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Title: TEACHER CHARACTERISTICS RELATED TO EFFECTIVE NUTRITION EDUCATION FOR ADOLESCENTS

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The relationship between nutrition-related teacher characteristics and effective nutrition education for adolescents was assessed in a sample of 71 Oregon high school nutrition teachers and 1,193 teenage students. The teacher characteristics assessed were knowledge of nutrition, knowledge confidence, teaching confidence, interest, flexibility, value, and dietary habits. Student learning in the cognitive domain was measured by differences in scores on a nutrition knowledge pretest and a posttest, taken before and after a unit on nutrition. Student learning in the affective domain was measured by differences in dietary scores and dietary scores per 1000 kcal based on 24-hour food records before and after the unit on nutrition. Of the seven teacher characteristics assessed, only teacher knowledge was significantly correlated ($p \leq .05$) with student

learning in both the cognitive and affective domains. Teaching confidence was also significantly correlated with student learning in the affective domain as assessed by changes in dietary scores per 1000 kcal. There were interrelationships between teacher characteristics: teacher knowledge with flexibility, knowledge confidence, value, and interest; in addition, value with knowledge confidence and interest; interest also with teaching confidence.

Teacher Characteristics Related to Effective Nutrition Education for Adolescents

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INTRODUCTION

There is a widespread concern about the dietary habits of teenagers in the United States. Their lifestyles are active; they often eat meals away from home, skip meals, or substitute snacks for meals (Hodges and Krehl, 1965; Huenemann et al., 1968). In addition, teenagers are frequently on weight reduction diets trying to conform to society's standards of slimness or as part of athletic training programs for competitive sports (Dwyer et al., 1967). Yet during adolescence caloric and nutrient needs are higher than at any other stage of the life cycle except for pregnancy and lactation (Food and Nutrition Board, 1974).

However, national surveys indicate that the adolescent often has the least adequate diet of any family member (Morgan, 1959; Household Food Consumption Survey, 1965-1966, 1972; Ten State Nutrition Survey, 1968-1970, 1972). Low intakes of iron, calcium, vitamin A, and ascorbic acid are often reported for adolescents of both sexes.

Because adolescents make many of their own food choices, nutrition education is frequently recommended as a means of improving their nutritional status (White House Conference on Food,

Nutrition, and Health, 1969). The results from dietary surveys provide justification for the need for nutrition education as well as evidence of the absence or ineffectiveness of past nutrition education efforts. Effective nutrition education has been defined as directed change in both nutritional knowledge and nutritional behavior (MacReynolds, 1970; Dwyer et al., 1970; Todhunter, 1974; Carruth and Anderson, 1977). Therefore, if nutrition education is effective, it will have an impact on the dietary habits of teenagers.

Although the need for nutrition education is generally recognized, the factors which contribute to effective nutrition education are not clearly defined. The effectiveness of traditional techniques has been questioned (Poolton, 1972; Dwyer, 1978). Recent studies verify that nutrition knowledge does not necessarily correlate with wise dietary choices (Baker, 1972; Schwartz, 1975; Picardi and Porter, 1976).

The high school teacher is the change agent in many nutrition education programs for teenagers. There have been no investigations which focused on high school teachers of nutrition reported in the literature. Nutrition knowledge and attitudes of various other groups have been assessed, including an evaluation of elementary school teachers (Petersen and Kies, 1972). In addition, no studies have been reported which related knowledge and attitudes of teachers to students' learning of nutrition. In other areas of health education,

teachers' knowledge and attitudes have been assessed. This topic was of particular concern when units about smoking and drugs were added to the high school curriculum (Irwin et al., 1970; Penn and Erekson, 1973; Chen and Rakip, 1974). In each case, knowledge and attitudes of the teacher were assumed to be important to an effective program, although the relationships between knowledge, attitudes, and effective teaching were not ascertained.

The purpose of this study was to identify teacher characteristics which are related to effective nutrition education for adolescents. Once identified, the teacher characteristics can be better developed through teacher training and teacher in-service programs. It is especially critical that the relative importance of these characteristics be identified since teachers of nutrition are trained in a variety of disciplines. In high schools, nutrition may be taught by teachers who are specialists in health, home economics, biology, physical education, or general science (Schubert, 1970).

This research project was timely for Oregon. With the class of 1978, high school graduation requirements in health have been increased to include one full year of course work. This means that the health curriculum offerings have been expanded in many schools, and nutrition is likely to be a component of those expanded courses.

On the national scene in 1977, money was appropriated as an amendment to the National School Lunch Act and Child Nutrition Act

of 1966 for nutrition education in elementary and secondary schools (Public Law 95-166, 95th Congress). Many states are now in the process of hiring nutrition education specialists and assessing existing programs of nutrition education in the schools. Identification of teacher characteristics which are related to effective nutrition education will contribute to meaningful programs and well-spent funds.

This study focused on the extent to which student learning in the cognitive and affective domains was related to the teacher's knowledge of nutrition, interest in nutrition, flexibility toward nutritional practices, confidence as a nutrition educator, and the values placed on nutrition concepts. The interrelationships between these five teacher characteristics were also examined. Data on the teacher characteristics were collected with two written questionnaires and four 24-hour dietary records. Student learning was evaluated by changes in knowledge and dietary habits as the result of a unit on nutrition; data were collected with written knowledge tests and 24-hour dietary records before and after the nutrition unit. The unit was not specifically prescribed, but was developed and taught by each teacher. This method allowed each teacher the freedom and flexibility to teach in the manner in which he or she was most competent and comfortable.

Since nutrition is identified as a component of both health and

home economics curricula in Oregon, teachers from both disciplines were included in the sample. The teacher sample consisted of 71 health and home economics teachers in western Oregon. The student sample was composed of one class, grades 9-12 inclusive, from each participating teacher. Data were collected from September, 1977 through March, 1978.

REVIEW OF LITERATURE

Assessment of Needs for Nutrition Education

Physiologically, adolescence is a time of stress; the teenager is a "rapidly changing biologic organism" (Heald, 1975). Maturation and rapid growth result in higher caloric and nutrient requirements than at any other stage of the life cycle except for pregnancy and lactation (Food and Nutrition Board, 1974). Fortunately, adolescent appetites generally escalate to match the growth spurt. However, in mid-teens the growth rate slows dramatically. At this point, appetite and previous eating patterns are a less valid guide; obesity is not an uncommon problem among adolescents of both sexes (Johnston, 1961; Dwyer et al., 1967; Ten State Nutritional Survey, 1968-1970, 1972). However, physiologically, the adolescent is extremely sensitive to caloric restriction. The nutritional status of adolescent girls is of particular concern because many are adding the stress of pregnancy. In the United States, one out of every four babies is born to a teenage mother (Milk, 1973). Nutritional status at the time of conception and the diet during pregnancy are important factors in the outcome of pregnancy in adolescent girls (Kaminzky et al., 1973).

The busy and active life styles of adolescents tend to augment their caloric and related nutrient needs. Participation in sports by

adolescents of both sexes is popular, and formal programs are increasing as a result of recent national legislation. In addition to participating in athletics and other school activities, many teens hold part-time jobs. Such involvement after school leaves little time for regular meals with the family. The prevalence of skipping breakfast has been widely reported in the literature and researchers conclude that it is likely to have a detrimental effect on the entire day's food intake (Young and Storvick, 1949; Hodges and Krehl, 1965; Ohlson and Hart, 1965; Harris, 1970). Lunch was the meal most frequently missed by teenagers in a California study, and one-third of the subjects showed marked irregularity in eating practices (Huenemann et al., 1968). Adolescents who had fewer than three meals per day tended to have poorer diets than those who ate more frequently (Hampton et al., 1967). Snacking between meals also is commonplace among teenagers; in the Ten State Survey, 78 percent of the adolescents reported snacking on the day of the dietary recall (Thomas and Call, 1973). However, several researchers claim that snacking is too heavily maligned. Rather than providing only "empty calories", snacks contribute significantly to the nutrient intakes of teenagers (Huenemann et al., 1968; Thomas and Call, 1973).

Considering their high physiological needs and busy life styles, it is not surprising that adolescents are frequently identified as a subgroup in our population whose dietary intakes are of concern.

National surveys indicate that the adolescent often is the least well-nourished of any family member (Morgan, 1959; Household Food Consumption Survey, 1965-1966, 1972; Ten State Nutrition Survey, 1968-1970, 1972).

Standards of dietary adequacy vary in different surveys. The most frequently used guide is the Recommended Dietary Allowance (RDA) established by the Food and Nutrition Board of the National Research Council, National Academy of Sciences. A margin of safety is incorporated into each allowance; therefore, two-thirds of the RDA is generally considered an adequate intake (Morgan, 1959). The Recommended Dietary Allowances are revised about every five years to reflect current research. Hence, standards of adequacy also reflect the time period a survey was conducted and conclusions should be evaluated on that basis (Leverton, 1968). In general, recommended allowances for calories, protein, and ascorbic acid have decreased over time; for iron, increased; and for calcium, varied. Several research groups have used other standards for certain nutrients such as those established by the Food and Agricultural Organization of the World Health Organization (Ten State Nutrition Survey, 1968-1970; 1972; Health and Nutrition Examination Survey, 1976).

Finally, most dietary survey data are presented as group mean intakes for some nutrients, the percent of "standard" of that

mean, or the percent of a group which does not meet a standard. Although it is possible to identify high risk groups by comparing mean intakes from different groups, group means will not reveal the distribution of nutrient intakes within a group. High mean intakes can mask the fact that a substantial number of individuals may have less than adequate intakes; this is especially true of nutrients such as vitamin A for which some foods may contribute very large amounts per serving (Abraham et al., 1977).

Low dietary intakes of iron, calcium, and vitamin A for many adolescents of both sexes have been reported repeatedly in national surveys. Nutrient deficiencies tend to be more frequent with adolescent females than males, probably due to the females' lower caloric intake. While dietary deficiencies are more prevalent in certain ethnic or low income groups, they cross all socio-economic strata. On the basis of preliminary data from the Health and Nutrition Examination Survey, 1971-1972 (1976) researchers identified low intakes of calories and iron as dietary problems for adolescents, with protein and vitamin A as additional problem nutrients for low-income teenagers. Mean nutrient intakes reported from several surveys are summarized in Table 1.

Findings in more limited local or state studies of adolescents are similar to those reported in the national surveys. Nutritional Status USA (Morgan, 1959) included Oregon adolescents in their

Table 1. Mean nutrient intakes of adolescents from surveys in U. S., 1963-1972.

Survey	Location	n	Age	Sex	kcal	Pro (g)	Fat (g)	Calcium (mg)	Iron (mg)	Vitamin A (IU)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)	Ascorbic Acid (mg)
Household Food Consumption Survey, 1965-6	Nation-wide	562	15-17	M	2989	114	-	1231	15.9	6320	1.56	2.56	--	75
		538	15-17	F	1999	78	-	821	11.0	5150	1.07	1.74	--	60
Ten State Nutrition Survey, 1968-1970	Nation-wide	547	15-16	M	2842	106	-	1186	15.5	5164	1.62	2.63	19.51	82
		611	15-16	F	2027	77	-	779	11.1	4161	1.12	1.80	14.97	64
HANES,[b] Preliminary 1971-1972	Nation-wide	1045	12-17	Both	2346	89	-	1110	12.6	4219	--	--	--	78
Wharton, 1963[a]	Illinois	67	13-15	M	2534	95	116	1104	14.1	4551	1.38	2.16	16.4	56
		79	16-18	M	2708	98	120	1044	14.5	4863	1.52	2.15	16.7	60
		156	13-15	F	2078	67	88	722	10.4	3113	1.03	1.44	12.8	60
		119	16-18	F	2007	68	93	613	10.8	5061	1.09	1.33	13.5	57
Hodges & Krehl, 1965	Iowa	128	14-18	M	3521	129	171	--	--	--	--	--	--	--
		124	14-18	F	2449	97	118	--	--	--	--	--	--	--
Hampton et al., 1967[a]	California	279	14-18	M	2818	114	134	1301	14.1	7309	1.35	2.47	19.5	91
		335	14-18	F	1949	75	88	893	9.6	5731	.90	1.69	13.0	78
Schorr et al., 1972	New York State	54	12-18	M	--	--	--	1308	15.4	5648	--	--	--	105
		64	12-18	F	--	--	--	843	8.8	3556	--	--	--	73

[a] Figures derived from published data.

[b] Health and Nutrition Examination Survey, United States 1971 – 72.

study; their dietary intakes were reported separately (Storvick et al., 1951). Although Oregon youth fared better than youth in many states, 20-30 percent of the 14-16 year old Oregon subjects had less than two-thirds of the recommended amounts for ascorbic acid and iron; 26 percent of the girls' diets were equally low in calcium. However, recommended allowances for adolescents for ascorbic acid have decreased substantially since then. The RDA for calcium is approximately the same for adolescents; allowances for iron have increased. By today's standards, calcium and iron intakes still would be a concern. Dietary intakes of vitamin A were considered adequate in the diets of most Oregon youth surveyed in 1959; the RDA for vitamin A has not changed.

Summaries of mean nutrient intakes from several other state studies are also included in Table 1. Problem nutrients, especially for girls, were the same: calcium, iron, vitamin A, and ascorbic acid (Wharton, 1963; Hampton et al., 1967; Schorr et al., 1972). In the most recent study, the percentage of subjects with less than 2/3 of the Recommended Dietary Allowance for ascorbic acid was 21 percent; calcium, 44 percent; vitamin A, 51 percent; and iron, 69 percent (Schorr et al., 1972). In a study with teenagers in Iowa, Hodges and Krehl (1965) reported a high consumption of dairy products, resulting in a high fat intake; 43.4 percent of the caloric intake was from fat. The caloric intake of

Iowa adolescents was higher than in other surveys; 2450 kcal for the girls, 3500 kcal for the boys. Hodges and Krehl concluded that although most Iowa teenagers were extremely well fed, some students had less than optimum intakes of one or more nutrients, especially iron. In all studies, it should be noted, protein is rarely identified as a problem nutrient; deficient intake is rare except in some low income groups (Health and Nutrition Examination Survey, 1971-1972, 1976).

In a few studies, data are reported as servings from each food group, rather than as nutrient intake. Findings suggest that adolescent diets are low in fruits, vegetables, and milk products (Warnick et al., 1955; Edwards et al., 1964). These results are compatible with the low intakes of calcium, vitamin A, and ascorbic acid reported in other studies.

A more precise way to estimate nutritional status is to evaluate clinical and biochemical indices. Clinical and biochemical data support the concern over adolescents' dietary habits. The prevalence of adolescent obesity is frequently reported in the literature (Johnston, 1961; Dwyer et al., 1967; Hampton et al., 1967; Ten State Nutrition Survey, 1968-1970, 1972; Barnes and Berger, 1975). Iron deficiency anemia exists in over 10 percent of American high school students; this fact is of special concern because depletion of iron stores occurs prior to the appearance of anemia (Duffy, 1975).

The Ten State Survey data reveal a high incidence of "deficient" or "low" hemoglobin values in all population subgroups, especially black populations. Youth from all ethnic groups in that study also had a high prevalance of low plasma vitamin A values. On the other hand, the adequacy of dietary protein is evidenced by the absence of "deficient" or "low" serum albumin or serum protein values. Based on data from the Ten State Survey, "protein nutrition appears to be adequate in most segments of the population" (Ten State Nutrition Survey IV, 1968-1970, 1972, p. 69).

Other evidence of the need for nutrition education is the teenagers' lack of nutritional knowledge. Dwyer et al. (1970), in a study with 1338 high school students in Massachusetts, reported a mean score of only 55 percent on a nutrition knowledge test. They commented "nutritionally illiterate adolescents soon become nutritionally illiterate adults" (p. 66). Dwyer et al. (1970) also summarized past studies on knowledge of nutrition among high school students; results were similar, showing a general lack of knowledge among teenagers. A high prevalence of misconceptions about nutrition has been reported among high school students and among college freshmen (Stephens, 1971; Tifft and Stanton, 1972; Osman and Ahrens, 1972). The White House Conference on Food, Nutrition, and Health of 1969 (p. 147) recognized "both the urgency for

immediate action to eliminate hunger and the need for a long-range program in nutrition education."

Status of Nutrition Education in U.S. Public Schools

The many definitions of nutrition education have similar themes; changes in both nutritional knowledge and nutritional behavior are critical to effective nutrition education.

"Sound nutrition education should enable each individual, throughout his life, to make wise decisions about his food choices" (White House Conference on Food, Nutrition and Health, 1969, p. 147).

"...the ultimate goal of nutrition education is behavioral" (Dwyer et al., 1970, p. 65).

"We cannot assume somebody has learned until he has modified his behavior" (MacReynolds, 1970, p. 13).

"Nutrition education is the process by which information about foods and their nutritive value is translated into action by the consumer" (Todhunter, 1974, p. 54).

"...all nutrition education programs are aimed at positive change in knowledge, attitude and practices" (Schwartz, 1975, p. 28).

"Nutrition education can be carried out by formal systems of education...in public school systems where children can be provided with a base of nutritional knowledge that will enable a high

school graduate to understand and cope with his nutritional environment" (Nesheim and Guthrie, 1978, p. 66).

According to the taxonomy of educational objectives defined by Bloom and coworkers (1956), learning is divided into three areas or domains: cognitive, affective, and psychomotor. The cognitive domain "includes those objectives which deal with the recall or recognition of knowledge and the development of intellectual abilities and skills" (Bloom et al., 1956, p. 7). The levels of learning in the cognitive domain, which must be mastered in progressive order, are knowledge, comprehension, application, analysis, synthesis, and evaluation. The affective domain includes objectives which describe "changes in interest, attitudes and values" (Bloom et al., 1956, p. 7). Levels of learning in the affective domain are receiving, responding, valuing, organization, and characterization (Krathwohl et al., 1964). Learning in the psychomotor domain has "objectives which emphasize muscular or motor skill, some manipulation of materials and objects, or some act which requires a neuromuscular co-ordination" (Krathwohl et al., 1964, p. 7).

Although learning in the psychomotor domain has little relationship to nutrition education, learning in the cognitive and affective domains has direct application to nutrition education. Learning in the cognitive domain is the "base of nutritional knowledge" in the definition of nutrition education by Nesheim and Guthrie (1978). It is

recalling, understanding, and applying nutrition concepts. The highest level of learning in the cognitive domain, evaluation, might be demonstrated by the ability to evaluate the adequacy of a week's diet or to assess a fad diet. Effective nutrition education in the affective domain influences an individual's attitudes and values toward food and nutrition. Dietary behavior is an evidence of those attitudes and values (Cosper and Wakefield, 1975; Schwartz, 1975). The highest level of learning in the affective domain, characterization by a value or value complex, implies "readiness to receive judgments and to change behavior in the light of evidence" (Krathwohl et al., 1964, p. 184).

Although there is uncertainty as to what nutrition education should be, evidence is lacking that nutrition education focused in the cognitive domain accomplishes the objective of improved dietary habits. Unfortunately, nutrition knowledge does not necessarily insure wise dietary choices (Guthrie, 1978; Mahoney and Caggiula, 1978). A list of recent studies which assessed nutrition knowledge and attitudes of various groups is in Table 2. Picardi and Porter (1976) reported a significant gain in nutrition knowledge as a result of a minicourse for 11th and 12th graders, but no improvement in dietary attitudes and behavior. Schwartz (1975) reported that there was not a significant correlation between nutritional knowledge and dietary practices of recent high school graduates nor did previous

Table 2. Nutrition knowledge and attitude surveys of various groups.

Researchers	Group	Size of Group (n)	Knowledge	Attitudes	Behavior	Nutrition Education Unit
Baker (1972)	4th & 5th graders	70	X		X	X
Bell & Lamb (1973)	4th & 5th graders	1500	X		X (school lunch only)	X
Blakeway & Knickrehm (1978)	1st, 2nd, & 3rd graders	5000			X (school lunch only)	X
Carruth & Anderson (1977)	EFNEP Aides	43		X		
Cho & Fryer (1974)	P. E. majors,	138	X			
	Students in basic nutrition course	81	X			
Dwyer et al. (1970)	High school students	1338	X			
Eppright et al. (1970)	Mothers of preschoolers	2000	X	X	X (children's diets)	
Emmons & Hayes (1973b)	Mothers &	486	X		X	
	children (grades 1-4)	783			(children's diets)	
FDA Consumer Survey (1975)	Adults	1664	X	X	X	
Grotkowski & Sims (1978)	Elderly adults	64	X	X	X	
Harrison et al. (1969)	Public Health Nurses	144	X			
Head (1974)	5th, 7th & 10th graders	4700	X		X	X
Krause & Fox (1977)	Physicians	400	X	X		
McCarthy & Sabry (1973)	University students (freshmen)	275	X (misconceptions)			
Morse et al. (1967)	Mothers of 7, 8, 9 graders	238	X			
Osman & Ahrens (1972)	College Freshmen (health students)	1331	X (misconceptions)			
Petersen & Kies (1972)	Elementary teachers (K-3)	910	X	X		
Phillips (1971)	2nd year medical students	254	X			

Table 2. Continued.

Researchers	Group	Size of Group (n)	Knowledge	Attitudes	Behavior	Nutrition Education Unit
Picardi & Porter (1976)	11th & 12th grade students	109 (6 classes)	X	X (attitude-behavioral test)	X	X
Podell, et al. (1978)	High school students	357	X	X	X	X
Schwartz (1975)	Former high school students	313	X	X	X	
Spitze (1976)	High school students	50	X	X		X
Tifft & Stanton (1972)	High school students	912	X (misconceptions)			
Vickstrom & Fox (1976)	Registered nurses	867	X	X		
Wakefield & Miller (1971)	College coeds	40	X (Basic 4)			
Wang (1971)	4-H Youth & homemakers	1406	X			
Whitehead (1960)	6th & 7th graders	264			X	X

enrollment in high school home economics classes significantly increase nutrition knowledge. Podell and coworkers (1978) reported a significant improvement in knowledge and attitudes of high school students as a result of a cardiovascular nutrition education program. Their subjects also reported changed eating patterns although the actual dietary intake was not assessed. Head (1974), in a nutrition education program at grades 5, 7, and 10, observed the greatest cognitive changes with the 5th grade students. Dietary changes were slight, but greatest with the 7th grade students. The amount of change in the cognitive and affective domains was least with the 10th grade students. Other nutrition education programs directed at elementary children have shown similar outcomes. Most researchers reported increased nutritional knowledge although dietary modification was minimal (Baker, 1972; Bell and Lamb, 1973; Blakeway and Knickrehm, 1978).

The difficult task of changing eating behavior is well recognized (Zifferblatt and Wilbur, 1977). Food habits are deeply imbedded in childhood development. Economic, cultural, social, and personal factors strongly influence food choices (Lewin, 1943; Cosper and Wakefield, 1975; Evans and Hall, 1978). Mahoney and Caggiula (1978) stressed that the goal is not merely education, but also persuasion. Guthrie (1978) pointed out several other reasons why food habits are difficult to change. The benefits of improved dietary

habits are often delayed and/or not easily visible. As nutrition educators, our goal is to bring about the selection of a variety of foods to provide for total adequate nutrition; this appeal is weak in light of the magic promises of commercial and cultist messages. And finally, because a variety of nutritional problems exist, we must have different messages for different groups.

Many reasons have been suggested for the limited effectiveness of past nutrition education efforts. Traditional methods of teaching nutrition have been questioned (Poolton, 1972; Schwartz, 1975; Picardi and Pariser, 1975). The Four Food Groups Guide is a commonly used teaching tool with all age groups. However, the research of Hampton and coworkers (1967) indicated that knowledge of the Four Food Groups improved food practices among adolescent boys, but not girls. Poolton (1972) suggested that the Four Food Groups approach is not an effective teaching tool for teenagers because it "tells" them what to do, thereby depriving them of discovery learning and problem solving. Huenemann (1973), at the National Education Conference in 1971, emphasized that most students at the high school level are capable of understanding the scientific basis of nutrition concepts. She suggested that today's youth are ready for a more sophisticated approach than the Four Food Groups Guide. The Four Food Groups Guide as a tool is further criticized because its use does not insure a diet which meets the Recommended Dietary

Allowances for all nutrients (Dwyer et al., 1978; King et al., 1978).

Several researchers have reported a lack of interest in nutrition among high school students. Dwyer and co-workers (1970) reported that interest in nutrition rated low compared with other high school subjects. In an assessment of health education programs in Tennessee, interest in nutrition ranked the lowest of health subject areas (Kirk et al., 1975). The apparent lack of interest in nutrition as a subject may be a factor in the ineffectiveness of nutrition education, either as an explanation for, or as evidence of, ineffective teaching.

The literature abounds with ideas to make nutrition education more interesting and effective. Several innovative approaches have been described such as a nutrient abacus (Meyers and Jansen, 1977), cartoon characters (Carruth and Foree, 1971), "discovery learning" games (Spitze, 1976), and mass media messages (Axelson and Del Campo, 1978). However, such approaches are only a partial answer to the dilemma of nutrition education (Gifft et al., 1972).

Attention also focuses on the role of the teacher as the change agent in nutrition education programs. The impact of teachers' attitudes on the effectiveness of nutrition education has been reported incidentally by several researchers. Head (1974) observed that teachers with negative attitudes used fewer innovative techniques and achieved less success in changing dietary patterns of their

students. Baker (1972) reported that one teacher's negative comments about a particular vegetable (squash) influenced her class even five months later when likes and dislikes of the students were evaluated.

Previous research studies have focused on nutrition knowledge and attitudes of elementary teachers (Petersen and Kies, 1972; Cook et al., 1977). A low level of nutrition knowledge, a mean score of 58 percent, was reported for a group of 916 elementary teachers in Nebraska in the Petersen and Kies study (1972); one-third of the sample had not studied nutrition at the college level. Data from the same study showed little relationship between knowledge score and attitudes toward the school feeding program. The authors (p. 14) suggested "that a greater knowledge of nutrition will not necessarily increase the probability that teachers will develop more positive attitudes toward teaching nutrition in the classroom." A quantitative assessment of nutrition education in elementary schools in New York and New Jersey was conducted by Cook and co-workers (1977). Nutrition was taught in 75 percent of the classrooms in their sample, with an average time expenditure of 9.7 hours class time per year. The teachers' previous training in nutrition (high school, college or in-service courses) was related to the decision to include nutrition in the elementary curriculum and to the amount of time spent on nutrition.

Nutrition knowledge and attitudes of various other change

agents also have been assessed. These current or future change agents include mothers, consumers, Expanded Food and Nutrition Education Program (EFNEP) aides, registered nurses and public health nurses, physicians, medical students, and college physical education majors. The various studies and the parameters assessed are included in Table 2. Although in each survey the importance of the nutritional knowledge and attitudes of the change agent is implied, the relationship to effective nutrition education has not been evaluated.

Effectiveness of other health education programs has been questioned also. In a review of smoking education programs, Thompson (1978, p. 250) stated "most methods used with youth have shown little success." Rabinowitz and Zimmerli (1974) reported more significant knowledge and attitudinal changes than behavioral changes as a result of a smoking education program for 12-15 year olds. Grant (1971, p. 385) stated "factual knowledge about drug use in and of itself, is no deterrent to abuse." When educational programs about smoking and drugs were added to high school curricula, many researchers focused on the competencies of teachers in these areas (Irwin et al., 1970; Fricke, 1971; Penn and Erekson, 1973; Chen and Rakip, 1974). In the Irwin study, the classroom climate and rapport of the teacher were found to be related to an effective smoking education program. In the other studies of health education, knowledge and attitudes of the teacher were assumed to be important, although

the relationship between knowledge, attitudes, and effective teaching was not specifically tested.

Mitzel (1960) identified three criteria to be used in teacher effectiveness research:

1) pre-existing variables such as teacher personality, knowledge and status characteristics,

2) process variables such as teacher behavior, pupil behavior, and teacher-pupil interactions,

3) product varibles defined as measures of student change.

Few studies have evaluated all three variables simultaneously, nor have shown conclusively a relationship between teacher competencies and student learning (Cantrell et al., 1977).

Assessment of Evaluation Methods

Measurement of Nutrition Knowledge

Learning in the cognitive domain is routinely evaluated with achievement tests. Assessment of knowledge may be done for a variety of purposes, but the procedures and criteria for test construction are similar. Guidelines for test construction are well defined in the literature (Gronlund, 1968; Sax, 1974; Prefontaine, 1975). Steps include identifying the learning objectives, translating those goals into performance indicators, outlining the subject matter content, and, finally, constructing individual test items. Test items

are categorized into the following five types: multiple choice, true-false, matching, short answer, and essay (Gronlund, 1968). On the basis of scoring ease and precision, these item types are classified as objective or subjective. The essay question is an example of a subjective item; the other types are considered objective items. Each type of test item has certain advantages over others and certain conditions in which it is the most appropriate. Each type of test item can be used to evaluate several levels of learning in the cognitive domain. Subjective test items are more appropriate to assess learning at the synthesis and evaluative levels (Gronlund, 1968). However, both short answer and essay question items lack the scoring precision and accuracy necessary in research studies (Sax, 1974).

According to current educational theory, the multiple choice test item has several advantages over matching and true-false items (Gronlund, 1968; Sax, 1974). These advantages of the multiple choice format are as follows:

1. It has great versatility; simple to complex levels in the cognitive domain can be measured depending on the design of the question,
2. With 4 or 5 choices of answer, guessing effects are minimal,
3. Test items can be constructed to show degrees of knowledge by using the instructions "select the best response,"

4. Item analysis is easily performed.

Gronlund (1968) suggested using the multiple choice format for all questions unless the nature of the subject matter dictates another choice. If there are only two possible answers, the true-false format is clearly better. Detailed recommendations for construction of all types of test items are given by Gronlund (1968) and Sax (1974).

Item analysis is routinely performed on individual test items after the test has been administered and scored. Three kinds of information are obtained by item analysis; as described by Gronlund (1968), this information is as follows:

1. For multiple choice items, the effectiveness of each distractor is determined,
2. The difficulty of each item, measured by the index of difficulty, is the percentage of respondents who answered that question correctly,
3. The discriminating power of an item, described by the index of discrimination, is the extent to which the item separates the most knowledgeable student from the least knowledgeable.

The 50 percent level of difficulty is considered ideal for test items since at this level maximum discrimination is possible (Gronlund, 1968).

The quality of an entire test is described by the terms, validity

and reliability. Validity of a test is the extent to which it measures what it is designed to measure. Reliability refers to the extent to which individual differences are measured consistently.

Since tests are designed for a variety of purposes, there are several kinds of validity. Validity has been classified into the following three types: content validity, criterion-related validity, and construct validity (French and Michael as cited by Gronlund, 1968). Content validity refers to how accurately the test measures the "larger universe of situations" (Gronlund, 1968, p. 160). There are no simple statistical procedures for determining this quality; content validity is based on logical analysis of the test instrument by a person knowledgeable in the subject matter. Criterion-related validity refers to the extent to which the test is useful in predicting future performance or in estimating current performance on some other measure. Criterion-related validity is essentially the degree of relationship between the test score and the measure to be predicted or estimated. The relationship may be expressed by a correlation coefficient or by an expectancy table. Construct validity refers to the test's usefulness in describing hypothetical qualities or constructs such as intelligence, reasoning ability, or mechanical aptitude. The process of validating constructs is a complicated procedure as outlined by Sax (1974).

