this discrepancy between consumption and selection behaviour. Firstly, it appears that "the deck was stacked" in favour of potato chips, cheez corn and chocolate bars since these snack foods were the most popular choices in both the pre- and post-simulated snack activity (TABLE 33). Moreover, a bag of peanuts was the least popular choice in the pre-test (selected by only one student in the entire sample of 214) and the third least popular snack food in the post-test. Raisins and ice cream were not favourites also. It was suggested by one teacher that ice cream bars might have been a more popular item than the dixie cups. In addition, several

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* The percentages on consumption behaviour were calculated by adding the percentages of positive "changers" and good "maintainers" from TABLE 15. The percentages on selection behaviour were calculated by adding the percentages of positive "changers" and good"maintainers"from TABLE 28.

TABLE 29

Comparison of Pre- and Post-Test Quality of Snack Foods Selected by NuDent Group (N=49)

Pre-Test Quality	Post-Test Quality: Poor	Post-Test Quality: Good
Good[1]	12	3
Poor[2]	19	15

$X^2 = 0.15$ 1df n.s.

1 Good to poor are those changes in the negative direction.

2 Poor to good are those changes in the positive direction.

TABLE 30

Comparison of Pre- and Post-Test Quality of Snack Foods Selected by Muncher Group (N=66)

Pre-Test Quality	Post-Test Quality: Poor	Post-Test Quality: Good
Good	17	5
Poor	34	10

$X^2 = 1.33$ 1df n.s.

TABLE 31

Comparison of Pre- and Post-Test Quality of Snack Foods Selected by Basic Group (N=49)

Pre-Test Quality	Post-Test Quality: Poor	Post-Test Quality: Good
Good	8	1
Poor	26	14

$X^2 = 1.14$ 1df n.s.

TABLE 32

Comparison of Pre- and Post-Test Quality of Snack Foods Selected by Control Group (N=50)

Post-Test Quality	Post-Test Quality: Poor	Post-Test Quality: Good
Good	12	0
Poor	29	9

$X^2 = 0.19$ 1df n.s.

TABLE 33

Pre- and Post-Test Snack Food Choices Ranked in Order of Popularity by Study Group and Total Sample

STUDY GROUP		Most Popular	2	3	4	5	6	7	Least Popular
NUDENT (N=49)	Pre-Test: Snack Food	Chips	Seeds	DairyMilk	Cheez Corn	Raisins	Wunderbar	Ice Cream	Peanuts
	% of Group	(36.7)	(22.4)	(18.4)	(10.2)	(6.1)	(4.1)	(2.0)	(0)
	Post-Test: Snack Food	Chips	Cheez Corn	Seeds	Wunderbar	Raisins	Dairymilk	Peanuts	Ice Cream
	% of Group	(34.7)	(18.4)	(16.3)	(10.2)	(8.2)	(8.2)	(4.1)	(0)
MUNCHER (N=66)	Pre-Test: Snack Food	Chips	Cheez Corn	DairyMilk	Seeds	Wunderbar	Raisins	Ice Cream	Peanuts
	% of Group	(24.2)	(22.7)	(18.2)	(15.2)	(12.1)	(7.6)	(0)	(0)
	Post-Test: Snack Food	Chips	DairyMilk	Wunderbar	Seeds	Cheez Corn	Ice Cream	Raisins	Peanuts
	% of Group	(31.8)	(19.7)	(18.2)	(13.6)	(9.1)	(4.5)	(1.5)	(1.5)
BASIC (N=49)	Pre-Test: Snack Food	Chips	Cheez Corn	DairyMilk	Wunderbar	Ice Cream	Peanuts	Seeds	Peanuts
	% of Group	(26.5)	(24.5)	(18.4)	(10.2)	(8.2)	(6.1)	(4.1)	(2.0)
	Post-Test: Snack Food	Cheez Corn	Chips	DairyMilk	Wunderbar	Seeds	Peanuts	Raisins	Ice Cream
	% of Group	(26.5)	(20.4)	(18.2)	(18.2)	(10.2)	(10.2)	(4.1)	(2.0)
CONTROL (N=50)	Pre-Test: Snack Food	Chips	Cheez Corn	Wunderbar	DairyMilk	Seeds	Raisins	Ice Cream	Peanuts
	% of Group	(26.0)	(24.0)	(24.0)	(18.0)	(4.0)	(2.0)	(2.0)	(0)
	Post-Test: Snack Food	Wunderbar	Chips	Cheez Corn	DairyMilk	Seeds Raisins	Peanuts		Ice Cream
	% of Group	(36.0)	(30.0)	(22.0)	(8.0)	(2.0) (2.0)	(2.0)		(0)
TOTAL (N=214)	Pre-Test: Snack Food	Chips	Cheez Corn	DairyMilk	Wunderbar	Seeds	Raisins	Ice Cream	Peanuts
	% of Group	(28.0)	(20.6)	(19.6)	(12.6)	(11.0)	(4.7)	(2.8)	(1.4)
	Post-Test: Snack Food	Chips	Wunderbar	Cheez Corn	DairyMilk	Seeds	Peanuts	Raisins	Ice Cream
	% of Group	(29.4)	(18.7)	(18.2)	(13.1)	(10.7)	(4.2)	(3.7)	(1.9)

teachers indicated that the sunflower seeds probably would have been more popular if the students were permitted to eat them on the school grounds. It thus appears that the author made a poor choice of ND and NØ snack foods for the simulated snack activity. However, the author experienced difficulty in choosing these snack items because the selection was very limited. The variety of nutritious non-cariogenic snack foods, in the majority of drug stores, includes only nuts, various types of seeds and beef and pepperoni sticks. Children are much more likely to obtain fresh fruit and raw vegetables at home than purchase them in a grocery store. In regard to nutritious cariogenic snack foods, ice cream bars, dixie cups, sesame snaps, granola bars are the extent of choices available at the corner store, whereas at home children may have the additional snack food alternatives of yogurt, peanut butter and jelly sandwiches, puddings, muffins and other sweetened cereal products.

Perhaps the students chose the ND and NØ snack foods out of habit and would have chosen them no matter what the alternatives were. The few nutritious, non-cariogenic snack foods available on corner store shelves are no competition for the vast variety of highly advertised candy bars and snack foods such as chips and cheezies. It is interesting to note that Dairy Milk was more popular than Wunderbar during the pre-test period, but the popularity was reversed in the post-test period. This was no doubt partly due to the heavy TV advertising that Wunderbar received during the fall and winter months.

Another reason why NØ and ND snack foods may have been chosen is the fact that these foods were introduced to the students as "treats". Sweets and other "junk foods"* are the type of food used predominantly

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* foods which are high in calories and very low in nutrients

as gifts, rewards, treats and tokens of affection. In a study of pre-school children in England, reviewed by Baric et al. (182), it was found that 98% of the children received sweets from their mothers for these reasons. Excluding those children from the sample whose mothers considered them to be too young to be given sweets in this way, 91% of the remainder received sweets from their grandparents, 82% were brought sweets by their fathers and 87% of the children received gifts of sweets from their relatives, friends, neighbours etc. Perhaps the children in this study perceived "treats" as meaning the opportunity to select a sweet snack food or other "junk foods".

