TEACHING METRIC UNITS IN FOOD PREPARATION TO PRESERVICE TEACHERS: A COMPARISON OF THREE STRATEGIES

by

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ABSTRACT

This study compared a lecture, a learning activity package and group decision as processes for assisting home economics preservice teachers learn about metric units used in food preparation. Cognitive knowledge, self-rated proficiency in using metric units, feelings about using metric units, attitude toward the teaching strategy and a metric behavior inventory were the criterion measures. Criterion measures were taken pre-/post-test and follow-up five weeks later. Findings indicated no significant difference in treatment groups on the cognitive knowledge test, attitude toward the teaching strategy or the metric behavior inventory. Significant differences were found on feelings about using metric units. Those in the learning activity package group made significant gains in score pre-test to follow-up. Significant differences were also found on self-rated proficiency in using metric units. The lecture treatment group made significant gains in score pre-test to follow-up.

CHAPTER 1

INTRODUCTION

The Metric System in Canada

In 1970 the Government of Canada stated its belief that the eventual adoption of the metric system (Systemes Internationale or SI) was inevitable and of national interest. Because of its simplicity and universality, approximately 90% of the world's population uses a metric system or is in the process of converting to a metric system.

Canada's conversion objective was to make the change in a manner that will "produce the greatest net benefit to the Canadian economy (White Paper on Metric Conversion, 1970, p. 1)." To achieve this objective, the Government of Canada established the Metric Commission whose function was to coordinate and stimulate metric conversion throughout the economy. To perform its task the Commission established ten steering committees responsible for coordinating the activities of all groups with related interests. In turn, 60 sector committees reported to the steering committees. For instance, Steering Committee Number Ten, Education, grouped together the sector committees comprised of representatives from elementary and secondary schools, universities and colleges, and post-secondary non-university education. The

guidelines within which each sector committee operated were classified according to the following phases: investigation, planning, scheduling and implementation. Target dates had been established for each of the phases. At various intervals sectors were expected to report back to the Commission to coordinate activities in all sectors. These target dates varied from sector to sector which means the re-education process has been gradual as opposed to a blitz-type program.

While the framework for changing to the metric system has been well delineated and described, the process for teaching the metric system to Canadian citizens has not been prescribed. For instance, the 1977 Metric Conversion Plan, Universities and Colleges simply stated to university and college personnel that

> . . . instructions are to: (1) determine courses to be adapted, (2) determine sequencing of course adaptations and introduce when possible, (3) plan course adaptations and introduce when possible, (4) change instructional operating procedures and manuals, and (5) introduce all course adaptations (Canadian Metric Commission, 1977a, p. 14).

The latter three objectives are to be met by 1980. The October 1978 Summary Report for Sector 10.04, Universities and Colleges, indicated that metric training was just beginning at the university level. Some of the assumptions of this report are that "those responsible [teachers] are committed to the implementation (Canadian Metric Commission,

1978, p. 1)." No mention, however, is made in either report of how to teach the metric system to the teachers. All the Commission's reports (1977, a, b, c; 1978) dealt with administrative and curricular changes with little direction given to the process of teaching the metric system to those who will ultimately have to incorporate the metric system into their courses.

Currently in public schools the implementation phase for conversion to the metric system has been reached. In order to prepare teachers to teach the metric system to public school students, professional organizations and school boards, since 1972, have provided access to metric workshops and inservice programs. There are still, however, teachers who have resisted the change to the metric system, due perhaps to lack of knowledge of the system and lack of committment. This has been evidenced by the lack of response to metric workshops for home economics teachers that this researcher has offered within the province of British Columbia.

Another sector of the teaching profession, as well, appears to have had limited experience with the metric system, that is, the preservice teacher. The preservice teacher is unprepared because Sector 10.04, Universities and Colleges, has not reached the implementation stage of the Canadian metric conversion plan.

Home economics preservice teachers have a particular need to be familiar with the metric system as the subjects dealt with under the umbrella of home economics probably encompass the largest number of topics to be affected by metric conversion. Eventually packaging units of all grocery and non-food items will be in metric units. Clothing, appliances and household goods will be measured in metric units. Metric units will also be used in recipes. A review of the literature disclosed no studies on the most effective means of preparing preservice home economic teachers for the task of teaching those metric units used in food preparation.

Processes of Teaching the Metric System

Not only is it the task of educators to find a process which will effectively teach specifics about the metric system, it would appear that changing attitudes will also need to be a consideration in the reeducation process. It seems that the more people know about the metric system the more they like it. According to a March 1977 Gallup Opinion Index (Reinken, 1977) there is a direct correlation between knowledge of the metric system and attitudes toward the metric system. While the acquisition of knowledge related to metric units used in food preparation could be relatively minor, changing attitudes may be more complex.

Whatever teaching approach is used, the experts have suggested that there are other considerations to make when

devising teaching strategies. Some feel that the best procedure for learning metric measuring is by the "hands-on" process (Warning, 1972) which involves the actual manipulating of materials. Some people consider learning metric units is like learning a new language (Odum, 1972); that is, people should be encouraged to learn metric terms and quantities rather than convert the metric units back into the previously used units. Another thought is to teach only what is needed when it is needed (Sokol, 1974). While there is some agreement on "thinking metric" (Chalupsky and Crawford, 1975; Odum, 1973; Warning, 1972), the best process for teaching metric measuring has not yet been determined.

There are a number of ways to impart knowledge and change attitudes. The mass media approach is often used by governments for changing attitudes as in the "buckle up for safety" campaign or in the campaign used to explain the function of war bonds during the Second World War. Salcedo (1974) found that mass media campaigns effect little attitudinal change, and in some cases there is even a boomerang effect, as in the campaign to change attitudes toward the use of gas versus oil in home heating. The mass media approach will likely be just as ineffective in changing attitudes of preservice home economics teachers toward the metric system. Further, mass media programs might not

provide sufficient knowledge needed for the teaching of the metric system to others.

Using groups is an alternative to the mass approach and within this framework there are a number of processes which might be used. Of these group approaches, the lecture, particularly at the university level, is a commonly used vehicle for imparting knowledge. While the lecture may be expeditious it does not provide for "hands-on" processes, for "thinking metric" or for group interaction. Finding qualified instructors to lecture could also be a problem since the metric planning phase has just begun at the university level.

Another process within the group framework is group decision. Group decision could allow for "thinking metric" and could incorporate "hands-on" experiences. Since learning about metric units has an affective component which might be easily incorporated into a group decision process, this might be an effective strategy. As in the case of the lecture, teachers would need to be conversant with metric units and group decision processes.

When mass media or group processes do not adequately meet the needs of the learners, then another alternative is to turn to individualized instruction. There are several types of individualized instruction models, but the one which is commonly used for isolated concepts is the learning

activity package. The advantage of this approach is that it can be designed to meet the needs of the learners, is self-contained and can be used when the learner is ready. The learning activity package also has limitations. The learner works in isolation as opposed to a group setting. While the cognitive component might be handled better by this process the affective component might not be so easily taught. Considerable effort, expertise and time as well, is needed to devise effective learning activity packages.

To be considered along with the experts' advice on how to teach the use of metric units in food preparation and the teaching strategy, is the matter of where and when to incorporate the teaching of metric units in the curriculum for preservice teachers of home economics. Because of the nature of the subject matter the teaching of metric units used in food preparation would likely be included as part of a home economics methods course. An appropriate time for this teaching to take place might be just prior to students going on practicuums.

Problem Statement

This researcher compared three strategies for teaching in terms of effectiveness in helping preservice home economics teachers acquire knowledge related to the use of metric units in food preparation, improve their proficiency in the use of metric units and develop a more positive

attitude toward using metric units. Also examined was the subject's attitude toward the teaching strategy. The three teaching strategies compared were: lecture, learning activity package and group decision.

Hypotheses to Be Tested

It was the intent of this study to test the null hypotheses that on repeated testing there were no significant differences in scores at the .05 level, among the three treatment groups--lecture, learning activity package and group decision on:

1. A metric knowledge test comprised of 24 multiple choice items.
2. On attitude toward using metric units on a semantic differential.
3. On a self-rated metric proficiency semantic differential.
4. On subsequent use of metric units measured on eight items of a behavior inventory.

Definitions

1. Behavior (metric) inventory--a list of activities related to the metric system which subjects might have pursued following the treatment.
2. Group decision--students in discussion groups of four or five, work on given problems to find solutions. Students

are asked to act individually in the implementation of solutions at the conclusion of the discussion.

3. Hands-on--the actual manipulation of materials needed to learn about a task.
4. Learning activity package--a self-contained unit of materials composed of objectives, concepts, learning experiences and pre- and post-tests. Learners select the learning experiences which relate to their needs and abilities and upon completion of the work write a post-test.
5. Lecture--a presentation of information made by an individual to a group.

Assumptions

The following assumptions were made:

1. The researcher was able to present the treatment sessions equally competently and without bias.
2. The information presented in the three treatment sessions was reliable.
3. The collection of post-test and metric behavior inventory data was done in a uniform manner.
4. The instruments used in data collection were reliable.
5. The subjects in the treatment groups were normally distributed in ability.
6. The subjects were equally motivated to learn about metric units.

7. The learning styles of the subjects in the three groups were normally distributed.
8. The classroom climate was positive so that learning could take place.
9. The events which occurred for the subjects during the six week lapse of time between the pre-test and the follow-up did not confound the results.

Limitations

The following were limitations for this study:

1. The treatment time was limited to a one-hour class session.
2. The participating subjects were limited to intact class groups enrolled in a home economics methods course for the academic year 1978-1979 at the University of British Columbia.
3. The subjects were drawn from one campus so it will not be possible to generalize to a larger population of home economics preservice teachers.