The reliability of a test refers to its consistency of measurement. Methods of determining reliability include the test-retest method, the equivalent forms method, the test-retest method with equivalent forms, and the internal consistency method. The reliability coefficient is a measure of consistency of measurement for all methods.

Internal consistency reliability coefficients may be estimated by several techniques such as the split-half technique or the Kuder-Richardson method (Kuder and Richardson, 1937; Sax, 1974). The reliability coefficient typically ranges between 0.60 and 0.80 for classroom tests; well developed standardized tests often are above 0.90 (Diederich as cited in Gronlund, 1968). Another measure of test reliability is the standard error of measurement, which is the "standard deviation of obtained scores around a theoretical true score" (Sax, 1974, p. 591). For tests containing 24 to 47 items, a standard error of 3 points is suggested (Diederich as cited in Gronlund, 1968). Gronlund (1968) suggests two ways to improve the reliability of a test. First, improve the difficulty of the test and the discriminating power of the individual test items. As stated, the ideal for both factors is at the 50 percent level. The second means of increasing the reliability of a test is to increase the length of the test; a greater number of test items will result in a bigger spread of scores.

Nutrition knowledge of many groups has been assessed with a variety of achievement tests (Table 2). Existing tests have several limitations. First, most nutrition tests were designed for specific groups and have limited application to other groups. Questionnaires used in studies of health professionals stressed nutrition problems rather than normal nutrition (Harrison et al., 1969; Phillips, 1971; Vickstrom and Fox, 1976; Krause and Fox, 1977). Other tests were designed for people anticipated to have less background knowledge than high school educators (Morse et al., 1967; Eppright et al., 1970; Wang, 1971; Petersen and Kies, 1972; Emmons and Hayes, 1973b; Spitze, 1976; Grotkowski and Sims, 1978). Some existing questionnaires focus only on limited aspects of nutrition, such as common misconceptions (Osman and Ahrens, 1972; McCarthy and Sabry, 1973). Another limitation is that nutrition tests become outdated quickly because nutrition knowledge is rapidly expanding.

Attitude Measurement

Several techniques have been devised to measure attitudes and values. One of the most widely used and successful tools was developed by Likert (1932). A Likert scale consists of a series of statements to which the subject responds by selecting from five choices ranging from strongly agree to strongly disagree. Another commonly used tool, the Thurstone scale, is a series of statements of

equal appearing intervals which have previously been given a scale value by a body of judges (Thurstone, 1928). Respondents are asked to agree or disagree with each statement; their responses are tabulated according to the previously established scale values. A Guttman scale is similar in format to that developed by Thurstone, but is a cumulative scale (Guttman, 1944).

Another type of attitude scale is the Rokeach Value Survey which measures value orientation (Rokeach, 1968). Respondents are asked to rank values in order of importance to them. Many of the same techniques used with achievement tests to measure reliability and validity are appropriate with attitude scales (Bohrnstedt, 1970; Fishbein and Ajzen, 1975).

Table 2 includes a summary of studies which measured attitudes about nutrition in various groups. Instruments which measure attitudes toward nutrition are few and focus on a limited number of attitudes. Flexibility toward food habits was measured with a scale developed for Expanded Food and Nutrition Education Program aides (Carruth and Anderson, 1977). Petersen and Kies (1972) measured attitudes of elementary teachers toward school feeding programs. The attitudes of mothers toward food preparation and meal planning were evaluated with an instrument developed by Eppright and coworkers (1970). A modification of this instrument was used by Schwartz (1975) to assess attitudes of recent high school

graduates. The importance of nutrition to high school students has been assessed by Picardi and Porter (1976), Schwartz (1975), and Spitze (1976). Attitudes and motivational factors in food choices were evaluated in young women (Cosper and Wakefield, 1975). Nutritional opinions regarding food fads were assessed (Jalso et al., 1965). Attitudes of health professionals about the importance of diet and the role of the dietitian have been evaluated. In almost all cases, the attitude instrument was developed to test the hypotheses of a specific research study.

Dietary Evaluation Methodology

A variety of methods are used to study food consumption patterns and dietary habits. Each method has advantages as well as limitations; there is no one best technique for all situations (Marr, 1971). Selection of a method depends on the objectives of the survey, the characteristics of the population under study, and the resources available. Two recent and comprehensive reviews of dietary methodology are by Pekkarinen (1970) and by Marr (1971). Dietary evaluation may focus on the entire population of a country, on groups within that population, or on individuals. The focus in this study was on food consumption patterns by members of small groups (classes) and by individuals (teachers).

The most common technique in dietary methodology involves

collection of information from individual subjects about their personal food habits. From such data, conclusions can be drawn about the food intake of groups, or under certain conditions, about the food habits of individuals. Data may be collected with written questionnaires or by personal interview. The current methods used to collect data from individuals include food records, food recalls, diet histories, and food intake frequencies (Mann et al., 1962; Pekkarinen, 1970; and Marr, 1971). Food record and recall techniques rely on data gathered over a specific, limited time period; the time period may or may not be representative of usual food habits. The diet history and food intake frequency methods are designed to reveal usual dietary habits.

Food records are accounts of actual food intake by the individual for a specific period of time, usually 1 to 7 days. Forms and instructions are provided to the individual prior to keeping the records. Amounts of food eaten may be recorded in actual weights or in common household measures.

Very precise data are obtained with weighed records of actual food intake (Marr, 1971). The weighed record technique is more commonly used to assess nutritional status in the British Isles than in the United States (Marr, 1971; Durnin et al., 1973). The weighed food record technique is very well suited to metabolic studies due to its high degree of accuracy and precision (Krehl and Hodges, 1965).

However, because the weighed record technique is tedious, expensive, and often requires assistance and supervision from the researcher, the sample size is generally small. Participants may not be representative of the population because of the time and effort required from each subject.

In the most commonly used type of food record, food intake is recorded in household measures. This type of food record, although less precise than the weighed food techniques, is considered a complete and relatively accurate technique (Eads and Meridith, 1948; Chalmers et al., 1952; Trulson, 1955; Trulson and McCann, 1959; Pekkarinen, 1970; Marr, 1971). Since the subject is aware of the survey in advance, he will be cognizant of his food intake and is not likely to omit foods from the record. However, there may be conscious or unconscious alteration of eating habits during the survey; this possibility should be considered in the interpretation of results (Young and Trulson, 1960). Cooperation from participants is generally good; the sample size can be large and representative of the population as a whole. To insure accurate recording of data, the subject's interest in the survey must be maintained throughout the recording period. Also, explicit explanations of measures must be provided to the subjects or accuracy will suffer.

As stated, food records may vary in length from one day to a week or more. Much research has been done to determine the length

of time food records must be kept to provide valid data (Widdowson and McCance, 1945; Chalmers et al., 1952; Young et al., 1953; Trulson, 1954; Trulson, 1955; Flores, 1962; Cellier and Hankin, 1963). The answer to this question depends on the objectives of the survey, the available resources, and characteristics of the subjects. To draw conclusions about dietary intakes of groups of people, valid information is obtained by food records of 1 to 30 days (Trulson, 1955; Chalmers et al., 1952). Greater precision is obtained in longer surveys; Trulson (1955) reported that standard deviations of the means decreased as the number of days increased from 1 to 3 to 7. However, Chalmers and coworkers (1952) suggested that for group studies, it is preferable to increase the size of the sample rather than have the participants keep records for more than 1 day.

If accurate conclusions are to be drawn about the nutrient intake of individual subjects, a longer time period of recording is required. Seven days have been recommended both as the minimum length of time to reflect an individual's dietary pattern and as the maximum number of days subjects will retain an interest in record keeping (Widdowson and McCance, 1945; Trulson, 1954; Trulson and McCann, 1959; Flores, 1962; Cellier and Hankin, 1963).

Several other factors should be considered in selecting an appropriate number of days to record food intake. The degree of precision required in the study is an important consideration and

inversely related to the number of days included in the dietary record (Chalmers et al., 1952). Studies which focus on certain nutrients require longer food records; greater variability of intake is reported for ascorbic acid, vitamin A, and calcium than for other nutrients (Young et al., 1953; Chalmers et al., 1952; Trulson, 1954). Characteristics of the subjects also influence how many and which days are appropriate for dietary food records. Chalmers and coworkers (1952) reported that college students ate considerably less food on weekends than on weekdays; such differences were less obvious with other age groups.

As dietary methodology has been perfected, there has been a tendency to collect food records for a shorter time period. Cellier and Hankin (1963) observed that 4 day records provided 90 percent of the information in 7 day records. The 3-day food record is frequently used (Wharton, 1963; Eppright et al., 1970; Schorr et al., 1972; Seiler and Fox, 1973).

To increase validity of the food records, some researchers repeat the recording process after a lapse of time (Huenemann and Turner, 1942; Hampton et al., 1967; Mojonnier and Hall, 1968). Repetition of the recording process takes into account daily and perhaps seasonal variations in diet.

Some subjects are not able to keep their own food records because of age or literacy limitations. In such studies, an adaptation

of the food record technique is used by asking another individual to keep the records or by employing observation techniques (Flores, 1962; Wilson et al., 1964; Eppright et al., 1970; Levy et al., 1975).

Another frequently used method of dietary evaluation is the dietary recall. In this method the subject is asked to recall, from memory, the food eaten during a designated time period. Amounts of food are estimated and recorded in household measures. This method is often termed the 24-hour recall since the time frame is usually the immediate past 24 hours. Longer time periods have been used. However, because memories fade, data are less accurate as the time length of the recall increases (Adelson, 1960). The 24-hour recall has been used successfully with a variety of age groups including elementary school children (Emmons and Hayes, 1973a; Frank et al., 1977). Subject cooperation is generally good; a large and representative sample is easily attainable. Because the data are based on past food intakes, dietary patterms of the subjects are not affected by the survey.

The 24-hour dietary recall is a widely used and accurate technique for gathering group data (Household Food Consumption Survey, 1965-1966, 1972; Ten State Nutrition Survey, 1968-1970, 1972; Health and Nutrition Examination Survey, 1971-1972, 1976; Madden et al., 1976). However, since the time period is short, the data may not be representative of an individual's usual diet. The method, therefore, is

not an appropriate means of determining the nutrient intake of individuals (Young et al., 1952b).

One major problem with the food recall method is that foods may be forgotten, resulting in incomplete data. A tendency to underestimate caloric intake has been reported (Madden et al., 1976). Accuracy can be increased with the use of a trained interviewer, a technique used in several national surveys (Household Food Consumption Survey, 1965-1966, 1972; Ten State Nutrition Survey, 1968-1970, 1972; Health and Nutrition Examination Survey, 1971-1972, 1976). Accuracy of the data also can be increased by repetition of the 24-hour recall after a lapse of time; the data are then pooled and mean intakes calculated (Balogh et al., 1971; Prothro et al., 1976).

Another method of dietary evaluation, the dietary history, was designed to identify an individual's usual dietary pattern (Burke and Stuart, 1938; Burke, 1947). Extensive information is collected by interview from each subject. Included in the interview are questions about usual food patterns and a listing of recent food intake. Burke (1947) stated that the recent intake information was the least important part of the interview, serving mainly as a cross check of accuracy. Because the data reflect long term food habits of an individual, data from diet histories can be correlated with clinical and biochemical findings (Burke and Stuart, 1938; Blecha, 1951). The method is also applicable to group surveys. Modifications of Burke's method have

been widely used both in longitudinal and epidemiological surveys (Beal, 1953; Meredith et al., 1960; Mann et al., 1962; Christakis et al., 1968; Finnegan et al., 1968). As described by Burke (1947) data from the diet history method were not quantitated; a rating scale was used for evaluation. However, other researchers have quantitated data from diet histories and have concluded that the method compares favorably with other methods of dietary evaluation (Young et al., 1952a and 1952b; Trulson, 1954; Epstein et al., 1956; Dawber et al., 1962; Stevens et al., 1963). The major disadvantages of the dietary history method are the expenses involved with the lengthy interviewing process and the need for highly skilled interviewers (Beal, 1967).

The food frequency method of dietary evaluation also focuses on usual food habits rather than food intake for a specific time period. The food frequency technique differs from the diet history in that attention focuses on a few foods or specific nutrients rather than the total dietary pattern. It is a useful technique for both individual and group data and it is successfully used in epidemiological studies (Stefanik and Trulson, 1962; Abramson et al., 1963; Hankin and Huenemann, 1967; Armstrong, 1975; Hankin et al., 1975).

Following collection of data by one of the previously discussed dietary methods, nutrient values are calculated from one of several food composition tables (Watt and Merrill, 1963; Bowes and Church,

1975; Orr, 1969; Home and Garden Bulletin Number 72, 1971 or 1977; Adams, 1975). Each table lists the nutrient content of a variety of foods in either 100 gram units or common household measurements. Nutrient content is based on average data, generally from several laboratories. Several limitations exist in the use of tables of food composition. Not all foods have been analyzed for nutrient content; this is especially true of new foods and new food combinations. With the advent of nutrient labeling, some content information is available from industry sources. Although tables of food composition are periodically revised to include additional food items (Rizek and Posati, 1977), there is a lag. Another limitation of food consumption tables is the inherent variability of nutrient content in the food itself. Differences may be attributed to variations in species, stages of maturity, geographic origins, growing conditions, marketing and storage conditions, and food preparation techniques (Whiting and Leverton, 1960; Harris, 1962; Eagles et al., 1966).

Individual and group dietary data are generally presented as mean nutrient intake per day for selected nutrients. Data may also be presented as daily mean nutrient intake per 1000 kilocalories. This method, often referred to as nutrient density, allows for incomplete reporting of food intake; it has been used to report data from recent national surveys (Ten State Nutrition Survey, 1968-1970, 1972; Health and Nutrition Examination Survey, 1971-1972; 1976).

The nutrient density approach permits evaluation of the quality of a diet or of food by the direct comparison of the two parameters which determine nutritional quality, nutrient content and caloric content. On this basis, the nutrient density approach has been recommended as a useful tool in nutrient labeling and nutrition education (Hansen et al., 1978).

If dietary data are to be compared with other characteristics of an individual or group, it is useful to have a single measure of dietary adequacy. Variations of a dietary score, based on degrees of adequacy of intake for several nutrients, have been used by several researchers (Seiler and Fox, 1973; Jakobovits et al., 1977). A more simple but less precise method used the total number of servings in each of the Four Food Groups, up to the recommended number of servings, as a measure of dietary adequacy (Allen et al., 1970).

RESEARCH PROCEDURES

Purpose and Design of the Study

The objective of this study was to identify teacher characteristics which are related to effective nutrition education for adolescents. The teacher characteristics assessed were:

1. knowledge of nutrition,
2. interest in nutrition,
3. self-confidence as a nutrition educator,
4. flexibility toward nutrition practices,
5. value placed on nutrition.

The hypothesis was that a high degree of accurate and current knowledge is necessary for an effective educator; other attributes are interrelated with the extent of the teacher's knowledge. It was further hypothesized that all of these factors influence the extent of students' learning about nutrition. The relative importance and interrelationships of these factors were analyzed. The model used is given in Figure 1.

In order to insure that an individual's teaching reflected his or her characteristics, a specific nutrition unit was not prescribed. This procedure allowed each teacher the freedom and flexibility to teach in the manner in which he or she was most competent and comfortable. Since nutrition is included in both health and home

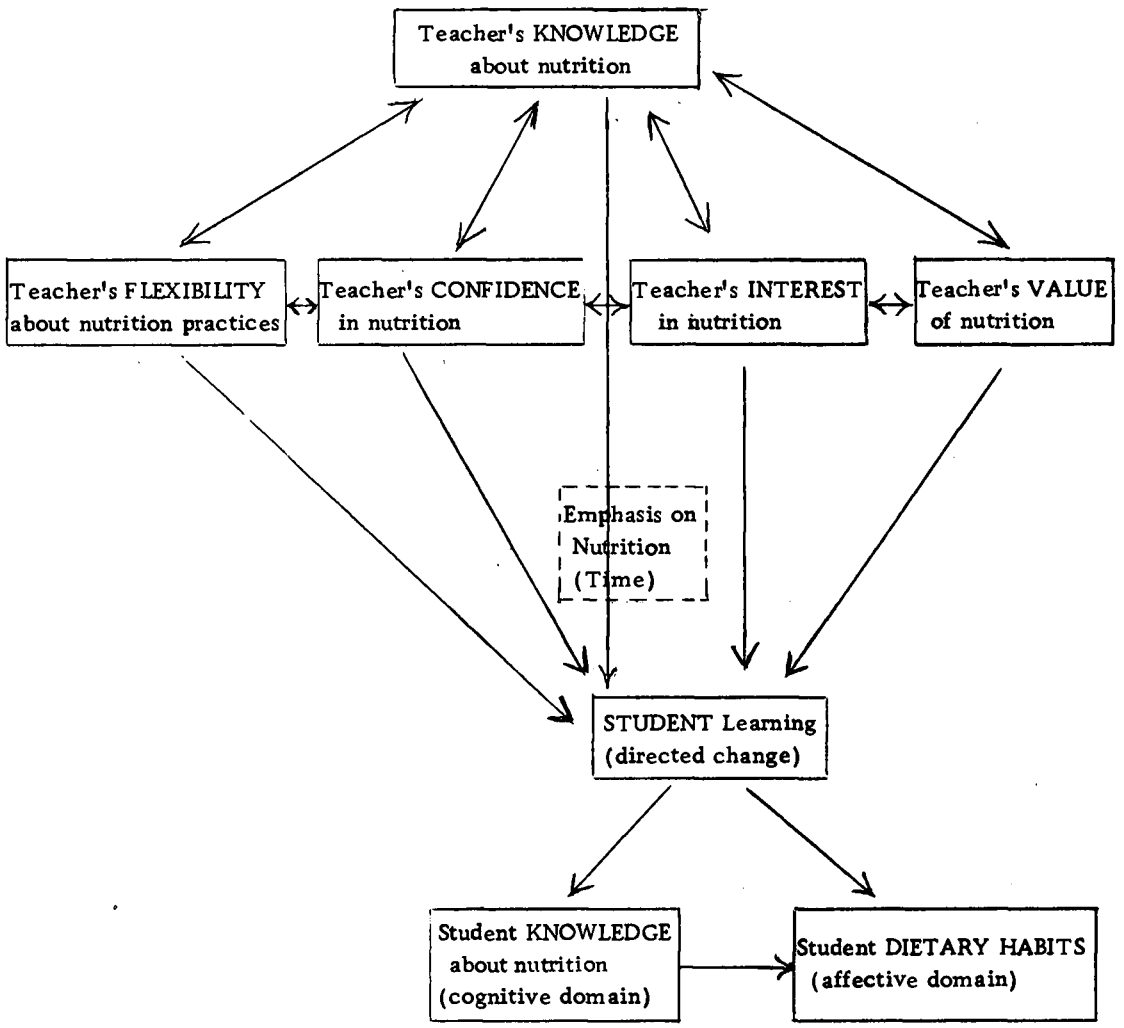

Figure 1. Proposed relationships of teacher characteristics to student learning about nutrition.

economics curricula in Oregon, teachers from both disciplines were included in the study. Data on the five teacher characteristics were collected with two questionnaires and four 24-hour food records.

To determine the effectiveness of nutrition education, student learning in both the cognitive and affective domains was evaluated. Learning in the cognitive domain was measured by the difference between a knowledge test taken before the unit on nutrition and a test taken one to three weeks after the unit was completed. To measure learning in the affective domain, students completed 24-hour food records before and after the unit on nutrition. The student sample consisted of one class from each teacher in the study. Student changes in the cognitive and in the affective domains were considered dependent variables.

Evaluation Instruments

Teacher Knowledge and Attitudes

As reviewed, a search of the literature failed to yield existing questionnaires which were considered appropriate for high school teachers of nutrition. Existing questionnaires were rejected because they focused on limited aspects of nutrition or because they were designed for people anticipated to have less background knowledge of nutrition than high school educators. Therefore, it was necessary

to design instruments to assess nutritional knowledge and nutritional attitudes of high school teachers.

Development and validation of the knowledge portion of the questionnaire involved several steps. The objective, multiple choice format was selected for all cognitive items because it best discriminates between degrees of knowledge, yet provides accurate, unbiased scoring (Gronlund, 1968; Sax, 1974). A classification matrix was developed to insure that the questionnaire contained a balance of items about various nutrients and nutrition topics as well as test items at several levels of knowledge. The questions were categorized into the following classifications: basic knowledge, advanced knowledge, applied knowledge, recent knowledge, and insignificant information. The term "insignificant information" was defined as facts and concepts which were unimportant to the high school educator, but facts that are traditionally used as interest items in nutrition courses. Using the classification matrix as a guide, individual questions were selected from a pool of multiple choice test items previously used in beginning nutrition courses at Oregon State University. Additional items were composed to complete the matrix and questions were rewritten when necessary. Principles of achievement test construction as described by Gronlund (1968) were followed. Responses were alphabetized as recommended by Sax (1974). Accuracy of each of the 87 cognitive items was verified by using the technique of

agreement by a panel of experts, in this case, faculty members in nutrition at Oregon State University. One hundred percent agreement by the panel was the criterion set for inclusion of an item in the final test. The 87 item test was also pilot tested on a group of secondary teachers who were attending summer session at Oregon State University. On the basis of responses from the two groups, 45 test items were selected for the final instrument. The knowledge instrument is Part B of teacher questionnaire II; a copy is included in Appendix B. Classification of the test items into the five categories (basic, advanced, applied, recent, or insignificant) was also verified by faculty members in nutrition at Oregon State University. Faculty members were given the classification categories, with definitions, and asked to place each of the 45 cognitive items into one of the five categories. The criterion used for classification was consensus of the majority. Although many questions could be categorized into more than one category, each test item was placed into only one. Categorical classification of each test item is given in Table 3.

Attitude and general information questions were developed specifically for health and home economics teachers. These questions are included in Teacher Questionnaire I and Part A of Teacher Questionnaire II. Copies of both instruments are included in Appendix B. The format of the attitude and general information items varied; included were Likert scale items, multiple choice items,

Table 3. Classification of teacher knowledge test items into categories of types of knowledge.

BASIC KNOWLEDGE

1. Why do adults gain weight?
   a. Overweight is hereditary
   b. Overweight is unavoidable with age
   c. Their calorie intake is higher than their energy output
   d. They like sweets

5. Which of the following statements is true about foods which contain carbohydrates other than sugars?
   a. are often an expensive source of calories
   b. are usually a source of "empty calories"
   c. are usually "fattening foods" which stimulate weight gain
   d. should be consumed as a larger proportion of the diet than currently (in U. S.)

8. Which of the following statements is true about essential amino acids?
   a. They can be synthesized by the cell if adequate carbon molecules are available.
   b. They can be used only for building muscle protein
   c. They cannot serve as sources of energy
   d. They must be provided pre-formed from food

10. What happens to protein that is consumed in excess of immediate body needs for protein?
   a. converted to energy sources and urea
   b. excreted as protein molecules by way of the urine
   c. stored as protein molecules in the liver and muscle
   d. totally converted to glycogen storage in the liver

12. If a diet were extremely low in fat, which of the following nutrients might be absorbed in insufficient amounts?
   a. calcium
   b. folacin
   c. vitamin A
   d. vitamin C

16. Which one of the following statements about vitamin E has been supported by research?
   a. effective in treating infertility in humans
   b. generally low in American diets
   c. protects polyunsaturated fats from oxidation
   d. significantly slows the aging process

26. In completely vegetarian diets which of the following nutrients will always be in short supply?
   a. carbohydrate
   b. protein
   c. thiamin
   d. vitamin B_{12}

27. Which of the following is true about the statement; Vitamin supplements are necessary for most Americans because we cannot meet our nutrient requirements with foods.
   a. Most research supports this position
   b. Most research does NOT support this position
   c. The evidence on this subject is inconclusive
   d. There is little research on this subject

Table 3. Continued.

35. What is the increase in calories per day needed by the pregnant woman?
    a. none
    b. 300 kcal
    c. 900 kcal
    d. 1500 kcal

38. The Recommended Dietary Allowances (RDAs) for the pregnant teenager will be the same as which of the following?
    a. any girl her age and size plus allowances for pregnancy
    b. any male teen of the same size
    c. any pregnant woman of equal size
    d. any teen girl minus 300 kcal daily to decrease the risk of toxemia and excessive weight gain

42. What are the nutrients that appear to be low in some U. S. diets according to surveys like the USDA Food Consumption Study and the HEW National Nutrition Survey?
    a. calcium, iron, vitamins A and C
    b. calcium, phosphorus, iron, vitamins D and E
    c. protein, pyridoxine, folacin, iodine
    d. protein, riboflavin, niacin, vitamin C

ADVANCED KNOWLEDGE

2. Which of the following factors primarily determines basal metabolic needs?
    a. altitude at which the individual lives
    b. amount of activity
    c. number of kilocalories consumed
    d. size of individual

6. The weight reduction diet should provide at least how many grams of carbohydrate?
    a. 10-40 grams
    b. 50-100 grams
    c. 110-150 grams
    d. 160-200 grams

13. At present, what % of the total calories in the average American diet come from fat?
    a. 15-25%
    b. 26-35%
    c. 36-45%
    d. 46-55%

19. What is the probable effect of very large doses of vitamin A as a supplement taken for six months or longer?
    a. acne prevented
    b. excess excreted in the urine
    c. nausea, bone soreness
    d. orangish tint to skin

Table 3. Continued.

22. Which of the following minerals is important for muscle contraction, nerve stimulation and blood clotting?
    a. calcium
    b. iron
    c. magnesium
    d. manganese

23. This vitamin is an important coenzyme for many reactions, especially those related to protein metabolism; its requirement is related to protein intake. Which vitamin is it?
    a. biotin
    b. folic acid
    c. pantothenic acid
    d. vitamin B_6

29. What is thought to be the major role of vitamin D?
    a. an antioxidant which protects polyunsaturated fatty acids
    b. a coenzyme in glycolysis
    c. a regulator of the metabolism of calcium and phosphorus
    d. controls absorption of sodium and potassium

34. A balanced and varied American diet of 2000 Kcalories daily is likely to contain how many mg of iron?
    a. 6
    b. 12
    c. 18
    d. 24

APPLIED KNOWLEDGE

3. Which of the following foods is highest in calories?
    a. 1 cup of whole milk
    b. 3 ounces of steak
    c. 10 potato chips
    d. 1 medium baked potato

7. Which of the following family members would require the greatest amount of protein per day?
    a. 10 year old daughter (37 kg) who takes ballet
    b. 15 year old son (68 kg) who is trying to lose weight before the wrestling season
    c. 34 year old mother (58 kg) who is pregnant
    d. 38 year old father (75 kg) who works as a logger

9. When may athletes need <u>more</u> protein than is usually required for their age and size?
    a. as part of the daily intake at all times
    b. during training for a new sport
    c. in the pre-game meal
    d. 3 days prior to a competitive event

15. Which of the following is a good source of vitamin A?
    a. cauliflower
    b. pineapple
    c. pumpkin
    d. red cabbage

Table 3. Continued.

17. In addition to 10 grams protein from breads and vegetables and the protein from 1 quart of milk per day, which of the following food combinations will provide the Recommended Dietary Allowance of 60 g protein, but no extra, for a 16 year old boy?
    a. 2 oz of cheddar cheese, 4 oz chicken
    b. 1 c baked beans, 2 hot dogs, 3 oz tuna
    c. 4 oz hamburger, 8 oz steak
    d. 2 T peanut butter, 1 egg

18. Under what conditions will a significant amount of riboflavin be destroyed?
    a. glass milk bottles left in sunlight
    b. lemon juice added to vegetables
    c. pasteurization of milk
    d. vegetables cooked in small amount of water

30. For the adolescent (11-18) the Recommended Dietary Allowance (RDA) for calcium is 1200 mg per day. Which of the following combinations of food will most closely meet that recommendation?
    a. 3 c milk, 1/2 c cottage cheese
    b. 3 c milk, 1 c strawberry yogurt
    c. 2 c milk, 3 oz canned salmon, 1/2 c cauliflower
    d. 2 c milk, 2 oz beef liver, 1/2 c beet greens

32. Iron is most readily absorbed from which of the following foods?
    a. eggs
    b. green vegetables
    c. meat
    d. whole grain cereals

33. Which of the following cooked foods has the greatest amount of iron?
    a. baked beans (1 cup)
    b. raisin bread (2 slices)
    c. salmon (3 oz)
    d. turnip greens (1/2 cup)

45. Which of the following is an example of complementary proteins?
    a. baked beans and cornbread
    b. 3 bean salad
    c. peanut casserole (peanuts, almonds, beef broth, potatoes)
    d. yams and sweet potatoes with brown sugar and butter

RECENT KNOWLEDGE OR RECENT EMPHASIS

11. Which of the following statements is true about people who have lactose (milk sugar) intolerance?
    a. are allergic to milk protein
    b. must avoid all milk products
    c. often tolerate small amounts of milk
    d. will not react to large doses of pure lactose

24. Which of the following nutrients is most susceptible to loss in processing of fruits and vegetables (i.e. cooking, canning, drying, etc.)?
    a. calcium
    b. folacin
    c. iron
    d. niacin

25. Impaired taste acuity, suboptimal growth, and delayed sexual maturation may be deficiency symptoms of which nutrient?
    a. copper
    b. protein
    c. selenium
    d. zinc

28. With the 1974 Recommended Daily Allowances (RDAs) how was the allowance for ascorbic acid affected?
    a. decreased 25% as a result of recent findings
    b. increased 25% as a result of recent findings
    c. increased substantially as a result of Pauling's work
    d. remained the same as the 1968 RDA

36. What would be a desirable weight gain by the end of pregnancy for a woman, 5'4", normally weighing 115 lbs?
    a. 8 lbs
    b. 15 lbs
    c. 25 lbs
    d. 35 lbs

37. What do recent studies indicate about sodium during pregnancy?
    a. has no essential function
    b. is not related to hypertension
    c. increased physiological need
    d. should be carefully restricted

39. Which of the following practices is desirable to prevent infant obesity?
    a. Dilute the commercial formula to 1/2 the normal concentration for the first six months
    b. Start the infant on solid food at the age of 3 weeks
    c. Rely on breast milk or prescribed amounts of infant formula for the first 6 months
    d. Use skim milk for the first year

40. Which of the following people is considered to be a reputable authority on nutrition?
    a. Dr. Robert Atkins
    b. Adele Davis
    c. Jean Mayer
    d. Linus Pauling

41. What are the United States Recommended Daily Allowances (U. S. RDA) for adults?
    a. higher than the Recommended Dietary Allowances (RDAs) for most Americans
    b. identical to the Recommended Dietary Allowances (RDAs)
    c. Lower than the Recommended Dietary Allowances (RDAs) for most Americans
    d. minimum amounts necessary to prevent deficiency diseases--the same as the MDR

Table 3. Continued.