If the present study was repeated, the simulated snack activity could possibly be improved by having a greater variety of snack food items provided at the school canteen free of charge at noon, recess and after school. The teacher in charge could record all choices and explain that the foods were donated by companies for advertising reasons. The students probably would not associate the food records, educational programme and this activity and thus the likelihood of a "treat" or "reward" connotation would be decreased.

It is apparent from the results of the post-knowledge test that the children in the NuDent, Muncher and Basic Groups knew that chocolate bars were bad for their teeth and that potato chips and cheez corn were not nutritious foods. However, this did not prevent them from selecting these foods. Perhaps a highly palatable foodstuff which a child knows he will enjoy has more immediate satisfaction than selecting a food that will not promote cavities. The task for nutritionists is to encourage food companies to develop nutritious, non-cariogenic snack foods that taste "great" and that can be easily obtained from corner stores at a price which is comparable to other snack foods.

VI. SUMMARY OF RESULTS AND CONCLUSIONS

A summary of the results of the variables assessed in this study are presented in TABLE 34. In making concluding remarks about the results, the hypotheses (Section III.B) will be used as an outline. It should be kept in mind that the evaluation was concerned with only the grade 5 students in Portage la Prairie and thus the conclusions can not be generalized to the population.

First Hypothesis: All children who receive a nutrition and dental health educational programme will improve their knowledge about nutrition and dental health.

It was found that students who received the NuDent, Muncher and Basic Educational Programmes significantly increased their knowledge test scores after education. The Control Group, which received no educational programme, demonstrated no significant change in knowledge test scores.

First Conclusion: Participation in the nutrition and dental health educational programmes improved the children's knowledge.

Second Hypothesis: All children who receive a nutrition and dental health educational programme will increase or maintain the consumption of nutritious and/or dentally acceptable snack foods.

It was found that only the students in the NuDent Group demonstrated a significant difference in the quality of snack foods they consumed after education. However the NuDent Educational Programme improved the snacking behaviour of only 38.5% of the students. Its success was greatly attributed to the preventive effect it had on the students who already consumed good snacks. Reinforcing good food practices is a positive

TABLE 34

Summary of the Results of the Variables Assessed by Study Group

STUDY GROUP	Variables				
	Increase in Knowledge about Nutrition and Dental Health	Increase or Maintain Consumption of Nutritionally &/or Dentally Acceptable Snack Foods	Decrease in Frequency of Sucrose Consumption Between Meals		Increase or Maintain Selection of Nutritionally &/or Dentally Acceptable Snack Foods
			Decrease in Sucrose Exposures	Decrease in Sucrose Ratios	
NUDENT	✓ [1]	✓	✓	✓	–
MUNCHER	✓	–	✓	✓	–
BASIC	✓	–	✓	–	–
CONTROL	– [2]	–	–	–	–

[1] ✓ indicates a significant difference in the direction hypothesized between the pre- and post-variables assessed ($p < .05$)

[2] – indicates no significant difference

effect of education.

Second Conclusion: Although the students who received the educational programmes increased their cognitive learning much more than did the students who were in the Control Group, they did not improve the quality of snack foods they consumed dramatically. This finding reinforces the comments made by Travers in 1963 (183) that we do not always do what we know is best for us.

The ultimate goal of education is to change behaviour in the "desired directions". In health education, the paradigm--knowledge before attitudes before behavioural changes--has been one of creating "cognitive dissonance" within the person's mind so that he will soon change his behaviour so as to be consistent with the information he knows and the attitude he holds (184). The assumed role of education in behaviour change has been to give the process a "push", to initiate the information gathering process which will then produce some attitude shifts and finally induce behavioural modification. For example, a model of smoking education would predict that (1) the accumulation of information on the negative effects of smoking would come to be believed varying degrees, by the smoker; (2) he would re-evaluate smoking as an activity, viewing the event as something associated primarily with "bad" or "unfavourable" health consequences rather than as one associated with "good" or "favourable" consequences; and (3) noting the inconsistency between his attitudes that he developed from what he knows about smoking and the fact that he still smokes, he will change his behaviour to bring his behaviour more in line with his attitudes; that is, quit smoking. However, people still smoke. Similarly, people commonly believe that sweets are not good for their teeth and that saturated fats and cholesterol-rich

foods are associated with obesity and heart disease but they still eat these foods. According to Swanson (184) the relationships between knowledge, attitudes and behavioural change are not as simple, nor as consistent as we have often assumed.

Clearly, knowledge is a necessary, but not necessarily sufficient, factor in behavioural change. A person must not only know certain information, but also believe in its usefulness, and the more immediate the usefulness, the better (185). According to Kegeles (186), in order for an individual to take a voluntary health action, he must: (1) feel susceptible to the illness or disease, (2) believe that the affliction would have serious consequences, and (3) feel that the need to take such action is more important than a variety of other things he might do. In addition, for a dietary health action to occur, the person must feel he has some control over his diet (160). This involves either the ability to purchase desirable foods or the ability to influence the family's food buyer.

Third Hypothesis: All children who receive a nutrition and dental health educational programme will decrease the frequency with which they consume sucrose-containing snack foods, between meals.

In contrast to the undesirable results of the qualitative snack food consumption data, it was found that all students who received an educational programme decreased the frequency with which they consumed sucrose-foods during snack periods. The Control Group did not demonstrate a significant change in either the number of sucrose exposures or sucrose ratios. It appears that it is more realistic to encourage children to cut down on the number of separate occasions that they eat sweet foods between meals than to tell them to eliminate sweet snacks

completely or to consider the nutritional value of every snack food they eat. Perhaps the students found it too confusing or frustrating to concern themselves with both the nutrient and sugar content of snack foods.

Third Conclusion: Participation in the nutrition and dental health educational programmes resulted in a decrease in the frequency of sucrose consumption between meals.

Fourth Hypothesis: All children who receive a nutrition and dental health educational programme will increase or maintain the selection of nutritionally and/or dentally acceptable snack foods.

It was found that the students in each of the four study groups did not improve the quality of the snack foods they selected in the simulated snack activity. Although the students who received the educational programmes knew that chocolate bars were bad for their teeth and that potato chips and cheez corn were not nutritious foods, they still selected these foods. This result also reinforces the comment of Travers (183) that we do not always do what we know is best for us.

Fourth Conclusion: The educational programmes were not effective in improving the nutritional and dental health quality of snack foods which the students selected in a simulated situation.

Fifth Hypothesis: The degree to which the major educational resources in each educational programme requires the active involvement of the children will be positively related to their knowledge about nutrition and dental health.

The comparative results of the knowledge test scores of the three educational groups suggested a trend in which educational resources that involve active participation of the students (puppets and comic/activity

books) are more likely to improve knowledge than those resources which require only passive involvement (films). However, it was also found that one class, who did not have the use of additional resources, and whose teacher was very "keen" on the subject matter, improved its knowledge to the same degree as the classes who used puppets and comic/activity books.

Fifth Conclusion: The more that resource materials actively involve students in a nutrition and dental health educational programme, the more likely the students' knowledge will improve. However, a highly motivated teacher may change students' knowledge without the aid of expensive resources.