CHAPTER 2

SELECTED REVIEW OF THE LITERATURE

The purpose of this study was to investigate teaching strategies for preservice home economics teachers that might be effective for changing attitude and increasing knowledge of metric units used in food preparation. This group is particularly in need of metric information. Before the implementation of the metric system was achieved in Canadian secondary schools this group had left the public school system and the universities had not yet reached the implementation stage in the Canadian metric conversion plan. As well, Canadian standards for recipe conversion were established in 1975, metric utensils are on the market and in schools, foods are being packaged in metric units and recipes are published in metric units. For the above reasons, Canadian preservice teachers of home economics would appear to have need for metric information related to food preparation before they proceed to practicuums in the secondary school system.

This chapter is concerned with a discussion of the structure for the Canadian metric conversion program, processes of learning and the three teaching strategies used for teaching the use of metric units in food preparation to

preservice home economics teachers. The three teaching strategies that were considered as possible alternatives for learning about the metric system were: lecture, learning activity package and group decision.

Structure for the Canadian Metric Conversion Program

In Canada, one of the aims of the metric conversion program is to raise the nation's awareness of the metric system, the premise being that if awareness is raised, then attitudes will change. The framework for this conversion process is the Metric Commission. To implement change, steering committees coordinate activities of sub-groups called sectors. All steering committees, under the Metric Commission, are committed to providing knowledge for the public through all sector levels. Each sector has a detailed plan description which delineates the exact process for the overall conversion in Canada.

Steps one through nine deal with administrative and management processes while steps ten through seventeen deal with public awareness and instructional activities. Step ten, Research and Development, is the beginning of the instructional phase.

Metric Literature

The need for information, supplies and research on the metric system after 1970 in Canada and the United States

produced a proliferation of not only inaccurate information, but a flood of supplies and materials that frequently contained errors (Chalupsky and Crawford, 1975). Further, of the 131 metric articles written between 1971 and 1973, only 43 dealt with education; of these, only four specifically dealt with preservice teachers (Bormet, 1974). While there has been much written on the metric system, little of this can be considered research. A review of the Canadian and American literature produced little evidence that research has been done regarding teaching processes for learning about metric units used in food preparation. What research could be found was a study on the adoption of the metric system by consumers (Adams, 1975) and a study of attitudes of high school students toward the metric system (King, 1976). Both of these studies suggested that attitude change is a part of the process of learning about the metric system (Adams, 1975; King, 1976). Because learning and teaching are closely tied, some discussion of learning processes is included in this review of the literature.

Processes of Learning

Authors in the field of metric education have made a number of assumptions regarding the learning of the metric system. First, learners should be taught what they need to know at the time they need to know. Second, when "hands-on" processes are employed a higher level of cognitive knowledge

is attained. Third, people should be encouraged to "think metric" as conversion from one system of measurement to another only delays the learning of the new system (Allen, 1977; Chalupsky and Crawford, 1975; Odum, 1973; Warning, 1972).

To be considered along with the above assumptions is the problem of whether learning metric units involves cognitive or affective learning, or a combination of both. Another consideration is whether learning cognitively or affectively about the metric system is best dealt with en mass, in groups or in an individual setting.

Processes of Teaching

The Lecture

At the university level, the lecture is a commonly used teaching strategy. Although the lecture may be common it is not always well done (Ausubel, 1968). In preparing an effective lecture, Davis (1976) suggests that the lecturer should know something about cognitive psychology. Knowing how the learners attend to, process and remember information is the key to a good lecture (Ausubel, 1968; Davis, 1976). In the lecture strategy it is the task of the teacher to help students focus on the main ideas so that processing and, ultimately, remembering occurs. In the case of the lecture strategy the main onus for success falls on the teacher. If

the information is poorly organized then the intended processing is unlikely to occur.

While the lecture may be an efficient means of imparting cognitive knowledge, given that it is well organized, it is generally found to be ineffective in changing attitudes (Cartwright, 1949). When Cartwright investigated research on the sale of war bonds he found only negligible change in the public's attitude toward purchasing war bonds. He further stated that mass influences, including the lecture, had negligible effect in changing attitudes. If learning about the metric system includes attitudinal change, then perhaps the lecture is an unsuitable vehicle of instruction. If, however, learning about the metric system is a cognitive process, then the lecture might be an effective approach.

The Learning Activity Package

The lecture could be considered as one of the traditional teaching strategies in that it is teacher directed. At the other end of the pole is the humanistic approach. In this theory of learning the importance of the individual learner is stressed. The uniqueness of the individual becomes the foundation for planning curriculum. Learning activity packages are one of the means of adapting curriculum to meet individual needs. A learning activity package is a self-contained unit of materials composed of explicit

objectives, concepts, suggested learning experiences and pre- and post-tests. Students are responsible for their own learning. The individual selects the learning experiences and pace of work to suit the individual's own learning style. Upon completion of the learning experiences the individual writes a post-test to check that the package objectives have been met. If the individual feels competent to meet the package objectives, the pre- and post-test can be written without working on the learning experiences. The onus for learning is placed on the learner in this strategy while the teacher serves as a resource person. Jones states in his work with learning activity packages, that,

> The individual learns in a manner that is characteristic of that learner. . . . Learners utilize a unique set of experiences in the learning process, and that effective learning takes place when the learner participates actively in the learning process (Jones, 1968, p. 179).

The above assumptions would seen to parallel current thinking on the learning of the metric system. Metric learning activity packages could be designed to meet the needs of the learners, involve the learner actively and encourage the learner to "think metric." Both the cognitive and affective objectives for learning about metric units could be attained with this teaching strategy.

The Group Decision Model

A third point of view concerning learning is the field theory approach. Cartwright (1951) and Lewin (1945) believed that behavior, attitudes, values and beliefs are all grounded in the groups to which the individual belongs. Research of these two authors indicated that attitudes were affected more by groups than by individuals. During the Second World War, Lewin applied group decision to a number of social problems with a fair amount of success. One of Lewin's studies dramatically showed the effects of group decision as opposed to a lecture on attitudes toward using organ meats, such as liver. The follow-up showed that only 3% of the housewives who heard the lecture served liver at least once in the week following the meeting, while 32% of those in the group decision session served liver in that same week (Lewin, 1958).

Radke and Klisurich (1947) further explored the possibilities of changing food habits of housewives in the midwestern United States. Some women attended a lecture about the value of milk in the diet while other women were involved in a group discussion which led to a final decision to increase milk consumption. The follow-up, two weeks later, showed greater consumption of milk on the part of the women in the group decision treatment compared with the lecture treatment. In the Lewin and Radke and Klisurich

studies a second follow-up, four weeks after the treatment, indicated an even further improvement in consumption of organ meats and milk.

As in the lecture and learning activity package, group decision also can easily include cognitive and affective components. If group decision can effectively change food habits, then perhaps group decision can also aid the preservice home economics teacher in the acceptance and use of metric units in food preparation.

Summary

Authors in the area of learning about metric units have stated that "hands-on" processes are best, that learning should take place when needed, that conversion from one system to another delays the learning process and, finally, that emphasis should be placed on "thinking metric" (Allen, 1977; Chalupsky and Crawford, 1975; Odum, 1973; Warning, 1972). In this study an attempt has been made to incorporate current theory on learning about metric units with some possible teaching strategies. All three teaching strategies discussed in this chapter--the lecture, learning activity package and group decision--would seem to be possible alternatives for learning about metric units used in food preparation.

CHAPTER 3

RESEARCH DESIGN AND PROCEDURES

This study was a comparison of three teaching strategies used for helping preservice home economics teachers learn metric units used in food preparation. This chapter deals with: the research design, criterion measures, development of the treatments, selection of the sample, administration of the study and procedures for analysis of data.

Research Design

A quasi-experimental design was used. Random assignment of subjects to treatment was not possible because intact classes were used. The three treatments were randomly assigned to three existing groups of preservice home economics teachers. Treatments were the three teaching strategies--the lecture, a learning activity package and a group decision process. This study was modelled after a study done by Lewin (1945) in which a follow-up was done a month after the treatment session. Lewin's work indicated that greater attitude change occurred when there was a time lapse after the treatment which allowed for subject reflection. Testing intervals (C_1-C_2, 10-12 days; C_2-C_3, 45-48

days) and criterion measures are shown in the following chart, with treatment occurring prior to the C_2 post-test:

	C_1	C_2	C_3
	10-12 days	45-48 days	
Criterion measures:			
Cognitive metric knowledge	x	x	x
Feelings about using metric units in food preparation	x	x	x
Self-rated proficiency in using metric units in food preparation	x		x
Metric behavior inventory			x
Attitude toward the teaching approach experienced		x	

Criterion Measures

Cognitive Measure

A content analysis was done on the lecture material identifying the four concepts: definition of prefixes and metric base units, units used in food preparation, replacement units and abbreviations. From this analysis a table of specifications was drawn to determine the percentage of information to be included on each of the four concepts.

The instrument used was modelled after a Canadian Home Economics Association Metric Committee test called "Think Metric." A multiple choice four-response format was used for ease in scoring and for reliability in cognitive objective testing (Gronlund, 1971). Twenty-four test items

comprised the final instrument. This instrument was then critiqued by a panel of experienced teachers in a graduate course in evaluation. The revised instrument was submitted to a member of the Canadian Home Economics Metric Committee for validation of the content. The same instrument was used pre/post-test and at the follow-up (Appendix A).