43. Which of the following is true about the statement: Large intakes of vitamin C (1-2 g per day) will prevent the common cold.
    a. Most research supports this position
    b. Most research does NOT support this position
    c. There is little research on this subject

44. Which of the following was recently recommended by the U. S. Senate Committee on Nutrition?
    a. Add bran to our diets whenever possible
    b. Decrease the total amount of fat in our diets, but increase the proportion of polyunsaturated fats
    c. Increase the proportion of calories from foods high in protein
    d. Provide for grain storage for national emergency

INSIGNIFICANT INFORMATION

4. Excessive intake of raw egg white will result in deficiency of which vitamin?
    a. biotin
    b. pantothenic acid
    c. riboflavin
    d. vitamin C

14. Acute thiamin deficiency would be characterized by which of the following?
    a. beri-beri
    b. pellagra
    c. rickets
    d. scurvy

20. What is the result of a deficiency in the absorption of cobalamin?
    a. pellagra
    b. pernicious anemia
    c. rickets
    d. scurvy

21. Which nutrient was substantially destroyed in an early commercial baby formula due to high processing temperatures?
    a. calcium
    b. niacin
    c. vitamin E
    d. vitamin B_6

31. What is the gland involved in the production of hormones which influence calcium absorption?
    a. adrenal
    b. hypothalamus
    c. parathyroid
    d. pituitary

completion questions, checklists, and items to rank (Table 4). The format selected was determined by the nature of the question, possible introduction of bias, and ease and accuracy of scoring. Validity of classification of the items was achieved by the technique of agreement by a panel of experts; in this case, faculty members in the departments of home economics education and foods and nutrition at Oregon State University. In addition, a portion of a scale developed by Carruth and Anderson (1977) for Expanded Food and Nutrition Education Program aides was included. The 8 item scale assessed flexibility toward nutritional practices. The attitude items and general information questions were pilot tested on the same group of secondary teachers who had taken the knowledge portion.

Because the entire instrument with knowledge, attitude, and general information components was lengthy, the instrument was divided into two questionnaires. The first part was taken by each teacher prior to teaching the unit on nutrition; the second part was taken after the nutrition unit was completed. Care was taken not to include items in the first part which might influence the character or content of the nutrition unit. All knowledge items were incorporated into Teacher Questionnaire II which was taken after the nutrition unit had been taught.

Table 4. Classification of teacher questionnaire items into categories of teacher characteristics related to nutrition and correlation coefficients.

	Characteristic	Correlation with score of other items in set (r value)	Point value
	CONFIDENCE	n = 71	
21.	Compared with other subjects you teach, how adequate is your knowledge of nutrition?	.79	5
	Very adequate 5 4 3 2 1 Not adequate		
22.	How confident do you feel in answering teenagers' questions about their nutrition concerns?	.79	5
	Very confident 5 4 3 2 1 Not confident		
23.	How confident do you feel in discussing the pros and cons of popular diets?	.85	5
	Very confident 5 4 3 2 1 Not confident		
24.	Do you consider nutrition easy to teach?	.71	5
	Easy 5 4 3 2 1 Difficult		
25.	How confident do you feel about your effectiveness as a nutrition educator?	.77	5
	Very confident 5 4 3 2 1 Little confidence		
	INTEREST	n = 71	
5.	Rank the following college courses from (5) most favorite to (1) least favorite _____ biology/physiology _____ history/political science _____ literature _____ nutrition _____ psychology	.51	5
14.	Have you read any books related to nutrition in the past year? Identify titles and authors if possible. _____	.46	4
15.	Have you read about nutrition in any magazines or journals in the past year? Identify the magazine or journal by name and indicate the approximate number of articles about nutrition which you have read in the past year. Name of magazine/journal — Number of articles read _____ _____ _____ _____ _____ _____	.44	6

Table 4. Continued.

	Characteristic	Correlation with score of other items in set (r value)	Point value
16.	If a workshop consisting of several evening sessions is planned for your area, which topic would be of most interest to you? Indicate a first and second choice.	.54	6
	_____ Techniques in Food Drying _____ Ski Conditioning _____ Crafty Crafts _____ First Aid for Emergencies _____ Physical Fitness is Fun _____ Teaching Personal Finance _____ Coaching Girl's Sports _____ Nutrition Fads and Fallacies _____ Recent Research in Nutrition _____ Microwave Menus _____ Teaching Weight Control _____ Improving Skills in the Basics (3 R's)		
17.	Which of the following TV specials would be most interesting to you? Rank your preferences 7 (most interesting) to 1 (Least interesting). _____ Current trends in education _____ Food additives--are they safe? _____ Cancer--what are your chances? _____ How well-nourished are Americans? _____ Teenagers and the sexual revolution _____ What does a high school diploma really mean?	.54	6
20.	Compared with other subjects you teach, how interesting is nutrition to you? Most interesting 5 4 3 2 1 Least interesting	.53	5
	VALUE	n = 62	
Answer #18 if you are a health teacher; omit #19 Answer #19 if you are a home economics teacher; omit #18			
18.	Which of the following areas do you feel is most important to include in your school's curriculum? Rank from 5 (most important) to 1 (least important). _____ Communicable diseases _____ Drug and alcohol abuse _____ Digestion and circulatory systems _____ Nutrition _____ Sports for leisure time	.31	5
19.	Which of the following areas do you feel is most important to include in your school's curriculum? Rank from 5 (most important) to 1 (least important) _____ Crafts and stitchery _____ Food Preservation _____ Holiday meals and entertaining _____ Nutrition _____ Tailoring		
11.	Compared with other subjects you teach, how important is nutrition to you? Very important 5 4 3 2 1 Not important	.39	5

Table 4. Continued.

	Characteristic	Correlation with score of other items in set (r value)	Point value
12.	If you are able to take a nutrition course at OSU next summer, which of the following do you feel would be most beneficial to you? Select one only.	.41	6
	_____ Food Additive Hazards		
	_____ Pregnancy and the Teenager		
	_____ Organic Gardening		
	_____ Therapeutic Nutrition for the Ill		
	_____ Special Nutritional Needs of the Athlete		
	_____ Effective Teaching Tools for Nutrition		
13.	If you could attend a conference on only one of the following topics, which would you select? Select only one.	.66	6
	_____ Alcoholic Teens		
	_____ Audiovisual Teaching Skills		
	_____ Nutrition for Teens		
	_____ An Ecologically Sound Environment		
	_____ Sex Education for Teens		
14.	In terms of your concern about maintaining good health, rank the following items from (5) most concern to (1) least concern.	.62	5
	_____ exercise		
	_____ annual medical exam		
	_____ sleep and rest		
	_____ well balanced diet		
	_____ "clean" environment		
35.	What is the major reason for inclusion or exclusion of fish in your diet? Select one only.	.31	2
	1. I don't like fish		
	2. I like fish		
	3. It is low in calories		
	4. It is low in cholesterol		
	5. It is a good source of protein		
	6. It is inexpensive		
	7. It is quick to prepare		
	8. It is low in saturated fats		
	9. Other (specify) _____		
36.	What is the major reason for inclusion or exclusion of margarine in your diet? Select one only.	.35	2
	1. I like the texture/consistency		
	2. I prefer the flavor of butter		
	3. I don't like margarine		
	4. It is high in calories		
	5. It is low in cholesterol and saturated fats		
	6. It is less expensive than butter		
	7. Other (specify) _____		

Table 4. Continued.

	Characteristic	Correlation with score of other items in set (r value)	Point value
37.	What is your major reason for inclusion or exclusion of liver in your diet? Select one only.	.13	2
	1. I like the taste		
	2. I dislike the taste and/or texture		
	3. It is inexpensive		
	4. It is easy to prepare		
	5. It is low in calories		
	6. It is high in cholesterol		
	7. It is a good source of iron and vitamin A		
	8. Other (specify) _____		
38.	What is your major reason for inclusion or exclusion of milk in your diet? Select one only.	.18	2
	1. I don't like milk.		
	2. Milk upsets my stomach		
	3. Milk is fattening		
	4. Milk is a good source of calcium		
	5. "Every body needs milk"		
	6. Milk is inexpensive		
	7. Milk is a good source of protein		
	8. I don't believe that adults need milk		
	9. Other (specify) _____		
	FLEXIBILITY	r not computed	

For questions 25-33, indicate whether you agree or disagree with the statement

		Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
26.	Children should eat what is on their plate, mother knows best					
27.	I usually will not taste a food if its appearance is similar to something I dislike					
28.	Knowing something is "good for me" has little or no influence on what I choose to eat.					
29.	I think traditional ways of preparing food are the best ways					
30.	In my opinion, the best advice when eating away from home is to avoid the unknown					

Table 4. Continued.

Characteristics		Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
31.	Learning the basic ideas in nutrition will probably alter my personal eating habits very little.					
32.	The Basic Four Food Groups are the only usable tools for planning an adequate diet					
33.	Restricting my meal patterns to familiar food ensures that I enjoy what I eat					

Student Knowledge

For several reasons it also was necessary to develop the knowledge questionnaire for the high school student portion of the sample. First, it was considered desirable to have the teacher and student questionnaires similar in content and format, although different in difficulty. Second, nutrition tests quickly become outdated by new research findings as well as by continuously changing food habits. Finally, most existing questionnaires for this age group were designed to evaluate specific nutrition units (Picardi and Porter, 1976; Spitze, 1976). The same procedures of test construction and verification were followed for the student knowledge tests as were used with the teacher questionnaire. Copies of the two student questionnaires, a pretest and a posttest, are included in Appendix C. The two forms were randomly pilot tested on 17 teenagers, some of whom had studied nutrition previously. The two forms, 31 items each, appeared comparable; the mean score on the pretest was 19.5 with a range of 11-27, and the mean score on the posttest 19.3 with a range of 12-26. One item was dropped from the test; the final questionnaire included 30 knowledge items, two of which were classified as insignificant knowledge.

Dietary Evaluation

For purposes of comparison, analysis, and ease of gathering information, the same method of dietary data collection was selected for both the student and teacher groups. Although several methods of dietary evaluation yield reliable information for educated, adult populations, the adolescent group presented more difficult problems. The dietary habits of teenagers complicate dietary evaluation. Adolescents tend to snack frequently, consume large quantities of food, and have less regular meal patterns than other age groups (Schorr et al., 1972). Such factors can easily contribute to omission or underestimation of food intake. In addition, the student sample had about 1,000 individuals, with diets to be evaluated before and after the nutrition unit. The sample size, and the resulting time and budget limitations, precluded the use of trained interviewers; data would have to be collected by each teacher. For these reasons, the method of dietary evaluation chosen was the food record. Because the student diets would be evaluated as group data and because the sample size was large, 24 hour food records before and after the nutrition unit were sufficiently long. The students were instructed to use only school days for their diet records. Rather than ask for foods eaten at traditional meals, respondents were asked to record food eaten during various time periods throughout the day. A

sample diet record form with instructions for students is included in Appendix C.

Although dietary data were collected from both student and teacher groups, the purposes of the data collection were different and, therefore, the procedures varied slightly. With the teacher group, the goal was to determine a representative dietary pattern for each individual teacher. This information was used as a possible measure of the extent to which each teacher valued nutrition concepts. Since the teacher diet records were treated as individual data rather than group data, records for more days were required per person. Each teacher was asked to complete four 24-hour diet records, two with each teacher questionnaire. Since this was an adult population, weekends were not excluded, but the day of the week was recorded. A sample diet record form with instructions for teachers is included in Appendix B. According to the technique suggested by Burke (1947) and Trulson (1954), another method of dietary data evaluation was used as a cross-check. A food frequency check list was included with Teacher Questionnaire I (Appendix B).

Approval of Human Subjects Committee

In accordance with university regulations regarding research with human subjects, all procedures and test instruments were reviewed by the Oregon State University Committee for the

Protection of Human Subjects. The project was conducted with its knowledge and approval.

Selection of Sample

Because the total number of high school nutrition teachers in Oregon was not known, a nested sampling plan was used; schools rather than teachers were drawn in the first phase of sample selection. A list of Oregon high schools was obtained from the Oregon School Directory, 1976-1977, published by the Oregon Department of Education. A geographical division of the state was made to facilitate a visit by the researcher to each high school in the sample; therefore, only the 163 schools located west of the Cascade Mountains were included in the population. The schools in western Oregon are not a homogeneous group, but represent a variety of sizes, socioeconomic levels, community sizes, and degrees of community isolation. Before the sample was selected, the population was further reduced to 155 schools by elimination of special purpose schools and those with no course offerings in home economics. All schools offer courses in health since one year of health is currently required for graduation from Oregon high schools. Using simple random sampling techniques with a table of random numbers, 50 high schools were drawn into the sample. An additional 15 schools were drawn for alternates. The 50 schools appeared representative of the

population. Included in the sample were metropolitan, suburban, small town, and rural schools.

The second phase of sample selection involved choosing two teachers from each school, one in health and one in home economics. First, a letter was sent to each high school principal to explain the purposes and procedures of the study. Second, a telephone call was made to each principal to answer questions concerning the survey and to secure his or her approval of the project. Each principal was asked to identify, by name, one health and one home economics teacher who included nutrition as a component part of a course. A few principals deferred the decision to a department chairman or other administrator. Next, a personal letter was sent to each teacher explaining the study and requesting participation; a return form was enclosed on which each was asked to indicate the approximate length and time frame of the nutrition unit. Examples of the letters sent to the principals and to the teachers are in Appendix A. The final step in the sample selection process was a phone call to each teacher to determine if the teacher was willing to participate in the study, to determine whether or not the nutrition unit met the established criteria, and to set a time for the researcher's visit.

Although the nutrition unit was not specifically prescribed, several criteria about the unit and about the student portion of the

sample were established. The following criteria for the nutrition unit were used in the sample selection process:

1. The unit must be comprehensive and general purpose; units with a single focus (e.g. weight control, nutritious snacks) will be excluded from the survey.
2. The unit must be a minimum of one week in length. Nutrition may or may not be integrated into other units in addition.
3. The unit must be taught during the first semester or early in the second semester of the 1977-78 school year. The unit must be completed by March 1.

The following criteria for the student portion of the sample were used:

1. The student sample will consist of one class from each teacher. The choice of classes will be made by each participating teacher, taking into consideration class enrollment and the timing, length, and focus of the nutrition unit.
2. Only one class from each teacher will be included in the sample even if that person teaches both health and home economics classes.
3. Any health or home economics class, grades 9-12 will be considered appropriate if other criteria are met.

Participation of both health and home economics teachers within a school was not necessary; a school was not excluded from the sample if only one teacher agreed to participate or if only one class met the above criteria.

Visits were arranged with 71 teachers in 43 high schools. Since the minimum sample size had previously been set at 70 teachers, the alternate schools were not used. The potential sample of 100 teachers, two from each of the 50 schools, was decreased by failure to conform to the above criteria as follows:

1. The principal and/or school district did not approve participation (2 schools; 4 teachers),
2. The same person taught all health and home economics classes (4 teachers),
3. Nutrition was not taught during the specified time period (9 teachers),
4. The nutrition unit was less than one week or nutrition was not included in the curriculum (11 teachers),
5. The teacher elected not to participate in the study (1 teacher).

Data Collection

The first stage of data collection occurred during the visit by the researcher to each of the 71 teachers in the sample. The visit

served several purposes: to answer questions about the study, to explain and standardize research procedures, to administer teacher Questionnaire I, and to deliver the Student Pretest Questionnaires. Written instructions for administering the questionnaires were also given each teacher. Following the visit, and prior to beginning the unit on nutrition, each teacher administered the Student Pretest Questionnaires and returned them by mail. Teachers were instructed not to look at the student tests so that the content of the nutrition unit would not be influenced by the questionnaire. Near the anticipated completion date of the nutrition unit, each teacher was sent a packet containing Teacher Questionnaire II and the Student Posttest Questionnaires. They again administered the student questionnaires according to written directions, completed the teacher questionnaire, and returned the instruments by mail. If necessary, follow-up phone calls were made to remind the teachers to return the questionnaires. A brief checklist, designed to clarify information collected earlier, was sent to each teacher in early May; a copy of that instrument is in Appendix B.

Description of Sample

Teachers

Descriptive statistics for the sample of teachers are in Table

5. Of the teachers who agreed to participate in the study, 45 percent were health teachers and 55 percent were home economics teachers.

Fifty-two percent of the sample had majored in home economics education at the baccalaureate level; 27 percent had majored in physical education; 10 percent had majored in health education; 11 percent in other areas. Fifty-eight percent held an Oregon endorsement to teach home economics; 32 percent held an endorsement to teach health. A master's degree was held by 32 percent of the participants; 41 percent had at least 24 credits beyond the baccalaureate degree. Fifty-one percent of the sample held an Oregon Basic Teaching Certificate (provisional); 38 percent had an Oregon Standard Teaching Certificate (permanent); the remainder of the sample had a Regular Vocational Certificate or Five Year Regular Teaching Certificate. The mean age of the participants was 31 $\pm$ 9 years (range 22-58 years) with an average of 6.8 $\pm$ 5.5 years of teaching experience. Forty percent of the teachers had taught for less than 3 years; 31 percent had taught for 10 years or more.

Students

Descriptive statistics for the student portion of the sample are in Table 6. The average student participant was 15 to 16 years old. Both the pretest and the posttest samples were predominantely female,

Table 5. Description of the 71 teachers in the sample.

Characteristic	Number	Percent
Number of teachers in sample	71	100
Health teachers	32	45
Home economic teachers	39	55
College major		
Home economics	37	52
Physical education	19	27
Health education	7	10
Other	8	11
Degree held		
Bachelor's Degree	19	27
Bachelor's + 24 or more credits	29	41
Master's Degree	12	17
Master's Degree + 30 or more credits	11	15
Type of teaching certificate		
Basic (provisional)	36	51
Standard (permanent)	27	38
Other	8	11
Oregon Health Endorsement	23	32
Oregon Home Economics Endorsement	41	58

Table 6. Description of classes and students in the sample.

Characteristic	Sample	
	Pretest	Posttest
Number of classes	68	62[a]
Mean number of students per class	17.5	17.3
Number of students completing knowledge test	1193	1073
Number of students completing dietary record	948	766
Mean age of students	15.5	15.6
Sex		
females (%)	64.9	68.8
males (%)	35.1	31.2

[a]An additional four sets of posttest questionnaires were apparently lost in the mail. Two classes did not complete any portion of the posttest questionnaire.

65 percent and 69 percent, respectively. Student participation in the survey was excellent; 1,193 adolescents in 68 classes completed knowledge pretests; 1,073 students in 62 classes completed knowledge posttests. Most of the difference in sample size between the pretest and the posttest can be attributed to the 6 classes which did not complete the study. The average class size for the pretest questionnaire was 17.5 and 17.3 for the posttest; class sizes ranged from 6 to 32 students. Dietary records were returned by 79 percent of the students in the pretest sample and 71 percent of the students in the posttest sample. The dietary records were returned to class on the day following the knowledge test which may partially explain the smaller number of respondents. In addition 2 teachers returned posttest knowledge questionnaires, but no diet records from their students.

Statistical Analysis

A variety of computer programs were used in the tabulation and analysis of data. These programs included an existing dietary analysis program, Statistical Programs in the Social Sciences (Nie et al., 1975), and Statistical Interactive Program System (Rowe and Barnes, 1976).

The knowledge portions of both student and teacher questionnaires were computer graded, giving a raw score based on the

number of correct answers, but excluding the insignificant knowledge questions which were treated separately. Item analysis was done for all knowledge questions. Mean, range, standard deviation, and the difference between pretest and posttest scores were calculated for each class of students. General information data from both teachers and students were tabulated by computer; group statistics were calculated when appropriate.

Scores on the other teacher characteristics, interest, confidence, value, and flexibility, were computer calculated by summing the responses in each area. Validity of each item, except for those in the flexibility group, was tested by correlating it with the total of the items designed to measure that characteristic. If any item showed a negative correlation below .01 with the total of others in the set, it was dropped as a measure of that characteristic. Although this was not found for any component questionnaire item, the teacher dietary score was treated separately rather than as a component of the value score. Similarly, teacher knowledge confidence was treated as a separate item rather than as part of teaching confidence. Summaries of the questions pertaining to each area, the scoring value of each item, and correlations are given in Table 4.

Dietary records were coded for computer analysis using Home and Garden Bulletin #72, 1971 edition. A few additional food items were added, using Handbook 456 (Adams, 1975) or nutrient labels as

sources. For each subject daily intakes of the following were calculated by computer: kilocalories, protein, fat, carbohydrate, calcium, iron, vitamin A, thiamin, riboflavin, niacin, and ascorbic acid. Nutrient intakes per 1000 kilocalories (kcal) were also computed for each subject. For the teacher group, mean daily intakes of the above nutrients were also computed, based on two to four days' diet records.

A dietary score was calculated by computer for each subject, using an adaptation of the method described by Seiler and Fox (1973). Each subject's daily intake of eight nutrients (protein, calcium, iron, vitamin A, thiamin, riboflavin, niacin, and ascorbic acid) plus kcal was compared with the Recommended Dietary Allowance, RDA (Food and Nutrition Board, 1974) for the appropriate age and sex group. For convenience, the 1974 RDA's for eight nutrients and energy are included in Table 7. Intakes equal to or less than 33 percent of the RDA were awarded 0 points, intakes of 34-65 percent of the RDA received 1 point, and intakes equal to or above 66 percent of the RDA received 2 points. Thus, the maximum dietary score was 18 points. A dietary score based on intakes of the eight nutrients per 1000 kcal was also calculated for each subject; the maximum score in this case was 16 points. The nutrient allowances per 1000 kcal are given in Table 8. Mean dietary scores and mean dietary scores per 1000 kcal were calculated for each class of students.

Table 7. Recommended Dietary Allowances of the Food and Nutrition Board, National Academy of Sciences--National Research Council (1974)[a]

	Age (years)	Energy (kcal)	Protein (g)	Calcium (mg)	Iron (mg)	Vitamin A activity (IU)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)	Ascorbic Acid (mg)
Males	11-14	2, 800	44	1, 200	18	5, 000	1.4	1.5	18	45
	15-18	3, 000	54	1, 200	18	5, 000	1.5	1.8	20	45
	19-22	3, 000	54	800	10	5, 000	1.5	1.8	20	45
	23-50	2, 700	56	800	10	5, 000	1.4	1.6	18	45
	51+	2, 400	56	800	10	5, 000	1.2	1.5	16	45
Females	11-14	2, 400	44	1, 200	18	4, 000	1.2	1.3	16	45
	15-18	2, 100	48	1, 200	18	4, 000	1.1	1.4	14	45
	19-22	2, 100	46	800	18	4, 000	1.1	1.4	14	45
	23-50	2, 000	46	800	18	4, 000	1.0	1.2	13	45
	51+	1, 800	46	800	10	4, 000	1.0	1.1	12	45

[a]Food and Nutrition Board, 1974. Recommended Dietary Allowances, 8th ed. National Research Council, National Academy of Sciences, Washington, D. C.

Table 8. Nutrient allowances per 1,000 kcal derived from Recommended Daily Dietary Allowances (1974)[a].

	(years)	Energy (kcal)	Protein (g)	Calcium (mg)	Iron (mg)	Vitamin A activity[b] (IU)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)	Ascorbic Acid (mg)
Males	11-14	2,300	15.7	429	6.4	1,786	0.50	0.54	6.4	16.1
	15-18	3,000	18.0	400	6.0	1,667	0.50	0.60	6.7	15.0
	19-22	3,000	18.0	267	3.3	1,667	0.50	0.60	6.7	15.0
	23-50	2,700	20.7	296	3.7	1,851	0.52	0.59	6.7	16.8
	51+	2,400	23.3	333	4.2	2,083	0.50	0.63	6.7	18.8
Females	11-14	2,400	18.3	500	7.5	1,667	0.50	0.54	6.7	18.8
	15-18	2,100	22.9	571	8.6	1,904	0.52	0.67	6.7	21.4
	19-22	2,100	21.9	381	8.6	1,904	0.52	0.67	6.7	21.4
	23-50	2,000	23.0	400	9.0	2,000	0.50	0.60	6.5	22.5
	51+	1,800	25.6	444	5.6	2,222	0.56	0.61	6.7	25.0

[a]Hansen, R., Wyse, B., Brown, G. 1978. Nutrient needs and their expression. Food Technology 32(2):44.

[b]Converted to IU.

The difference in the dietary scores before and after the nutrition unit was also calculated for each class.

Correlations were computed between teacher characteristics, number of nutrition courses taken, number of related science courses, and years of teaching experience. Estimated adequacy of unit length, length of the unit, and whether or not nutrition was integrated into additional units were included in the correlations. Student data included in the correlations were mean changes in student knowledge and mean changes in student dietary scores and in dietary scores per 1000 kcal. A model of the relationship between teacher characteristics and adolescents' learning of nutrition was developed and tested by multiple regression.

RESULTS AND DISCUSSION

Assessment of Teacher Characteristics

The purpose of this study was to identify teacher characteristics which are related to effective nutrition education for adolescents. The teacher characteristics assessed were teachers' knowledge, confidence, interest, flexibility, and value related to nutrition. It was hypothesized that these characteristics are interrelated and that all contribute to student learning of nutrition in the cognitive and affective domains. Data for each teacher characteristic will be presented before the interrelationships are examined.

Nutrition Background

This sample of 71 nutrition teachers had a varied background in nutrition and related courses. Most of the teachers (89 percent) had taken a college nutrition course; only eight of the teachers had not done so at the college level. Five of those eight teachers had not taken any college courses which even included nutrition. Almost half of the teachers (45 percent) had taken 2 or more college courses in nutrition. A college nutrition course is required in Oregon for certification to teach secondary health and home economics classes. The only similar studies identified in the literature were for elementary teachers (Petersen and Kies, 1972; Cook et al., 1977). In their

states and in Oregon, a college nutrition course is not required for elementary certification.

Teachers in this sample were also asked about their college background in science courses related to nutrition. Seventy-nine percent of these teachers reported that they had taken a course in physiology; 62 percent reported a biology course. Forty-nine percent of the sample had taken inorganic chemistry; 21 percent, organic chemistry; and 12 percent, biochemistry.

Teacher Knowledge

The distribution of scores on the nutrition knowledge questionnaire is shown in Figure 2. The scores ranged from 22 to 85 percent correct with a mean score of 48 percent. This mean score is low considering that the questions were taken from introductory nutrition courses; 89 percent of these teachers had taken an introductory course in nutrition.

Reliability of the nutrition knowledge test designed for this study was 0.66, as determined by Kuder-Richardson Formula 21 (Gronlund, 1968). Reliability, as determined by the standard error of measurement, was 3.2 (Gronlund, 1968). Both measures of reliability are within acceptable ranges (Gronlund, 1968). Reliability of the test instrument would be improved by increasing the length.

The difficulty index of the teacher knowledge test was 0.48, very close to the ideal 0.50 (Gronlund, 1968). As a research

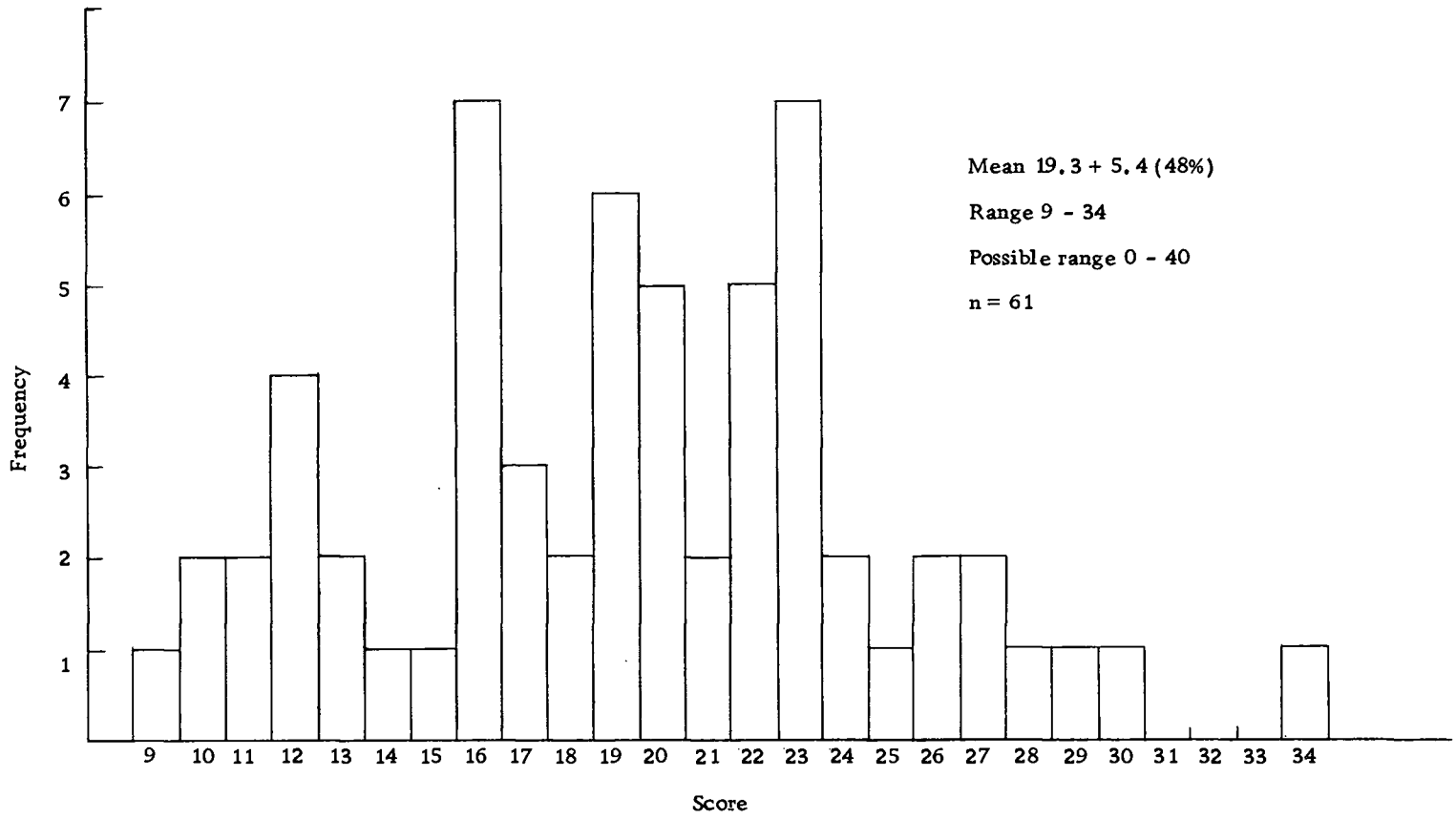

Figure 2. Distribution of Oregon high school nutrition teachers' nutrition knowledge scores.

instrument, this test is useful. However, with a difficulty level of 0.48, the test was discouraging for the respondents. On the basis of comments from the teachers, it is recommended that a few additional items that are relatively easy be included.

Item analyses were performed on individual test items. The index of difficulty and the discrimination index for each question are given in Table 9. No test item should have a negative discrimination index. All but two items were within the acceptable range of difficulty, 0.1 to 0.9 (Dwyer et al., 1970). The question about sodium restriction during pregnancy (item 37) had a very low index of difficulty, 0.05; it should be eliminated from the test. The question, "Why do adults gain weight?" (item 1) was answered correctly by all teachers. However, it was included in the questionnaire to place the teachers at ease during the testing process and it probably should be retained in the test for that purpose.