Sixth Hypothesis: The degree to which the major educational resources in each educational programme requires the active involvement of the children will be positively related to their consumption of nutritionally and/or dentally acceptable snack foods.

The puppets and comic/activity book, which actively involved the students, were the most effective resources since only the NuDent Group demonstrated a significant change in the consumption of snack foods after education. However the significance of this effect was attributed to the fact that more students in the NuDent Group maintained good habits and fewer students changed in negative direction than in the other groups. Given more time, the NuDent Programme may have had a greater impact on changing a greater number of students who had poor consumption habits. Further research is required to validate this speculation.

Sixth Conclusion: The more that resource materials actively involve students in a nutrition and dental health educational programme the more likely it is that students will maintain the consumption of nutritionally

and/or dentally acceptable snack foods.

Seventh Hypothesis: The degree to which the major educational resources in each educational programme requires the active involvement of the children will be inversely related to the frequency with which they consume sucrose-containing snack foods between meals.

The comparative results showed that there was no difference in the effect of the three educational programmes in decreasing the frequency of sucrose consumption.

Seventh Conclusion: The addition of a resource which passively involves students (film) or the addition of resources which actively involve students (puppets, comic/activity books) had no differential effect in motivating the students to decrease the frequency with which they consume sucrose-foods between meals.

Eighth Hypothesis: The degree to which the major educational resources in each educational programme requires the active involvement of the children will be positively related to their selection of nutritionally and/or dentally acceptable snack foods.

It was found that all three educational programmes were ineffective in motivating the students to change the quality of the snack foods they selected.

Eighth Conclusion: Neither the resources which required active involvement (puppets, comic/activity books) nor the resources which required passive involvement (film) of the students in the learning process improved the selection of nutritionally and/or dentally acceptable snack foods.

Overall, this investigation suggests that the success or failure of an educational programme depends on the personalities involved and the methods and resources used. Educational resources which focus on student participation rather than those which rely on passive involvement

are more likely to be effective in improving knowledge and motivating children to change their dietary behaviour.

However, regardless of the educational resources used to promote good snacking habits in this study, the results indicate that the educational programmes, in themselves, could be improved. Perhaps the programmes may be more successful in changing consumption behaviour if they are run for longer than a one-month period and if time is allowed for follow-up and reinforcement. If the teachers cannot devote more time to the programme it would be advisable to concentrate on only one message, that is, sucrose and dental caries, instead of confounding the issue with the nutritional value of foods.

Furthermore, attention should be directed to increasing parental involvement in nutrition and dental health educational programmes since a child's practices and habits are influenced considerably by the habits, attitudes and knowledge of his parents. In a five-year study reported by Linn in 1976, (187) in which 147 mothers, fathers or grandmothers in charge of children, 3 through 11 years of age, were interviewed about the child's oral hygiene habits, it was found that there was little concern about the contribution to decay made by the frequent consumption of sugar-containing foods. Only 1% of the respondents knew that frequent snacking on sweet food increased the chance of decay. Furthermore, Baric et al. (182) reported that parents generally have the attitude that deciduous teeth of children are characterized by their impermanence and therefore do not require careful attention because the child will lose them eventually. It is disheartening that during the period when the child is expected to acquire routines, habits and attitudes, which will influence his life's behaviour related to dental health, that the general expectations

concerning his teeth are that they are of a transient nature and that everything will be better when the permanent teeth are acquired. The American Dental Association (12) reported that dental health educational programmes conducted under the sponsorship of parent-teacher associations have been effective, in many cases, in informing parents of the basic facts of dental health and the importance of prevention. In addition, the school could keep parents informed of the objectives and activities of the dental health programme through bulletins and meetings so that the parents understand the programme and, in turn, cooperate more effectively with the school.

Ideally, the establishment of routines relevant to preventive dental health should be started during primary socialization (182). Prevention should start before a poor habit is acquired. For example, if we want to reduce the risk of lung cancer in the population in general, the aim of health education should be to prevent people from taking up the habit of smoking cigarettes. The target population will thus include the age groups who have not started to experiment with cigarettes and who have not developed positive attitudes to cigarette smoking. With respect to nutrition and dental health, education should coincide with the establishment of dietary habits which will greatly influence future patterns of sugar consumption. Health educators should make certain not to miss this sensitive period in a child's life.

Furthermore, both parents should be made aware of their important role as the socializing agents through educational programmes in family planning clinics, prenatal classes and well-baby clinics. The role of school teachers, then, should be to provide the students with the knowledge which is necessary for a rational explanation of behaviour. With

respect to nutrition and dental health in particular, parents should teach their children proper dietary and dental habits during the early socialization period, and the school, through the provision of knowledge, should reinforce the positive behaviours established during early childhood in the home.

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VII APPENDICES

APPENDIX A

An Example of the Format of the 3 Teachers' Manuals

TEACHER MANUAL FOR THE NUDENT EDUCATIONAL PROGRAMME

WEEK I

INTRODUCTION - DAY I

Tell the class that for the next month they will be learning about their diet and dental health. Impress upon them the fact that they can prevent cavities and tooth loss by simply following the NuDents' secret clues to diet and oral hygiene. "Preventive dentistry means that YOU have as big a role in keeping your mouth healthy as your dentist does. The care of your teeth every day is a great deal more important than what goes on in the dentist's office; in fact if you pay attention to the preventive techniques that we discuss for the next few weeks-all the rest of your dental visits will probably be only for examination and cleaning."

Hand out the NuDent comic books which they will use during the month. Advise the students that the comic books are NOT TO BE TAKEN HOME until after the education programme is over.

A.M. - (Perhaps in English class or during library time). Instruct the students to read the first story in the NuDent comic book and be sure they have their pencils ready to fill in the blanks. Introduce them to the characters with the NuDent puppets, telling them a bit about the characters and the first story. Tell them that after they finish the story that you will be asking for volunteers to put on a puppet show* to tell the NuDent message from the first story. (if there are no volunteers, select a few class leaders, also a few other students could work on the stage props for the puppet show. Instructions included.) They could practice at recess or lunch time with your supervision (important for the accuracy of the message), and put the show on during the last class of the day. Be sure the students relate the nutritional and dental health messages correctly.

* NOTE The purpose of the puppet show is to reinforce the educational message presented in the comic book. By performing the show the participating children will be forced to learn the message and the audience will receive the message in another manner.

P.M. - Puppet Show

DAY II

PURPOSE: To highlight the important points about 4-4-3-2 Balanced Diet from the first comic story.

BEHAVIOURAL OBJECTIVES	TEACHING CONCEPTS i.e. LESSON CONTENT	ACTIVITIES	RESOURCES & BACK-UP PREP FOR TEACHER
1.The pupil can classify foods into the correct Food Group	Most of the foods we eat can be classified into one of the four food groups, based on their similarity of food value. There are 4 food groups: Milk & Dairy Products Includes cheese, cottage cheese, yoghurt, cream soup, egg nog, milk pudding Meat, Fish, Poultry, Eggs, Dried Peas & Beans Includes all meats, fish, chicken, turkey, eggs, chili, beans and nuts Fruits and Vegetables Includes apples, bananas, pears, all citrus fruits etc., potatoes, carrots and all green vegetables etc. Bread and Cereal Includes all breads and cereals, rice, spaghetti, macaroni, crackers, and noodles.	NOTE: the teachers will use one or more of the NuDent puppets to do all the teaching concepts. Have a few of the Nu-Dents hand out the activity sheet "Sort These Foods Into Their Groups", then have the students complete the activity.	NuDent Puppets A Guide For All Reasons-Manitoba's Food Guide Information on the 4 food groups could be written on the black-board or flip chart. Activity Sheets "Sort These Foods Into Their Groups"

(Con't.)