Affective Measure

A ten-point semantic differential was used to measure feelings about using metric units in preparing food. According to a Gallup Opinion Index (Reinken, 1977) either the public likes the metric system or doesn't like it, so the lowest level on the semantic differential was determined to be "hostile" with a score of one. Other intervals were keyed to Bloom's (1956) Taxonomy on Affective Behavior. At the upper end of the scale, ten was judged to be "at ease" which was selected to represent Bloom's valuing level. Two descriptive phrases either side of the midpoint were used to describe feelings that fell between one and five, and five and ten. Just below the midpoint was "somewhat uncomfortable" (receiving level) and just above the midpoint was "somewhat at ease" (responding level). No descriptive phrases were used at the midpoint. This instrument and all affective criterion measures were developed with the assistance of two faculty of education associates at the University of Simon Fraser. For reference this measure is included in Appendix B.

Self-rated proficiency with the metric system was measured on a semantic differential of zero to ten with a description of what might possibly occur at the zero, five and ten level of proficiency. At the zero level, no metric terms would be used to describe measurement. At the mid-point, a value of five was assigned if subjects converted on two of the four units of measurement (mass, volume, length or temperature). The rationale for this designation was that, in Canada, metric units of temperature and length are used, but not all mass or volume units have been converted to metric units. A value of ten was designated to represent the top end of the semantic differential, indicating total conversion to metric units (Appendix C).

Attitude toward the teaching strategy was measured on a semantic differential with a range of one to ten with intervals of one. The hierarchy of this scale was reversed in that a value of one was designated as the highest score (liked very much) and a value of ten as the lowest score (disliked very much). The scoring of this scale was reversed in order to ensure that subjects read the statement carefully. This semantic differential was administered after the treatment session (Appendix D).

Metric Behavior Inventory

To ascertain the extent of further application of knowledge about metric units that might have occurred after

the treatment, a metric behavior inventory was used. The inventory was divided into items related to personal use and items for teaching use. Some of the items developed for the inventory were also based on the premise that the subjects would be practice teaching following the treatment. As a means of ensuring accurate responses specific names of recipes, literature or lessons were asked for. This instrument was critiqued and checked for reliability by two faculty of education associates at Simon Fraser University (Appendix E).

Post-test and Follow-up

For the purposes of this study post-test refers to the instruments administered directly following the treatment--the cognitive test, and the two semantic differentials on feelings about using metric units and attitude toward the teaching strategy. Follow-up refers to the cognitive metric knowledge test, the semantic differential on self-rated proficiency, feelings about using metric units in food preparation and the metric behavior inventory.

Development of the Treatment

In all three treatments the following remained constant. The same introduction was given verbally to the group decision subjects and the lecture subjects while the learning activity package subjects read the introduction as part of

the package. All three groups received a file of metric information (Appendix F). Following each of the treatment sessions the researcher encouraged subjects to pursue activities which might increase their proficiency in using metric units. The time allotted for the treatment sessions was one hour each.

The Lecture

Since 1974 this researcher had used a lecture method for teaching other home economics teachers, both preservice and inservice, about using metric units in food preparation. For this study the lecture was revised and updated in terms of standards established by the Canadian Metric Commission. From these previous lectures a content analysis was done to establish the major concepts for this study. These concepts were: definitions of prefixes and metric base units, units used in food preparation, replacement units in food preparation and abbreviations used in recipes. For each of these concepts, overhead transparencies were developed to visually describe the concepts. All this material was validated in terms of standards established by the Canadian Metric Commission through a member of the Canadian Home Economics Association Metric Committee. The lecture and accompanying overhead transparencies were field tested with a class of food study students at The University of Arizona.

Learning Activity Package

At a workshop in 1978 with teachers of Home Economics Related Occupations (HERO) programs, this researcher worked on developing a learning activity package for using metric units in the preparation of food. This learning activity package was keyed to the same concepts as in the lecture, but designed for high school students. It was later revised in terms of preservice teachers but basically the information did not change. The learning activity package was evaluated by three members of an Arizona curriculum committee on the basis of a checklist called "Criteria for Development and Evaluation of Learning Packages"(Appendix G). The committee commented that although the package was good it was too long. With this in mind, a number of activities were omitted, but the four components of the package were retained. The committee also expressed concern at the complexity of the activities for high school students, but since college students would be using the package further revision was not considered necessary. As well as considering the length, complexity and format, content validity was checked by a member of the Canadian Home Economics Metric Committee. The package was further critiqued by an English teacher in terms of language usage. The packages were then given to a group of senior high school home economics students for field

testing. Appendix H is a sample page of the final seven-page learning activity package.

Group Decision

For the group decision treatment, four activities were designed to include the four major concepts on metric units used in food preparation. Within the four activities these concepts were incorporated: definitions of prefixes and metric base units, units used in food preparation, replacement units in food preparation and abbreviations. A fifth item asked the group to list activities they could do to reinforce their learning about metric units. The guide was submitted to two authorities in group work at the University of Simon Fraser for critiquing. The final guide and materials were field tested with five adults not in home economics or teacher preparation. The instrument used appears in Appendix I.

Selection of the Sample

One year prior to the study, a request was made of the field development officer at the University of British Columbia to conduct the study with preservice home economics teachers at that university. Approval was granted by the screening committee at that university (Appendix J). Permission was then received from the instructor of Home Economics Methods 404 classes.

Students registered in this course held undergraduate degrees and were taking a further one-year education program to qualify for teaching certification. Students met for two consecutive hours each week over the year. The course was concerned with teaching skills, curriculum development and other home economics related concerns. In conjunction with this course there was a three-week practicuum where subjects might be expected to use metric units in classrooms.

There were 70 students in the three classes. Fifty-six of these consented to participate in the study. Thirty-six subjects completed the pre-test, post-test and follow-up and another seven completed the pre-test and post-test.

Administration of the Study

To determine which treatment would be assigned to each class, the teaching strategies were written on slips of paper and then drawn from a hat by an impartial associate. Subjects were not told which treatment they would be receiving. The results of the draw were:

Group 1	Learning Activity Package	Session 1
Group 2	Lecture	Session 2
Group 3	Group Discussion	Session 3

Date	Time (Duration)	Procedure	Group
79 01 04	0930h 15 m	consent form biographic data pre-test	all
79 01 15	0930h 60 m	learning activity package post-test	1
79 01 16	0930h 60 m	lecture post-test	2
79 01 16	1030h 60 m	group decision post-test	3
79 03 07	1200h 15 m	inventory follow-up	1
79 03 08	1200h 15 m	inventory follow-up	2
79 03 09	1200h 15 m	inventory follow-up	3

Setting

The treatment sessions were conducted in an area called the resource center which consisted of an anti-room and a classroom. This area was equipped with blackboards, overhead projector, subject files, kitchen facilities and chair-desks sufficient for 25 students. The three classes of Home Economics Methods 404 met regularly in this area. The entire resource center was used for administering the learning activity package treatment and the group decision treatment. Only the classroom was used for the lecture treatment.

Introductory Session

One week prior to the treatment all three classes of Home Economics Methods 404 course were met by the researcher and course instructor in one session. This session was not held in the resource center but in an adjoining area large enough to accommodate the three classes. At this time, the study was explained and subjects were asked to participate. Following these remarks subjects completed the consent form which was designed to comply with criterion of the Human Subjects Committees at both The University of Arizona and the University of British Columbia (Appendix K). Subjects then completed the biographical data sheet (Appendix L) and pre-test (Appendices A, B and C). Since this was the first day back to class after the Christmas break there were a number of students not in attendance. The introductory remarks, however, were taped by the researcher. Later, those absent students listened to the tape and completed the consent form, biographical data sheet and the pre-test under the direction of a fellow student who was present in the first session.

Treatment Session--Lecture

This session was conducted in the classroom of the resource center. The same introduction that appeared on the metric learning activity package was given by the researcher. Subjects were told they could pick up a file of metric

resource materials (Appendix F) after the lecture. Overhead transparencies were used as a means of reinforcing concepts in the lecture. The lecture was 25 minutes long. The metric resource files were distributed and a 10-minute question period followed. As in all treatment sessions, the post-test was completed before the end of the session. Before leaving the classroom subjects were encouraged by the researcher to pursue some further metric activities as a means of becoming more comfortable with the metric system of measuring.

Treatment Session--Learning Activity Package

Prior to the treatment sessions all materials needed for working on the learning activity package were gathered together in large boxes. Four stations were set up with all needed materials. These materials included: food, scales, thermometers, rulers, tape measures, metric measuring cups and spoons and pertinent reading material. Two stations were set up in the anti-room and two stations were set up in the classroom. Subjects were each given a file of metric materials for reference (Appendix F). The learning activity package was distributed with the instructions to begin at any section, to complete as much as was felt needed, and to work individually. Subjects were encouraged to read the introduction before beginning the package. The twelve

subjects in this treatment broke off into small groups and proceeded to follow the directions in the package. For the most part, subjects did work individually and moved from station to station as required. The researcher was available for further direction during this treatment session. Five minutes before the end of the session, subjects were asked to report back to the classroom. Subjects handed in the metric learning activity package and completed the post-test. After completing the post-test subjects were encouraged to pursue further metric activities as a means of becoming more comfortable with the metric system of measuring.

Treatment Session--Group Decision

This group met in the classroom for the introduction, beginning instructions and organization into groups. Groups were arranged by having the subjects number off by five. There were three to five members in each of the five groups. Each group was asked to appoint a recorder and chairperson. Three groups stayed in the classroom and two groups moved to the anti-room. Subjects were given a study guide (Appendix I) and a file of metric resource materials (Appendix F) before joining their respective groups. The groups convened in the classroom five minutes before the end of the hour. Subjects handed into the researcher the completed study guide before completing the post-test. As in the preceding

treatment sessions, subjects completed the cognitive metric knowledge test and the two semantic differentials (feeling about using metric units and attitude toward the teaching strategy). Before leaving the session, as in the other treatment sessions, subjects were encouraged to pursue further metric activities as a means of becoming more comfortable with the metric system of measuring.