Table 10 contains a survey of scores in the various categories of nutrition knowledge: basic knowledge, advanced knowledge, applied knowledge, recent knowledge or recent emphasis, and insignificant information. As expected, teachers scored highest on the basic knowledge portion of the test with a mean score of 60 percent correct. Insignificant information was retained at the same level; the mean score on that portion was 59 percent correct. Teachers scored least well on the recent knowledge portion with a mean score

Table 9. Item analysis of nutrition knowledge test designed for high school teachers.

Item number	Difficulty index	Discrimination index
1	1.00	.00
2	0.48	.27
3	0.51	.34
4	0.52	.28
5	0.46	.18
6	0.69	.35
7	0.38	.28
8	0.59	.40
9	0.31	.31
10	0.48	.43
11	0.33	.41
12	0.67	.37
13	0.30	.18
14	0.79	.29
15	0.84	.42
16	0.39	.41
17	0.33	.30
18	0.74	.42
19	0.26	.24
20	0.75	.41
21	0.44	.22
22	0.57	.14
23	0.33	.25
24	0.31	.17
25	0.30	.10
26	0.34	.41
27	0.67	.24
28	0.21	.07
29	0.82	.35
30	0.31	.57
31	0.43	.25
32	0.36	.14
33	0.31	.34
34	0.54	.25
35	0.51	.40
36	0.56	.34
37	0.05	.29
38	0.77	.45
39	0.64	.42
40	0.33	.29

Table 9. Continued.

Item number	Difficulty index	Discrimination index
41	0.23	.30
42	0.70	.45
43	0.79	.24
44	0.56	.43
45	0.39	.34

Table 10. Summary of Oregon secondary teacher nutrition knowledge scores.[a]

Category	Score (%)	Number of items	Mean raw score	S.D.	Range of scores (%)
Total nutrition knowledge	48	40	19.3	5.4	23-85
Basic knowledge	60	11	6.6	2.1	18-100
Advanced knowledge	50	8	4.0	1.3	13-88
Applied knowledge	45	10	4.5	1.9	0-80
Recent knowledge	39	11	4.3	1.8	10-91
Insignificant information	59	5	2.9	1.1	20-100

[a] n = 61.

of only 39 percent. There was a significant correlation between the various categories of nutrition knowledge. Correlation coefficients are presented in Table 11.

These results are similar to those reported in the literature for other groups. Harrison and coworkers (1969) reported great variation in all areas of nutrition knowledge in their sample of public health nurses. Physicians scored higher on basic nutrition questions than on those relating to therapeutic nutrition (Krause and Fox, 1977). Registered nurses were least knowledgable about application of nutrition principles (Vickstrom and Fox, 1976), also an area of weakness for the high school teachers in this sample.

Although other studies have used different test instruments, the low level of nutrition knowledge scores in this survey is consistent with the findings of other researchers who surveyed nutrition educators (Harrison et al., 1969; Petersen and Kies, 1972; Vickstrom and Fox, 1976; Krause and Fox, 1977). On the basis of test scores, all of the above researchers recommended increased professional education in nutrition.

Confidence

Teacher confidence in nutrition was measured in two ways: direct questions in which the teacher evaluated his or her own confidence as a nutrition educator and as a part of the nutrition

Table 11. Correlation coefficients between categories of teacher knowledge.

Category of knowledge	Correlation Coefficient[a]				
	Total	Basic	Advanced	Applied	Recent
Total Knowledge					
Basic	.84**				
Advanced	.64**	.38**			
Applied	.80**	.61**	.39**		
Recent	.72**	.45**	.36**	.37**	
Insignificant	.37**	.23	.27*	.35**	.31*

[a]* significant, $p \leq .05$, ** significant, $p \leq .01$. $n = 61$.

knowledge questionnaire in which the teacher indicated a degree of certainty for each cognitive item. The two measures will be referred to as teaching confidence and knowledge confidence. There was considerable variation in the measure, teaching confidence. Scores ranged from 10-24 points; the maximum score possible, 25 points, indicated the highest degree of confidence. Distribution of the confidence scores is shown in Figure 3. As a group, these teachers had a moderate degree of teaching confidence; the mean score was 16.9 ± 3.4. For three of the five items comprising the measure, the lowest degree of confidence was not selected by any teacher. These were the items referring to their confidence in answering teenagers' questions, their confidence regarding evaluation of popular diets, and their effectiveness as nutrition educators. Of the five items in this set, the teachers as a group were most confident about their ability to answer teens' questions. Although 52 percent of the teachers ranked themselves midway in their effectiveness as nutrition educators, 1/3 of the sample indicated above average confidence with a rank of 4 or 5. A moderately high degree of confidence of this group was indicated by responses to the question, "How adequate is your knowledge of nutrition?" Forty-one percent of the teachers ranked themselves midway with a 3; 42 percent selected a 4 or 5. This group of teachers showed the least confidence with the question, "Do you consider nutrition easy to teach?" The

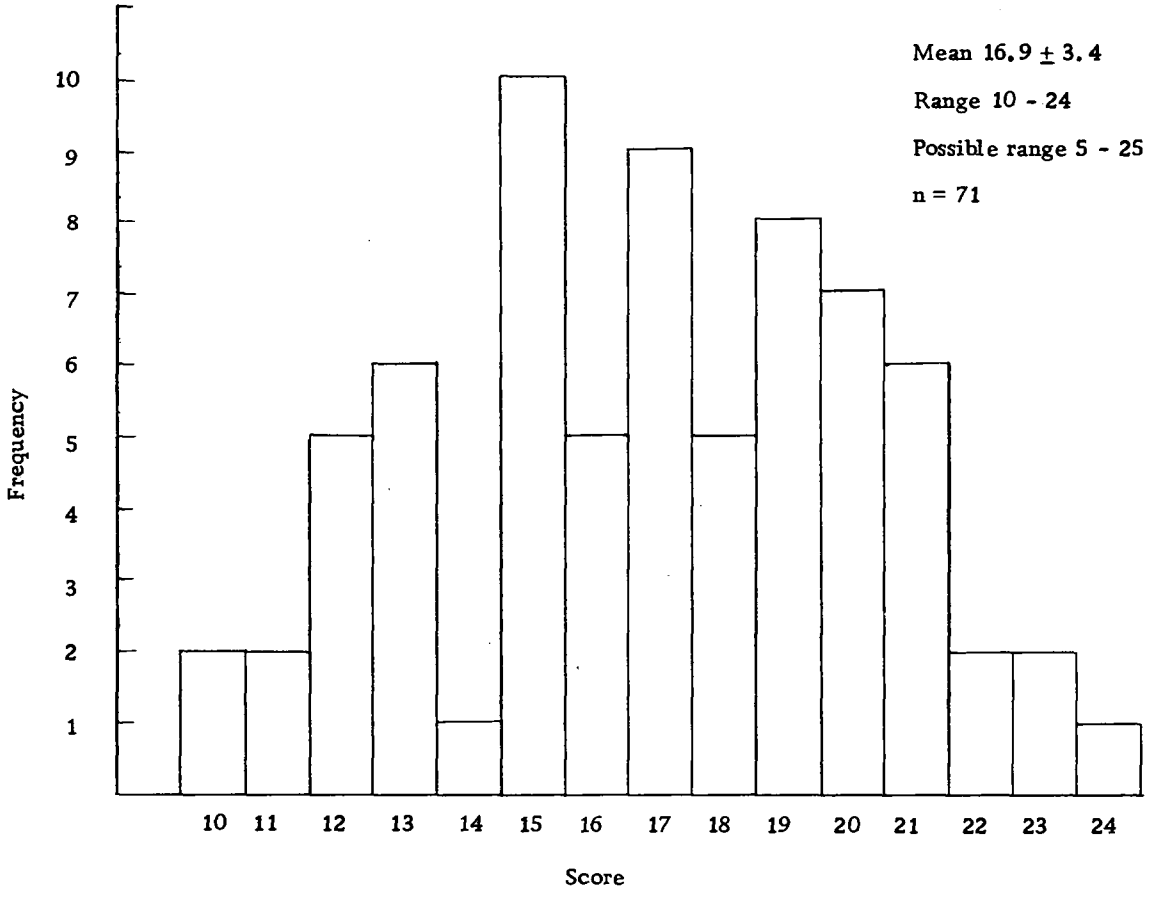

Figure 3. Distribution of teaching confidence scores in Oregon high school teachers of nutrition.

mean response was 3.0 on the basis of choices from 1 (difficult) to 5 (easy).

A wide variation in knowledge confidence was indicated by raw scores which ranged from 78 to 196 of a possible score of 225 points. Distribution of knowledge confidence scores is given in Figure 4. The mean score for knowledge confidence was 128 $\pm$ 26 Translated into the terms used to indicate degree of certainty, the mean response was 2.9 with a response of 3 defined as "reasonably certain, but some doubt". This score is in close agreement with the difficulty level of 0.48 on the knowledge test. The correlation coefficient between knowledge confidence and accuracy of knowledge was 0.52 which is highly significant. The more confident teachers were also the more knowledgeable.

Several other researchers have measured confidence on knowledge questions (Petersen and Kies, 1972; Schwartz, 1975; Cho and Fryer, 1974; Vickstrom and Fox, 1976). In each case, the knowledge score was computed taking into consideration for each item both the correctness of response and the degree of certainty. Because separate scores for the two factors are not presented by other researchers, comparisons with this study are limited. However, several researchers commented that knowledge scores of their subjects appear deceptively low because of the incorporation of the certainty factor. A high prevalance of uncertainty is implied

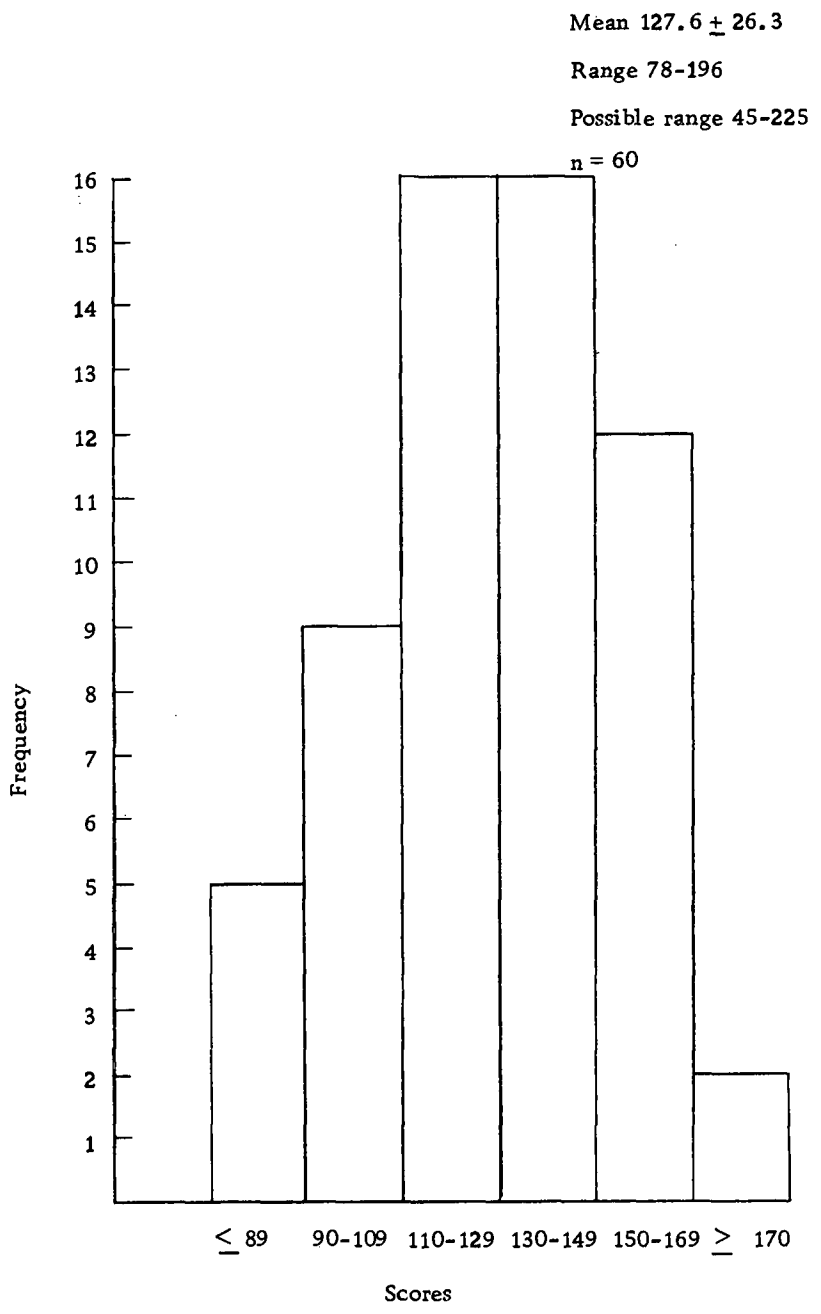

Figure 4. Distribution of Oregon high school nutrition teachers' knowledge confidence scores.

(Petersen and Kies, 1972; Cho and Fryer, 1974; Vickstrom and Fox, 1976). The data in this study were not analyzed in this way because of the need for separate measures of knowledge and confidence. However, a comparison would have been of interest.

Interest

There was great variation of interest in nutrition among the teachers in this sample. Raw scores for this characteristic ranged from 6 to 28 of a possible 32 points. Distribution of interest scores is shown in Figure 5. The mean score was 18.5 ± 4.0 indicating only a moderate interest in nutrition among these teachers. Forty-eight percent of the teachers had not read any books related to nutrition in the past year and 56 percent had read two or fewer articles in magazines or journals.

However, more than moderate interest in nutrition was indicated by several other factors. Seventy percent of the sample indicated an interest in attending a workshop on a nutrition subject. This interest is probably related to the fact that many teachers considered nutrition a difficult subject to teach. A high degree of interest in nutrition was also indicated by responses of the teachers to the question, "Compared with other subjects you teach, how interesting is nutrition to you?" Sixty-one percent rated nutrition 4 or 5 on the 5 point scale ranging from 5, "most interesting", to

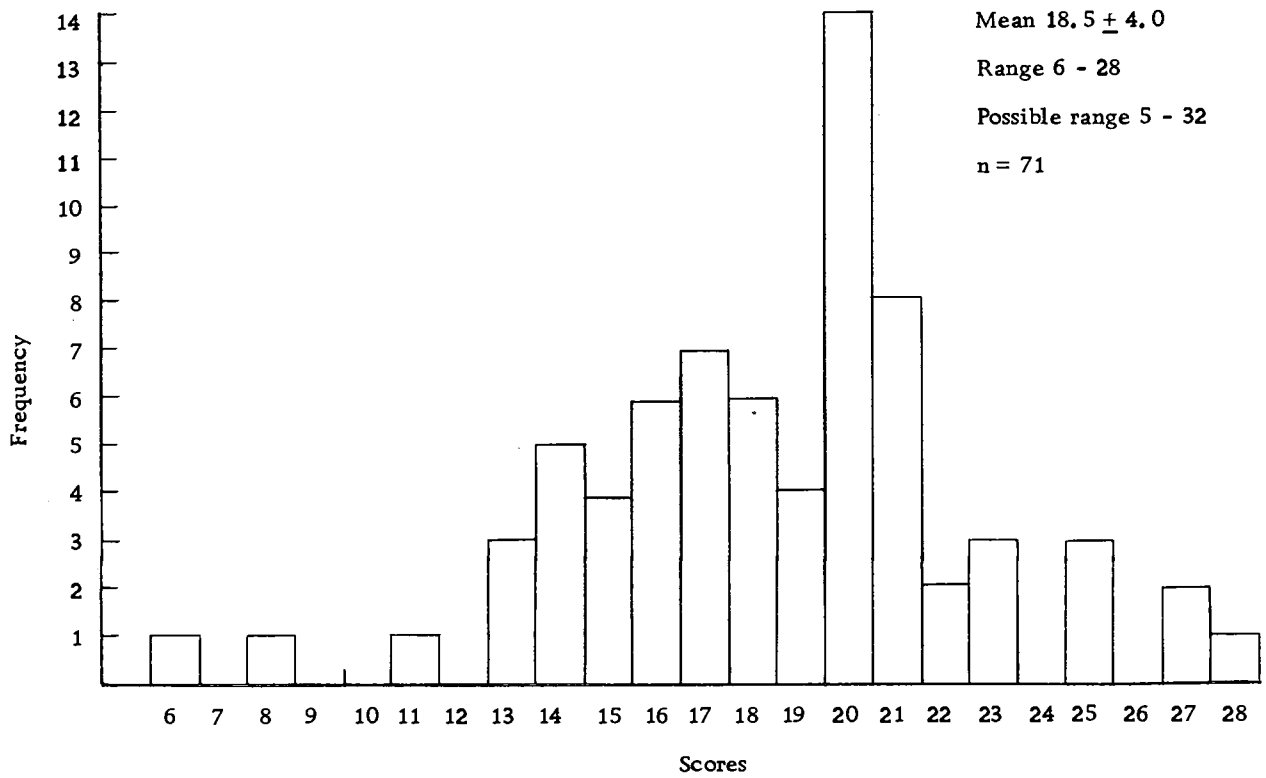

Figure 5. Distribution of Oregon high school nutrition teachers' interest scores.

1 "least interesting." The high response rate of teachers in this survey is also an indication of interest in nutrition. As stated, only one teacher whose unit met the criteria refused to participate. Of the 71 teachers visited, 66 completed both portions of the survey (93 percent). Personal comments from the teachers throughout the data collection period also indicated a high degree of interest in nutrition.

Flexibility

This group of teachers also showed wide variation in their flexibility in nutrition practices. On the 40 point scale scores ranged from 18 (fairly rigid) to 38 (very flexible). Distribution of scores is shown in Figure 6. The group mean score was 29.9 ± 3.4, indicating that this sample of teachers was more flexible than rigid in their attitudes about nutritional practices. Differences between mean responses to questions in this set were slight. This group of teachers was slightly more flexible in their attitudes than the Expanded Food and Nutrition (EFNEP) aides assessed in a study by Carruth and Anderson (1977) for which this measure was designed. Marked differences between the two groups were shown by responses to the statement, "The Basic 4 food groups are the only usable tools for planning an adequate diet." The teachers tended to disagree with the statement while the aides showed general agreement. A

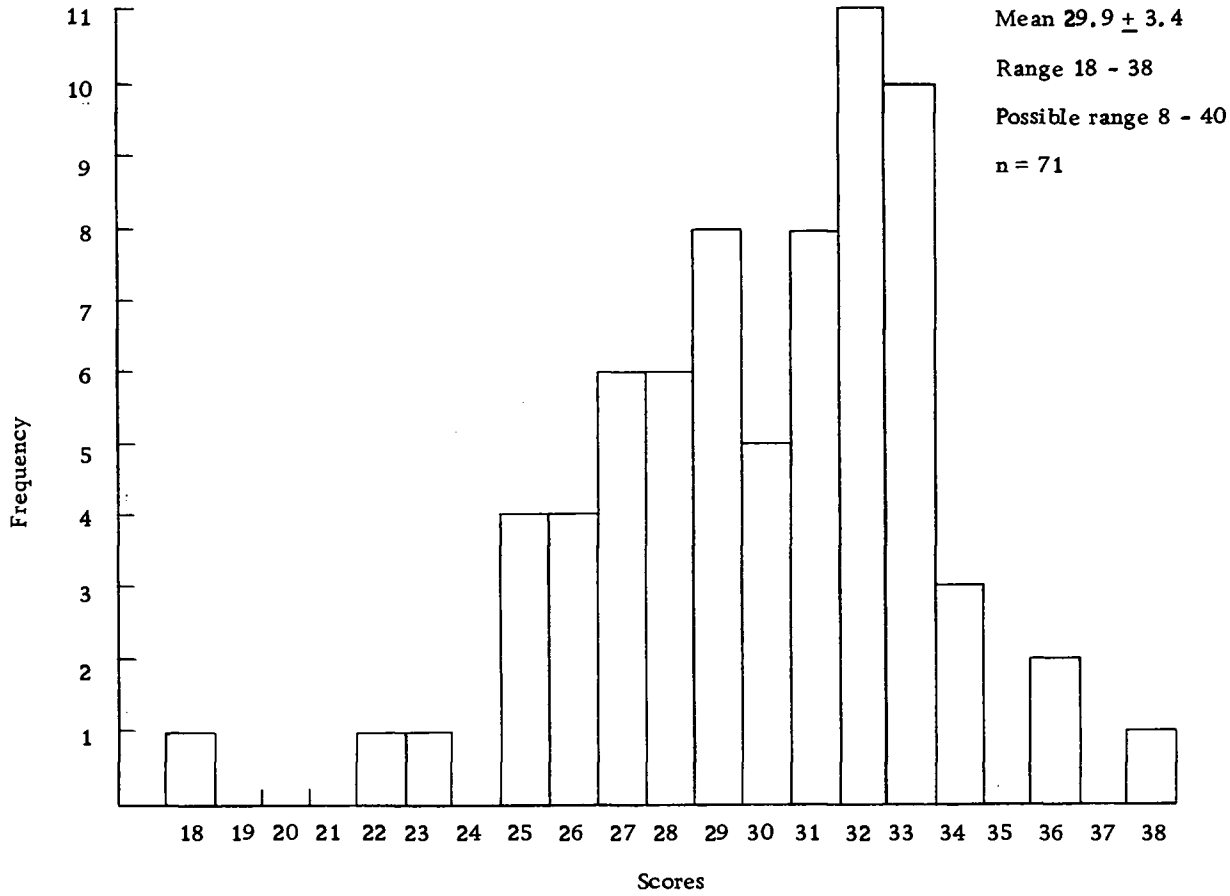

Figure 6. Distribution of Oregon high school nutrition teachers' flexibility scores.

degree of difference between the two groups was also indicated by responses to the statement, "In my opinion, the best advice when eating away from home is to avoid the unknown." Since EFNEP aides are generally low income individuals, economic and educational factors may explain the differences in response between the two groups.

Value

The value placed on nutrition was measured in two ways. One was personal dietary habits of the teachers as reflected in their dietary scores. The second was teacher's reasons for selecting or not selecting certain foods and direct and indirect questions in which each teacher was asked to rank the importance of nutrition. The teachers' dietary practices, it is realized, reflect knowledge of nutrition and other considerations as well as value. On the basis of preliminary analysis of the data, it seemed more appropriate and meaningful to present the dietary scores as one measure rather than as a component of the value category. Distribution of teachers' dietary scores is shown in Figure 7. The distribution is markedly skewed toward the right.

As a group these teachers placed a high degree of value on nutrition. The scores ranged from 15 to 34 out of a possible 35 points. The mean score was 26.8 $\pm$ 7.3 which indicates that nutrition

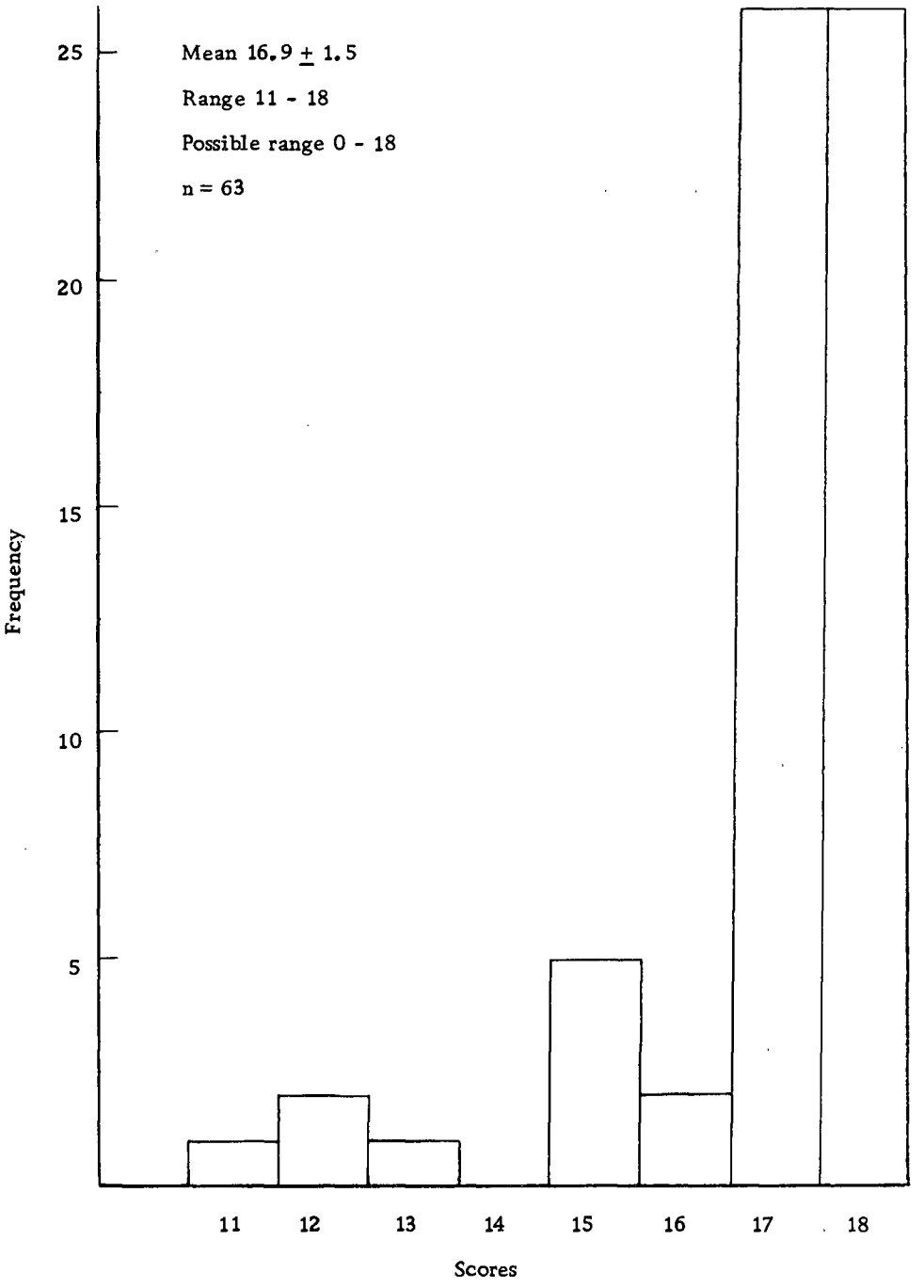

Figure 7. Distribution of Oregon high school nutrition teachers' dietary scores.

is highly valued by these teachers. Distribution of value scores excluding dietary score, is shown in Figure 8. The consistent pattern of value responses is shown on the individual items comprising this set. When asked to compare the importance of nutrition to other subjects they teach, 73 percent of the teachers rated nutrition 4 or 5, with 5 equivalent to "very important". Forty-four percent of the sample ranked nutrition "most important" compared to other health practices. Nutritional concerns also had an effect on food choices. Nutrition-related reasons were given by subjects for including the following foods in their diets: milk, 63 percent; margarine, 41 percent; liver, 31 percent; and fish, 24 percent.

The value placed on nutrition by these teachers is also reflected in their dietary habits. This group of teachers generally had diets that were nutritionally adequate. The measures of adequacy, the dietary score and the dietary score per 1000 kcal, were high (Table 12). The mean dietary score was 16.9 of a possible 18 points; the mean dietary score per 1000 kcal was 15.6 of a possible 16 points. Distribution of the more stringent measure, dietary score, is shown in Figure 7. Mean nutrient intakes of the group also reflected the adequacy of their diets. Mean nutrient intakes, mean nutrient intakes per 1000 kcal, and the percentage of subjects below 2/3 of the Recommended Dietary Allowance (RDA) for each nutrient are summarized in Tables 13 and 14.

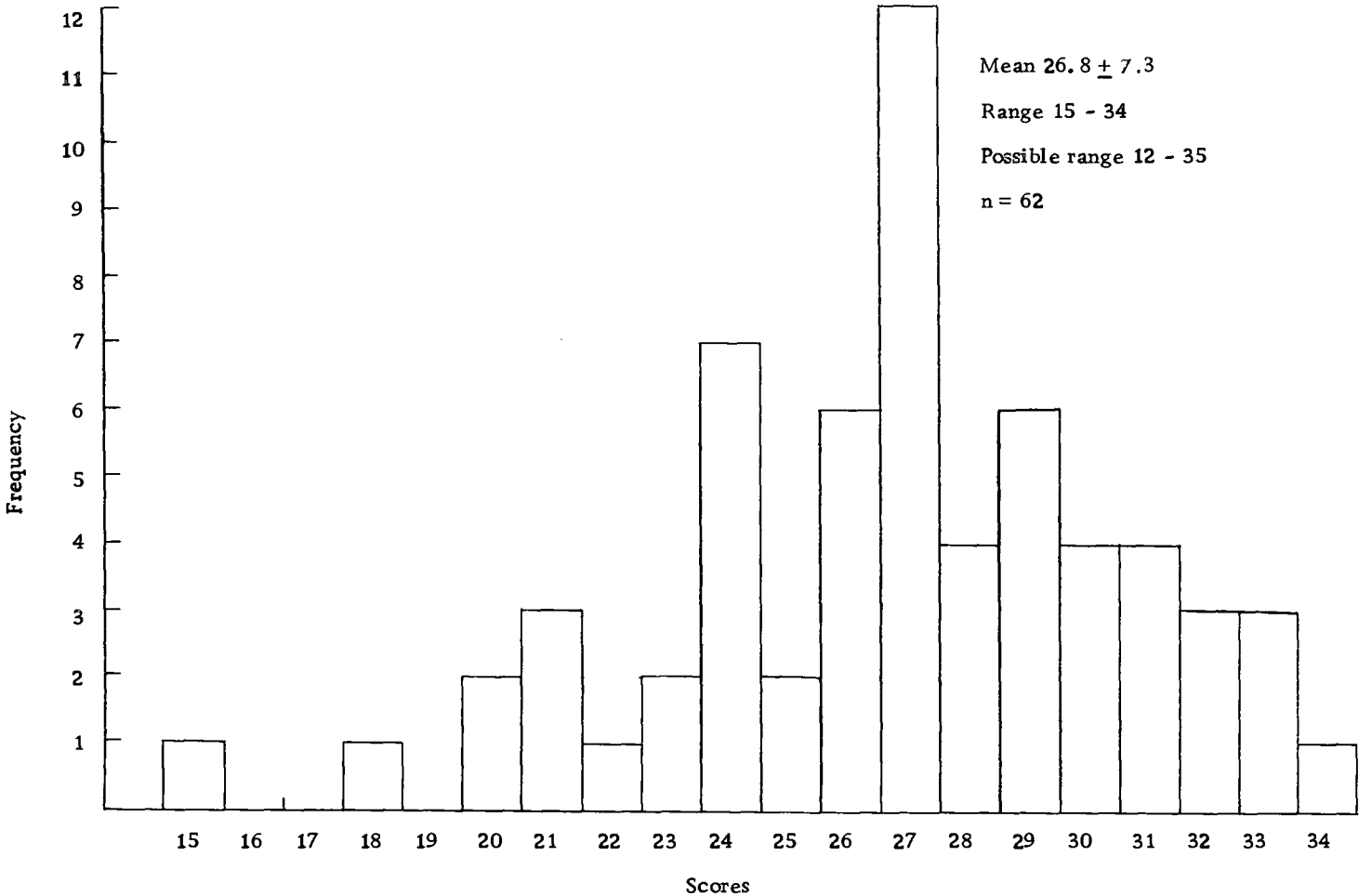

Figure 8. Distribution of Oregon high school teachers' value scores.