BEHAVIOURAL OBJECTIVES	TEACHING CONCEPTS i.e. LESSON CONTENT	ACTIVITIES	RESOURCES & BACK-UP PREP FOR TEACHERS
2.The pupil can name the recommended number of servings from each group	To give our bodies all the nourishment it needs to live and grow we must eat certain amounts from each of the 4 food groups. This is the NuDents' 4-4-3-2 Secret Clue: 4 servings from the Bread & Cereals Group 4 servings from the Fruits & Vegetables Group 3 servings from the Milk Group 2 servings from the Meat Group	Make sure they fill in the blanks for the recommended number of servings on the sheet "Sort These Foods into Their Groups". Go over the right answers. By filling this sheet out the students will be prepared to play food bingo.	
3.The pupil can give examples of foods belonging to each group	Variety in food choices is the key to good nutrition. The more variety you have in your day's food intake the more likely your body will receive all the nourishment it needs.	Play Food Bingo 3 ways if time permits (at least the first way) 1.Full card 2.Vertically 3.Diagonally Instructions are attached. Use Buck to call numbers.	2 Caller's Numbers Sheets, Bingo Cards, pencils, 6 packages Sunflower seeds for prizes
4.The student can select foods which when combined form a well-balanced meal	Each day, our food intake should be balanced because no one food group gives us all the nourishment we need. Foods must work together. The easiest way to ensure this is to eat foods from the Four Food Groups at every meal. Thus a well-balanced meal is made up of one food from each of the Four Food Groups.	Play Food Bingo again. Only this time to win the students have to get a row across or diagonally to get a balanced meal (one food from each of the 4 food groups). Again have Buck call the numbers and play several games if time permits.	

TEACHER MANUAL FOR THE MUNCHERS (FILM) EDUCATIONAL PROGRAMME

WEEK I

INTRODUCTION - DAY I

Tell the class that for the next month they will be learning about their diet and dental health. Impress upon them the fact that they can prevent cavities and tooth loss by simply practising a few of the "Munchers'" preventive measures in diet and oral hygiene. "Preventive dentristry means that YOU have as big a role in keeping your mouth healthy as your dentist does. The care of your teeth every day is a great deal more important than what goes on in the dentist's office; in fact, if you pay attention to the preventive techniques we discuss for the next few weeks - all the rest of your dental visits will probably be only for examination and cleaning.

Introduce the whole topic of Nutrition and Dental Health by showing the film "The Munchers--a Fable"(10 minute film).

DAY I

PURPOSE: To discuss the principle of a 4-4-3-2 balanced diet.

BEHAVIOURAL OBJECTIVES	TEACHING CONCEPTS i.e. LESSON CONTENT	ACTIVITIES	RESOURCES & BACK-UP PREP FOR TEACHER
1.The pupil can classify foods into the correct Food Groups	Most of the foods we eat can be classified into one of the 4 Food Groups based on their similarity of food value. There are 4 Food Groups: MILK & DAIRY PRODUCTS Includes cheese, cottage cheese, yogurt, cream soups, milk puddings, egg nog MEAT, FISH, POULTRY, EGGS, DRIED PEAS AND BEANS Includes all meats & fish, chicken, turkey, eggs, chili, pork & beans, nuts FRUITS & VEGETABLES Includes apples, bananas, pears, all citrus fruits etc, potatoes, carrots, & all green vegetables etc. BREADS AND CEREALS Includes all breads and cereals, rice, spaghetti, macaroni, crackers, and noodles	Rerun the section on Balanced Diet in the "Munchers" film ie. from: Mr. Filling - "The same foods that keep bodies healthy keep teeth healthy. Foods that make up a balanced diet" ... to: Mr. Filling - "That's the spirit!" (see attached script) Hand out the activity sheet "Sort These Foods Into Their Groups" and then have the students complete the activity.	A Guide For All Reasons-Manitoba's Food Guide Information on the 4 food groups could be written on the blackboard or flipchart Film - "Munchers" (to start at a specific part) Activity Sheets - "Sort These Foods Into Their Groups"

(Con't.)

BEHAVIOURAL OBJECTIVES	TEACHING CONCEPTS i.e. LESSON CONTENT	ACTIVITIES	RESOURCES & BACK-UP PREP FOR TEACHER
2.The pupil can name the recommended number of servings from each food group.	To give our bodies all the nourishment it needs to live and grow we must eat certain amounts from each of the 4 food groups: 4-4-3-2 4 servings from the Breads & Cereals group 4 servings from the Fruits and Vegetables Group 3 servings from the Milk Group 2 servings from the Meat Group	Make sure they fill in the blanks for the recommended number of servings on the sheet "Sort These Foods Into Their Groups". Go over the right answers. By filling this sheet out the students will be prepared to play food bingo.	
3.The pupil can give examples of foods belonging to each group.	Variety in food choices is the key to good nutrition. The more variety you have in your day's food intake the more likely your body will receive all the nourishment it needs.	Play Food Bingo - 3 ways if time permits (at least the first way): 1.full card 2.vertically 3.diagonally Instructions are attached.	2 Callers' Numbers Sheets Bingo Cards Pencils 6 packages sunflower seeds.
4.The student can select foods which when combined form a well-balanced meal.	Each day, our food intake should be balanced because no one food group gives us all the nourishment we need. Foods must work together. The easiest way to ensure this is to eat foods from the 4 Food Groups at every meal. Thus a well-balanced meal is made up of one food from each of the 4 Food Groups.	Play Food Bingo again. Only this time to win the students have to get a row across or diagonally to get a balanced meal (one food from each of the 4 food groups). Play several games if time permits.	

WEEK I

INTRODUCTION - DAY I

Tell the class that for the next month they will be learning about their diet and dental health. Impress upon them the fact that they can prevent cavities and tooth loss by simply practising a few preventive measures in diet and oral hygiene. "Preventive dentistry mean that YOU have as big a role in keeping your mouth healthy as your dentist does. The care of your teeth every day is a great deal more important than what goes on in the dentist's office; in fact, if you pay attention to the preventive techniques that we discuss for the next few weeks - all the rest of your dental visits will probably be only for examination and cleaning.

PURPOSE: To discuss the principle of a 4-4-3-2 balanced diet.