Treatment Session--Follow-up

Approximately two weeks after the treatment sessions, subjects went on 3-week practicuums in the secondary schools. Upon their return to the university campus the follow-up was administered. The follow-up included the cognitive metric knowledge test, two semantic differentials (self-rated proficiency using metric units and feeling about using metric units in food preparation) and the metric behavior inventory. The intent of the follow-up was to see if the lapse of time had affected attitude, knowledge or proficiency in relation to using metric units in food preparation.

All three groups were retested by the course instructor. Instructions for the administration of the instruments were provided in writing as well as on tape (Appendix M). The instructor administered the follow-up to 32 subjects and later followed-up on five absent subjects and had them complete the follow-up within the same week as the others.

Procedures for Analysis of Data

Cognitive Criteria

The researcher scored the cognitive metric knowledge test and awarded one point for each correct response. The scores for the three tests were recorded against the subject's code number as each test was marked. Data was used on all subjects who completed at least the pre-test and post-test. A t test was done on the cognitive knowledge pre-test scores of those subjects who completed the pre-test under the direction of a student and those who completed the pre-test under the direction of the researcher. A further t test was done on the cognitive knowledge test scores of those who completed the post-test (36) and those who were not present for the follow-up to determine if there was any significant difference in the groups. The difference in the groups was not significant at the .05 level. All 43 subjects' test scores were used in an analysis of variance.

Affective Criterion

Three semantic differentials were used to measure attitude toward using metric units in food preparation, self-rated proficiency in using metric units and attitude toward the teaching strategy. Each of these was scored by using a template marked off in units of one. In the case of

scores between the intervals the nearest whole integer was used. This data was analyzed using split plot analysis of variance with a significance level of .05.

Metric Behavior Inventory

The metric behavior inventory included eight items. Since the subjects could have given more than one response for five of these items, scaling was used. If subjects left the item blank or said, "none," a score of zero was recorded. If subjects said, "several" or "can't remember which ones," a score of one was recorded. Grouping of results was then done as the "N's" in the Chi square cells were too small to provide statistical significance. Three of the eight items required a yes/no response. A "no" response was recorded as zero and a "yes" response was recorded as one. This data was subjected to chi square analysis.

All data was recorded on IBM coding sheets and this information was placed on IBM cards. Statistical analyses were run at The University of Arizona.

CHAPTER 4

RESULTS

The intent of this study was to compare three teaching strategies--the lecture, learning activity package and group decision with preservice home economics teachers on metric units used in food preparation. This chapter includes description of subjects, data analysis of the cognitive criterion measure and data analysis of the affective criteria measures.

Description of Subjects

All subjects were women in the age range of 18-37. All but one subject received her secondary education in Canada and most were educated in an urban setting. The post-secondary education level ranged from 4-7 years with most subjects at the fifth year level. All but six subjects had been exposed to some metric measuring in their secondary or post-secondary education. More than half of the subjects had some experience with group decision processes and learning activity packages. Slightly more than half of the subjects lived in households with children under 16 years of age who might have knowledge about the metric system and therefore influenced others in the household. At the pretest most of the subjects considered their proficiency in

metric measuring in a middle range. Nearly all subjects who experienced the lecture and group decision strategy taught foods courses in the practicuum. Only half of the learning activity package group taught foods on the practicuum (Table 1).

Data Analysis

Split plot analysis of variance was used to test differences between independent variables--treatment and repeated test results--and the interaction between treatment groups and tests. This analysis was applied to one cognitive and three affective criterion measures. Treatment groups were: lecture, learning activity package and group decision. Repeated test results in this chapter are referred to as pre-test, post-test and follow-up. A .05 level of probability was considered significant in all data analysis.

Data Analysis of Cognitive Criteria Measure

An examination of Table 2 indicates that mean scores on the cognitive criterion measure for each of the three groups improved from pre-test to post-test. There was, however, a diminished group mean score between post-test and follow-up. More graphically, Figure 1 indicates the relationship between groups and mean test scores. The learning activity package group appeared to have the greatest gain

Table 1. Demographic data of subjects by group.

	Lecture N=12	Learning Package N=15	Group Decision N=16
Age range:			
18-22	7	7	8
23-27	4	7	8
28-32	1	1	1
33-37	-	-	1
over 38	-	-	-
Elementary education in a:			
rural setting	3	6	3
urban setting	3	7	10
mostly rural	1	2	-
mostly urban	-	-	3
Secondary education in a:			
rural setting	3	5	2
urban setting	9	9	12
mostly rural	-	-	1
mostly urban	-	1	1
Courses taken involving metric units:			
none	-	5	-
home economics	3	5	10
industrial education	-	-	-
math	6	1	3
science	8	6	8
other, P.E.	-	-	1
Years in post-secondary education:			
4	-	3	-
5	9	9	13
6	2	3	2
7	-	-	1
Secondary education outside Canada	-	-	1

Table 1--Continued

	Lecture N=12	Learning Package N=15	Group Decision N=16
Ages of children in the same household:			
none	4	12	9
preschool	-	-	-
6-10	3	-	1
11-15	3	1	2
over 16	6	2	6
Experience with:			
learning packages	6	5	11
group decision	6	7	13
neither	5	7	3
Self-rated proficiency with metrics pre-test:			
low 1- 4	3	3	8
5- 7	9	11	5
8-10	-	-	2
Taught foods in practicuum	11	7	13

Table 2. Mean scores on cognitive knowledge by treatment group on repeated test scores.

Treatment	Pre-test	Post-test	Follow-up	Test Means
Lecture:				
N	15	15	12	
Means	14.67	17.27	17.17	16.31
Learn. Act. Package:				
N	12	12	8	
Means	15.92	19.25	17.63	17.59
Group Decision:				
N	17	17	16	
Means	14.53	16.35	16.25	15.70

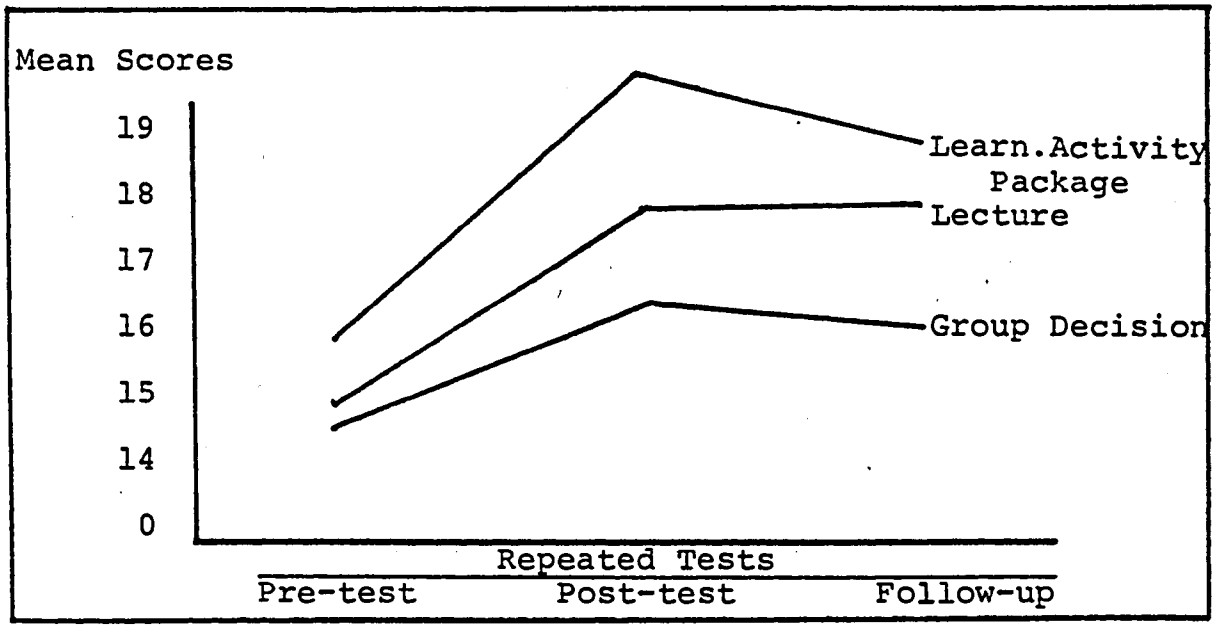

Figure 1. Group mean scores by treatment group on repeated cognitive tests.

pre-test to post-test and the greatest loss of score at the time of the follow-up. While the graph indicates gains and losses, analysis of variance determines the significance of this data. Analysis of variance, however, can only indicate the significance level. Further post hoc testing was necessary to determine where these differences lay. Post hoc testing compared the three groups, one to another, on group mean scores corrected by the error term and the number of degrees of freedom. Post hoc testing indicated that differences existed as a result of three different test mean

scores for each group and not as a result of differences in treatments (Table 3). All three groups did better pre- to post-test. No treatment was significantly better than another. The null hypothesis that there were no significant differences between treatment group scores at the .05 level on a 24-item cognitive criterion measure was retained. Regardless of the treatment, use of any of the three teaching strategies resulted in learning.

Table 3. Analysis of variance on cognitive knowledge with repeated tests.

Source	df	MS	F	P
Between:				
Treatment groups	2	35.2211	4.4469	<.01 >.05
Error	41	7.9235		
Within:				
Repeated tests	2	77.6481	29.4128	.0001
Treatment/tests	4	2.3763	.8977	.4685
Error	74	2.6423		

Data on Affective Criterion Measures

For the affective criterion measure on attitude toward using metric units in food preparation, Table 4 indicates group mean scores on the three repeated tests. In all treatment groups, over the three testing periods, there were gains in group mean scores. Figure 2 indicates graphically the relationship between treatment groups and group mean scores over the three repeated tests. The most gain appeared to be for the lecture group with the least gain for group decision. While the graph shows the relationship, the analysis of variance (Table 5) indicates that all treatment groups improved to a significant degree. Post hoc testing indicated significant gains, however, only for the learning activity package group from pre-test to follow-up. Treatment groups did differ to a significant degree. The null hypothesis that there was no significant difference among the groups on a semantic differential on attitude toward using metric units in food preparation was rejected. The learning activity package treatment appeared to effect greater attitude change.