Table 12. Mean dietary scores and mean dietary scores per 1000 kcal[a] for Oregon high school nutrition teachers and students from dietary records.

Group		n	Mean dietary score ± SD (maximum 18 pts)	Mean dietary score/ 1000 kcal ± SD (maximum 16 pts)
Teachers, all		63	16.9 ± 1.6	15.6 ± 0.8
Teachers, male		14	16.9 ± 1.6	15.8 ± 0.4
Teachers, female		49	16.9 ± 1.5	15.5 ± 0.9
Students, all	pre	952	14.0 ± 4.3	14.1 ± 1.9
	post	766	13.7 ± 4.3	14.1 ± 1.8
Students ≤ 15,	pre	542	14.1 ± 4.3	14.1 ± 1.9
	post	420	13.5 ± 4.3	14.2 ± 1.8
Students ≥ 16,	pre	410	14.0 ± 4.3	14.1 ± 2.0
	post	346	13.9 ± 4.2	14.1 ± 1.9
Students	pre	339	15.0 ± 3.9	14.7 ± 1.5
male	post	236	14.9 ± 3.7	14.8 ± 1.5
Students	pre	609	13.5 ± 4.4	13.8 ± 2.1
female	post	531	13.2 ± 4.4	13.8 ± 1.9
Students male	pre	172	15.1 ± 3.6	14.7 ± 1.6
≤ 15	post	115	14.8 ± 3.7	14.8 ± 1.5
Students male	pre	167	14.8 ± 4.1	14.7 ± 1.4
≥ 16	post	121	15.0 ± 3.8	14.9 ± 1.5
Students	pre	367	13.6 ± 4.5	13.9 ± 2.0
female ≤ 15,	post	304	13.1 ± 4.4	13.9 ± 1.8
Students	pre	242	13.3 ± 4.4	13.6 ± 2.2
female ≥ 16,	post	225	13.3 ± 4.4	13.7 ± 2.2

[a]Dietary score was calculated by giving 2 points for each of 8 nutrients plus calories which provided 2/3 or greater of the RDA for that nutrient, 1 point for 1/3-2/3 RDA, and 0 points for less than 1/3 RDA. Dietary score/1000 kcal was calculated in the same way on the basis of 8 nutrients.

Table 13. Mean nutrient intakes from dietary records[a, b] of male and female Oregon high school nutrition teachers.

Dietary factor	Males (n = 14) Mean intake	± SD	% subjects < 2/3 RDA[c, d]	Females (n = 49) Mean intake	± SD	% subjects < 2/3 RDA[c, d]
Kcal	2389.	422.	7	1765.	392.	8
Protein (g)	91.	21.	0	72.	17	2
Fat (g)	120.	20.	-	81.	23.	-
Carbohydrate (g)	238.	72.	-	189.	49	-
Calcium (mg)	983.	306.	0	881.	292.	6
Iron (mg)	13.4	3.2	7	11.8	3.8	57
Vitamin A (IU)	5530.	3440.	43	6230.	4320.	10
Thiamin (mg)	1.24	0.3	21	1.05	0.39	14
Riboflavin (mg)	1.91	0.53	0	1.69	0.54	2
Niacin (mg)	18.2	5.3	7	14.6	4.6	6
Ascorbic acid (mg)	119.	79.	21	118.	48.	0

[a]Nutrients calculated from Home and Garden Bulletin No. 72, 1971.

[b]Based on 2-4 days dietary records.

[c]Based on 1974 RDA.

[d]No subject had less than 1/3 of the RDA for any nutrient, except for iron; 4% of females had less than 1/3.

Table 14. Mean nutrient intakes per 1000 kcal from dietary records[a, b] of male and female Oregon secondary nutrition teachers.

	Males (n = 14)			Females (n = 49)		
Dietary factor	Mean/ 1000 kcal	± SD	% subjects < 2/3 RDA[c, d]	Mean/ 1000 kcal	± SD	% subjects < 2/3 RDA[c, d]
Protein (g)	38.	6.	0	41	7	0
Fat (g)	51	7	-	45	6	-
Carbohydrate (g)	98	19.	-	107.	15	-
Calcium (mg)	416	116.	0	505.	145.	6
Iron (mg)	5.6	0.9	0	6.7	2.1	35
Vitamin A (IU)	2300.	1320.	14	3550.	2470	2
Thiamin (mg)	0.52	0.10	0	0.60	0.20	2
Riboflavin (mg)	0.81	0.20	0	0.97	0.29	2
Niacin (mg)	7.6	1.5	0	8.4	3.0	4
Ascorbic acid (mg)	49.	33.	7	68.	25.	0

[a] Nutrients calculated from Home and Garden Bulletin No. 72, 1971.

[b] Based on 2-4 days dietary records.

[c] Based on 1974 RDA.

[d] No subjects had less than 1/3 of the RDA for any nutrient.

Mean nutrient intakes of the female teachers exceeded the RDA for all nutrients except iron. Fifty-seven percent of the subjects had less than 2/3 of the RDA for iron. The difficulty of meeting the current RDA for iron, 18 mg, is well recognized (Food and Nutrition Board, 1974).

The mean nutrient intakes of the male teachers exceeded the RDA for all nutrients except thiamin. Thiamin requirements are based on caloric intake; the mean caloric intake of this group of men was lower than the standard established by the Food and Nutrition Board. Using the nutrient density approach of nutrient intake per 1000 kcal, the mean thiamin intake of this group was adequate.

However, it is also important to identify the portion of the population which has marginal intakes (below 2/3 RDA). Using this approach, problem nutrients for the males were identified as vitamin A, ascorbic acid and thiamin. Percentage of male subjects with inadequate intakes of these nutrients were 43, 21, and 21, respectively.

This group of teachers had generally better diets than adults sampled in the HANES survey (as shown in Tables 15 and 16). Male teachers had higher mean intakes of the problem nutrients, vitamin A and ascorbic acid, than the males, 18-44 years of age, above poverty level in the HANES survey. Mean intakes of the female

Table 15. Comparison of mean nutrient intakes of Oregon high school nutrition teachers with adults reported by Health and Nutrition Examination Survey (HANES)[a].

	Teachers		HANES	
Dietary factor	Male	Female	Male	Female
kcal	2389	1765	2806	1680
Protein (g)	91	72	111.22	68.53
Calcium (mg)	983	881	1028	642
Iron (mg)	13.4	11.8	16.60	10.58
Vitamin A (IU)	5530	6230	5169	4038
Ascorbic Acid (mg)	119	118	94.85	81.02

[a]Source of HANES data: Health and Nutrition Examination Survey, 1971-1972, p. 37: adults 18-44 years above poverty level for mixed races.

Table 16. Comparison of mean nutrient intake per 1000 kcal of Oregon teachers with adults reported by Health and Nutrition Examination Survey (HANES).[a]

	Teachers		HANES	
Dietary factor	Male	Female	Male	Female
Protein (g)	38	41	39.64	40.79
Calcium (mg)	416	505	366.36	382.14
Iron (mg)	5.6	6.7	5,92	6.30
Vitamin A (IU)	2300	3550	1842	2404
Ascorbic Acid (mg)	49	68	33.80	48.23

[a]Source of HANES data: Health and Nutrition Examination Survey, 1971-1972, p. 45: adults 18-44 years above poverty level for mixed races.

teachers were higher than in that study for protein, calcium, iron, vitamin A, and ascorbic acid.

In this sample of teachers, diets of the females were qualitatively better than the males. Intakes of the two groups are compared using the nutrient density method (Table 14). Mean nutrient intakes per 1000 kcal of the female teachers were higher for all nutrients. Fat intake was desirably lower. In the diets of the female teachers, 41 percent of the calories were from fat, compared to 46 percent in the diets of the males (Table 17). However, both intake levels are higher than currently recommended (U.S. Senate Select Committee on Nutrition and Human Needs, 1977).

Accuracy of the teachers' dietary records were verified by using another method of data collection, the food frequency checklist. A summary of the frequency with which selected foods were eaten is in Table 18. The generally adequate diets of this group of teachers are supported by data presented in the food frequency tables. Daily intake of milk was reported by 76 percent of the teachers; 75 percent of the sample reported eating cheese at least 3 times per week. Daily consumption of citrus fruits was reported by 41 percent of the sample and an additional 44 percent included them in their diet at least 3 times per week. Ninety-three percent of the teachers reported a yellow or green vegetable at least 3 times per week. Seventy-two percent of the teachers included other fruits

Table 17. Distribution of calories from protein, fat, and carbohydrate in diets of nutrition teachers and students in Oregon high schools.

Group		n	Percent kcal from Protein	Fat	Carbohydrate
Teachers (all)		63	16.1 ± 2.8	42.0 ± 6.0	42.0 ± 6.6
Teachers (male)		14	15.2 ± 2.6	45.6 ± 6.4	39.2 ± 7.6
Teachers (female)		49	16.4 ± 2.8	40.9 ± 5.6	42.8 ± 6.2
Students (all)	Pre	974	15.2 ± 4.8	40.4 ± 7.8	45.3 ± 10.1
	Post	785	15.3 ± 4.0	40.5 ± 8.3	45.1 ± 10.4
Students (male)	Pre	341	15.4 ± 4.3	40.9 ± 7.2	44.4 ± 9.7
	Post	236	15.8 ± 3.7	41.6 ± 7.7	43.3 ± 9.5
Students (female)	Pre	611	15.2 ± 5.0	40.1 ± 8.2	45.7 ± 10.4
	Post	531	15.0 ± 4.1	40.0 ± 8.5	46.0 ± 10.6
Students ≤ 15 (All)	Pre	548	15.2 ± 4.4	40.5 ± 7.6	45.1 ± 9.9
	Post	426	15.3 ± 4.1	39.9 ± 8.0	45.7 ± 10.0
Students ≥ 16 (All)	Pre	426	15.2 ± 5.2	40.2 ± 8.1	45.5 ± 10.5
	Post	359	15.2 ± 3.9	41.3 ± 8.6	44.4 ± 10.9
Students (male) ≤ 15	Pre	172	15.5 ± 4.3	40.7 ± 7.1	44.4 ± 9.9
	Post	115	15.8 ± 3.9	40.5 ± 8.0	44.3 ± 9.9
Students (male) ≥ 16	Pre	169	15.2 ± 4.2	41.0 ± 7.3	44.4 ± 9.5
	Post	121	15.8 ± 3.5	42.7 ± 7.2	42.3 ± 9.2
Students (female) ≤ 15	Pre	367	15.1 ± 4.5	40.4 ± 7.8	45.4 ± 9.9
	Post	304	15.0 ± 4.1	39.5 ± 8.0	46.5 ± 9.9
Students (female) ≥ 16	Pre	244	15.2 ± 5.8	39.7 ± 8.6	46.2 ± 11.1
	Post	227	14.9 ± 4.1	40.7 ± 9.2	45.4 ± 11.6

Table 18. Frequency of intake of foods and food groups by Oregon high school nutrition teachers.[a]

Food or food group	Percentage of subjects reporting frequency of intake					
	Once or more daily	3-6 times per week	Once or twice weekly	About once every two weeks	About once a month	Rarely or never
Beef, pork, veal, lamb	44	31	23	3	0	0
Fish and shellfish	0	4	38	38	18	1
Chicken and turkey	0	7	51	34	9	0
Legumes	3	13	23	24	21	13
Eggs	9	48	28	9	3	4
Citrus fruits	41	44	11	1	0	0
Yellow and green vegetables	69	24	7	0	0	0
Other vegetables and fruit	72	20	6	1	0	0
Vegetable oils and margarine	66	17	13	1	0	1
Milk	76	10	6	0	1	6
Cheese, yogurt	25	49	18	4	1	1
Whole grain, enriched bread and cereals	68	25	7	0	0	0
Bran or products which include it	16	24	25	16	4	13
Pastry or cake	1	23	37	28	7	4
Candy	0	9	23	24	14	31
Pop (regular)	1	10	18	14	13	41
Low-calorie pop	6	10	21	11	7	42

[a] n = 71.

and vegetables on a daily basis. On the basis of the data, vitamin A and ascorbic acid would not appear to be problem nutrients. As suggested by Trulson (1954), daily intakes of these nutrients can be misleading due to their occurrence in relatively few foods.

Relationship Between Teacher Variables

Correlation coefficients between the teacher variables are presented in Table 19. As hypothesized, there were many significant interrelationships between the teacher characteristics. Teacher knowledge was significantly correlated ($p \leq .05$) with confidence about knowledge, value, interest, and flexibility. The teacher's interest in nutrition was significantly correlated ($p \leq .05$) with several characteristics in addition to knowledge: teaching confidence, knowledge confidence, and value. The value placed on nutrition was correlated ($p \leq .05$) with teacher's knowledge, knowledge confidence, and interest. Teacher flexibility was significantly correlated ($p \leq .05$) only with knowledge. Teaching confidence showed a significant correlation ($p \leq .05$) only with the teacher's interest in nutrition. Dietary habits of the teachers, as described by the dietary score and dietary score per 1000 kcal, were not significantly correlated to any other characteristics. However, the

Table 19. Correlation coefficients between characteristics related to nutrition in Oregon high school nutrition teachers.

	Knowledge	Knowledge confidence	Teaching confidence	Interest	Flexibility	Value	Dietary score	Number of college nutrition courses	Number of related college science courses
Knowledge									
Knowledge confidence	.52**								
Teaching confidence	.20	.13							
Interest	.52**	.34**	.37**						
Flexibility	.31*	.17	.13	.18					
Value	.44**	.32*	.06	.29*	.11				
Dietary score	.03	-.21	-.17	-.12	-.14	-.04			
Number of college nutrition courses	.29*	.15	.18	.40**	.29*	.36**	-.04		
Number of related college science courses	-.02	-.05	.22	.17	-.01	.11	-.25*	.22	
Years of teaching experience	-.12	-.23	.06	.06	-.05	.10	.11	.17	.37**

* Significant r value, $p \leq .05$.

** Highly significant r value, $p < .01$

generally good dietary habits of this group reduced the ranges for these scores.

In addition, the number of college nutrition courses was significantly correlated ($p \leq .05$) with the teacher's knowledge (total and basic), value, flexibility, and interest in nutrition. The number of college science courses was negatively correlated ($p \leq .05$) with the teacher's dietary score. There was a weak positive relationship between the number of science courses and the teacher's confidence ($p \leq .10$). The years of teaching experience was negatively correlated ($p \leq .05$) with the teacher's recent knowledge score.

Description of Nutrition Education Units

Although the nutrition unit was not specifically prescribed, several criteria for the unit were established to reduce variability of the sample. As described in the Research Procedures section, it was specified that the nutrition unit must have a general focus rather than be limited to one or two topics. It was also specified that the nutrition unit must be at least one week in length.

Data on the nutrition unit were gathered in Teacher Questionnaires I, II, and III which are in Appendix B. On Teacher Questionnaire II teachers were asked to include a list of the performance indicators for this nutrition unit. . Many teachers reported that performance indicators for the unit had not yet been established. Other

teachers did not respond to this question. Because usable data were received from only a small portion of the sample, teachers were asked to complete Questionnaire III, a check list identifying which topics had received major emphasis in the nutrition units they taught. Summary data from the check list are included in Table 20. There were many similarities in the nutrition units included in this study. The following topics were emphasized in 90 percent or more of the nutrition units: the Four Food Groups, the relationship of diet to health, and food sources of nutrients. Seventy-eight percent of the teachers reported their students used the Four Food Groups Guide as a tool in planning meals; sixty-eight percent of the teachers included students' evaluation of their own dietary habits. Two-thirds of the teachers emphasized functions of nutrients in the body. A similar percentage of teachers reported that the following topics were not emphasized: food fads, retention of nutrients in food preparation, and use of the Recommended Dietary Allowance. About half of the teachers reported that their units also emphasized nutritional deficiency diseases, nutrient labeling, nutritious snacks, or weight control.

Prior to beginning the nutrition unit, teachers were asked to identify two major nutritional problems of their students. There was strong consensus of opinion among the teachers. Frequent consumption of junk food was selected by 76 percent of the teachers;

Table 20. Topics which received major emphasis in nutrition education units in health and home economics classes in selected Oregon high schools.[a, b]

Topic	Percent of teachers reporting major emphasis
Basic Four food groups and servings of each required daily	98
Relationship of diet to good health	96
Food sources of various nutrients	90
Meal planning using Basic Four as a guide	78
Student analysis of own diet by keeping diet records	68
Nutrient functions in body	66
Nutritional deficiency diseases	54
Nutritious snacks	53
Weight control	43
Nutrient labeling	42
RDAs - Recommended Dietary Allowances	37
Food fads and myths	35
Retention of nutrients in food preparation	30
Nutrition and athletics	14
Nutritional needs during pregnancy	12

[a]Data reported by teachers.

[b]n = 52.

skipping meals was identified as a major problem by 46 percent. After the unit had been taught, 71 percent of the teachers indicated they had emphasized one or both of the nutritional problems they themselves had previously identified.

There were also similarities in the teaching techniques employed in these nutrition units. Ninety percent of the teachers used the lecture technique, study guides were used by 87 percent, group discussion by 84 percent, and visual aids by 82 percent.

The length of the nutrition unit was not significantly correlated with any of the measures of student learning: changes in student knowledge scores, changes in dietary scores, and changes in dietary scores per 1000 kcal.

The length of time spent on nutrition education by these teachers ranged from 5, the minimum to be included, to 30 days. The average length of the nutrition unit was 12.7 ± 5.7 days, with approximately 50 minutes of instruction per day, a total of 10.6 hours. In addition, nutrition was integrated into other units by 60 percent of the teachers.

Fifty-four percent of the teachers described the length of the nutrition unit as "about right" although 40 percent indicated that more time would be desirable. The teachers who spent less time on nutrition were more likely to regard the time as "not enough" ($p \leq .01$).

Contrary to the findings of Cook and coworkers (1977), the length of time spent on nutrition education was not correlated with the teacher's background in nutrition. In addition, there were no significant correlations between any of the teacher characteristics and the length of the nutrition unit. The teacher's estimation of adequacy of time on nutrition was not related to the teacher characteristics which were assessed in this study or to changes in student knowledge or diet.

Effect of Nutrition Education on Students

Changes in Nutrition Knowledge

The difference between the class means on students' pretest and posttest knowledge scores was used as a measure of the effectiveness of the nutrition education unit. For the students as a group the mean change was slight, + 0.83 (3%) on the 28 point test. However, on the basis of individual classes, greater changes were observed (Table 21). The mean change for individual classes ranged from -2.11 to +7.40 points (-8 to + 26 percent). Of the 62 classes, 48 had a gain in nutrition knowledge following the nutrition education unit. Mean knowledge scores decreased in 14 classes, although losses were slight in 8 of them. There were no apparent similarities among groups with negative changes in scores.

Table 21. Scores[a] of Oregon high school students on nutrition knowledge tests, before and after nutrition education.

	Pretest		Posttest		
Teacher	Mean	SD	Mean	SD	Mean Change
110	11.47	3.92	b	b	b
111	14.00	2.97	14.80	2.57	0.80
113	11.08	2.67	11.63	3.13	0.54
114	9.72	5.44	9.35	2.23	-0.37
115	10.33	2.60	10.32	2.51	-0.01
116	10.55	2.56	10.19	2.69	-0.36
118	10.48	2.93	11.16	2.29	0.68
119	12.33	3.80	b	b	b
120	11.69	2.84	13.38	3.15	1.69
122	13.18	3.61	11.07	3.73	-2.11
124	11.94	3.25	13.06	3.71	1.12
126	10.65	2.62	12.59	2.37	1.94
128	10.77	2.87	11.40	2.74	0.63
129	13.86	2.93	12.22	2.95	-1.65
131	10.80	3.32	12.38	4.37	1.58
133	11.64	3.78	14.47	3.67	2.84
134	8.93	2.81	16.33	4.51	7.40
135	10.52	3.22	b	b	b
136	11.83	2.84	11.96	3.13	0.13
141	10.46	3.16	10.58	3.86	0.11
142	11.55	3.19	11.22	3.73	-0.33
143	12.75	2.49	b	b	b
144	9.96	2.60	10.47	3.08	0.51
145	13.95	2.93	12.44	2.71	-1.51
146	11.64	3.39	13.38	4.49	1.74
149	12.00	3.26	11.76	2.98	-0.24
153	12.94	3.88	10.92	2.29	-2.02
158	11.83	3.03	12.31	3.32	0.47
159	11.11	3.08	12.00	2.83	0.89
210	8.00	3.16	10.79	3.66	2.79
212	12.52	3.17	13.55	3.59	1.03
213	11.15	2.44	13.19	3.27	2.03
214	11.33	3.20	14.08	2.57	2.75
215	10.95	2.28	11.05	3.17	0.09
216	11.93	3.54	17.62	2.33	5.69
217	8.00	2.86	9.93	2.13	1.93
218	9.43	3.07	10.90	2.84	1.47
219	10.21	4.29	b	b	b
220	10.00	2.64	11.46	2.52	1.46
221	9.80	2.65	9.86	3.44	0.06
222	13.19	2.10	12.71	2.87	-0.48
223	9.59	2.03	10.79	2.08	1.20
224	9.78	2.39	13.60	2.59	3.82
227	11.84	3.35	13.61	2.75	1.77
228	11.89	3.92	13.00	2.33	1.11

Table 21. Continued.

Teacher	Pretest Mean	Pretest SD	Posttest Mean	Posttest SD	Mean Change
229	12.21	2.94	13.20	3.63	0.99
230	10.50	1.38	11.38	2.56	0.88
231	11.36	3.89	[b]	[b]	[b]
233	12.71	2.98	12.25	2.06	-0.46
236	10.94	2.67	11.39	2.03	0.44
239	10.17	2.71	10.83	1.83	0.67
240	11.43	2.37	14.00	2.45	2.57
241	10.38	3.03	10.78	2.95	0.41
242	10.25	2.53	10.44	2.61	0.19
243	11.08	3.30	9.63	2.54	-1.45
244	10.13	2.03	11.21	2.46	1.09
245	11.00	2.95	12.78	2.88	1.78
246	12.20	3.44	14.65	3.08	2.45
247	11.11	3.53	11.06	3.86	-0.05
248	9.64	2.71	10.64	3.18	1.00
249	9.06	1.95	12.40	2.16	3.34
252	10.42	3.63	11.47	2.78	1.05
253	9.56	3.48	12.27	3.73	2.70
254	10.29	2.64	11.61	2.62	1.32
256	10.79	2.36	8.71	2.79	-2.07
257	11.18	2.18	12.64	3.38	1.45
258	11.25	2.93	13.82	3.16	2.57
259	8.65	4.12	9.72	3.01	1.08
Total	11.02[c]	3.26	11.85[d]	3.36	0.83

[a] Pretest and posttest had maximum scores of 28 points.

[b] No posttest data.

[c] Based on 68 classes.

[d] Based on 62 classes.

The student knowledge scores on both the pretest and the posttest were low; out of 28 points the mean raw scores were 11.02 and 11.85, 39.4 and 42.3 percent, respectively. There was a range, however, in class means on both tests (Table 21). On the pretest, class means ranged from 28.6 to 50.0 percent, a difference of 21.4 percent between classes. Individual scores on the pretest ranged from 7 to 79 percent. There was a wider range in class mean scores on the posttest, from 31.1 to 62.9 percent, a difference of 31.8 percent between classes. Individual scores on the posttest ranged from 4 to 96 percent correct.

The standard errors of measurement were 2.59 and 2.61 for the pretest and posttest, respectively. Reliability indices of the student knowledge tests (Gronlund, 1968), as calculated by Kuder-Richardson Formula 21 were .37 and .39 for the pretest and posttest respectively. Reliability indices can range from 0, indicating no consistency of measurement, to 1 indicating perfect reliability. Both tests had rather low reliability. Partial explanation lies in the difficulty index for each test, .39 on the pretest and .43 on the posttest. The length of the test also is a factor in the reliability of the instrument. Length of these tests were planned so that students could complete them in 20 to 30 minutes.

Item analyses were performed on individual test items; discrimination and difficulty indices are given in Table 22.

Table 22. Item analysis of nutrition knowledge pretest and post-test designed for high school students.

Pretest item number	Difficulty index	Discrimination index
1	0.74	.36
2	0.49	.44
3	0.51	.30
4	0.83	.24
5	0.33	.45
6	0.45	.18
7	0.58	.32
8	0.54	.28
9	0.21	.21
10	0.10	.12
11	0.23	.25
12	0.41	.25
13	0.16	.15
14	0.14	.01
15	0.20	.26
16	0.75	.31
17	0.23	.13
18	0.41	.35
19	0.19	.19
20	0.12	.04
21	0.36	.27
22	0.44	.38
23	0.70	.32
24	0.19	.08
25	0.34	.27
26	0.66	.40
27	0.34	.39
28	0.38	.30
29	0.10	.01
30	0.55	.22

Posttest item number	Difficulty index	Discrimination index
1	0.73	.34
2	0.93	.26
3	0.91	.28
4	0.15	.15
5	0.51	.40
6	0.52	.30
7	0.49	.31

Table 22. Continued.

Posttest item number	Difficulty index	Discrimination index
8	0.35	.20
9	0.21	.20
10	0.13	.14
11	0.35	.19
12	0.42	.39
13	0.44	.25
14	0.45	.50
15	0.46	.26
16	0.54	.47
17	0.41	.37
18	0.42	.30
19	0.55	.42
20	0.24	.22
21	0.15	.11
22	0.65	.38
23	0.16	.05
24	0.24	.22
25	0.20	.11
26	0.56	.33
27	0.32	.06
28	0.26	.16
29	0.84	.31
30	0.28	.21

Responses to some questions are of special interest. Questions concerning the Four Food Groups were answered correctly by 70 percent of the students on the pretest and 75 percent on the posttest (items 1, 26 and 2, 26, respectively). The insignificant information items, (17 and 18 on the pretest, 18 and 19 on the posttest), were answered correctly by 32 percent of the students on the pretest and 49 percent on the posttest. Questions concerning food sources of various nutrients were difficult for the students, especially if they were not given the commonly known "best" source (pretest items 15, 21, 25; posttest items 4, 10, 17, 25). Although most students correctly identified an appropriate after-school snack (pretest item 30, posttest item 29), students had difficulty selecting an adequate breakfast when given unusual choices (pretest item 29, posttest item 30).

The findings of this study are consistent with those reported by other researchers. A general lack of nutrition knowledge among teenage students has been reported (Dwyer et al., 1970; Tifft and Stanton, 1972). The effectiveness of past nutrition education efforts has been questioned. Schwartz (1975) assessed nutrition knowledge of post high school students; she found no significant relationship between nutrition knowledge and previous enrollment in high school home economics classes. Several researchers reported many

misconceptions about nutrition among college freshmen (Osman and Ahrens, 1972; McCarthy and Sabry, 1973).

Prior to beginning the nutrition unit, students were asked to identify previous sources of nutrition information. Sixty-seven percent of the sample had taken health or home economics classes which included a nutrition component. Students had learned about nutrition from other sources, also: 80 percent identified parents as a source of nutrition information; 93 percent identified other family members; 70 percent identified television; 60 percent, magazines; 54 percent, books; 33 percent, coaches; and 31 percent, friends. The high percentage of students who indicated they had learned about nutrition on television probably included those who had watched the U. S. D. A. nutrition education television series, Mulligan Stew.

Changes in Students' Dietary Habits

The dietary intake of each student was summarized by calculating a dietary score and a dietary score per 1000 kcal. The dietary score was based on a scale of 18 which indicated that the day's diet provided at least 2/3 of the RDA for eight nutrients and kilocalories. The dietary score per 1000 kcal was a 16 point scale based on 2/3 or more of the RDA for the same eight nutrients. From the scores of each student, class means were calculated

for the pretest and posttest. Each pretest class mean was subtracted from the posttest class mean to yield a mean change dietary score and a mean change dietary score per 1000 kcal for each class. Data from each class are presented in Table 23. Class mean changes in dietary scores ranged from -5.13 to +4.43. The mean change for all classes was -0.03 $\pm$ 1.74. Class mean changes in dietary score per 1000 kcal ranged from -2.77 to +2.17 with a mean change of +0.10 $\pm$ .90.

Also included in Table 23 are the mean ages of the students and the sex distribution of each class. Neither the age nor the sex ratio of the class was significantly correlated with mean change; therefore, these factors will not be considered further.

The questions may be asked, "Was nutrition education needed by these students? Would change have been expected?"

Results of this survey indicated that the dietary habits of these teenagers were indeed cause for concern. Data are summarized in Tables 12, 24-30. The mean dietary scores for the adolescents as a group were 14.0 on the pretest and 13.7 on the posttest. These are considerably lower than the 16.9 mean dietary score reported by their teachers (Table 12). The mean dietary score per 1000 kcal was also low, 14.1 for the students compared with 15.6 for their teachers. This nutrient density approach, mean intake per 1000 kcal, takes into account the possibility of

Table 23. Summary of dietary scores[a] and characteristics of Oregon high school nutrition classes.

Class	Mean change in dietary scores	Mean change in dietary scores/ 1000/kcal	Mean pretest age (years)	Sex ratio (% female)
110	b	b	15.3	0.25
111	-1.95	-0.01	16.9	0.82
113	-0.86	-0.49	15.2	0.38
114	-0.07	1.13	14.7	0.47
115	0.88	0.23	15.3	0.50
116	0.14	-0.52	14.4	0.00
118	0.10	0.93	14.8	0.61
119	b	b	15.3	0.38
120	1.23	0.08	15.3	0.31
122	b	b	16.4	0.58
124	0.37	-0.29	16.0	0.75
126	-0.49	-0.25	16.0	0.47
128	-0.35	0.15	14.2	0.55
129	0.88	0.61	17.4	0.55
131	-5.13	-0.78	15.6	0.30
133	b	b	15.6	0.44
134	2.70	1.93	15.7	0.75
135	b	b	14.9	0.69
136	3.06	1.06	16.4	0.54
141	-2.42	-0.78	14.0	0.73
142	-1.16	-0.16	14.1	1.00
143	b	b	16.5	0.63
144	0.62	0.62	16.2	0.43
145	-2.05	-0.99	15.3	0.44
146	-0.47	0.16	15.2	0.63
149	0.16	0.01	15.9	0.38
153	-0.11	-0.43	15.1	0.56
158	-0.05	0.40	15.2	1.00
159	-1.00	-0.24	16.6	0.59
210	0.36	0.65	15.2	0.69
212	-1.90	0.20	14.8	0.88
213	2.00	-0.45	16.2	0.75
214	-2.66	-0.94	16.3	0.79
215	0.89	0.71	14.3	0.72
216	-1.37	1.06	16.1	0.62
217	0.54	1.17	14.5	0.00
218	-0.35	-0.57	14.4	1.00

Table 23. Continued.