BEHAVIOURAL OBJECTIVES	TEACHING CONCEPTS i.e. LESSON CONTENT	ACTIVITIES	RESOURCES AND BACK-UP PREP FOR TEACHER
1.The pupil can classify foods into the correct Food Groups	Most of the foods we eat can be classified into one of the 4 Food Groups based on their similarity of food value. There are 4 Food Groups: MILK & DAIRY PRODUCTS Includes cheese, cottage cheese, yogurt, cream soups, milk puddings, egg nog MEAT, FISH, POULTRY, EGGS, DRIED PEAS AND BEANS Includes all meats and fish, chicken, turkey,egg, chili, pork & beans, nuts (Con't.)	Hand out the activity sheet "Sort These Foods Into Their Groups" and then have the students complete the activity.	A Guide For All Reasons-Manitoba's Food Guide Information on the 4 Food Groups could be written on the blackboard or a flip chart Activity Sheets "Sort These Foods Into Their Groups"

BEHAVIOURAL OBJECTIVES	TEACHING CONCEPTS i.e. LESSON CONTENT	ACTIVITIES	RESOURCES AND BACK-UP PREP FOR TEACHER
	FRUITS AND VEGETABLES Includes apples, bananas, pears, all citrus fruits, etc., potatoes, carrots & all green vegetables etc.		
2.The pupil can name the recommended number of servings from each food group.	BREADS AND CEREALS Includes all breads and cereals, rice, spaghetti, macaroni, crackers & noodles. To give our bodies all the nourishment it needs to live and grow we must eat certain amounts from each of the 4 Food Groups: 4-4-3-2 4 servings from the Breads & Cereals Group 4 servings from the Fruits and Vegetables Group 3 servings from the Milk Group 2 servings from the Meat Group	Make sure they fill in the blanks for the recommended number of servings on the sheet "Sort These Foods Into Their Groups". Go over the right answers. By filling this sheet out the students will be prepared to play food bingo.	
3.The pupil can give examples of foods belonging to each group.	Variety in food choices is the key to good nutrition. The more variety you have in your day's food intake the more likely your body will receive all the nourishment it needs.	Play Food Bingo-3 ways if time permits (at least the first way): 1.full card 2.vertically 3.diagonally Instructions are attached	2 Callers' Numbers Sheets Bingo cards Pencils 6 packages sunflower seeds for prizes

(Con't.)

BEHAVIOURAL OBJECTIVES	TEACHING CONCEPTS	ACTIVITIES	RESOURCES AND BACK-UP PREP FOR TEACHER
4.The student can select foods which when combined form a well-balanced meal.	Each day, our food intake should be balanced because no one food group gives us all the nourishment we need. Foods must work together. The easiest way to ensure this is to eat foods from the 4 Food Groups at every meal. Thus a well-balanced meal is made up of one food from each of the 4 Food Groups.	Play Food Bingo again. Only this time to win the students have to get a row across or diagonally to get a balanced meal (one food from each of the 4 food groups). Play several games if time permits.	

APPENDIX B

Letter to Parents of Grade 5 Children

THE UNIVERSITY OF MANITOBA
FACULTY OF HOME ECONOMICS
WINNIPEG, CANADA R3T 2N2
TELEPHONE 204 474-9901

DEPARTMENT OF FOODS AND NUTRITION

September 29, 1976

Dear Parents,

As a graduate student with the Department of Foods and Nutrition at the University of Manitoba, I am currently involved in a research project on nutrition and dental health education. I am especially interested in the effect that various educational resources will have on children's snacking behaviour. Research has shown that it is the frequency of sugar consumption that is the major dietary cause of tooth decay. It is hoped that the education programme will reinforce those children who are already selecting nutritious snacks that are not harmful to their teeth, and will motivate other children to select such snacks in preference to sugary foods that are low in nutritional value.

A research project of this nature is greatly needed as very little effort has been exerted in the area of evaluation of both nutrition and dental health education in the schools. It is hoped that with your child's assistance, this study will provide more information in this area.

The purpose of this letter is both to inform you that such a study will be taking place in all the schools in Portage la Prairie and to ask your permission to allow your child to participate in this project. The project is not harmful in any way, indeed it will provide an enjoyable educational experience for your child.

The study will run from October 12th to December 13th. Your child will be required to keep a record of the food he or she eats on October 13th, 14th, 15th and 16th and then again on December 1st, 2nd, 3rd, and 4th. Your child will also be asked to fill out a knowledge questionnaire about nutrition and dental health. In the meantime your child will learn about diet, oral hygiene and the prevention of tooth decay with the use of puppets, comic books, films, games and various other activities.

It should be noted that this investigation has the approval of both the superintendent of the Portage la Prairie school division and the school principals. Your child's teacher will be trained by a nutritionist to do the teaching.

I sincerely hope that you will seriously consider assisting me with this study. Please indicate whether or not you wish your child to participate by completing the permission slip below and return it in the enclosed stamped and self-addressed envelope before Tuesday, October 12th.

Yours sincerely,

Helen Hale
Graduate student

Name of child _____

School _____

I do consent _____

I do not consent _____

APPENDIX C

Nutrition and Dental Health Knowledge Test

PLEASE PRINT
YOUR NAME _____
(First Name) (Last Name)

YOUR AGE _____ BOY _____ TODAY'S DATE _____
GIRL _____

SCHOOL _____ GRADE _____

Hello!

Would you please help me with these questions about food and the care of your teeth. Please answer ALL questions. This is not a test. There will be no grades. Thank you.

Helen

PART I

Most foods belong to one of four food groups:

a) Milk and Dairy Products

b) Meat

c) Fruits and Vegetables

d) Breads and Cereals

1. Which of the following foods belong to the Milk Group? Put an (X) in the blank beside the foodsthat belongs to the Milk Group.

___ Buttermilk

___ Mayonnaise

___ Cheddar cheese

___ Ice cream

___ Fish

___ Yogurt

___ Butter

___ Cream soups

___ Milk puddings

___ Cottage cheese

2. Which of the following foods belong to the Meat Group? Put an (X) in the blank beside the foods that belong to the Meat Group.

___ Roast beef

___ Peanuts

___ Yogurt

___ Eggs

___ Liver

___ Fish

___ Butter

___ Chicken

___ Hamburger

___ Hot dog

___ Gravy

___ Pork and beans

3. Which of the following foods belong to the Fruits and Vegetables Group? Put an (X) in the blank beside the foods that belongs to the Fruits and Vegetables Group.

___ Potatoes

___ Chili

___ Turnip

___ Lemon

___ Celery

___ Yogurt

___ Spinach

___ Grapes

___ Muffins

___ Banana

___ Raisins

___ Cheese

___ Carrots

4. Which of the following foods belong to the Breads and Cereals Group? Put an (X) in the blank beside the foods that belong to the Breads and Cereals Group.

___ Rice

___ Corn flakes

___ Strawberries

___ Muffins

___ Pancakes

___ Corn

___ Rye bread

___ Oatmeal

___ Peas

___ Spaghetti

___ Macaroni

___ Raisins

PART II

INSTRUCTIONS:

After each question there are several choices for the answer. Put an (X) in the blank beside the ONE right answer. If you don't know the answer put an (X) beside "don't know". Please answer ALL questions.

Here is an example:

Winnipeg is the capital city of what province?