Mean scores for the affective criterion measure on self-rated proficiency related to using metric units, pre-test to follow-up appear on Table 6. All groups changed from one testing period to another but not in the same direction. Self-rated proficiency increased in the lecture and

Table 4. Mean scores on attitude toward using metric units in food preparation by treatment groups.

Treatment	Pre-test	Post-test	Follow-up	Test Means
Lecture:				
N	15	15	12	
Means	5.40	5.87	7.50	6.17
Learn. Act. Package:				
N	11	11	9	
Means	4.73	6.18	7.22	5.97
Group Decision:				
N	15	15	15	
Means	5.73	6.06	6.31	6.04

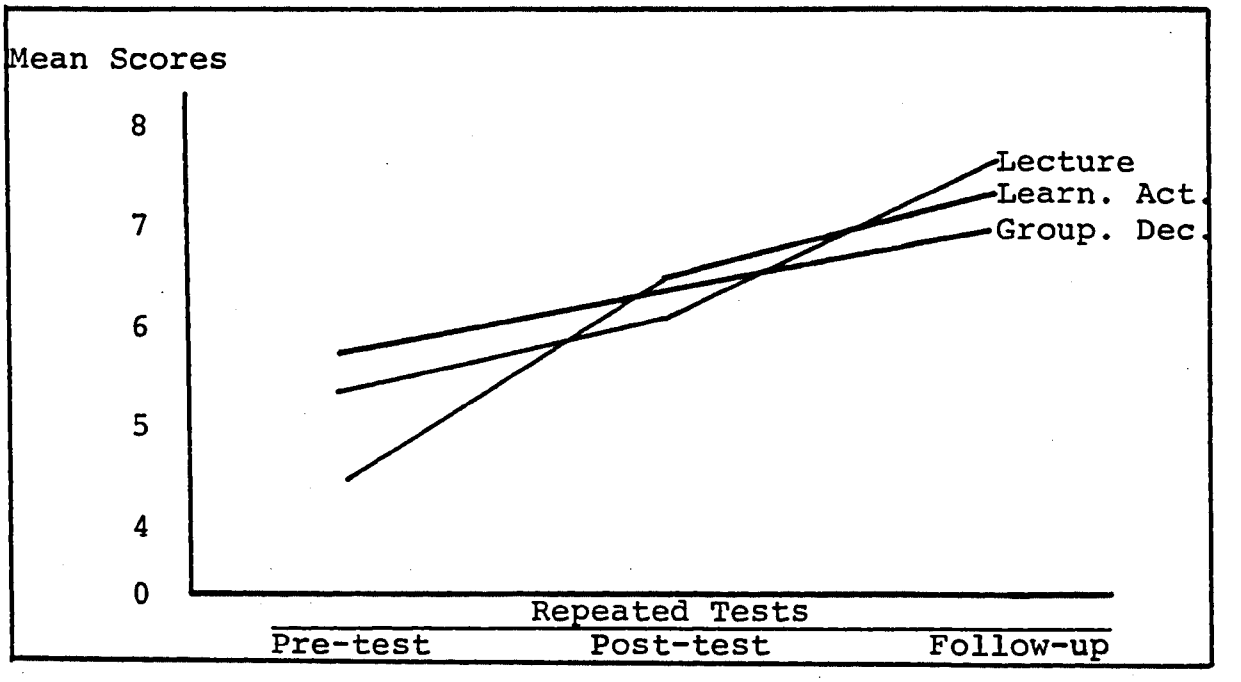

Figure 2. Treatment mean scores on attitude toward using metric units on repeated tests.

Table 5. Analysis of variance on attitude toward using metric units in food preparation with repeated tests.

Source	df	MS	F	P
Between:				
Treatment groups	2	.3753	.0671	.5000
Error	41	5.5906		
Within:				
Repeated tests	2	21.8726	14.3974	.0001
Treatment/tests	4	3.8525	2.5358	.0477
Error	70	1.5192		

Table 6. Mean scores on self-rated proficiency in using metric units by treatment groups on repeated tests.

Treatment	Pre-test	Follow-up	Test Means
Lecture:			
N	14	12	
Means	4.86	7.50	6.08
Learn. Act. Package:			
N	12	9	
Means	5.17	4.44	4.86
Group Decision:			
N	16	12	
Means	4.56	6.31	5.44

group decision treatment but decreased for the learning activity package group. Figure 3 indicates the interaction between treatment groups and test results. In the analysis of variance (Table 7) significant differences existed between treatment groups, test results and repeated tests. Further post hoc testing, however, indicated significant differences existed only for the lecture group on self-rated proficiency. The null hypothesis that there was no significant difference in scores at the .05 level among the three treatment groups on self-rated proficiency was rejected. Those in the lecture group perceived their proficiency at a higher level than those in the other two groups.

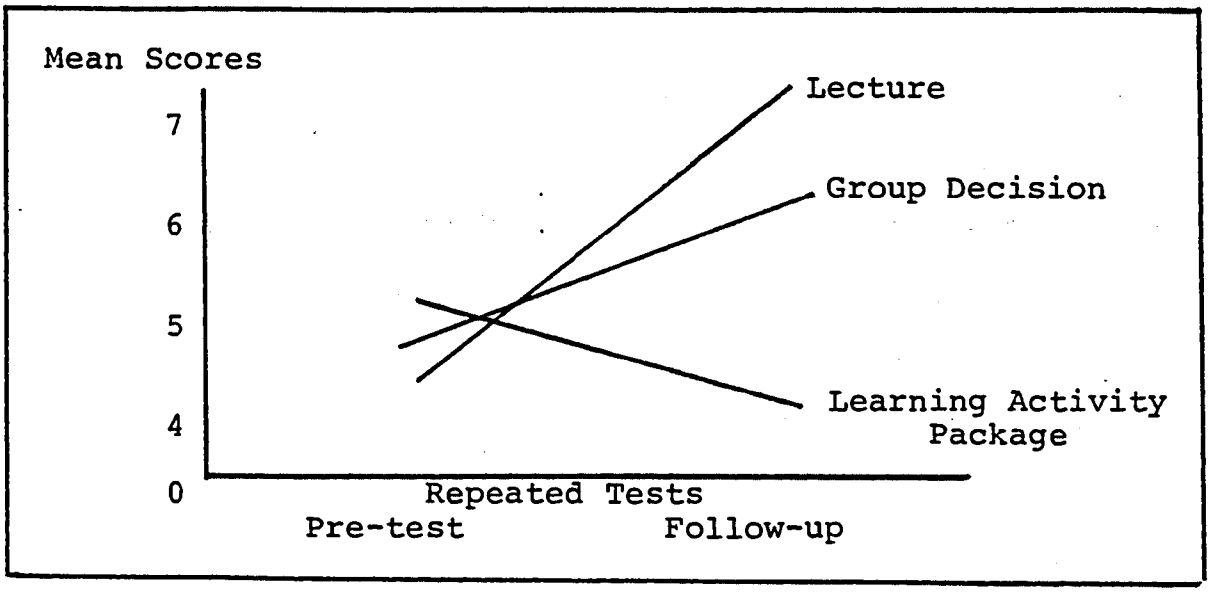

Figure 3. Treatment group mean scores for self-rated proficiency on repeated tests.

Table 7. Analysis of variance for self-rated proficiency in using metric units.

Source	df	MS	F	P
Between:				
Treatment groups	2	8.7271	2.002	>.01 <.05
Error	40	4.3573		
Within:				
Repeated tests	1	37.5556	15.1523	.0005
Treatment/tests	2	15.3264	6.18	.0053
Error	33	2.4785		

Analysis of the affective criterion measure, attitude toward the teaching strategy, failed to show significant differences (Table 8). The null hypothesis that there was no significant difference in scores at the .05 level among the three treatment groups on a semantic differential on attitude toward the teaching strategy was rejected. All three treatment groups viewed the teaching strategy favorably.

The chi square analysis of data (Appendix N) on the eight items in the metric behavior inventory indicated no significant differences between treatment groups on responses

Table 8. Analysis of variance for attitude toward teaching strategy.

Source	df	MS	F	P
Between groups	2	9.5372	2.5531	.0923
Within groups	35	3.7355		

to the eight items. The null hypothesis that there were no significant differences in scores at the .05 level among the three treatment groups on eight items in a metric behavior inventory was retained. The teaching strategy appeared to have no influence on subjects' pursuit of further metric activities following the treatment.

CHAPTER 5

FINDINGS, CONCLUSIONS, DISCUSSION, IMPLICATIONS AND RECOMMENDATIONS

The purpose of this chapter is to summarize the findings of the study, to draw conclusions based on the findings, to discuss the study, to determine the implications and to make recommendations pertinent to the problem of how to effectively teach the use of metric units used in food preparation to preservice home economics teachers.

Summary of Findings

The major findings of this study are related to the null hypotheses. The null hypothesis that there were no significant differences in scores on repeated testing among the three treatment groups: lecture, learning activity package and group decision, on a 24-item multiple choice cognitive knowledge test was retained. The null hypothesis that there were no significant differences in treatment group scores on a semantic differential on attitude toward using metric units in food preparation was rejected. Subjects in the learning activity package group made significant gains from pre-test to follow-up. The null hypothesis that there were no significant differences in treatment group scores on a self-rated semantic differential on

proficiency in the use of metric units was rejected. Those who received the lecture rated themselves significantly higher than those in the other two groups. The null hypotheses that there were no significant differences in treatment group scores on attitude toward the teaching strategy and scores on an eight-item metric behavior inventory were retained. Statistical analysis failed to show significant differences for these two hypotheses.