Class	Mean change in dietary scores	Mean change in dietary scores/ 1000/kcal	Mean pretest age (years)	Sex ratio (% female)
219	[b]	[b]	15.7	0.18
220	-2.15	-1.30	15.3	0.82
221	-2.70	-0.69	15.3	0.69
222	-0.86	-1.79	16.8	0.83
223	1.45	2.17	14.7	0.53
224	1.90	0.97	14.6	0.75
227	0.74	1.28	16.0	0.73
228	-1.76	0.38	15.1	1.00
229	1.50	1.33	16.5	0.50
230	4.43	-0.29	16.7	0.33
231	[b]	[b]	16.6	0.00
233	0.10	1.40	17.4	1.00
236	-4.22	-0.75	16.5	0.87
239	1.67	0.50	15.3	0.67
240	2.32	0.57	16.8	1.00
241	0.72	0.02	14.7	0.95
242	-0.93	-0.15	14.7	0.45
243	2.56	-0.11	14.9	0.67
244	0.84	1.07	15.2	0.91
245	1.69	0.87	14.3	0.88
246	-0.80	1.20	15.8	0.93
247	0.21	-2.77	17.1	0.76
248	0.88	-1.00	14.5	0.85
249	-1.21	-0.30	15.6	0.47
252	1.46	-0.21	16.5	0.92
253	1.29	-0.44	15.3	1.00
254	1.07	-0.73	15.5	0.85
256	0.96	0.09	14.1	0.43
257	-1.26	0.74	15.2	1.00
258	-0.92	0.56	17.0	1.00
259	-2.22	-0.82	14.8	1.00

[a]Dietary score was calculated by giving 2 points for each of 8 nutrients plus calories which provided 2/3 or greater of the RDA for that nutrient, 1 point for 1/3-2/3 RDA, and 0 points for less than 1/3 RDA. Dietary score/1000 kcal was calculated in the same way on the basis of 8 nutrients. [b]No data.

incomplete reporting of food intake. Therefore, this method may be a valid basis for assessment of food choices, especially in groups that may tend to omit food items if this omission is non-selective.

As shown in Tables 12, 24-30, there were few differences in dietary habits of the group before and after the nutrition unit. One observable difference was a slight decrease in calories on the posttests for all age and sex groups (Tables 25, 27, and 29). Iron and vitamin A intakes of males over 16 showed some improvement. This was evidenced by the higher mean intakes per 1000 kcal on the posttest and by the lower percentage of subjects who had less than 2/3 of the RDA (Table 30). A slight improvement in calcium intake was also observed for both males and females over 16 years (Tables 28 and 30).

As shown in Table 24, inadequate nutrient intakes were reported by a substantial number of students. This is true for all nutrients included in this survey except protein. The prevalence of low intakes, below 2/3 of the RDA, ranges from 19 percent of the sample for riboflavin to 60 percent of the sample for iron. About 50 percent of the students had less than 2/3 of the RDA for vitamin A on the days of the survey; 40 percent of the sample were low in calcium and thiamin; 30 percent of the students were low in ascorbic acid and niacin. More critically deficient diets are those

Table 24. Percentage of students in selected Oregon high schools with inadequate nutrient intakes[a, b, c, d], all classes, sexes combined.

	Total intake				Intake/1000 kcal			
	% subjects < 2/3 RDA		% subjects < 1/3 RDA		% subjects < 2/3 RDA		% subjects < 1/3 RDA	
Dietary factors	Pre[b]	Post[b]	Pre[b]	Post[b]	Pre[b]	Post[b]	Pre[b]	Post[b]
kcal	28.9	33.9	5.6	5.2	-	-	-	-
Protein	8.4	9.5	2.0	1.6	0.7	0.4	0.1	0.0
Calcium	39.1	39.9	13.7	16.1	24.2	22.5	5.5	5.7
Iron	58.8	62.7	16.3	17.9	42.8	41.6	2.2	3.1
Vitamin A	47.5	52.5	19.3	18.5	38.0	37.1	9.4	7.3
Thiamin	39.6	42.2	9.8	9.9	11.6	10.6	0.5	0.3
Riboflavin	18.7	20.5	5.4	4.8	3.6	3.8	0.3	0.1
Niacin	31.2	34.7	9.2	10.3	14.5	16.2	1.9	1.2
Ascorbic acid	30.9	34.1	14.9	17.1	23.7	25.5	10.4	11.7

[a] Nutrients calculated from Home and Garden Bulletin No. 72, 1971.

[b] Data based on 24 hour diet records; Pre were based on dietary records kept before the nutrition unit; Post on dietary records kept 1-3 weeks after completion of the nutrition unit.

[c] Based on 1974 RDA.

[d] n = 952, pretest.
n = 766, posttest.

below 1/3 of the RDA in one or more nutrients; these percentages ranged from 9-19 percent of the samples for vitamin A, iron, calcium, ascorbic acid, thiamin, and niacin. On the basis of mean intake per 1000 kcal, the same problem nutrients were identified. Percentages of subjects with intakes less than 2/3 of the RDA on the pretest were: iron, 43 percent; vitamin A, 38 percent, calcium, 24 percent; ascorbic acid, 24 percent; niacin, 14 percent; and thiamin, 12 percent.

Nutrient inadequacies were evident in the diets of both male and female students as shown in Tables 25 and 26. Group mean intakes of the males were less than 2/3 of the RDA for kcal, iron, vitamin A, and thiamin. Percentages of male subjects with intakes less than 2/3 of the RDA for the same nutrients on the pretest were 23, 38, 45, and 32, respectively. Although group mean intakes of the males appeared adequate for calcium, niacin, and ascorbic acid, a substantial number of subjects had less than 2/3 of the RDA on the days of the survey. For the pretest these percentages were: calcium, 24 percent; riboflavin, 15 percent; niacin, 26 percent; and ascorbic acid, 28 percent.

For the female students, mean intakes were below the RDA for kcal, calcium, iron, vitamin A, thiamin, and niacin. Percentages of female subjects with less than 2/3 of the RDA on the pretest were as follows: kcal, 32 percent; calcium, 47 percent;

Table 25. Mean nutrient intakes[a, b, c] of adolescents in selected nutrition classes in Oregon high schools by sex (pretest and posttest)[d, e].

Dietary factor	Test Period	Males: Mean intake ± SD	Males: % subjects < 2/3 RDA[c]	Males: % subjects < 1/3 RDA[c]	Females: Mean intake ± SD	Females: % subjects < 2/3 RDA[c]	Females: % subjects < 1/3 RDA[c]
kcal	Pre	2790. ± 1251.	23.3	4.7	1867. ± 913	31.9	5.9
	Post	2569. ± 1034.	26.3	3.8	1806. ± 892.	37.2	5.7
Protein (g)	Pre	106. ± 54.	5.3	0.3	69. ± 35.	10.0	2.8
	Post	101 ± 46.	5.5	0.4	66. ± 32.	11.3	2.1
Fat (g)	Pre	127. ± 62.	--	--	84 ± 45	--	--
	Post	121 ± 58.	--	--	81. ± 42.	--	--
Carbohydrate (g)	Pre	309 ± 150.	--	--	214. ± 115.	--	--
	Post	274. ± 117.	--	--	208. ± 129	--	--
Calcium (mg)	Pre	1463. ± 987.	23.9	9.1	931 ± 632	47.3	16.1
	Post	1342 ± 781.	23.3	5.9	903. ± 556.	47.3	20.4
Iron (mg)	Pre	15.0 ± 9.2	38.3	6.5	10.1 ± 5.9	70.1	21.5
	Post	13.6 ± 6.5	42.8	8.9	10.0 ± 5.9	71.5	21.7
Vitamin A (IU)	Pre	4660. ± 5390.	45.5	17.3	3630. ± 3470.	48.8	20.3
	Post	5100 ± 7520	46.2	16.5	3400. ± 4300.	55.2	19.4
Thiamin (mg)	Pre	1.34 ± 0.71	31.9	6.2	0.91 ± 0.54	43.7	11.5
	Post	1.31 ± 0.68	33.5	7.6	0.92 ± 0.58	45.9	10.8
Riboflavin (mg)	Pre	2.62 ± 1.57	14.7	3.2	1.65 ± 1.00	20.9	6.4
	Post	2.40 ± 1.16	10.6	3.0	1.60 ± 0.93	24.8	5.7

Table 25. Continued.

Dietary factor	Test Period	Males: Mean intake ± SD	Males: % subjects < 2/3 RDA[c]	Males: % subjects < 1/3 RDA[c]	Females: Mean intake ± SD	Females: % subjects < 2/3 RDA[c]	Females: % subjects < 1/3 RDA[c]
Niacin (mg)	Pre	20.7 ± 12.9	26.3	6.5	13.7 ± 8.8	33.8	10.7
	Post	19.2 ± 12.2	30.1	8.1	12.9 ± 8.0	36.9	11.3
Ascorbic Acid (mg)	Pre	81. ± 81.	27.9	12.0	71 ± 77.	32.6	16.7
	Post	82. ± 105.	25.0	13.1	64. ± 63.	38.2	18.8

[a]Nutrients calculated from Home and Garden Bulletin No. 72, 1971.

[b]Data based on 24 hour diet records.

[c]Based on 1974 RDA.

[d]Males n = 341 pretest, n = 236 posttest. Females n = 611 pretest, n = 531 posttest.

[e]Pretest data based on dietary records kept before the nutrition unit, posttest data based on dietary records kept 1-3 weeks after completion of the nutrition unit.

Table 26. Mean nutrient intakes per 1000 kcal[a, b, c] of adolescents, by sex, in selected nutrition classes in Oregon high schools (pretest and posttest)[d, e].

Dietary factors	Test Period	Males: Mean intake/1000 kcal ± SD	Males: % Subjects < 2/3 RDA[c]	Males: % Subjects <1/3 RDA[c]	Females: Mean intake/1000 kcal ± SD	Females: % Subjects < 2/3 RDA[c]	Females: % Subjects <1/3 RDA[c]
Protein (g)	Pre	38 ± 11	0	0	38 ± 13	1.0	0.2
	Post	40 ± 9	0	0	37 ± 10	0.6	0
Fat (g)	Pre	45 ± 8	--	--	45 ± 9	--	--
	Post	46 ± 9	--	--	44 ± 9	--	--
Carbohydrate (g)	Pre	111 ± 24	--	--	114 ± 26	--	--
	Post	108 ± 24	--	--	115 ± 27	--	--
Calcium (mg)	Pre	508 ± 223	14.2	2.7	499 ± 236	29.6	7.1
	Post	517 ± 210	12.3	1.7	502 ± 228	26.8	7.4
Iron (mg)	Pre	5.5 ± 2.8	17.7	0.3	5.6 ± 2.8	56.5	3.3
	Post	5.4 ± 1.7	13.1	1.3	5.7 ± 2.6	54.4	4.0
Vitamin A (IU)	Pre	1680 ± 1750	35.7	9.7	2150 ± 2660	39.2	9.2
	Post	2020 ± 2980	28.4	6.4	2060 ± 2920	41.0	7.8
Thiamin (mg)	Pre	0.48 ± 0.14	8.6	0	0.50 ± 0.19	13.1	0.8
	Post	0.52 ± 0.18	7.2	0.4	0.51 ± 0.21	11.9	0.2
Riboflavin (mg)	Pre	0.92 ± 0.32	1.2	0	0.89 ± 0.34	4.8	0.5
	Post	0.94 ± 0.28	0.8	0	0.89 ± 0.35	5.1	0.2

Table 26. Continued.

Dietary factors	Test Period	Males: Mean intake/1000 kcal ± SD	Males: % Subjects < 2/3 RDA[c]	Males: % Subjects < 1/3 RDA[c]	Females: Mean intake/1000 kcal ± SD	Females: % Subjects < 2/3 RDA[c]	Females: % Subjects < 1/3 RDA[c]
Niacin (mg)	Pre	7.6 ± 3.5	13.0	1.2	7.6 ± 4.5	15.2	2.1
	Post	7.5 ± 3.4	14.4	0.4	7.3 ± 3.5	16.9	1.5
Ascorbic Acid (mg)	Pre	31. ± 33.	20.9	6.8	41. ± 48.	25.3	12.5
	Post	35. ± 51.	20.3	9.7	39. ± 43.	27.8	12.7

[a]Nutrient calculated from Home and Garden Bulletin No. 72, 1971.

[b]Data based on 24 hour diet records.

[c]Based on 1974 RDA.

[d]Males, n = 341 pretest, n = 236 posttest. Females n = 611 pretest, n = 531 posttest.

[e]Pretest data based on dietary records kept before the nutrition unit, posttest data based on dietary records kept 1-3 weeks after completion of the nutrition unit.

iron, 70 percent; vitamin A, 49 percent; thiamin, 44 percent; riboflavin, 21 percent; niacin, 34 percent; and ascorbic acid, 33 percent. Nutrient intakes of teenagers are frequently marginal for all nutrients except protein. Although the prevalence of low intakes appears lower when the nutrient density approach is used (Table 26), marginal intakes were reported by 10 percent or more of the population for all nutrients except thiamin, riboflavin and protein.

Mean nutrient intakes of this group were similar to those reported by other researchers (Tables 1 and 16). Although mean calorie intake of this group was slightly lower than that reported in previous studies, mean intakes of calcium and ascorbic acid were slightly higher.

As reported by other researchers (Household Food Consumption Survey, 1965-1966, 1972; Hampton et al., 1967; Ten-State Nutrition Survey 1968-1970; 1972), the diets of adolescent females are generally poorer than the males. Dietary scores of the females on the pretest and posttest were 13.5 and 13.2 compared with 15.0 and 14.9 for the males (Table 12). Dietary scores per 1000 kcal were 13.8 for the females and 14.7 and 14.8 for the males. As is shown in Table 25, the prevalence of low intakes of all nutrients among females was greater than among the males. It is frequently hypothesized that such differences are due to the lower calorie intake of females. This effect is seen by comparison of nutrient densities

for both groups; mean intakes per 1000 kcal for both males and females were quite similar (Table 26). It is simply more difficult for the young woman to meet her nutrient needs from a diet which does not exceed her energy requirements. In addition, the social pressure for weight control may influence caloric intake.

Dwyer et al. (1967) reported that 38 percent of their teenage subjects were dieting on the day of the survey. Similar percentages in this study reported low caloric intake. Less than 2/3 of the recommended number of calories were reported by 32 percent of the females on the pretest and 37 percent on the posttest. For the males, these figures were 23 percent and 26 percent.

For analysis of data, the group was also divided on the basis of age. Diets of teenagers 15 years or less were compared with those 16 and over. Data are summarized, by age and sex, in Tables 27-30. There were few differences in the groups divided by ages. The percentages of subjects with less than 2/3 and less than 1/3 of the RDA for most nutrients were similar. As expected, the older teenage girls consumed slightly fewer calories. The prevalence of low intake of vitamin A was higher with the younger males than with the older males, 50 percent versus 40 percent.

The wide variability of nutrient intakes is caused by several factors. The data are based on 24-hour dietary records; if the data had been based on mean intakes over a period of several days, the

Table 27. Mean nutrient intakes[a, b, c] of adolescent females, by age groups, in selected nutrition classes in Oregon high schools (pretest and posttest)[d, e].

Dietary factor	Test Period	Females, age 15 or less: Mean intake ± SD	Females, age 15 or less: % Subjects < 2/3 RDA[c]	Females, age 15 or less: % Subjects < 1/3 RDA[c]	Females, age 16 or over: Mean intake ± SD	Females, age 16 or over: % Subjects < 2/3 RDA[c]	Females, age 16 or over: % Subjects < 1/3 RDA[c]
kcal	Pre	1903. ± 942.	32.2	6.0	1814 ± 866	31.4	5.8
	Post	1820. ± 892	41.1	5.9	1787 ± 895	32.0	5.3
Protein (g)	Pre	71. ± 36	8.7	3.0	66. ± 33	12.0	2.5
	Post	67. ± 34.	10.5	1.6	65. ± 29.	12.4	2.7
Fat (g)	Pre	86. ± 46.	--	--	81. ± 44.	--	--
	Post	81. ± 44	--	--	81. ± 39.	--	--
Carbohydrate (g)	Pre	216 ± 119.	--	--	211. ± 109.	--	--
	Post	211. ± 115.	--	--	204. ± 146.	--	--
Calcium (mg)	Pre	957 ± 675.	46.0	15.3	892. ± 560.	49.2	17.4
	Post	921 ± 577.	48.0	20.4	880. ± 527.	46.2	20.4
Iron (mg)	Pre	10.2 ± 5.6	68.9	21.0	10.0 ± 6.3	71.9	22.3
	Post	10.0 ± 6.4	70.7	21.4	9.5 ± 5.0	72.4	22.2
Vitamin A (IU)	Pre	3610. ± 3570.	48.2	18.8	3660. ± 3320	49.6	22.5
	Post	3310. ± 4270.	56.6	20.7	3520. ± 4340.	53.3	17.6
Thiamin (mg)	Pre	0.94 ± 0.53	40.1	11.7	0.88 ± 0.55	49.2	11.2
	Post	0.94 ± 0.62	44.7	11.2	0.89 ± 0.50	47.6	10.2
Riboflavin (mg)	Pre	1.71 ± 1.05	19.1	6.5	1.57 ± 0.92	23.6	6.2
	Post	1.62 ± 1.00	25.0	4.6	1.56 ± 0.84	24.4	7.1

Table 27. Continued.

Dietary factor	Test Period	Females, age 15 or less: Mean intake ± SD	% Subjects < 2/3 RDA[c]	% Subjects < 1/3 RDA[c]	Females, age 16 or over: Mean intake ± SD	% Subjects < 2/3 RDA[c]	% Subjects < 1/3 RDA[c]
Niacin (mg)	Pre	13.9 ± 8.4	33.5	10.1	13.3 ± 9.5	34.3	11.6
	Post	12.8 ± 8.2	38.8	12.2	12.9 ± 7.7	34.2	10.2
Ascorbic acid (mg)	Pre	68. ± 76.	33.5	18.0	75 ± 78.	31.1	14.8
	Post	64. ± 64.	38.5	20.1	62. ± 63	37.9	17.2

[a]Nutrients calculated from Home and Garden Bulletin No. 72, 1971.

[b]Data based on 24 hour diet records.

[c]Based on 1974 RDA.

[d]Females, age 15 or less, n = 367 pretest, n = 304 posttest. Females, age 16 or over, n = 244 pretest, n = 227 posttest.

[e]Pretest data based on dietary records kept before the nutrition unit, posttest data based on dietary records kept 1-3 weeks after completion of the nutrition unit.

Table 28. Mean nutrient intake per 1000 kcal[a, b, c] of adolescent females, by age groups, in selected nutrition classes in Oregon high schools (pretest and posttest)[d, e].

Dietary factor	Test Period	Females, age 15 or under: Mean intake/1000 kcal ± SD	Females, age 15 or under: % Subjects < 2/3 RDA[c]	Females, age 15 or under: % Subjects <1/3 RDA[c]	Females, age 16 or over: Mean intake/1000 kcal ± SD	Females, age 16 or over: % Subjects <2/3 RDA[c]	Females, age 16 or over: % Subjects < 1/3 RDA[c]
Protein (g)	Pre	38. ± 11.	0.3	0	38. ± 15	2.1	0.4
	Post	38 ± 10	0.3	0	37. ± 10	0.9	0
Fat (g)	Pre	45. ± 9.	--	--	44. ± 10	--	--
	Post	44. ± 9.	--	--	45. ± 10.	--	--
Carbohydrate (g)	Pre	114. ± 25.	--	--	115. ± 28	--	--
	Post	116 ± 25	--	--	113 ± 29	--	--
Calcium (mg)	Pre	497. ± 230.	27.8	7.1	502 ± 245.	32.2	7.0
	Post	505. ± 227	26.6	6.3	498 ± 229.	27.1	8.9
Iron (mg)	Pre	5.5 ± 2.4	54.0	2.5	5.8 ± 3.3	60.3	4.5
	Post	5.8 ± 3.0	47.7	3.6	5.5 ± 2.0	63.6	4.4
Vitamin A (IU)	Pre	2030. ± 2230.	37.3	9.3	2330. ± 3190	42.1	9.1
	Post	2010. ± 3250.	41.8	7.9	2120 ± 2410	40.0	7.6
Thiamin (mg)	Pre	0.50 ± 0.18	13.1	0.8	0.49 ± 0.20	13.2	0.8
	Post	0.52 ± 0.22	10.9	0	0.51 ± 0.19	13.3	0.4
Riboflavin (mg)	Pre	0.89 ± 0.37	3.8	0.3	0.89 ± 0.39	6.2	0.8
	Post	0.89 ± 0.37	3.3	0	0.89 ± 0.33	7.6	0.4

Table 28. Continued.

Dietary factor	Period	Females, age 15 or under: Mean intake/1000 kcal ± SD	Females, age 15 or under: % Subjects < 2/3 RDA[c]	Females, age 15 or under: % Subjects < 1/3 RDA[c]	Females, age 16 or over: Mean intake/1000 kcal ± SD	Females, age 16 or over: % Subjects < 2/3 RDA[c]	Females, age 16 or over: % Subjects < 1/3 RDA[c]
Niacin (mg)	Pre	7.6 ± 4.5	15.3	1.1	7.6 ± 4.5	15.2	3.7
	Post	7.2 ± 3.6	17.8	1.0	7.3 ± 3.3	15.9	2.2
Ascorbic Acid (mg)	Pre	37. ± 41	24.3	13.6	48 ± 57	26.9	10.7
	Post	39. ± 42.	28.9	13.5	38 ± 44	26.2	11.6

[a]Nutrients calculated from Home and Garden Bulletin No. 72, 1971.

[b]Data based on 24 hour diet records.

[c]Based on 1974 RDA.

[d]Females, age 15 or less, n = 367 pretest, n = 304 posttest. Females, age 16 or over, n = 244 pretest, n = 227 posttest.

[e]Pretest data based on dietary records kept before the nutrition unit, posttest data based on dietary records kept 1-3 weeks after completion of the nutrition unit.

Table 29. Mean nutrient intake[a, b, c] of adolescent males, by age group, in selected nutrition classes in Oregon high schools (pretest and posttest)[d, e].

Dietary factor	Test Period	Males, age 15 or under: Mean intake ± SD	Males, age 15 or under: % Subjects < 2/3 RDA[c]	Males, age 15 or under: % Subjects < 1/3 RDA[c]	Males, age 16 or over: Mean intake ± SD	Males, age 16 or over: % Subjects < 2/3 RDA[c]	Males, age 16 or over: % Subjects < 1/3 RDA[c]
kcal	Pre	2857. ± 1410.	23.3	4.1	2722. ± 1064	23.4	5.4
	Post	2481. ± 955.	24.3	6.1	2652 ± 1102	28.1	1.7
Protein (g)	Pre	109. ± 57	3.5	0	104 ± 51	7.2	0.6
	Post	97. ± 40.	6.1	0.9	105. ± 51.	5.0	0.
Fat (g)	Pre	129 ± 68	--	--	125. ± 56.	--	--
	Post	115. ± 57	--	--	126. ± 59.	--	--
Carbohydrate (g)	Pre	318 ± 170	--	--	299 ± 127	--	--
	Post	268. ± 106	--	--	280 ± 127.	--	--
Calcium (mg)	Pre	1501 ± 1072	23.8	8.7	1424 ± 895	24.0	9.6
	Post	1255 ± 669	25.2	7.0	1426 ± 869.	21.5	5.0
Iron (mg)	Pre	15.7 ± 10.7	35.5	5.2	14.3 ± 7.4	41.3	7.8
	Post	13.2 ± 5.7	47.0	7.8	14.1 ± 7.2	38.8	9.9
Vitamin A (IU)	Pre	4880 ± 6760	50.6	18.0	4450. ± 3490.	40.2	16.6
	Post	4360. ± 3950.	52.2	16.5	5810. ± 9740.	40.5	16.5
Thiamin (mg)	Pre	1.41 ± 0.81	27.3	4.7	1.26 ± 0.57	36.5	7.8
	Post	1.28 ± 0.60	29.6	5.2	1.34 ± 0.74	37.2	9.9
Riboflavin (mg)	Pre	2.71 ± 1.74	12.2	2.3	2.53 ± 1.37	17.4	4.2
	Post	2.28 ± 1.04	11.3	4.3	2.53 ± 1.27	9.9	1.7

Table 29. Continued.

Dietary factor	Test Period	Males, age 15 or under: Mean intake ± SD	Males, age 15 or under: % Subjects < 2/3 RDA[c]	Males, age 15 or under: % Subjects < 1/3 RDA[c]	Males, age 16 or over: Mean intake ± SD	Males, age 16 or over: % Subjects < 2/3 RDA[c]	Males, age 16 or over: % Subjects <1/3 RDA[c]
Niacin (mg)	Pre	21.3 ± 13.3	22.1	3.5	20.1 ± 12.4	30.5	9.6
	Post	18.9 ± 12.4	27.8	6.1	19.4 ± 12.	32.2	9.9
Ascorbic Acid (mg)	Pre	83. ± 84	31.4	11.0	79. ± 77	24.3	13.0
	Post	82. ± 120.	26.1	14.8	83. ± 90.	24.0	11.6

[a]Nutrients calculated from Home and Garden Bulletin No. 72, 1971.

[b]Data based on 24 hour diet records.

[c]Based on 1974 RDA.

[d]Males, age 15 or under, n = 172 pretest, n = 115 posttest. Males, age 16 or over, n = 169 pretest, n = 121 posttest.

[e]Pretest data based on dietary records kept before the nutrition unit, posttest data based on dietary records kept 1-3 weeks after completion of the nutrition unit.

Table 30. Mean nutrient intake[a, b, c] per 1000 kcal of adolescent males by age groups, in selected Oregon high schools (pretest and posttest)[d, e].

Dietary factors	Test Period	Males, age 15 or under: Mean intake ± SD	Males, age 15 or under: % Subjects < 2/3 RDA[c]	Males, age 15 or under: % Subjects < 1/3 RDA[c]	Males, age 16 or over: Mean intake ± SD	Males, age 16 or over: % Subjects < 2/3 RDA[c]	Males, age 16 or over: % Subjects < 1/3 RDA[c]
Protein (g)	Pre	39. ± 11.	0	0	38. ± 11.	0	0
	Post	40. ± 10.	0	0	39 ± 9.	0	0
Fat (g)	Pre	45. ± 8.	--	--	46. ± 8.	--	--
	Post	45. ± 9.	--	--	47 ± 8.	--	--
Carbohydrate (g)	Pre	111. ± 25.	--	--	111. ± 24.	--	--
	Post	111. ± 25.	--	--	106 ± 23	--	--
Calcium (mg)	Pre	506. ± 218	15.1	3.5	510 ± 228	13.2	1.8
	Post	504. ± 197	13.9	0.9	530. ± 221	10.7	2.5
Iron (mg)	Pre	5.7 ± 3.4	15.1	0	5.3 ± 1.8	20.4	0.6
	Post	5.4 ± 1.6	12.2	0.9	5.3 ± 1.9	14.0	1.7
Vitamin A (IU)	Pre	1660. ± 2030.	37.2.	11.0	1690 ± 1420	34.1	8.4
	Post	1810. ± 1630.	33.0	8.7	2210 ± 3850	24.0	4.1
Thiamin (mg)	Pre	0.50 ± 0.15	8.1	0	0.47 ± 0.13	9.0	0
	Post	0.53 ± 0.18	5.2	0.9	0.51 ± 0.19	9.1	0
Riboflavin (mg)	Pre	0.93 ± 0.33	1.7	0	0.91 ± 0.31	0.6	0
	Post	0.92 ± 0.27	0	0	0.95 ± 0.28	1.7	0

Table 30. Continued.

Dietary factors	Test Period	Males, age 15 or under: Mean intake ± SD	Males, age 15 or under: % Subjects <2/3 RDA[c]	Males, age 15 or under: % Subjects <1/3 RDA[c]	Males, age 16 or over: Mean intake ± SD	Males, age 16 or over: % Subjects < 2/3 RDA[c]	Males, age 16 or over: % Subjects < 1/3 RDA[c]
Niacin (mg)	Pre	7.7 ± 3.4	9.9	1.2	7.4 ± 3.7	16.2	1.2
	Post	7.7 ± 3.7	10.4	0.9	7.3 ± 3	18.2	0
Ascorbic Acid (mg)	Pre	30 ± 28	22.1	6.4	31 ± 37	19.8	7.2
	Post	38 ± 63	21.7	11.3	33 ± 35	19.0	8.3

[a]Nutrients calculated from Home and Garden Bulletin No. 72, 1971.

[b]Data based on 24 hour diet records.

[c]Based on 1974 RDA.

[d]Males, age 15 or under, n = 172 pretest, n = 115 posttest. Males, age 16 or over, n = 169 pretest, n = 121 posttest.

[e]Pretest data based on dietary records kept before the nutrition unit, posttest data based on dietary records kept 1-3 weeks after completion of the nutrition unit.

variability would have been less. Certain nutrients, such as ascorbic acid and vitamin A, occur in relatively few foods. This tends to result in extreme variability for these nutrients.

Many students apparently had a choice of their food intake; only 2 percent reported no choice in their food intake; 38 percent reported complete choice of all food eaten on the day of the survey.

Relationships Between Teacher Characteristics and Student Learning of Nutrition

It was hypothesized that the teacher characteristics, knowledge, confidence, interest, flexibility, and value of nutrition, are related to effective nutrition education for adolescents. Correlation coefficients between these teacher characteristics and student learning are presented in Table 31.

In this study, students' learning in the cognitive domain was measured by differences in scores between a nutrition knowledge test given before (pretest) and after (posttest) a unit on nutrition. Of the teacher characteristics related to nutrition, only teacher knowledge was significantly correlated ($r = .30$, $p \leq .05$) with changes in student knowledge. Students' knowledge changes were significantly correlated ($p \leq .05$) with two components of teacher knowledge, basic and applied, but not with the teacher's

Table 31. Correlation coefficients between nutrition related characteristics of Oregon high school teachers and measures of effective nutrition education in their students.

Teacher characteristics	Measures of effective nutrition education in students		
	Mean change in students' knowledge	Mean change in students' dietary scores	Mean change in students' dietary scores/1000 kcal
Knowledge	0.30*	0.16	0.31*
Knowledge confidence	0.20	0.04	0.21
Teaching confidence	0.02	0.16	0.29*
Interest	0.17	0.31*	0.11
Flexibility	0.15	-0.01	-0.05
Value	0.06	-0.01	0.05
Dietary Score	0.21	0.12	0.14

* Significant r value, $p \leq 0.05$

advanced or recent knowledge. However, questions could conceivably have been placed in more than one category. The number of nutrition courses which the teacher had taken was weakly correlated ($p \leq .10$) with students' knowledge gain.

The values for the multiple regressions that were done showed that only teacher's knowledge was significantly related to students' knowledge gain ($F = 4.63$, $p \leq .05$). Other characteristics did not contribute significantly to the model. However, teacher knowledge explained only a small amount of the variation in student knowledge gain ($r^2 = .08$). When the variable, students' pretest scores, was added to the regression model, a higher percentage of the variability in scores was explained ($R^2 = .27$; $F = 10.2$, $p \leq .01$). Although the other teacher characteristics did not contribute significantly to the model, they did contribute to the student knowledge change; for the full model, $R^2 = .33$. However, many factors which contributed to students' knowledge change have not been identified in this study.