___ 1. Alberta

___ 2. Quebec

X 3. Manitoba

___ 4. Ontario

___ 5. Don't know

QUESTIONS:

1. Which ONE of the food groups gives you the most calcium?

___ 1. Meat Group

___ 2. Milk Group

___ 3. Breads and Cereals Group

___ 4. Fruits and Vegetables Group

___ 5. Don't know

2. Food that helps cause cavities is?

___ 1. Raw

___ 2. Sugary

___ 3. Spoiled

___ 4. Overcooked

___ 5. Don't know

3. A substance which helps to protect teeth against decay is?

___ 1. Salt

___ 2. Flouride

___ 3. Chlorine

___ 4. Sugar

___ 5. Don't know

4. Which ONE of the following helps build strong muscles and helps repair your body cells?

___ 1. Fat

___ 2. Carbohydrate

___ 3. Calcium

___ 4. Protein

___ 5. Don't know

5. What does a "balanced diet" mean?

___ 1. Balancing the fat, sugar and protein so each is the same.

___ 2. Eating just as much solid food as drink.

___ 3. Balancing calories and nutrients from the four food groups.

___ 4. Counting up the calories in each and every food.

___ 5. Don't know

6. As a snack food potato chips are:

___ 1. Nutritious and good for your teeth.

___ 2. Nutritious and bad for your teeth.

___ 3. Good for your teeth but not nutritious.

___ 4. Bad for your teeth and not nutritious.

___ 5. Don't know

7. Which ONE of the following is the major mineral you need for healthy teeth and bones?

___ 1. Iron

___ 2. Calcium

___ 3. Magnesium

___ 4. Iodine

___ 5. Don't know

8. Which ONE of the following groups of foods makes up a balanced meal?

___ 1. Milk and pancakes

___ 2. Tuna-lettuce sandwich and milk

___ 3. Fish and chips

___ 4. Eggs and fruit juice

___ 5. Don't know

9. To be healthy your body needs how many helpings from the Meat Group each day?

___ 1. 1 helping each day

___ 2. 2 helpings each day

___ 3. 3 helpings each day

___ 4. 4 helpings each day

___ 5. None

___ 6. Don't know

10. What is the main component in plaque?

___ 1. Bacteria

___ 2. Viruses

___ 3. Food

___ 4. Calculus

___ 5. Don't know

11. If a friend asked for your advice on how to prevent cavities which would you suggest?

___ 1. Snack on fruits and vegetables

___ 2. Drink milkshakes instead of soft drinks

___ 3. Buy a new toothbrush every month

___ 4. Eat licorice instead of carmels

___ 5. Don't know

12. Which ONE of the following foods is the best source of protein?

___ 1. Potatoes

___ 2. Chicken

___ 3. Corn

___ 4. Banana

___ 5. Don't know

13. Vitamin A is needed by your body because?

___ 1. It builds and keeps your teeth and bones strong

___ 2. It helps build your blood

___ 3. It is the chief source of energy to your body

___ 4. It keeps your eyes healthy

___ 5. Don't know

14. Here is what Sally had for lunch today:

Cheeseburger on a bun
Peaches

Does Sally need anything extra to make her lunch have helpings from each of the four food groups?

___ 1. Yes - a helping from the Fruits and Vegetables Group

___ 2. Yes - a helping from the Meat Group

___ 3. Yes - a helping from the Milk Group

___ 4. No - already has helpings from all four food groups

___ 5. Don't know

15. Plaque is?

___ 1. A brown thick layer

___ 2. A sticky almost colourless film

___ 3. A greenish stain

___ 4. A collection of food

___ 5. Don't know

16. Which ONE of the following is the MOST nutritious snack food?

___ 1. Peanuts

___ 2. Potato chips

___ 3. Popcorn

___ 4. Pop

___ 5. Don't know

17. Carbohydrate is needed by your body because?

___ 1. It builds and keeps your teeth and bones strong

___ 2. It helps build your blood

___ 3. It is the chief source of energy to your body

___ 4. It keeps your eyes healthy

___ 5. Don't know

18. If a cavity develops in a tooth, how should it be treated?

___ 1. Have the tooth filled

___ 2. Keep the tooth completely clean

___ 3. Use aspirin when the tooth hurts

___ 4. Drink milk until the tooth heals

___ 5. Don't know

19. Plaque can be removed effectively by?

___ 1. Eating an apple

___ 2. Flossing and brushing

___ 3. Using a mouthwash

___ 4. Rinsing with water

___ 5. Don't know

20. Which ONE of the following foods is the best source of calcium?

___ 1. Liver

___ 2. White bread

___ 3. Beets

___ 4. Cheese

___ 5. Don't know

21. To be healthy how many helpings of food does your body need from the Fruits and Vegetables Group each day?

___ 1. 1 helping each day

___ 2. 2 helpings each day

___ 3. 3 helpings each day

___ 4. 4 helpings each day

___ 5. None

___ 6. Don't know

22. As a snack food ice cream is:

___ 1. Nutritious and good for your teeth

___ 2. Nutritious and bad for your teeth

___ 3. Good for your teeth but not nutritious

___ 4. Bad for your teeth and not nutritious

___ 5. Don't know

23. To help prevent tooth decay plaque should be removed?

___ 1. After meals and before bed

___ 2. Only by the dentist

___ 3. Whenever the teeth feel funny

___ 4. At least once a week

___ 5. Don't know

24. Which ONE of the following foods is NOT a good protein food?

___ 1. Fish

___ 2. Baked beans

___ 3. Eggs

___ 4. Spinach

___ 5. Don't know

25. Which ONE of the following helps build red blood cells?

___ 1. Protein

___ 2. Calcium

___ 3. Iron

___ 4. Vitamin A

___ 5. Don't know

26. When sugar is present the plaque bacteria on your teeth produce?

___ 1. Enzymes

___ 2. Juices

___ 3. Acid

___ 4. Mold

___ 5. Don't know

27. As a snack food sunflower seeds are?

___ 1. Nutritious and good for your teeth

___ 2. Nutritious and bad for your teeth

___ 3. Good for your teeth but not nutritious

___ 4. Bad for your teeth and not nutritious

___ 5. Don't know

28. If you needed more Vitamin A and Vitamin C in your diet which food group would you need to eat more of?

___ 1. Milk and dairy products

___ 2. Fruits and vegetables

___ 3. Meat and fish

___ 4. Breads and cereals

___ 5. Don't know

29. To be healthy your body needs how many helpings from the Breads and Cereals Group each day?

___ 1. 1 helping each day

___ 2. 2 helpings each day

___ 3. 3 helpings each day

___ 4. 4 helpings each day

___ 5. None

___ 6. Don't know

30. Which ONE of the following foods does NOT belong in the Meat Group?

___ 1. Chili

___ 2. Mushrooms

___ 3. Fish

___ 4. Pork and beans

___ 5. Don't know

31. When does plaque form on teeth?

___ 1. If sweets are eaten

___ 2. All the time

___ 3. Once a day

___ 4. After each meal

___ 5. Don't know

32. Which ONE of the following groups of foods makes up a balanced meal?

___ 1. Turkey, steak and fish

___ 2. Hamburger and pop

___ 3. Potatoes, oatmeal, bread and bananas

___ 4. Fish, bread, carrots and milk

___ 5. Don't know

33. Which ONE of the following foods provides mostly calories and very few other nutrients?

___ 1. Apple

___ 2. Peanut butter

___ 3. Ice cream

___ 4. Licorice

___ 5. Don't know

34. You have been given a piece of chocolate cake. If you are concerned about preventing cavities when would be the best time to eat the cake?