Conclusions

Analysis of data indicated that all of the three teaching strategies compared in this study were effective processes for improving cognitive metric knowledge. A short review of how the authorities view learning metrics might be of help in explaining why treatments were equally effective.

1. Allen (1977), Chalupsky and Crawford (1975) and Sokol (1974) have all indicated that metric information should be presented when the learner needs it and then only teach as much as is needed to complete a task.
2. The use of "hands-on" processes for learning about metric units raises cognitive knowledge.
3. Conversion from one system to another only delays the conversion process.
4. "Thinking metric" should be encouraged.

All of these premises were incorporated into one or another of the teaching strategies. The first premise regarding the learner's needs was considered in that all treatment sessions were conducted just prior to the preservice teachers going into the high schools on practicuums. The timing of the study could have been an important factor in whether the subjects learned or not. Since nearly all subjects were going to be teaching in foods classrooms they might all have felt the need for information regardless of the learning process. When learners are just looking for information the lecture often is the most expeditious process. As well, these learners were all well educated and used to lecture strategy. This researcher feels that the lecture was organized so that attending to, processing and remembering were likely to occur (Ausubel, 1968). As for the "hands-on" processes, these were amply provided for in the learning activity package. Further, subjects could choose which activities to do and complete as much as they felt they needed to. In all three treatment groups emphasis was placed on "thinking metric" and not converting from one system to another. If learning about the use of metric units in food preparation is in the cognitive domain for learning, then all of the above premises were considered in one treatment or another.

There is some speculation that learning about using metric units in food preparation has a very minor cognitive component and that the major component belongs in the effective domain for learning.[1] The group decision process might have been as successful as the other two treatments because of the opportunity for members of the group to interact and influence each other. During the group decision treatments the researcher did note that often the most vocal members in the groups were those who were more conversant with using metric units. The influence of strong group members can effect an attitude change so that the acquisition of cognitive knowledge occurs. This view of learning has been well supported by Cartwright (1951) and Lewin (1945).

Closely tied to the effectiveness of the teaching strategy is how the subjects viewed the treatment sessions. In this study the subjects showed no significant differences in how they felt about the teaching strategy. All groups rated the particular strategy in which they participated at much the same level. On a semantic differential of one (high) to ten (low), mean scores ranged from 2.62 to 4.44. This indicates that all groups perceived the strategy more favorably than unfavorably. Again, these subjects might have recognized their own limitations and need for

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1. This view has been expressed by Isabelle Morrison, Education Officer, Western Ontario Region, Ministry of Education, in a letter dated December 5, 1978.

information regarding the use of metric units in food preparation and might have been glad to get information regardless of the process.

In administering the treatment sessions the researcher suggested activities that might increase proficiency in using metric units. It should be noted that some of these suggestions were incorporated into a metric behavior inventory. Analysis of the metric inventory data, however, revealed that regardless of the treatment subjects were motivated to pursue further metric activities following the treatment sessions. Again, it is possible that the influence of the practicuum motivated the subjects to the same degree. The three null hypotheses related to cognitive knowledge, attitude toward the teaching strategy and metric behavior inventory were all retained. The researcher feels that the subjects' need for information may have been of more concern than the type of teaching strategy or the subjects' attitudes toward the teaching strategy or pursuing further metric activities.

Statistical significance, however, was found on feelings about using metric units. Those in the learning activity package group did feel more at ease using metric units. This could have been a direct result of having the chance to manipulate measuring tools in the "hands-on" processes which were included in the learning activity

package. Because of these experiences subjects might also have used metric measuring on the practicuum, lending support to the premise that facility comes with practice. Again, the influence of the practicuum on subjects' feelings about using metric units cannot be discounted.

While those in the learning activity package treatment were more comfortable in using metric units they did not rate their proficiency as highly as the lecture group did. It is interesting to note that less than half of this group had taught foods in the practicuum which could account for a diminished score on self-rated proficiency. These students may not have had much opportunity to develop proficiency. The lecture group was significantly higher than the other two groups on self-rated proficiency. All but one member of this group taught foods on the practicuum indicating they may have had more opportunity to develop proficiency. The lecture group also had higher cognitive knowledge scores on the pre-test which indicates some link with proficiency. This link seems to parallel the findings of King (1975) where it was found that students who have a greater extent of awareness were more likely to have a positive attitude toward the metric system. The Gallup Opinion Index (Reinken, 1977) also indicates a relationship between knowledge and attitude in that the more the public knows about the metric system, the more they like it.

Before concluding some mention should be made regarding the follow-up. Lewin (1945) found in his work that further change in attitude occurred when subjects were re-tested a month after administering the treatment. In this study subjects in the learning activity package treatment did have a significant change in feelings about using metric units pre-test to follow-up, but not post-test to follow-up. While no substantial support was found for attitude change occurring at a later time, all three groups did improve pre-test to follow-up.

Discussion

While the findings and conclusions indicate that the learning activity package is effective in producing attitude change and that the lecture process resulted in greater self-rated proficiency, this researcher has a number of recommendations to make regarding the reasons for retaining the hypotheses related to cognitive knowledge, attidue toward the teaching strategy and the metric behavior inventory. Some explanation for no differences in treatment groups may be found in the sample, research design, criterion measures, instrument designs and administration of this study.

The population from which the sample was drawn numbered 70 at the time arrangements were made at the University of British Columbia for conducting the study. These 70 subjects were evenly distributed in three classes. At the

beginning of the study there were approximately 20 subjects in each class. By the end of the study one group has less than 10 subjects and one group was slightly over 10. This loss of subjects was disappointing to the researcher as obtaining statistically significant results with small groups is difficult. An explanation for loss of subjects will be discussed in the administration of the study.

As for the research design, it should be noted that this study was a quasi-experimental design in that there was no random assignment to groups. Intact groups were used to comply with the University of British Columbia's restrictions on the study. A stronger research design would have been a control group-experimental group pre-/post-test design. This type of an experiment, however, was beyond the scope of this researcher.

In regard to the independent variable (teaching strategies) this researcher feels confident that content validity and reliability were acceptable, but the last question on the group decision study guide could have been more strongly worded so that subjects felt more of a committment to follow through on other metric activities.

On the criterion measures, some minor changes might have produced a great power of discrimination. For the cognitive knowledge test the addition of more questions would have provided a greater range of scores. On the

attitude measures a smaller numerical value (seven as opposed to ten) might have forced the subjects to lean toward one end of the scale or the other. This was not considered too critical as some subjects could have regarded their proficiency and attitude in a mid-range, particularly when descriptive phrases were used to describe some of the values on the semantic differential.

Administration of the study could also have confounded the results. Ideally learning activity packages are not used within a rigid time frame. Learners should be able to work at their own pace, when they are ready. In this study, because of other course requirements, only one hour could be set aside for each group to receive this treatment. In administering the group decision strategy, some subjects were distracted by the arrival of curriculum materials at the center and chose to leave their groups to unpack these materials. As a result, their input to their groups was minimal. This lack of involvement could have influenced responses, particularly on the attitude toward the teaching strategy criterion measure. No intervening variables seemed to be involved in the lecture strategy.

The final problem with administration arose when the data collection was done on the follow-up, five weeks after the treatment and just after the subjects returned to campus following practicuums. The researcher was unable to conduct

these follow-up sessions and sent taped directions and materials so that the course instructor could administer the follow-up. Some subjects did not attend class in this week as they were possibly recovering from strenuous practicuums. The instructor for the course did follow-up on five subjects in that same week, but in a discussion with her later, the instructor expressed minor irritation regarding the absence of subjects. This irritation might have biased subjects' responses, particularly on the attitude measures.

Implications

For teaching the use of metric units in food preparation to home economics preservice teachers, the three teaching strategies compared in this study appeared to be equally effective. Which process is used will depend on time, the resources of the instructor, curriculum and the needs of the class members. If finding time in which to teach content in a methods course is a problem, the students could be given metric learning activity packages to complete on their own. On the other hand, if content is important the lecture might be an appropriate strategy, particularly if a well qualified resource person is available. Included in most methods courses are some learning activities related to teaching strategies. The group decision process might be one of those strategies that could be used to teach content as well as process. This study indicates that learning

about metric units can be done with any of the three strategies compared.

Recommendations for Further Research

This researcher would recommend that the following be considered in further research on how to teach the use of metric units in food preparation:

1. If an adequate enrollment of preservice home economics teachers could be obtained, further pertinent data might strengthen this study.
2. Because of the nature of the subject matter, a similar study could be conducted with inservice home economics teachers, home economics senior high school students or consumers. Each of these groups might have need for metric knowledge needed in food preparation.
3. To strengthen this study, an experimental/treatment group(s), pre-test/post-test research design could be used.
4. The affective criterion measures in this study need to be tested further to ensure reliability. These instruments could also be expanded so that construct validity could be determined.
5. The items on the metric behavior inventory could be revised so that the items are more discriminating.

6. Other teaching strategies such as demonstrations or programmed learning could be included as treatments in order to evaluate their effectiveness in teaching metric units used in food preparation.
7. The learners could select the appropriate time to complete the learning activity package and not be constrained by time limits.
8. An extension of this study might be to match learning styles to teaching strategies.

APPENDIX A

COGNITIVE KNOWLEDGE TEST

Code #__/__/__/

CAN YOU THINK METRIC?

Directions: Place a check (✓) in the blank beside the best answer.