Students' learning in the affective domain, as a result of nutrition education, was measured by changes in their dietary scores or by changes in their dietary scores per 1000 kcal. The latter measure allows for nonselective incomplete recording or low caloric intake; the two measures were significantly correlated ($r = .40$, $p \leq .01$). Only teacher interest was significantly correlated ($r = .31$, $p \leq .05$) with changes in students' dietary scores. However, changes

in students' dietary scores per 1000 kcal were significantly correlated ($p \leq .05$) with both the teacher's knowledge and teaching confidence. Of the components of teacher knowledge, basic and applied knowledge showed significant relationships ($p \leq .05$) to changes in students' dietary scores per 1000 kcal.

Multiple regression analysis did not reveal any further combination of teacher characteristics which was significantly related to students' dietary habits. The combined characteristics, knowledge and teaching confidence, were significantly related ($F = 4.84$, $p \leq .05$) to changes in students' dietary scores per 1000 kcal. These two characteristics, in combination, explained some of the variability in changes in students' dietary habits ($R^2 = .15$). Although the other characteristics as measured did not contribute significantly, they did contribute to the changes in students' dietary habits. For the full model $R^2 = .25$. Other factors, not investigated in this study, thus also contributed to changes in student dietary habits.

There was also a significant correlation ($r = .32$, $p \leq .05$) between changes in students' knowledge and changes in students' dietary scores per 1000 kcal. The other measure of students' dietary adequacy, the dietary score, was not significantly related to their cognitive learning.

The teacher's concern about his or her students, was measured by responses of students to three questions. Teacher concern was not significantly correlated to student learning in either the cognitive or affective domain.

The multiple regression analyses discussed above were used to test the model which shows the significant correlations ($p \leq .05$) between teacher characteristics and effective nutrition education for adolescents. The model is given in Figure 9. The other teacher characteristics interrelated with teacher knowledge (knowledge confidence, interest, flexibility, and value) did not have a significant correlation with student learning in either the cognitive or affective domain. Teaching confidence, although not significantly correlated with teacher's knowledge, did show a significant relationship to student learning in the affective domain. The results of this study suggest that the teacher characteristics, knowledge and teacher confidence, are independent characteristics. However, since all measures except for flexibility were developed for this study, the teacher characteristics may not have been completely assessed.

Implications of This Study

Results of this study emphasize the importance of teacher's knowledge and teaching confidence to effective nutrition education for adolescents. Teacher's knowledge was significantly correlated

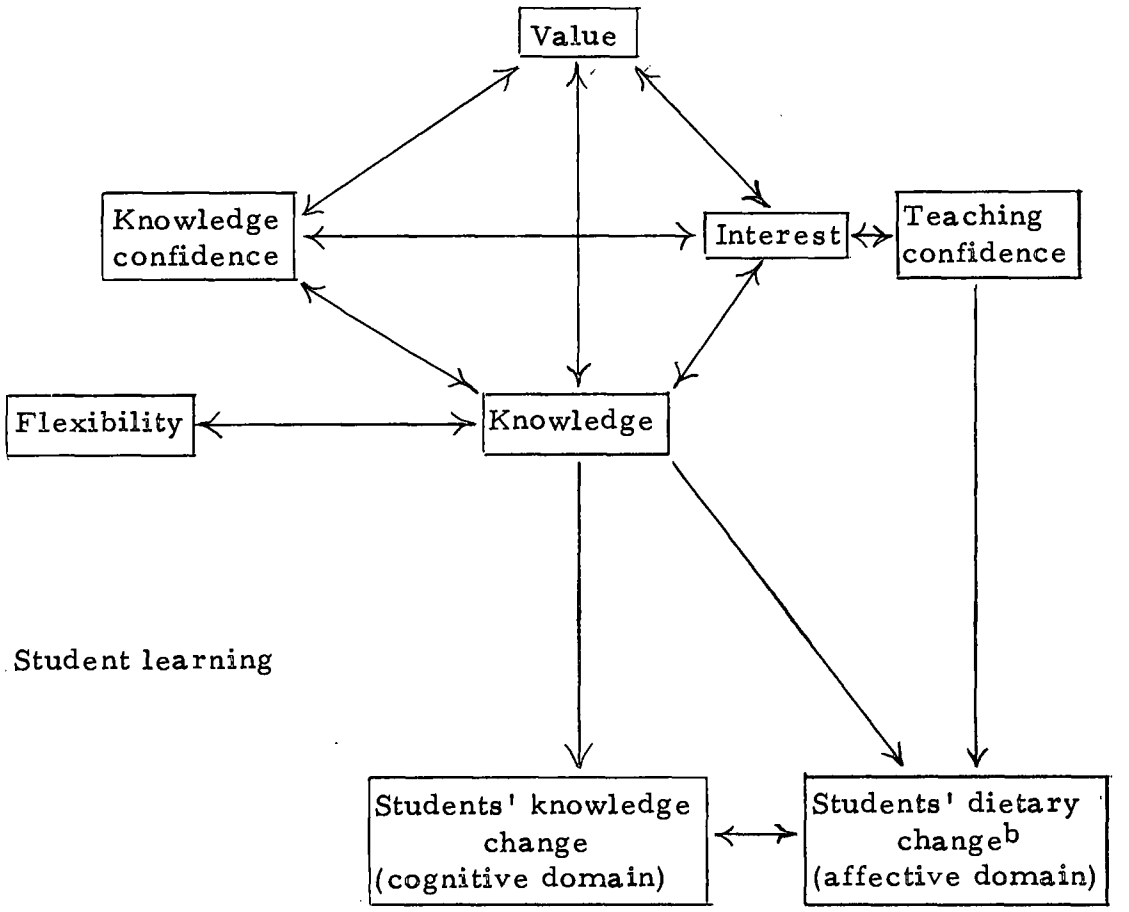

Figure 9. Model with significant relationships ($p \leq .05$) between teacher characteristics[a] and effective nutrition education for adolescents.

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[a]Note that teachers' dietary scores and dietary scores per 1000 kcal do not appear because they were not significantly correlated with other characteristics.

[b]As measured by change in dietary scores per 1000 kcal.

to students' learning in both the cognitive and affective domains. Teaching confidence was also significantly correlated to students' learning in the affective domain. Although the other teacher characteristics as assessed in this study were interrelated with teacher knowledge, they were not significantly related to changes in students' knowledge of nutrition or changes in their dietary habits. Results of this research have implications for both teacher educators and high school teachers.

The importance of a strong nutrition knowledge base to effective teaching is confirmed by results of this study. In addition, nutrition knowledge scores of the high school teachers in this sample were significantly correlated with the extent of their college preparation in nutrition. The desirability of two or more nutrition courses in teacher preparation programs is supported by these findings. It is recommended that college educators in nutrition continue to concentrate on developing a strong knowledge base in students. Basic and applied nutrition are especially important areas for the effective high school teacher.. As assessed by the teacher knowledge test, applied nutrition knowledge was an area of weakness. Therefore, it is also recommended that application receive greater emphasis in college courses. Applied knowledge was not significantly related to the number of nutrition courses taken by these teachers.

Recent nutrition knowledge was a weak area with this group, especially with the more experienced teachers. It would appear from replies to questions concerning sources of information that teachers have few recent sources, unless they have purchased the latest edition of their college textbook. Some means of communicating recent findings to teachers in the field would be highly desirable. A regularly published newsletter with such information would be useful to high school teachers. It should be directed to all teachers teaching nutrition, whatever their teaching area may be.

In addition to the knowledge component of college nutrition courses, these findings suggest that emphasis should also be placed on developing the confidence of future nutrition teachers. How to achieve such confidence was not investigated in this study; further research is needed in this area.

Additional implications of this research for high school teachers focus on characteristics of their students. Dietary habits of adolescents are indeed cause for concern; effective nutrition education is needed in the high school curriculum. As researchers in other areas have found, results of this study show that intakes of calcium, iron, vitamin A, and ascorbic acid were inadequate for many Oregon youth. Special emphasis should be placed on these nutrients in high school courses. Although protein is important physiologically, it does not appear to be a problem in most

adolescent's diets. On the basis of responses to the knowledge tests, students had difficulty with application questions; additional emphasis in this area is warranted. Teaching techniques that help students identify many food sources of nutrients would be useful.

In assessing the direction for further research, there is still much to be learned about the role of the teacher's confidence in effective education. The instrument used to measure this characteristic should be further developed as an initial step. Research also needs to be done on effective ways of developing this characteristic in the college curriculum.

SUMMARY

The relationships between selected teacher characteristics and effective nutrition education were assessed. The teacher characteristics were knowledge of nutrition, knowledge confidence, teaching confidence, interest, flexibility, value, and dietary habits. Seventy-one high school nutrition teachers and 1,193 of their students in western Oregon constituted the sample.

Teacher's knowledge of nutrition was shown to be significantly related ($p \leq .05$) to high school students' learning in both the cognitive domain, as measured by changes in nutrition knowledge, and in the affective domain, as measured by changes in dietary intake per 1000 kcal. Teaching confidence, the teacher's own evaluation of his or her effectiveness as a nutrition educator, was also significantly correlated ($p \leq .05$) with students' learning in the affective domain. Other teacher characteristics related to nutrition which were assessed in this study (knowledge confidence, interest, flexibility, value, and teachers' dietary habits) were significantly related ($p \leq .05$) with teacher knowledge, but not with changes in students' knowledge or students' dietary habits.

The mean score on the teacher nutrition knowledge test was 48 percent correct; the scores ranged from 23 to 85 percent. Basic nutrition knowledge was the area of greatest strength in this group

of health and home economics teachers; applied nutrition knowledge and recent nutrition knowledge were the weakest areas. As a group, the teachers had very adequate dietary intakes. Iron was the only problem nutrient identified for the female teachers; vitamin A intakes in a few male teachers were marginal.

Teenagers' nutrition knowledge was assessed before and after a nutrition education unit. Mean scores on the student knowledge pretest and posttests were 39 and 43 percent, respectively. Although group changes in knowledge as a result of nutrition education were slight (+ 3 percent), individual class mean differences ranged from -8 to + 26 percent.

Dietary records of these students indicated that many individuals had marginal intakes of one or more nutrients. Problem nutrients for these Oregon teenagers were calcium, iron, vitamin A, and ascorbic acid. Although mean changes in students' dietary scores as a result of nutrition education were slight, there was a significant correlation ($p \leq .05$) between changes in student knowledge and changes in dietary scores per 1000 kcal.

Results of this study suggest several areas of further research needs. The importance of teacher characteristics to student learning of nutrition needs further investigation. The interrelationships between knowledge and other characteristics bear further study with refined techniques.

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APPENDICES

APPENDIX A

August, 1977

Dear Principal

As a doctoral student in nutrition with a minor in education at Oregon State University, I am conducting a reasearch survey on nutrition education in Oregon senior high schools. Numerous national studies have indicated that the adolescent is frequently the least well-nourished of any age group. The purpose of this study is to identify teacher characteristics, excluding personality, which are related to effective nutrition education for teenagers. The results of this investigation will be used in planning college nutrition courses and workshops for high school teachers.

Using random sampling techniques, High School has been selected. From your school, one home economics teacher and one health teacher who will be incorporating nutrition in their curriculum by mid-year will be asked to participate. The survey will include only one class from each teacher. Both students and teachers will be asked to respond to questionnaires covering nutritional practices, attitudes and knowledge. Pre- and post-questionnaires will be given to the students and they will be asked to record their food intake for two days. The pre- and post-questionnaires will require only a portion of a class period for the students to complete. The testing times will be flexible and planned to coordinate with each teacher's lesson plans as well as with the school schedule. All questionnaires have been pilot tested, the project has been approved by the Human Subjects Committee at Oregon State University, and reviewed by Pauline Goodwin, State Specialist, Home Economics, and Len Tritsch, State Specialist, Health Education. Confidentiality of information and identity of participants in the survey are assured.

I plan to visit each school in the study to further explain the procedures and to administer the first set of questionnaires. I will call you in August to answer any questions you may have and to ask your help in identifying the appropriate teachers in your school. After talking with you, a similar letter will be sent to each teacher explaining the survey and requesting participation in the study.

Sincerely,

Jean Skinner
Graduate Student

JS:MW:SLL:lcd

Sylvia L. Lee
Professor and Head
Department of Home Economics Education

Margy Woodburn
Professor and Head
Department of Foods and Nutrition

August, 1977

Dear Teacher,

As a doctoral student in nutrition with a minor in education at Oregon State University, I am conducting a research survey on nutrition education in Oregon senior high schools. Numerous national studies have indicated that the adolescent is frequently the least well-nourished of any age group. The purpose of this study is to identify teacher characteristics, excluding personality, which are related to effective nutrition education for teenagers. The results of this investigation will be used in planning college nutrition courses and workshops for high school teachers.

Using random sampling techniques, High School has been selected. From your school, one home economics teacher and one health teacher who will be incorporating nutrition in their curriculum by mid-year will be asked to participate. The survey will include only one class from each teacher. Both students and teachers will be asked to respond to questionnaires covering nutritional practices, attitudes and knowledge. Pre- and post-questionnaires will be given to the students and they will be asked to record their food intake for two days. The pre- and post-questionnaires will require only a portion of a class period for the students to complete. The testing times will be flexible and planned to coordinate with each teacher's lesson plans as well as with the school schedule. All questionnaires have been pilot tested, the project has been approved by the Human Subjects Committee at Oregon State University, and reviewed by Pauline Goodwin, State Specialist, Home Economics, and Len Tritsch, State Specialist, Health Education. Confidentiality of information and identity of participants in the survey are assured.

I plan to visit each school in the study to further explain the procedures and to administer the first set of questionnaires. I will call you soon to answer any questions you may have and then to set a time for my visit to your school if you are willing to participate. Please fill out the enclosed form and return it as soon as possible in the enclosed envelope.

Jean Skinner
Graduate Student

Margy Woodburn
Professor and Head
Department of Foods and Nutrition

Sylvia L. Lee
Professor and Head
Department of Home Economics Education

JS:MW:SLL:lcd

May 8, 1978

Dear Teacher:

We're sure many of you are wondering what has happened with the nutrition survey which you and your students participated in earlier this year. We have not forgotten you! The participation rate was excellent; the sample includes 71 teachers from 44 schools and over 1200 adolescents. However, this meant months of coding and recording data in preparation for the computer analysis which is now in progress. We will have some results to report to you soon. Copies of the student pre and post tests and the knowledge portion of the teacher questionnaire, with answer keys, will be sent to you also at that time.

We want to take this opportunity to thank you for participating in the survey. We know that participation required a great deal of time and effort on your part. Your efforts are very evident by the careful recording done by your students.

At this time we do need some additional information from you. The first part of the enclosed questionnaire asks you to identify areas of major emphasis in the nutrition unit you taught to the survey class. The second part asks a few additional questions about your own health habits, a suggestion made by one of you teachers. The questions involve a "yes" or "no" response and will take only a few minutes of your time; a return envelope is enclosed. Of course, the results are confidential.

Thank you for your cooperation.

Sincerely,

Jean Skinner
Graduate Student

Margy Woodburn
Professor and Head
Department of Foods and Nutrition

JS:MW:lcd

Name _____

School _____

Area: Health _____; Home Economics _____

My school is on _____ semester system

_____ trimester system

_____ quarter system

I will be teaching nutrition subject matter this fall to _____ (number) classes.

I will begin the nutrition unit on _____.
(date)

If you are teaching several classes and will be beginning the nutrition units at different times please indicate the time each unit will begin

_____

_____

_____

I will complete the nutrition unit on or about _____.

I intend to integrate nutrition into other units in this class _____ yes; _____ no.

Which units? _____

_____

_____

My preparation period is _____
(Indicate the time of day)

Is your school on the same schedule each day? _____ yes _____ no.

If not, please explain.

Phone number I can be reached at school _____ Ext. _____

If you would not object to receiving a call at home in the early evening,

indicate your home phone number _____

Directions for Teachers

Enclosed are _____ student questionnaires about nutrition. Please give these questionnaires to one class of students before you begin the unit on nutrition. The students will complete a similar questionnaire 1-3 weeks after the nutrition unit has been completed. Do not worry about students who are absent; absences will be ignored in both the pre and post tests. However, don't select a day that you have a mass epidemic at your school or that many students have been excused for field trips, etc.

The enclosed questionnaire has two parts.

Part 1 (yellow paper) has 31 multiple choice items plus three general information items and will take the students 15-20 minutes to complete. Please allow enough time for them to complete Part 1 in class, and do not allow them to take the questionnaire out of the classroom.

Verbal directions by teacher to students on day 1.

1. Select the one best answer to each question. If you don't know, guess. Circle your answer.

2. Do not put your name on the questionnaire.

3. We cannot discuss the questionnaire now, but will later in the term after the research project has been completed.

Return all questionnaires in the stamped envelope provided to you.

Part II (white paper) is a 24 hour diet record form which the student will return to class tomorrow, hopefully completed. You might allow a few minutes at the beginning of class tomorrow to complete and collect the diet records. Try to avoid giving the questionnaire on a Friday.

Verbal directions by teacher to student on day 2.

1. Have you included amounts of food?

2. Have you described the food; for instance - whole milk, 2%, or skim milk?

3. Have you forgotten to list any food which you ate? How about snacks?

Please return the diet forms (page 2 only) in the stamped envelope provided to you. Call me if you have any questions (home - 757-0286).

THANK YOU!

Directions for Teachers

It is time to complete the nutrition education survey which you started earlier this semester. Teacher Questionnaire II is attached. It has parts A, B, and C; you may want to do these at different times and that is all right. However, please do not look at the student post-test until you have completed parts A and B; part C is your diet record. Do not use any resources (books, charts, etc.) to answer Teacher Questionnaire II.

Enclosed in this packet are _____ post-tests for your students. Please give the post-tests to the same class of students who took the pre-tests at the beginning of your nutrition unit. Give the post-tests within three weeks after you complete the nutrition unit. However, if you integrate nutrition into several other units, you will give the post-tests after that. Do not worry about individual students who may have been absent for either test; just give the test on a "normal" day. As before, do not give the tests on a Friday, so that weekend days are not included in the student's diet records.

The student questionnaire has two parts.

Part I (blue paper) has 30 multiple choice items plus four general information items and will take the students about 20 minutes to complete. Please allow enough time for them to complete Part I in class, and do not allow them to take the questionnaire out of the classroom.

Verbal directions by teacher to students on day 1.

1. Select the one best answer to each question. If you don't know guess. Circle your answer.

2. Do not put your name on the questionnaire.

Part II (yellow paper) is a 24 hour diet record form which the students will return to class tomorrow, hopefully completed. You might allow a few minutes at the beginning of class tomorrow to complete and collect the diet records. Try to avoid giving the questionnaire on a Friday.

Verbal directions by teacher to students on day 2.

Check your diet records for the following:

1. Have you included amounts of food?

2. Have you described the food; for instance - whole milk, 2%, or skim milk?

3. Have you forgotten to list any food which you ate? How about snacks?

Please return the diet forms and questionnaires in the stamped envelope provided to you. Call me if you have any questions (home - 757-0286).

THANK YOU!

APPENDIX B

Teacher Questionnaire I

1. When you received your baccalaureate degree, what was your maior: Check the one most appropriate answer.

_____ health education
_____ home economics education
_____ physical education
_____ general science
_____ other (specify) _____

2. Which of the following college science courses have you taken for credit? Check all which apply.

_____ inorganic chemistry
_____ organic chemistry
_____ biochemistry
_____ physiology
_____ biology
_____ general science
_____ natural science

3. Which of the following college courses in nutrition have you taken for credit? Check all which apply.

_____ basic nutrition
_____ a 2nd nutrition course
_____ nutrition for teachers
_____ other (specify) _____

4. Have you taken any other college courses in which nutrition was included? List by name or general description.

_____ none
_____
_____
_____
_____

5. Rank the following college courses from (5) most favorite to (1) least favorite.

_____ biology/physiology
_____ history/political science
_____ literature
_____ nutrition
_____ psychology

6. Since graduation, but during the past five years, have you taken any courses or workshops which focused on nutrition? Please indicate the approximate name of the course/workshop and sponsoring institution.

Name	Sponsoring institution/organization
_____	_____
_____	_____
_____	_____

7. Which is the highest degree which you now hold? Check one only.

_____ Bachelor's degree
_____ Bachelor's degree plus 24 credits
_____ Master's degree
_____ Master's degree plus 30 or more credits
_____ Ph. D. or Ed. D.

8. Which is the highest Oregon credential which you now hold? Check one only.

_____ Basic Teaching Certificate
_____ Standard Teaching Certificate
_____ Regular Vocational Certificate
_____ 5 year Regular Teaching Certificate
_____ Life Teaching Certificate

9. Do you currently hold an Oregon endorsement to teach health? _____ yes _____ no
to teach home economics? _____ yes _____ no

10. How many years have you taught (full or part-time)? Include the current year as one year (i. e. a first year teacher will respond one year).

_____ years

11. If you have questions about nutrition, to whom or where do you go for answers?

_____

12. What do you consider the major nutrition problems of your students? Indicate a first and second choice.

_____ weight control
_____ skipping meals
_____ between meal snacks
_____ fad diets
_____ not enough protein
_____ junk food
_____ anemia
_____ not enough money
_____ athletic training
_____ home influence
_____ other (specify) _____
_____ no problems

13. What type of school lunch is available to students in your school? Check all which apply.

_____ type A
_____ ala carte choice
_____ snack bar
_____ vending machines
_____ none
_____ student store which serves _____
_____ don't know

14. Have you read any books related to nutrition in the past year? Identify titles and authors if possible.

_____
_____
_____

15. Have you read about nutrition in any magazines or journals in the past year? Identify the the magazine or journal by name and indicate the approximate number of articles about nutrition which you have read in the past year.

Name of magazine/journal	Number of articles read
_____	_____
_____	_____
_____	_____
_____	_____

16. If a workshop consisting of several evening sessions is planned for your area, which topic would be of most interest to you? Indicate a first and second choice.

_____ Techniques in Food Drying
_____ Ski Conditioning
_____ Crafty Crafts
_____ First Aid for Emergencies
_____ Physical Fitness is Fun
_____ Teaching Personal Finance
_____ Coaching Girls' Sports
_____ Nutrition Fads and Falicies
_____ Recent Research in Nutrition
_____ Microwave Menus
_____ Teaching Weight Control
_____ Improving Skills in the Basics (3 R's)

17. Which of the following TV specials would be most interesting to you? Rank your preferences 6 (most interesting) to 1 (least interesting).

_____ Current trends in education
_____ Food additives--are they safe?
_____ Cancer--what are your chances?
_____ How well-nourished are Americans?
_____ Teenagers and the sexual revolution
_____ What does a high school diploma really mean?

Answer #18 if you are a health teacher; omit #19.

Answer #19 if you are a home economics teacher; omit #18.

18. Which of the following areas do you feel is most important to include in your school's curriculum? Rank from 5 (most important) to 1 (least important).

_____ Communicable diseases
_____ Drug and alcohol abuse
_____ Digestion and circulatory systems
_____ Nutrition
_____ Sports for leisure time

19. Which of the following areas do you feel is most important to include in your school's curriculum? Rank from 5 (most important) to 1 (least important).

_____ Crafts and stitchery
_____ Food preservation
_____ Holiday meals and entertaining
_____ Nutrition
_____ Tailoring

In questions 20 - 25, circle the number which best describes how you feel.

20. Compared with other subjects you teach, how interesting is nutrition to you?

Most interesting				Least interesting
5	4	3	2	1

21. Compared with other subjects you teach, how adequate is your knowledge of nutrition?

Very adequate				Not adequate
5	4	3	2	1

22. How confident do you feel in answering teenagers' questions about their nutrition concerns?

Very confident				Not confident
5	4	3	2	1

23. How confident do you feel in discussing pros and cons of popular diets?

Very confident				Not confident
5	4	3	2	1

24. Do you consider nutrition easy to teach?

Easy				Difficult
5	4	3	2	1

25. How confident do you feel about your effectiveness as a nutrition educator?

Very confident				Little confidence
5	4	3	2	1

For questions 26 - 33*, indicate whether you agree or disagree with the statement.

		Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
26.	Children should eat what is on their plate, mother knows best.					
27.	I usually will not taste a food if its appearance is similar to something I dislike.					
28.	Knowing something is "good for me" has little or no influence on what I choose to eat.					
29.	I think traditional ways of preparing food are the best ways.					
30.	In my opinion, the best advice when eating away from home is to avoid the unknown.					
31.	Learning the basic ideas in nutrition will probably alter my personal eating habits very little.					
32.	The Basic Four Food Groups are the only usable tools for planning an adequate diet.					
33.	Restricting my meal patterns to familiar food ensures that I enjoy what I eat.					

*Portion of a test instrument developed by Carruth and Anderson (1977). Permission to use instrument received by personal communication with Dr. Carruth.

34. How often do you eat each of the following foods? Check in only one column for each food.

Food	Once or more daily	3-6 times per week	Once or twice weekly	About once every two weeks	About once a month	Rarely or never
Beef, pork, veal, lamb						
Fish and shellfish						
Chicken and turkey						
Legumes						
Eggs						
Citrus fruits						
Yellow & green vegetables						
Other vegetables & fruit						
Vegetable oils & margarine						
Milk						
Cheese, yogurt						
Whole grain enriched bread and cereals						
Bran or products which include it						
Pastry or cake						
Candy						
Pop (regular)						
Low-calorie pop						

35. What is the major reason for inclusion or exclusion of fish in your diet? Select one only.

1. I don't like fish.
2. I like fish.
3. It is low in calories.
4. It is low in cholesterol.
5. It is a good source of protein.
6. It is inexpensive.
7. It is quick to prepare.
8. It is low in saturated fats.
9. Other (specify) _____

36. What is the major reason for inclusion or exclusion of margarine in your diet? Select one only.

1. I like the texture/consistency.
2. I prefer the flavor of butter.
3. I don't like margarine.
4. It is high in calories.
5. It is low in cholesterol and saturated fats.
6. It is less expensive than butter.
7. Other (specify) _____

37. What is your major reason for inclusion or exclusion of liver in your diet? Select one only.

1. I like the taste.
2. I dislike the taste and/or texture.
3. It is inexpensive.
4. It is easy to prepare.
5. It is low in calories.
6. It is high in cholesterol.
7. It is a good source of iron and vitamin A.
8. Other (specify) _____

38. What is your major reason for inclusion or exclusion of milk in your diet? Select one only.

1. I don't like milk.
2. Milk upsets my stomach.
3. Milk is fattening.
4. Milk is a good source of calcium.
5. "Every body needs milk."
6. Milk is inexpensive.
7. Milk is a good source of protein.
8. I don't believe that adults need milk.
9. Other (specify) _____

39. What is your major reason for the frequency which you take vitamin supplements? Select one only.

1. I feel I need them daily.
2. I feel I need them occasionally.
3. They make me feel better.
4. I need them, but I forget to take them.
5. I feel I don't need them.
6. Other (specify) _____

40. What vitamin supplements do you use? _____

Teacher Questionnaire II
Part A

1. Which of the following teaching techniques did you use with this class in the nutrition unit just completed?

_____ movies
_____ filmstrips
_____ slide/tape
_____ lecture
_____ study guides
_____ student written reports
_____ student oral reports
_____ discussion--large groups
_____ discussion--small groups
_____ role playing
_____ case studies
_____ field trips
_____ guest speakers
_____ other (list)

2. Have performance indicators been established for this unit? If so, please enclose a copy or list them here and on the reverse side.

3. Check which of the following topics you included with this class in the nutrition unit this year. Rank the four topics which received the most emphasis with (1) indicating the most emphasis, and (4) indicating least emphasis.

_____ weight control
_____ skipping meals
_____ between meal snacks
_____ fad diets
_____ not enough protein
_____ junk foods
_____ health foods
_____ anemia
_____ not enough money
_____ athletic training
_____ home influence
_____ deficiency diseases
_____ nutritional labeling
_____ other (specify)

4. What is the grade level of this class?

_____ 9th grade
_____ 10th grade
_____ 11th grade
_____ 12th grade
_____ mixed (specify) _____

5. How long was the nutrition unit? _____ days _____ weeks

6. Did you integrate nutrition into other units taught this class?

_____ yes _____ no
If yes, indicate which units

7. Do you integrate nutrition into other courses you teach?

_____ yes _____ no
If yes, indicate which courses

8. Do you feel the time spent on nutrition was adequate?

   a. more than enough time
   b. all the time nutrition deserves--other important areas
   c. about the right amount of time to maintain interest
   d. not enough time

Omit #9 if you are a home economics teacher; answer #10

9. How much time did you spend on each of the following "units" with this class?

   _____ drug and alcohol abuse
   _____ sex education
   _____ mental health
   _____ communicable diseases

Omit #10 if you are a health teacher; answer #9 (above)

10. How much time did you spend on each of the following "units" with this class?

   _____ food preservation
   _____ party meals
   _____ microwave cookery
   _____ cooking on a budget

11. Compared with other subjects you teach, how important is nutrition to you?

Very important				Not important
5	4	3	2	1

12. If you are able to take a nutrition course at OSU next summer, which of the following do you feel would be <u>most</u> beneficial to you? Select <u>one</u> only.

   _____ Food Additive Hazards
   _____ Pregnancy and the Teenager
   _____ Organic Gardening
   _____ Therapeutic Nutrition for the Ill
   _____ Special Nutritional Needs of the Athlete
   _____ Effective Teaching Tools for Nutrition

13. If you could attend a conference on only one of the following topics, which would you select? Select only <u>one.</u>

   _____ Alcoholic Teens
   _____ Audiovisual Teaching Skills
   _____ Nutrition for Teens
   _____ An Ecologically Sound Environment
   _____ Sex Education for Teens

14. In terms of your concern about maintaining good health, rank the following items from (5) most concern to (1) least concern.

_____ exercise
_____ annual medical exam
_____ sleep and rest
_____ well balanced diet
_____ "clean" environment

Continue with Part B on the next page.

15. What reading sources did your students use in this nutrition unit (textbooks--title and author, pamphlets, etc.)?

Part B (Note: for Appendix copy, correct answers have been underlined.)

For each question, select the one best response and circle the appropriate letter. Also, for each question, indicate the degree of certainty you feel that your response is correct and check in the appropriate column.

Very confident	Rather confident	Reasonably certain but some doubt	Rather uncertain	Very uncertain

1. Why do adults gain weight?

   a. Overweight is hereditary
   b. Overweight is unavoidable with age.
   c. Their calorie intake is higher than their energy output.
   d. They like sweets.

2. Which of the following factors primarily determines basal metabolic needs?

   a. altitude at which the individual lives
   b. amount of activity
   c. number of kilocalories consumed
   d. size of individual

3. Which of the following foods is highest in calories?

   a. 1 cup of whole milk
   b. 3 ounces of steak
   c. 10 potato chips
   d. 1 medium baked potato

*4. Excessive intake of raw egg white will result in deficiency of which vitamin?

   a. biotin
   b. pantothenic acid
   c. riboflavin
   d. vitamin C

5. Which of the following statements is true about foods which contain carbohydrates other than sugars?

   a. are often an expensive source of calories
   b. are usually a source of "empty calories"
   c. are usually "fattening foods" which stimulate weight gain
   d. should be consumed as a larger proportion of the diet than currently (in U. S.)