___ 1. At morning recess for a snack

___ 2. With your noon meal

___ 3. At afternoon recess for a snack

___ 4. After school for a snack

___ 5. Don't know

35. Spaghetti, macaroni, crackers and noodles belong to which food group?

___ 1. Milk Group

___ 2. Fruits and Vegetables Group

___ 3. Meat Group

___ 4. Breads and Cereals Group

___ 5. Don't know

36. Which ONE of the following is the MOST IMPORTANT factor in the cause of tooth decay?

___ 1. The amount of sugar you eat

___ 2. The number of times you eat the sugary foods

___ 3. The stickiness of the sugary food that you eat

___ 4. The amount of coffee you drink

___ 5. Don't know

37. Which ONE of the following foods IS a good source of iron?

___ 1. Milk

___ 2. Roast beef

___ 3. Orange juice

___ 4. Lettuce

___ 5. Don't know

38. Which ONE of the following foods does NOT contain hidden sugar?

___ 1. Chocolate milk

___ 2. Raisins

___ 3. Popcorn

___ 4. Vanilla pudding

___ 5. Don't know

39. Carmels are more harmful than pop to your teeth because?

___ 1. They have more sugar

___ 2. They are sticky and cling to your teeth

___ 3. They have more calories

___ 4. They make less plaque

___ 5. Don't know

40. Here is a set of sentences which tells how cavities happen:

a) Acid attacks the enamel on your teeth

b) Plaque builds up on your teeth

c) You eat a candy bar

d) Some bacteria in plaque make acid

Which is the right order for the sentences above to tell a story about how tooth decay happens?

___ 1. a), b), c), d)

___ 2. b), c), d), a)

___ 3. c), b), d), a)

___ 4. d), c), b), a)

___ 5. Don't know

APPENDIX D

Three-Day Food Record Form

MY DIET DIARY

Instructions for keeping a Diet Diary:

1. Please record everything you eat or drink on _____
2. Eat as you ordinarily do - just remember to write down everything you eat or drink.
3. List the food or drink in the order eaten. If nothing is eaten, write the word nothing.
4. Indicate the time you begin any meal or between-meal eating.
5. Use a separate line for each food or drink.
6. Draw a circle around the foods you eat together.
7. Indicate the kind of food eg. canned peaches, baked potato, fried chicken, raw carrots.
8. Indicate additions to food - in cooking or at the table: butter, sugar, cream, etc.

DON'T FORGET to bring your Diet Diary back to school every morning!

SAMPLE OF ONE DAY'S DIET DIARY *

NAME: Jane Smith DATE: Wed, October 13, 1976

MEAL	TIME	FOOD OR DRINK
Breakfast	7:30 A.M.	1 cup tea with sugar; milk 1 cup apple drink 2 slices white toast honey
Between-Meal Eating	10:30 A.M.	1 cup milk 2 cookies
	11:00 A.M.	2 cookies
Lunch		Nothing

*Don't forget to take this back to school!

NAME: Jane Smith DATE: Wed, October 13, 1976

MEAL	TIME	FOOD OR DRINK
Between-Meal Eating	4:30 P.M.	1 bag potato chips 1 bottle 7-up
Dinner	6:00 P.M.	1 pork chop mashed potatoes peas with butter 1 piece apple pie 1 cup chocolate milk
Evening s/or Before Bed eating	8:30 P.M.	1 can Coke 2 chocolate doughnuts 1 glass orange drink
	10:30 P.M.	1 piece pizza 1 can Coke

MY DIET DIARY *

NAME: _____ DATE: _____

MEAL	TIME	FOOD OR DRINK
Breakfast		
Between-Meal Eating		
Lunch		

*Don't forget to take this back to school!

NAME: _____ DATE: _____ Page 2

MEAL	TIME	FOOD OR DRINK
Between-Meal Eating		
Dinner		
Evening s/oe Before Bed Eating		

TIME PLAN

Teacher Workshop - October 6th, 6:30-9:30 p.m.

Tuesday, October 12th:

Study begins: A lady from the University of Manitoba is doing a survey on the kinds of foods boys and girls your age eat in the fall and you have been selected to participate in her study. Lady tells class how to keep a Diet Diary (4-day food record) for Wed., Oct. 13th, Thurs., Oct. 14th, Friday, Oct. 15th and Sat., Oct. 16th (will take approximately ½ hour). She will hand out the Food Record Forms for Wednesday, Oct. 13th and Thursday, Oct. 14th at this time. The student is to return a diet record to class every morning. Stress this with your students.

Thursday, October 14th:

Lady collects food records for Wed., Oct. 13th first thing in the morning and checks them over in another room. If she has any questions about the diet records she will speak individually to the particular student involved. If any of the students forget their diet records at home they can get them at noon or else the lady will have to give the student a private dietary interview. She will hand out the Food Record Form for Friday, October 15th at this time.

Friday, October 15th:

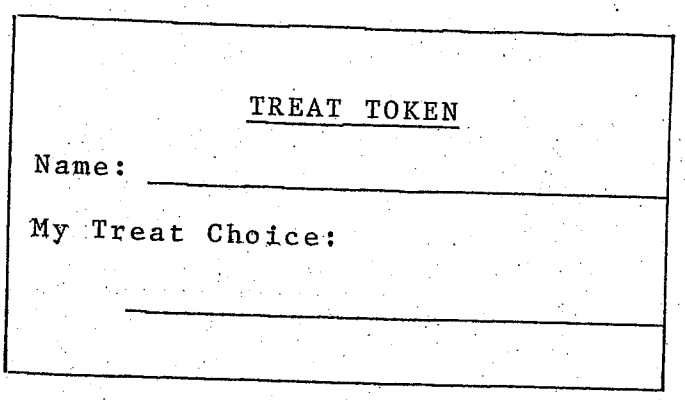
Lady collects food records for Thursday, October 14th first thing in the morning and checks them over etcetera, as before. She will hand out the Food Record Form for Saturday, October 16th at this time and reminds the students that they have 2 record forms to bring in on Monday morning ie., Friday's and Saturday's.

Monday, October 18th:

Lady collects food records for October 15th

and 16th, first thing in the morning, and checks them over as before.

When she is finished she tells the class that in gratitude for their participation in her survey she would like to give them a TREAT. She shows them the selection of TREATS that are available and hands out the tokens for the students to fill out quietly and independently.



She stresses that all the treats are worth the same amount of money and that she needs their tokens as she has to go out and buy all the treats.

The lady will then write a master sheet of all the students' choices and give a copy to the teacher. The treats will be provided on Tuesday, October 19th, at the end of the day and the teacher will be able to hand out the treats according to her list.

Wednesday, October 27th: Questionnaire Distribution

Nutritionists will come to school and leave questionnaires at the Principal's office in the morning and pick them up at the end of the day.

Monday, November 1st: Educational Programme begins.

Wednesday, November 24th: Educational Programme ends.

Tuesday, November 30th:

Lady from University of Manitoba is doing another dietary survey on the kinds of foods boys and girls your age eat in the

winter.