1. A gram is about the weight of:
   ____ an apple
   ____ a dime
   ____ a bubble gum ball
   ____ a pineapple

2. A metre is about the height of:
   ____ a door
   ____ a kitchen counter
   ____ a chair seat
   ____ a dining table

3. Water freezes and boils respectively at:
   ____ 32°C and 212°C
   ____ 100°C and 200°C
   ____ 0°C and 100°C
   ____ -10°C and 100°C

4. A one cup measure holds about:
   ____ 2 millilitres
   ____ 20 millilitres
   ____ 250 millilitres
   ____ 100 millilitres

5. A MacDonald's quarter pounder is about:
   ____ .5 kilograms
   ____ 125 millilitres
   ____ 1 decilitre
   ____ 100 grams

6. An average size ice cube is:
   ____ 3 x 5 centimetres
   ____ 10 x 12 millimetres
   ____ 15 x 20 centimetres
   ____ 6 x 8 millimetres

7. Lukewarm, which is normal body temperature, is about:
   ____ 96.8°Celsius
   ____ 25°Celsius
   ____ 37°Celsius
   ____ 48°Celsius

8. Milk is sold in units of:
   ____ 1.5 litres
   ____ 1 litre
   ____ 1 decilitre
   ____ 1 kilolitre

9. The diameter of a dinner plate is about:
   ____ 35 centimetres
   ____ 25 centimetres
   ____ 75 millilitres
   ____ 50 millilitres

10. A teaspoon of sugar is about:
    ____ 3 millilitres
    ____ 5 millilitres
    ____ 1.5 millilitres
    ____ 1 millilitre

11. A can of soup holds about:
    ____ 1.5 litres
    ____ 1 litre
    ____ 0.3 litres
    ____ 0.6 litres

12. Ground coffee is sold in:
    ____ milligrams
    ____ litres
    ____ millilitres
    ____ grams

13. A standard round cake has a diametre of:
____ 50 centimetres
____ 30 centimetres
____ 20 centimetres
____ 10 centimetres

14. A centimetre is as wide as:
____ a dime
____ the baby fingernail
____ a pencil's lead
____ a paper match

15. Metric units are multiples of:
____ 5
____ 12
____ 10
____ 100

16. A litre measures:
____ length
____ mass
____ volume
____ weight

17. A gram measures:
____ length
____ mass
____ volume
____ weight

18. When "centi"prefaces a metre this means:
____ 1/10 of a metre
____ 1/100 of a metre
____ 100 times a metre
____ 10 times a metre

19. The abbreviation for litre is:
____ L
____ 1
____ *l*
____ L.

20. The abbreviation for kilograms is:
____ kg
____ KG
____ kgs
____ kg.

21. If a recipe is converted to metric units the volume will be:
____ slightly more
____ slightly less
____ no different

22. In following a recipe one is not likely to find:
____ deciletres being used
____ kilograms being used
____ kilolitres being used
____ centilitres being used

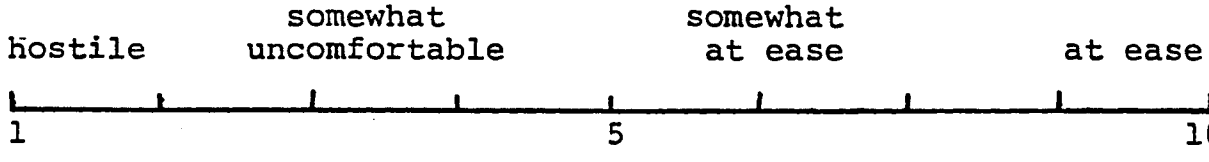
23. In halving or doubling recipes in metric units, fractions:
____ will be used
____ will not be used
____ will depend on the recipe
____ will be used to measure liquids

24. A moderate oven temperature is:
____ 175°C
____ 200°C
____ 150°C
____ 125°C

APPENDIX B

ATTITUDE TOWARD USING METRIC UNITS IN FOOD PREPARATION

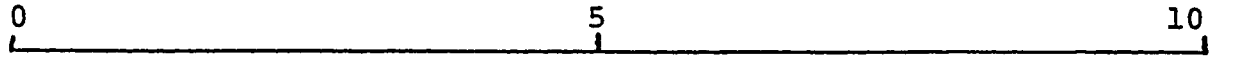
Place an (x) on the line that indicates your <u>feelings</u> about using metrics in food preparation



APPENDIX C

SEMANTIC DIFFERENTIAL ON SELF-RATED METRIC PROFICIENCY

On a continuum of 0-10 place a check (✓) which would indicate your proficiency with the use of metric units.

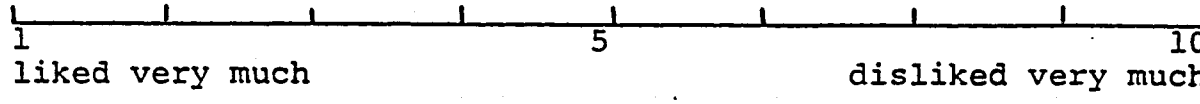


0	5	10
-uses no metric terms to describe length, mass, temperature or volume	-uses metric terms to describe temperature, length, mass and volume but converts from one system to another on two scales	-uses metric terms to describe mass, volume, temperature and length in all measuring without converting

APPENDIX D

SEMANTIC DIFFERENTIAL ON ATTITUDE TOWARD THE TEACHING STRATEGY

Place an (x) on the line which indicates your attitude towards the learning method.



APPENDIX E

METRIC INVENTORY

Code #__/__/__/

I would like to know if there has been any change in your attitude or use of metric measurement since the presentation on metrics in January. Please answer the following questions as they relate to you for the period between the January presentation and the present time.

1. Name any metric recipes you have clipped for your files.

_____

_____

2. Name any recipes you have converted to metric.

_____

_____

3. Indicate which pieces of metric measuring utensils you have borrowed or purchased since January.
dry measuring set _____ dry measuring set _____
liquid measuring cup _____

4. Name any new metric recipes you have prepared since the presentation in January. _____

_____

5. Name any resource materials ordered from the handouts provided in January. _____

_____

6. Name the titles/sources of any metric literature read.

_____

_____

7. State the topic/s of any lesson/s given on metrics in your practicuum. _____

_____

8. Posted a temperature decal on your stove. yes___ no___

9. Indicate on a ten-point scale the degree of influence the January metric presentation had on your present ability to work in metric units.

very little a great deal
1 10

10. Place a check (✔) on the line that indicates your present feelings about using metrics in food preparation.

hostile somewhat uncomfortable somewhat at ease at ease
1 10

11. Did you teach a Foods and Nutrition course in the practicuum? yes___ no___

If more space is required please use the back of this page.

APPENDIX F

LIST OF METRIC RESOURCE MATERIALS

1. _____ Your Handy Metric Handbook. Metric Commission Canada, Ottawa, Canada.

2. _____ How to Metricook. Maple Leaf Mills Limited, Toronto, Canada, 1975.

3. _____ Style Guide for Metric Recipes. The Metric Committee, Canadian Home Economics Association. Ottawa, Canada. Revised 1977.

4. _____ Metric Resource List. Canadian Home Economics Association. Ottawa, Canada.

5. _____ Dual reading temperature decal. B. C. Hydro Company.

APPENDIX G

CRITERION FOR DEVELOPMENT AND EVALUATION OF LEARNING ACTIVITY PACKAGES*

CHECK--if satisfactory

-Help Wanted (Introduction)

_____ 1. Does it capture the attention of the HERO student?

_____ 2. Will it motivate the HERO to continue the package?

_____ 3. Does it relate the need for the package to the realistic world of work for HERO?

_____ 4. Is it an accurate representation of what's to follow?

_____ 5. Is it equally appropriate for students around the state?

_____ 6. Is the introduction brief? (Student should not be able to pass pre-test from this information.)

-Job Competency (Objectives)

_____ 1. Is the objective clearly stated?

_____ 2. Can it be easily understood by a variety of HERO students?

_____ 3. Are objectives limited to no more than four?

_____ 4. Are objectives measurable?

-Application (Pre-test)

_____ 1. Does each question in the pre-test relate to a Job Competency (Objective)?

_____ 2. Does it measure current level of HERO's knowledge?

_____ 3. Does it help HERO to self-evaluate (aware of strengths and weakness)?

_____ 4. Is it clear that taking the test is optional?

_____ 5. Can HERO or HERO coordinator quickly give feedback on results of pre-test?

-Training Activities (Learning Activities)

_____ 1. Are activities related to Job Competency?

_____ 2. Are there learning alternatives (what you do more than one approach so that one activity selected from A, B or C achieves competency #1, etc.) which provide for a variety of learning styles (how you do it: how a student learns, e.g., reads, listens, researches, etc.)?

_____ 3. Is package as self-contained as possible?

_____ 4. Are directions clearly stated?

-Job Progress (Post-test)

_____ 1. Does each question in the post-test relate to a Job Competency (Objective)?

_____ 2. Does it measure current level of HERO's knowledge?

_____ 3. Does it help HERO to self-evaluate (aware of strengths and weakness)?

_____ 4. Can HERO or HERO coordinator quickly give feedback on results of post-test?

-Quest (Additional Activities)

_____ 1. Are activities related to further study of Job Competency?

_____ 2. Are activities optional activities?

_____ 3. Are activities student-initiated?

_____ 4. Are activities self-directed?

*(Developed by an Arizona HERO Curriculum Committee.)

APPENDIX H

SAMPLE PAGE OF THE METRIC LEARNING

ACTIVITY PACKAGE

Section C: LENGTH

To measure length you will be using a metre which is about the length of a yard plus the length of your index finger. To measure smaller amounts within the metre you will use centimetres or millimetres.

A centimetre is the width of your baby fingernail and there are 100 centimetres in a metre.

A millimetre is approximately the thickness of a dime and there are 1,000 in a metre and ten in a centimetre.