* Insignificant information question

Very confident	Rather confident	Reasonably certain but some doubt	Rather uncertain	Very uncertain

6. The weight reduction diet should provide at least how many grams of carbohydrate?

   a. 10-40 grams
   b. 50-100 grams
   c. 110-150 grams
   d. 160-200 grams

7. Which of the following family members would require the greatest amount of protein per day?

   a. 10 year old daughter (37 kg) who takes ballet
   b. 15 year old son (68 kg) who is trying to lose weight before the wrestling season
   c. 34 year old mother (58 kg) who is pregnant
   d. 38 year old father (75 kg) who works as a logger

8. Which of the following statements is true about essential amino acids?

   a. They can be synthesized by the cell if adequate carbon molecules are available.
   b. They can be used only for building muscle protein.
   c. They cannot serve as sources of energy.
   d. They must be provided pre-formed from food.

9. When may athletes need more protein than is usually required for their age and size?

   a. as part of the daily intake at all times
   b. during training for a new sport
   c. in the pre-game meal
   d. 3 days prior to a competitive event

10. What happens to protein that is consumed in excess of immediate body needs for protein?

    a. converted to energy sources and urea
    b. excreted as protein molecules by way of the urine
    c. stored as protein molecules in the liver and muscle
    d. totally converted to glycogen storage in the liver

11. Which of the following statements is true about people who have lactose (milk sugar) intolerance?

    a. are allergic to milk protein
    b. must avoid all milk products
    c. often tolerate small amounts of milk
    d. will not react to large doses of pure lactose

Very confident	Rather confident	Reasonably certain but some doubt	Rather uncertain	Very uncertain

12. If a diet were extremely low in fat, which of the following nutrients might be absorbed in insufficient amounts?

    a. calcium
    b. folacin
    c. vitamin A
    d. vitamin C

13. At present, what % of the total calories in the average American diet comes from fat?

    a. 15-25%
    b. 26-35%
    c. 36-45%
    d. 46-55%

*14. Acute thiamin deficiency would be characterized by which of the following?

    a. beri-beri
    b. pellagra
    c. rickets
    d. scurvy

15. Which of the following is a good source of vitamin A?

    a. cauliflower
    b. pineapple
    c. pumpkin
    d. red cabbage

16. Which one of the following statements about vitamin E has been supported by research?

    a. effective in treating infertility in humans
    b. generally low in American diets
    c. protects polyunsaturated fats from oxidation
    d. significantly slows the aging process

17. In addition to 10 grams protein from breads and vegetables and the protein from 1 quart of milk per day, which of the following food combinations will provide the Recommended Dietary Allowance of 60g protein, but no extra, for a 16 year old boy?

    a. 2 oz of cheddar cheese, 4 oz chicken
    b. 1 c baked beans, 2 hot dogs, 3 oz tuna
    c. 4 oz hamburger, 8 oz steak
    d. 2 T peanut butter, 1 egg

Very confident	Rather confident	Reasonably certain but some doubt	Rather uncertain	Very uncertain

18. Under what conditions will a significant amount of riboflavin be destroyed?

a. glass milk bottles left in sunlight
b. lemon juice added to vegetables
c. pasteurization of milk
d. vegetables cooked in small amount of water

19. What is the probable effect of very large doses of vitamin A as a supplement taken for six months or longer?

a. acne prevented
b. excess excreted in the urine
c. nausea, bone soreness
d. orangish tint to skin

*20. What is the result of a deficiency in the absorption of cobalamin?

a. pellagra
b. pernicious anemia
c. rickets
d. scurvy

*21. Which nutrient was substantially destroyed in an early commercial baby formula due to high processing temperatures?

a. calcium
b. niacin
c. vitamin E
d. vitamin B_6

22. Which of the following minerals is important for muscle contraction, nerve stimulation and blood clotting?

a. calcium
b. iron
c. magnesium
d. manganese

23. This vitamin is an important coenzyme for many reactions, especially those related to protein metabolism; its requirement is related to protein intake. Which vitamin is it?

a. biotin
b. folic acid
c. pantothenic acid
d. vitamin B_6

Very confident	Rather confident	Reasonably certain but some doubt	Rather uncertain	Very uncertain

24. Which of the following nutrients is most susceptible to loss in processing of fruits and vegetables (i.e. cooking, canning, drying, etc.)?

a. calcium
b. folacin
c. iron
d. niacin

25. Impaired taste acuity, suboptimal growth, and delayed sexual maturation may be deficiency symptoms of which nutrient?

a. copper
b. protein
c. selenium
d. zinc

26. In completely vegetarian diets which of the following nutrients will always be in short supply?

a. carbohydrate
b. protein
c. thiamin
d. vitamin B_{12}

27. Which of the following is true about the statement; Vitamin supplements are necessary for most Americans because we cannot meet our nutrient requirements with food.

a. Most research supports this position.
b. Most research does NOT support this position.
c. The evidence on this subject is inconclusive.
d. There is little research on this subject.

28. With the 1974 Recommended Daily Allowances (RDAs) how was the allowance for ascorbic acid affected?

a. decreased 25% as a result of recent findings
b. increased 25% as a result of recent findings
c. increased substantially as a result of Pauling's work
d. remained the same as the 1968 RDA.

29. What is thought to be the major role of vitamin D?

a. an antioxidant which protects polyunsaturated fatty acids
b. a coenzyme in glycolysis
c. a regulator of the metabolism of calcium and phosphorus
d. controls absorption of sodium and potassium

Very confident	Rather confident	Reasonably certain but some doubt	Rather uncertain	Very uncertain

30. For the adolescent (11-18) the Recommended Dietary Allowance (RDA) for calcium is 1200 mg per day. Which of the following combinations of food will most closely meet that recommendation?

a. 3 c milk, 1/2 c cottage cheese
b. 3 c milk, 1 c strawberry yogurt
c. 2 c milk, 2 oz canned salmon, 1/2 c cauliflower
d. 2 c milk, 2 oz beef liver, 1/2 c beet greens

*31. What is the gland involved in the production of hormones which influence calcium absorption?

a. adrenal
b. hypothalamus
c. parathyroid
d. pituitary

32. Iron is most readily absorbed from which of the following foods?

a. eggs
b. green vegetables
c. meat
d. whole grain cereals

33. Which of the following cooked foods has the greatest amount of iron?

a. baked beans (1 cup)
b. raisin bread (2 slices)
c. salmon (3 oz)
d. turnip greens (1/2 cup)

34. A balanced and varied American diet of 2000 Kcalories daily is likely to contain how many mg of iron?

a. 6
b. 12
c. 18
d. 24

35. What is the increase in calories per day needed by the pregnant woman?

a. none
b. 300 Kcal
c. 900 Kcal
d. 1500 Kcal

Very confident	Rather confident	Reasonably certain but some doubt	Rather uncertain	Very uncertain

36. What would be a desirable weight gain by the end of pregnancy for a woman, 5'4", normally weighing 115 lbs?

    a. 8 lbs
    b. 15 lbs
    c. 25 lbs
    d. 35 lbs

37. What do recent studies indicate about sodium during pregnancy?

    a. has no essential function
    b. is not related to hypertension
    c. increased physiological need
    d. should be carefully restricted

38. The Recommended Dietary Allowances (RDAs) for the pregnant teenager will be the same as which of the following?

    a. any girl her age and size plus allowances for pregnancy
    b. any male teen of the same size
    c. any pregnant woman of equal size
    d. any teen girl minus 300 Kcal daily to decrease the risk of toxemia and excessive weight gain

39. Which of the following practices is desirable to prevent infant obesity?

    a. Dilute the commercial formula to 1/2 the normal concentration for the first six months.
    b. Start the infant on solid food at the age of 3 weeks.
    c. Rely on breast milk or prescribed amounts of infant formula for the first 6 months.
    d. Use skim milk for the first year.

40. Which of the following people is considered to be a reputable authority on nutrition?

    a. Dr. Robert Atkins
    b. Adele Davis
    c. Jean Mayer
    d. Linus Pauling

Very confident	Rather confident	Reasonably certain but some doubt	Rather uncertain	Very uncertain

41. What are the United States Recommended Daily Allowances (U. S. RDA) for adults?

   a. higher than the Recommended Dietary Allowances (RDAs) for most Americans
   b. identical to the Recommended Dietary Allowances (RDAs)
   c. lower than the Recommended Dietary Allowances (RDAs) for most Americans
   d. minimum amounts necessary to prevent deficiency diseases--the same as the MDR

42. What are the nutrients that appear to be low in some U. S. diets according to surveys like the USDA Food Consumption Study and the HEW National Nutrition Survey?

   a. calcium, iron, vitamins A and C
   b. calcium, phosphorus, iron, vitamins D and E
   c. protein, pyridoxine, folacin, iodine
   d. protein, riboflavin, niacin, vitamin C

43. Which of the following is true about the statement: Large intakes of vitamin C (1-2 g per day) will prevent the common cold.

   a. Most research supports this position.
   b. Most research does NOT support this position.
   c. There is little research on this subject.

44. Which of the following was recently recommended by the U. S. Senate Committee on Nutrition?

   a. Add bran to our diets whenever possible
   b. Decrease the total amount of fat in our diets, but increase the proportion of polyunsaturated fats.
   c. Increase the proportion of calories from foods high in protein.
   d. Provide for grain storage for national emergency.

45. Which of the following is an example of complementary proteins?

   a. baked beans and cornbread.
   b. 3 bean salad
   c. peanut casserole (peanuts, almonds, beef broth, potatoes)
   d. yams and sweet potatoes with brown sugar and butter

Teacher Questionnaire III

Part I. The following questions pertain to the nutrition unit you taught to the survey class. Please identify the topics which received major emphasis. Answer "yes" if a topic received major emphasis; answer "no" if the topic was not covered or mentioned only in a minor way.

Yes	No		
____	____	1.	Basic Four food groups and servings of each required daily.
____	____	2.	Meal planning using Basic Four as a guide.
____	____	3.	Food fads and myths.
____	____	4.	Nutritional deficiency diseases.
____	____	5.	Relationship of diet to good health.
____	____	6.	Student analysis of own diet by keeping diet records.
____	____	7.	Nutrient functions in body.
____	____	8.	Nutritional needs during pregnancy.
____	____	9.	Nutrient labeling.
____	____	10.	Food sources of various nutrients.
____	____	11.	Nutritious snacks.
____	____	12.	Weight control.
____	____	13.	Nutrition and athletics.
____	____	14.	Retention of nutrients in food preparation.
____	____	15.	RDAs - Recommended Dietary Allowances.
____	____	16.	Other - Specify _____

TEACHER DIETARY RECORD INSTRUCTIONS

WHAT DO I EAT?

Using the forms on the following pages, please keep track of all food and beverages you eat and drink for the next two days. Begin with today's breakfast. You do not need to consider water, but include everything else - milk, lo-cal pop, tea, coffee, etc. Try to estimate the amounts of food eaten as closely as possible using common measures - cups, ounces, slices, etc. Don't forget to include second helpings. If the food is a combination of several things, such as pizza or tossed salad, describe the ingredients as best you can - be a detective! Be sure to include all the food you eat - at meals and in between - even those "tastes" and "nibbles". It will be easiest to remember what you eat if you write it down as soon as possible, right after eating!

Height _____ (inches) Weight _____ (pounds) Day of week _____

Sex _____ (male) _____ (female) Age _____

	Food and Description	Amount	Other Information
Food eaten before 10 AM			
Food eaten from 10 AM - 2 PM			
Food eaten from 2 PM - 5 PM			
Food eaten from 5 PM - 8 PM			
Food eaten after 8 PM			

How much choice did you have in selecting your food today?

a. No choices, all my food was served to me.
b. No choice for meals, but some choice for snacks.
c. Limited choice for meals, many choices for snacks.
d. Complete choice for some meals, limited choice for some meals, many choices for snacks.
e. Complete choice of all food eaten today.

APPENDIX C

STUDENT PRE-TEST

HELLO!

You have been selected to participate in a survey about teenage nutrition. The purpose of the survey is to find out what you eat and what you know about nutrition. The results of the survey will be used to improve nutrition education programs for adolescents. Students from fifty high schools in western Oregon will be participating in the study. Because we want the survey to represent all teenagers, we hope you will agree to participate, but the choice is yours. Most of Questionnaire A will be completed in class today; the other part will take a few minutes of your time and you will bring it to class with you tomorrow. Your teacher will give you Questionnaire B later this term. Of course, the information you give is confidential; your name and the name of your school will not be connected in any way with your responses. Because this is part of a research project, your teacher cannot go over the questionnaire with you until the unit on nutrition is completed. If you agree to participate in the survey, begin answering the TEEN NUTRITION INVENTORY now. Notice that there are two parts. You will complete Part I in class today; Part II, which is only one page, you will fill out and return to class tomorrow.

Thank you for your help,

Jean Skinner
graduate student,
Oregon State University

TEEN NUTRITION INVENTORY

PART I

1. Please check which of the following science courses you have taken in high school. Include 9th grade, also.

_____ Biology
_____ Human biology/physiology
_____ General science
_____ Chemistry
_____ Physics
_____ Health
_____ Other (list)

2. What classes have you taken which included nutrition?

3. Where else, besides classes, have you learned about nutrition? Check all which apply.

_____ Friends
_____ Parents
_____ Books
_____ Magazines
_____ Television
_____ 4-H or Scouts
_____ Coaches
_____ Other (list)

Select the one best response to each question. If you don't know, use your best guess. Circle your answer. (Note: for Appendix copy, correct answers have been underlined.)

1. What are the "Basic 4"?

a. The 4 food groups which are recommended for inclusion in meal planning each day.
b. The 4 nutrients needed for health: protein, fats, carbohydrates and vitamins.
c. The 4 proteins which are basic for growth.
d. The 4 vitamins which are needed each day as a basis for health

2. What is a Calorie?

a. A measurement of the energy value in foods
b. A measurement of the vitamin content in foods
c. A way of measuring body fatness
d. The amount of fat in foods

3. Which of the following would contribute the most calories to the diet?

a. A medium potato
b. One hamburger bun
c. 2/3 cup of cooked rice
d. Two tablespoons of mayonnaise

4. Which of the following would be a safe and effective way to lose weight?

a. Eat only foods high in protein
b. Eat only one meal per day
c. Eliminate carbohydrates from diet
d. Reduce the daily intake of calories

5. Which class of nutrients furnishes the chief source of energy on a world basis?

   a. Carbohydrates
   b. Fats
   c. Proteins
   d. Vitamins

6. Which of the following lunches would be most nutritious for the teen age boy who is trying to lose 5 lbs before wrestling season begins?

   a. Skip lunch
   b. 1 c skim milk, 1 c cottage cheese, celery (2 stalks) spread with peanut butter (2 T).
   c. 1 small bag potato chips
   d. 1 c vegetable soup, 1 c skim milk, 1 slice toast.

7. The Recommended Dietary Allowances (RDAs) for the pregnant teenager will be the same as which of the following?

   a. Any pregnant woman of equal size
   b. Any teen girl minus 300 Kcalories (calories) daily to decrease the risk of toxemia and excessive weight gain
   c. Any male teen of the same age
   d. Any girl her age and size plus allowances for pregnancy

8. Which of the following is a common problem in American diets?

   a. Not enough protein
   b. Too high in calcium
   c. Too high in calories
   d. Too low in fat

9. If a diet were extremely low in fat, which of the following nutrients might be absorbed in insufficient amounts?

   a. Iron
   b. Folacin
   c. Vitamin C
   d. Vitamin A

10. The diet of a well-trained athlete should contain extra amounts of which of the following?

   a. Calories
   b. Iron
   c. Protein
   d. Vitamin E

11. Which of these statements is most nearly true?

   a. As protein quality increases, the total quantity needed can decrease.
   b. The total amount of protein needed by an individual is a set amount, not affected by the source of protein.
   c. To meet the protein allowance, 75% of the protein should come from animal sources.
   d. Gelatin is as good a source of protein as fish.

12. What does the body do with protein that is eaten in excess of immediate body needs for protein and energy?

a. Convert it to body fat and urea.
b. Convert it into muscle.
c. Excrete it as protein - by way of the urine.
d. Store it as protein for future needs.

13. Protein in the diet is the body's only source of which of the following?

a. Carbon
b. Hydrogen
c. Iron
d. Nitrogen

14. In completely vegetarian diets, which of the following nutrients will always be in short supply?

a. Carbohydrate
b. Protein
c. Thiamin
d. Vitamin B_{12}

15. Which of the following is a good source of vitamin A?

a. Cabbage
b. Cauliflower
c. Pineapple
d. Sweet potatoes

16. The Recommended Dietary Allowance (RDA) for vitamin C for a 16 year old boy can be met by which of the following foods?

a. 1/2 c prune juice
b. 1/2 c cooked spinach
c. 1 cut fresh pineapple
d. 1 orange (fresh)

*17. Beri-beri is caused by a severe deficiency of which nutrient?

a. Niacin
b. Protein
c. Thiamin
d. Vitamin C

*18. Rickets is caused by a severe deficiency of which nutrient?

a. Iron
b. Calories
c. Thiamin
d. Vitamin D

*Insignificant information question.

19. Because of the high caloric intake during adolescence, the need for which nutrient is higher than at any other time during one's lifetime?

a. Thiamin
b. Vitamin A
c. Vitamin C
d. Zinc.

20. Which one of the following nutrients would partially be destroyed if chopped broccoli were cooked in excess water?

a. Vitamin C
b. Vitamin A
c. Vitamin D
d. Chlorophyll

21. Which of the following foods has the greatest amount of iron?

a. 1 pint whole milk
b. 1/2 c. orange juice
c. 3 oz salmon
d. 3 oz lean beef

22. Vitamin D, "the sunshine" vitamin, can also be obtained from food. What is the major food source in American diets?

a. Eggs
b. Enriched cereals
c. Fortified milk
d. Unprocessed milk (raw milk)

23. It is recommended that a good source of vitamin C be included in the diet at least how often?

a. Every meal
b. Daily
c. Weekly
d. Every two weeks

24. What is the Recommended Dietary Allowance (RDA) for iron for a 15 year old boy?

a. The same as a teen girl
b. The same as an adult man
c. Less than an adult woman
d. The same as a 10 year old boy

25. Which of the following foods provides the calcium equivalent to that in 8 oz milk?

a. 1/2 c ice cream
b. 1/2 c asparagus
c. 1 c buttermilk
d. 1/2 c beet greens

26. Which statement is true about the "fruit and vegetable" group of the Basic 4?

a. Is a major source of calories
b. Is a major source of protein
c. Is chiefly important as a carrier of minerals, vitamins, and fiber (cellulose)
d. Does not include potatoes as a vegetable

27. It is known that a well-balanced diet will prevent which of the following diseases?

a. Cancer
b. Common cold
c. Heart attacks
d. Scurvy

28. The Recommended Dietary Allowances (RDAs) are levels of intake of essential nutrients

a. Adequate to meet the requirements of every individual
b. Identical to the U. S. Recommended Daily Allowances (USRDA)
c. Adequate to meet the known nutritional needs of almost all healthy persons
d. The amounts of nutrients needed per person in the national food supply

29. Which of the following breakfasts will most nearly provide 1/4 of the day's nutrient needs for a 16 year old girl?

a. 1 glass Tang (8 oz.), 2 fried eggs, 4 links sausage, 1 sweet roll, coffee
b. 3 waffles with maple syrup, lemonade
c. 1 slice cold pizza, glass of milk
d. 1 piece chocolate cake, glass of milk

30. Which of the following would be the most appropriate after-school snack for a 15 year old boy who is trying to add pounds before the beginning of football season?

a. 2 "Big Macs" (hamburgers), chocolate milkshake
b. 2 apples
c. 2 chocolate bars
d. French fries and pop

STUDENT POST-TEST

HELLO!

You may remember that your school was selected to participate in a survey about nutrition education. Earlier this semester you completed a questionnaire about nutrition. Now it is time to see how much you have learned and how your ideas about nutrition have changed. This questionnaire is very similar to the one you took earlier. Part I has 24 multiple choice questions, part II is a diet record for you to record what you eat for one day. Continue now with part I; return part II to class tomorrow.

Thank you for your help,

Jean Skinner
graduate student
Oregon State University

Teen Nutrition Inventory 2

Part I (Note: for Appendix copy, correct answers have been underlined.)

Select the one best response to each question. If you don't know, use your best guess. Circle your answer.

1. Which of the following terms is used as a measure of the amount of energy a food contains?

   a. Calories
   b. Carbohydrates
   c. Nutrients
   d. Vitamins

2. The "Basic 4" food groups include 1) milk and milk substitutes, 2) meats, 3) fruits and vegetables. What is the 4th category?

   a. Bread and butter
   b. Breads and cereals
   c. Legumes and poultry
   d. Fats (butter and margarine)

3. Why do adults gain weight?

   a. Overweight is hereditary
   b. Overweight is unavoidable with age
   c. They eat more than they use up
   d. They like sweets

4. Which of the following foods would contribute the most calories to the diet?

   a. 10 potato chips
   b. 1 baked potato
   c. 3 oz steak, trimmed of visible fat
   d. 8 oz whole milk

5. For most people in the world, the major source of energy comes from which of the following nutrients?

   a. Carbohydrates
   b. Fats
   c. Proteins
   d. Vitamins

6. Which of the following lunches would be most nutritious for the teen age girl who is trying to lose 5 lbs before the gymnastic season begins?

   a. Skip lunch
   b. 1 c skim milk, 1 c yogurt, 1 apple
   c. 1 small bag of cheese crackers
   d. 1 c vegetable soup, 1 c skim milk, 1 slice bread

7. The Recommended Dietary Allowances (RDAs) for the pregnant teenager will be the same as which of the following?

   a. Any girl her age and size plus allowances for pregnancy
   b. Any boy of the same age
   c. Any pregnant woman of equal size
   d. Any teen girl minus 300 calories daily to decrease the risk of toxemia and excessive weight gain

8. Which of the following nutrients are often low in U. S. diets according to national surveys?

   a. Iron and calcium
   b. Protein and iron
   c. Protein and vitamin C
   d. Vitamins D and E

9. What is one important use of fat in the diet?

   a. Carrier for vitamin C
   b. Carrier for protein
   c. Carrier for vitamin D
   d. Carrier for niacin

10. Which of the following foods has the greatest amount of iron?

    a. 1 c yogurt
    b. 1/2 fresh grapefruit
    c. 3 oz fish
    d. 3 oz hamburger

11. When is extra protein needed by athletes?

    a. As part of the daily intake at all times
    b. In the pre-game meal
    c. 3 days prior to a competitive event
    d. During the training period for a new sport

12. Why are vegetable proteins of a poorer quality than animal proteins?

    a. They contain less energy
    b. They slow down digestion
    c. They lack certain amino acids
    d. They contain less fat

13. What happens to protein that is consumed in excess of immediate body needs for protein and energy?

    a. Converted to body fat and urea
    b. Converted into muscle
    c. Excreted as protein--by way of the urine
    d. Stored as protein in the liver

14. What are amino acids?

a. Toxic food additives
b. Necessary food preservatives
c. The fundamental unit of all proteins
d. An acid found in many fruits

15. In completely vegetarian diets, which of the following will always be supplied in smaller amounts than a diet which contains animal foods?

a. Carbohydrate
b. Cholesterol
c. Thiamin
d. Vitamin C

16. Which of the following is a good source of vitamin A?

a. Potatoes
b. Beets
c. Oranges
d. Winter squash (yellow)

17. Which of the following is a good source of vitamin C?

a. Bananas
b. Onions
c. Peaches
d. Strawberries

*18. Pellagra is caused by a severe deficiency of which nutrient?

a. Copper
b. Niacin
c. Vitamin A
d. Vitamin E

*19. Scurvy is caused by a severe deficiency of which nutrient?

a. Protein
b. Riboflavin
c. Vitamin C
d. Vitamin D

20. Because of the high caloric intake during adolescence, the need for which nutrient is higher than at any other time during one's lifetime?

a. Niacin
b. Vitamin E
c. Vitamin C
d. Zinc

* Insignificant information questions.

21. Under what conditions will a significant amount of riboflavin be destroyed?

a. By heat in cooking of vegetables
b. High temperatures as in processing (canning) vegetables
c. Glass bottles left in sunlight
d. Pasteurization of milk

22. What is the major source of vitamin D in the American diet?

a. Eggs
b. Enriched cereals
c. Fortified milk
d. Unprocessed milk (raw milk)

23. It is recommended that a good source of leafy green or yellow vegetables be included in the diet at least how often?

a. Once a day
b. Every other day
c. Weekly
d. Every two weeks

24. A balanced and varied American diet of 2000 calories daily is likely to how nearly meet the iron needs of a 16 year old girl?

a. Almost always fulfill her needs.
b. Greatly exceed the Recommended Dietary Allowance (RDA) in most cases
c. Will fulfill the Recommended Dietary Allowance (RDA) only if the diet follows the Basic 4.
d. Will not meet her needs unless liver and iron fortified cereals are often included.

25. Which of the following foods provides the calcium equivalent to that in 8 oz milk?

a. 8 oz strawberry yogurt
b. 1/2 cup borccoli
c. 1/2 cup cottage cheese
d. 1/2 cup spinach

26. Which of the following statements is true about the "meat group" of the Basic 4?

a. Is most likely to be present in insufficient amounts in the American diet
b. Would need the equivalent of 12 oz cooked lean meat to provide recommended amounts
c. For the "vegetarian", equivalents of dried peas, beans or nuts can substitute in this group.
d. Is responsible for furnishing large amounts of vitamin C.

27. Large intakes of vitamin C (1-2 g per day) will prevent common cold. Which of the following statements is true?

a. Most nutrition authorities support this statement.
b. Most nutrition authorities do not support this statement.
c. There is little known on this subject.

28. What are the U. S. Recommended Daily Allowances (USRDA)?

a. Higher than the Recommended Dietary Allowances (RDAs) for most Americans
b. Identical to the Recommended Dietary Allowances (RDAs)
c. Lower than the Recommended Dietary Allowances for most Americans
d. Minimum amounts necessary to prevent deficiency diseases--the same as the MDR

29. Which of the following would be the most appropriate after-school snack for a 17 year old girl who does not want to gain weight?

a. 1 "Big Mac" (hamburger), and chocolate shake
b. French fries and pop
c. 2 apples, glass of milk
d. one chocolate bar and a low-calorie Coke

30. Which of the following breakfasts will most nearly provide 1/4 of the day's nutrient needs for a 16 year old boy?

a. Orange pop, 2 fried eggs, sausage, 3 slices toast with butter and jam
b. 2 waffles with maple syrup and ice cream, 1/2 grapefruit, 1 c milk
c. 3 doughnuts, coffee
d. 2 scrambled eggs, 2 glasses of milk

For the following questions, indicate how you feel. The questions apply to this class only.

31. In the nutrition unit which you studied recently, which of the following activities were included? Check all those which apply. Star (*) the two activities from which you learned the most.

_____ Movies
_____ Filmstrips
_____ Slide/tape
_____ Lecture
_____ Study guides
_____ Student written reports
_____ Student oral reports
_____ Discussion--large groups
_____ Discussion--small groups
_____ Role playing
_____ Case studies
_____ Field trips
_____ Guest speakers
_____ Other (list)

32. How concerned is your teacher about your diet?

a. Very concerned
b. Quite concerned
c. Slightly concerned
d. He/she doesn't care

33. How concerned is your teacher about your health?

a. Very concerned
b. Quite concerned
c. Slightly concerned
d. He/she doesn't care

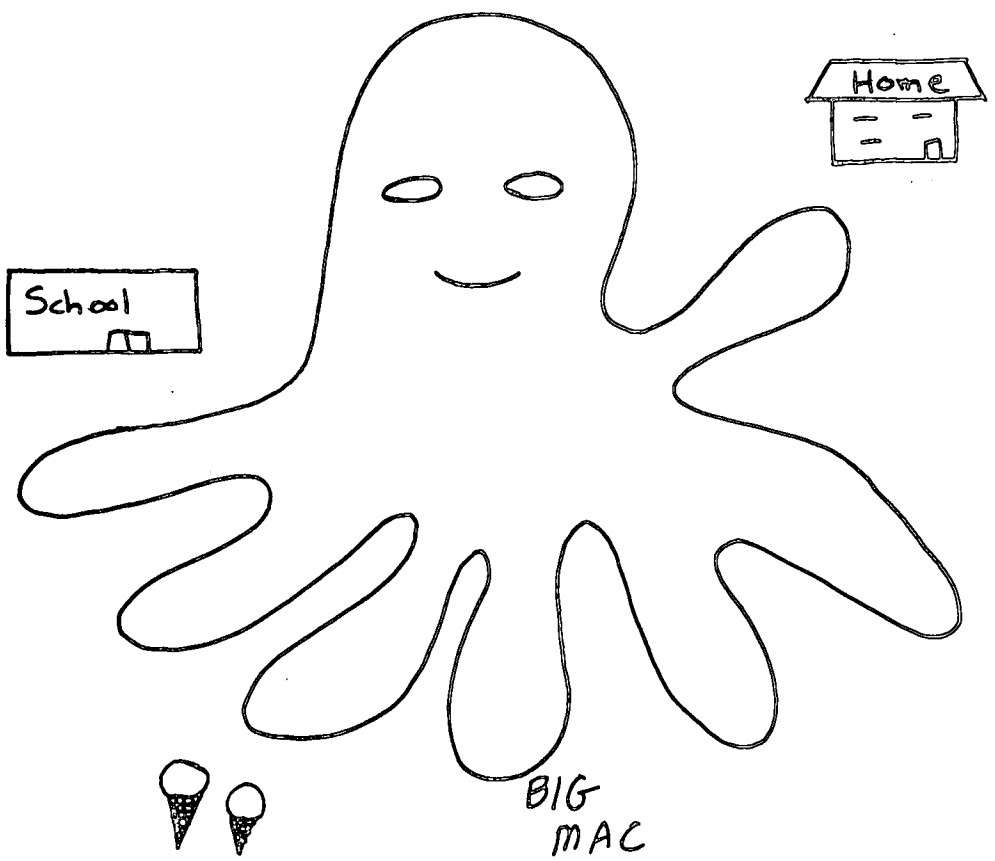
34. How concerned is your teacher about your problems?

a. Very concerned
b. Quite concerned
c. Slightly concerned
d. He/she doesn't care

PART II

WHAT DO I EAT?

Using the form on the following page, please keep track of all food and beverages you eat between now and this time tomorrow. You do not need to consider water, but include everything else - milk, lo-cal pop, tea, coffee, etc. Try to estimate the amounts of food eaten as closely as possible using common measures - cups, ounces, slices, etc. Don't forget to include second helpings. If the food is a combination of several things, such as pizza or tossed salad, describe the ingredients as best you can - be a detective! Be sure to include all the food you eat - at meals and in between - even those "tastes" and "nibbles". It will be easiest to remember what you eat if you write it down as soon as possible. Take the form with you today, fill it out, and bring it back to class tomorrow.



STUDENT DIETARY RECORD FORM

Height _____ (inches) Weight _____ (pounds)

Sex _____ (male) _____ (female) Age _____

	Food and Description	Amount	Other Information
Food eaten before 10 AM			
Food eaten from 10 AM - 2 PM			
Food eaten from 2 PM - 5 PM			
Food eaten from 5 PM - 8 PM			
Food eaten after 8 PM			

How much choice did you have in selecting your food today?

a. No choices, all my food was served to me.
b. No choice for meals, but some choice for snacks.
c. Limited choice for meals, many choices for snacks.
d. Complete choice for some meals, limited choice for other meals, many choices for snacks.
e. Complete choice of all food eaten today.