Lady tells class again how to keep a Diet Diary (4-day food record) for Wed., Dec. 1st, Thurs., Dec. 2nd, Friday, Dec. 3rd and Sat., Dec. 4th (will take approximately ½ hour). She will hand out the Food Record Forms for Wed., Dec. 1st and Thurs., Dec. 2nd at this time. The student is to return a diet record to class every morning. Stress this with your students.

Thursday, December 2nd:

Lady collects food records for Wed., Dec. 1st first thing in the morning and checks them over in another room. If she has any questions about the diet records she will speak individually to the particular student involved. If any of the students forget their diet records at home they can get them at noon or else the lady will have to give the student a private dietary interview. She will hand out the Food Record Form for Friday, Dec. 3rd at this time.

Friday, December 3rd:

Lady collects food records for Thurs., Dec. 2nd first thing in the morning and checks them over etcetera, as before. She will hand out the Food Record Form for Sat., Dec. 4th at this time and reminds the students that they have 2 record forms to bring in on Monday morning ie., Friday's and Saturday's.

Monday, December 6th:

Lady collects food records for Dec. 3rd 4th first thing in the morning and checks them over etcetera, as before.

When she is finished she tells the class that again in gratitude for their participation in her survey she would like to give them a TREAT. Proceeds as for SIMULATED SNACK SELECTION ACITIVITY as before.

Monday, December 13th: Questionnaire Distribution

Nutritionist will come to school and leave

questionnaires at Principal's office in the morning and pick them up at the end of the day.

END OF STUDY

APPENDIX F

An Example of Snack Food Classification

NAME: Subject #104 MY DIET DIARY * DATE: Post Thur. December 2 hr

MEAL	TIME	FOOD OR DRINK
Breakfast	8:00	1 cup tea with milk and sugar. 1 bowl porridge 1 piece toast
Between-Meal Eating	10:00	some toffee NIL
Lunch	12:00	1 peanut-butter sandwich 4 cookies 1 glass orange juice

*Don't forget to take this back to school!

NAME: Subject #104 DATE: Thurs. December 2, 76

MEAL	TIME	FOOD OR DRINK
Between-Meal Eating	4:30	4 candies ~~ND~~ 1 piece of bread with butter ND 1 bowl soup ~~vegetable soup~~ ND ~~ND~~
	5:00	1 package sweethearts ~~ND~~ 1 cup fresh ~~ND~~
Dinner		Nothing
Evening &/or Before Bed Eating	(9:00)	1 peanut-butter sandwich ND 2 candies ~~ND~~

No. of sucrose exposures (i.e. snack periods containing sucrose) = 4
Total no. of snack time periods = 4

ND - 3
ND - 0
~~ND~~ - 0
~~ND~~ - 5

APPENDIX G

Statistical Tables and Procedures

TABLE I

ANOVA of Pre-Test Knowledge Test Scores of the 8 Classes

Source of Variation	df	SS	MS	F
Among Classes	7	408.73	58.39	1.47 n.s.
Within Classes	205	8118.99	39.60	

TABLE II

Percentage of Students in Each Study Group that Consumed "Good" and "Poor" Snack Foods in the Pre-Test Period

STUDY GROUP	Quality of Snack Food Consumed		TOTAL
	Good	Poor	
	%	%	%
NUDENT	28.2 (11)	71.8 (28)	100 (39)
MUNCHER	28.6 (12)	71.4 (30)	100 (42)
BASIC	28.6 (8)	71.4 (20)	100 (28)
CONTROL	24.1 (7)	75.9 (22)	100 (29)
TOTAL	29.0 (40)	71.0 (98)	100 (138)

$\chi^2 = 0.230$ df = 3 n.s.

TABLE III

Hypothetical Ordering[1] of Proportions of Students in Each Study Group Who Maintained the Consumption of "Good" Snack Foods in the Post-Test Period

STUDY GROUP	TOTAL N	NUMBER WHO MAINTAINED GOOD SNACK FOODS	PROPORTION WHO MAINTAINED GOOD SNACK FOODS
NUDENT	39	9	.231 ($=p_1$)
MUNCHER	42	5	.119 ($=p_2$)
BASIC	28	2	.071 ($=p_3$)
CONTROL	29	2	.169 ($=p_4$)
			.123 ($=\bar{p}$)

$$\bar{\chi}^2 = \frac{1}{\bar{p}\,\bar{q}} \sum_{i=1}^{n} m_i (p_i - \bar{p})^2 = 5.713 \qquad c_1 = 0.4389 \qquad c_2 = 0.5525 \qquad p < .05$$

[1] Analyzed by Bartholomew's Test (154) for qualitatively ordered proportions.

TABLE IV

Comparison[1] of the Ranks of Between-Meal 3-Day Total Number of Sucrose Exposures of Each Student Across the 4 Study Groups in the Pre-Test Period

STUDY GROUP	Sum of Sucrose Exposure Ranks
NUDENT (N=41)	3102.50
MUNCHER (N=42)	3207.50
BASIC (N=31)	2356.50
CONTROL (N=32)	2064.00

[1] Compared using the Kruskal Wallis Test (155) with the formula corrected for ties:

$$H = \frac{\frac{12}{N(N+1)} \sum_{j=1}^{m} \frac{R_j^2}{n_j} - 3(N+1)}{1 - \frac{\sum T}{N^3 - N}}$$

where $T = t^3 - t$ (when t is the number of tied observations in a tied group of scores)

N = number of observations in all k samples together

H = 1.8494 3 df n.s.

TABLE V

Comparison[1] of the Ranks of the Sucrose Ratios of Each Student Across the 4 Study Groups in the Pre-Test Period

STUDY GROUP	Sum of Sucrose Ratio Ranks
NUDENT (N=41)	2768.00
MUNCHER (N=42)	3342.00
BASIC (N=31)	2311.50
CONTROL (N=32)	2306.50

H = 1.5274 3 df n.s.

[1]Compared using the Kruskal Wallis Test (155)

PROCEDURE I

Comparison of the 4 Study Groups in the Amount of Change in the Number of Sucrose Exposures on the Basis of Ranks (Jonckheere's Test)

PROCEDURE for Jonckheere's Distribution-Free Test for Ordered Alternatives:

H_o = NUDENT= MUNCHER = BASIC = CONTROL in the amount of change

H_a = NUDENT $\geq$ MUNCHER $\geq$ BASIC $\geq$ CONTROL in the amount of change where at least one of the inequalities is strict.

1. Compute $\frac{k(k-1)}{2}$ Mann-Whitney U Counts

$$T = \sum_{i=1}^{n} R(x_i)$$

$$U = T - \frac{n(n+1)}{2}$$

2. Compute

$$J = \sum_{j=1}^{k=6} U \qquad J = \underline{4377.00}$$

3. Large Sample Approximation

$$J^* = \frac{J - E_o(J)}{[\mathrm{var}_o(J)]^{\frac{1}{2}}} = \frac{J - \left\{\left(N^2 - \sum_{j=1}^{k} n_j^2\right)/4\right\}}{\left\{\left[N^2(2N+3) - \sum_{j=1}^{k} n_j^2(2n_j+3)\right]/72\right\}^{\frac{1}{2}}}$$

$$= \underline{1.42} \quad p < 0.78 \quad \text{n.s.} \quad (z_{.05} = 1.65)$$