Directions

Do as many of the following activities as you find necessary to be competent in identifying the length of a metre, centimetre and millimetre. Record your answer in the spaces provided. If there is no answer blank, just do the exercise without recording an answer. Place a (✔) beside those items completed.

Activities

You will need metric tape or rule, carrots, celery, cucumber, knife, cutting board, baking pans.

1. Find any three items that are approximately one millimetre, one centimetre, one metre.

	millimetre	centimetre	metre
a.	_____	_____	_____
b.	_____	_____	_____
c.	_____	_____	_____

2. Find the size in metric units of three different baking pans.

name of pan	size
_____	_____
_____	_____
_____	_____

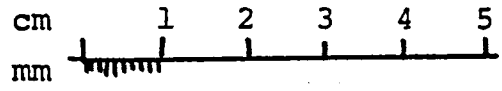
3. Prepare a relish plate using carrots, celery and cucumber.
   - cut the carrots into 8 centimetre lengths
   - cut the cucumber into 5 millimetre slices
   - cut the celery into 10 centimetre lengths

   No ruler for this job . . . use your eye to judge the distance! When you are finished check the lengths with a ruler.

4. Underline the key words in the leading paragraph.

5. Read a Metric Guide for Cookware and Bakeware.

If you feel comfortable about what you have learned carry on to Section D: Temperature. If not, repeat those activities that would be helpful to you.



APPENDIX I

GROUP DECISION STUDY GUIDE

code numbers of group members

__/__/__/ __/__/__/

METRES AND LITRES ARE NEATER

Group Decision

Directions: The materials in the handouts may be used to complete this exercise. There are posters as well which might be useful. Please appoint a recorder for your group who will hand in the completed question sheet.

1. What metric units of measure will you need to prepare a dinner? e.g., roast beef, potatoes, peas, salad, banana nut bread, tea.

2. What are the equivalent units of measure in the imperial system? e.g., 250mL = 1 cup.

3. Choose a familiar recipe requiring baking. Write the recipe in metric units. e.g., banana nut bread.

4. Why is the title of this activity appropriate? METRES AND LITRES ARE NEATER?

5. What are some things you could do to reinforce your understanding of metrics?

APPENDIX J

APPROVAL FROM HUMAN SUBJECTS COMMITTEE AT THE UNIVERSITY OF BRITISH COLUMBIA

PROJECT TITLE: Investigation of relative effectiveness of three means of teaching metric measurement in relation to food preparation.

PRINCIPAL INVESTIGATOR: Evelyn Kerr

DEPARTMENT: Education DATE: Dec. 4, 1978

The protocol describing the above-named project has been reviewed by the BEHAVIORAL SCIENCES SCREENING COMMITTEE and the experimental procedures outlined by the principal investigator were found to be acceptable on ethical grounds for research involving human subjects.

Dr. R. Rodgers, CHAIRMAN Behavioural Sciences Screening Committee	Dr. R. D. Spratley Research Administrator Office of the President
DATE: _____	DATE: _____

APPENDIX K

SUBJECT CONSENT FORM

I agree to participate in this study of "The effectiveness of three methods of teaching metric measuring in relation to food preparation." I understand that my involvement will be confined to scheduled class time.

I understand participants are free to ask questions at any time or withdraw without ill will or risk. Further, participation or non-participation will not be reflected in grades for this course.

I understand that numbers will be used in place of names throughout the study to ensure confidentiality, and at the end of the study these records will be destroyed.

Signature_____ Date_____

The number which appears at the bottom of this page will be used throughout the study in place of your name. To designate which class you are in prefix your number with
"1" if you meet on Monday at 0930 hours,
"2" if you meet on Tuesday at 1030 hours,
"3" if you meet on Tuesday at 1130 hours.

Tear off this section on the dotted line. Your name and corresponding code number will be retained and only used if you need to refresh your memory for identifying further materials.

Name_____(please print)

Code number __/__/__/

APPENDIX L

BIOGRAPHICAL DATA

Code __/__/__/

Directions: Place a check (✓) beside those items which best describe you.

Personal data

1. age:
   - 18-22 _____
   - 23-27 _____
   - 28-32 _____
   - 33-37 _____
   - over 38 _____

2. elementary education (grades 1-6) was received in a:
   - rural setting _____
   - urban setting _____
   - both, but mostly rural _____
   - mostly urban _____

3. secondary education (grades 7-12) was received in a:
   - rural setting _____
   - urban setting _____
   - both, but mostly rural _____
   - mostly urban _____

4. courses taken which involved working in metric units were:
   - none _____
   - home economics _____
   - industrial education _____
   - math _____
   - science _____
   - others (please list) _____

5. years spent in post-secondary schooling:
   - 2 _____
   - 3 _____
   - 4 _____
   - 5 _____
   - 6 _____

6. ages of any children living in the same household:

none _____
preschool _____
6-10 _____
11-15 _____
over 16 _____

Experience

A. I have had experience with the following teaching or learning strategies:

1. learning activities packages (modules, LAPS, HELPS) _____
2. group decision making _____
3. neither _____

Please give examples of the situations if 1 or 2 is checked.

_____

_____

B. On a continuum of 0-10 place a check (✓) which would indicate your proficiency with the use of metric.

0	5	10
-uses no metric terms to describe length, mass, temperature or volume	-uses metric terms to describe temperature, length, mass and volume but converts from one system to another on two scales	-uses metric terms to describe mass, volume, length and temperature in all measuring without converting

APPENDIX M

INSTRUCTIONS FOR ADMINISTRATION

OF FOLLOW-UP

Dear Judy and Eda,

I have enclosed a tape which gives the directions for this part of the study. If a recorder is not available my message follows. Lyn has kindly agreed to be my messenger to get this material to you but I will call on Friday to find a time and place to pick up the completed forms.

I can't foresee any problems with the questionnaires; it is fairly straightforward.

My message is as follows:

> Good morning, this is Evelyn Kerr speaking. I'm sorry I can't be with you today to complete the last part of my study in which you kindly consented to participate.
>
> This time I'm interested in knowing whether you have had any opportunity since January to use any metrics, to what extent and lastly, what further knowledge you may have gained since the January session.
>
> There are two short questionnaires to complete which will take you approximately ten minutes.
>
> Please make sure your code number is in the top right hand corner of both questionnaires. You should have three pages in all. If you have forgotten your code number see your instructor who has your name and code number on a sheet of paper.
>
> If you have completed any part of the study I would appreciate your completing this last step. I should have this material tabulated by the beginning of April and if you wish your results please call me at 738-1636.
>
> Many thanks for your contribution to this study. I hope you have gained some knowledge and have found the materials useful.

Perhaps the easiest way to deal with the code numbers is to call out the names and corresponding number after you have distributed the questionnaires.

When the students are finished could they please place the completed forms in the corresponding envelope.

Thanks to you and your group, Eda, for allowing me to conduct this study. I'm hoping the results will provide some useful data.

Sincerely

Evelyn Kerr

P.S. Code numbers are attached and in order in which the treatments took place. Those who met on Monday a.m. at 0930 are group 1, Tuesday at 0930 are group 2, and Tuesday at 1030 are group 3.

APPENDIX N

CHI SQUARE TABLES ON METRIC BEHAVIOR INVENTORY

Table N-1. Relationship between treatment and behavior with respect to having clipped metric recipes.

Treatment	Number of Recipes Clipped 0	1-4	Total
Lecture	4	7	11
Learning Activity Package	4	5	9
Group Decision	6	8	14
	14	20	34
Raw chi square .1611 2df		p>.10 <.05	

Table N-2. Relationship between treatment and behavior with respect to having converted recipes into metric units.

Treatment	Number of Recipes Converted 0	1-8	Total
Lecture	2	9	11
Learning Activity Package	3	6	9
Group Decision	3	11	14
	8	26	34
Raw chi square .6897 2 df		p>.25 <.10	

Table N-3. Relationship between treatment and behavior with respect to having bought or borrowed metric measuring utensils.

Treatment	Not Borrowed/ Bought	Borrowed/ Bought	Total
Lecture	2	6	8
Learning Activity Package	1	4	5
Group Decision	4	5	9
	7	15	22
Raw chi square 1.15471 2 df		p>.50 <.25	

Table N-4. Relationship between treatment and behavior with respect to having prepared recipes using metric units.

Treatment	Number of Recipes Prepared 0	1-8	Total
Lecture	5	5	10
Learning Activity Package	3	4	7
Group Decision	4	10	14
	12	19	31
Raw chi square 1.1856 2 df		p>.25 <.10	

Table N-5. Relationship between treatment and behavior with respect to having ordered metric resource material.

Treatment	Number of Ordered Items 0	1-3	Total
Lecture	6	1	7
Learning Activity Package	3	1	4
Group Decision	12	0	12
	21	2	23
Raw chi square 2.7574 2 df		p>.75 <.50	

Table N-6. Relationship between treatment and behavior with respect to having read metric resource material.

Treatment	Number of Items Read 0	1-2	Total
Lecture	4	4	8
Learning Activity Package	1	5	6
Group Decision	7	5	12
	12	14	26
Raw chi square 2.8781 2 df		p>.75 <.50	

Table N-7. Relationship between treatment and behavior with respect to posting a temperature decal.

Treatment	Not Posted	Posted	Total
Lecture	8	4	12
Learning Activity Package	6	2	8
Group Decision	14	1	15
	28	7	35
Raw chi square 3.12500 2 df			p>.9 <.75

Table N-8. Relationship between treatment and behavior with respect to having taught lessons on metric units.

Treatment	Number of Lessons Taught 0	1-8	Total
Lecture	6	4	10
Learning Activity Package	1	7	8
Group Decision	6	7	13
	13	18	31
Raw chi square 3.939 2 df		p>.90 <.75	

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