

AN ABSTRACT OF THE THESIS OF

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Dr. E. Wayne Courtney

The purpose of this research was to assess the gain in critical thinking skills with a consideration of grade point averages during a semester in two high school home economics courses, and one language arts course which was used as a control group.

The study was conducted by administering the California Critical Thinking Skills Test: College Level (CCTST) as a pretest and a posttest to students (n = 101) in three classes; Food Science, (grades 10 - 12), Nutrition and Food Preparation, (grades 10 - 12), and Intermediate Composition, (grade 11).

The study utilized a two-way fixed analysis of covariance design. The dependent variable was the adjusted CCTST posttest score. Independent variables consisted of grade point average (two levels, those students with g.p.a.'s of 2.75 or above and those with g.p.a.'s below 2.75), and class grouping (three levels, including Food Science, Intermediate Composition and Nutrition and Food Preparation). The

covariate was the CCTST pretest score. Analyses were performed by SPSS/PC+, with covariate adjustment using the pretest as an influence on posttest scores.

After adjustment by the covariate (pretest score), students with higher g.p.a.'s were found to be significantly higher on CCTST mean scores. No statistically significant main effect was found for levels of class group. In addition, no statistically significant interaction was observed between levels of class groups and grade point average.

As a result of the findings, it is concluded that the students did not have statistically significant gain in critical thinking skills in any of the tested classes as assessed by the CCTST. There is a great need for students to learn critical thinking skills. Efforts must be included in the training of teachers so that they can guide students in learning critical thinking skills. An effort must be made to adjust lessons and change pedagogy so that students' critical thinking skills can be improved at the high school level.

TESTING FOR CRITICAL THINKING SKILLS
IN SELECTED COURSES

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TESTING FOR CRITICAL THINKING SKILLS IN SELECTED COURSES

Chapter 1

BACKGROUND AND RELATED LITERATURE

Introduction to the Study

This study was designed to determine the level of skills in critical thinking during a semester (18 weeks) in two home economics courses; one, a new course offered for the first time as a pilot class (Food Science), the other, a traditional home economics course (Nutrition and Food Preparation). A language arts class (Intermediate Composition), scheduled outside of the home economics department was used as a control section. The research was conducted in the Anchorage School District at Robert Service High School during the 1991-92 school year. Pretests and posttests were used to assess gain in critical thinking skills in each of the selected classes.

Importance of the Study

Curriculum decisions are made for various reasons which include staffing problems, program needs, budgetary concerns, political pay-offs, updating, and perhaps as many reasons as there are decision-makers. There are many areas of concern when a new course is offered. One area of concern for the Anchorage School District was to test for the learning which goes beyond knowledge gain to include critical thinking. The Anchorage School District mission statement and goals for the 1990 - 1991 school year included the following statement about critical thinking.

"The mission of the Anchorage School District includes providing a comprehensive high quality educational program in a positive, supportive climate for the youth of Anchorage to enable them to:

- ...
- develop critical thinking and reasoning skills
- acquire knowledge and understanding requisite for the society in which they live
- prepare themselves for a rapidly changing world. . . " (Anchorage School District, 1990).

There has been no assessment of the Anchorage School

District goal to determine if students have gained in critical thinking skills. As Grow (1991) emphasized, educators must determine whether students come to class with critical thinking skills developed, or if these skills are gained while in attendance at school. Therefore, the need to determine whether the students learn higher-order thinking skills, such as critical thinking, is of high importance..

A concern early in the modern critical thinking movement was tested by Benjamin Bloom (Bloom & Broder, 1950). In Bloom's research, students were asked to think aloud and solve reasoning problems. Low-aptitude students approached problems differently than did the high-aptitude students. The low-aptitude students were likely to spend little time solving a problem. Their answers were often based on feelings, impressions or guesses. Whereas high-aptitude students spent more time, and used a sequential analysis of known information and past experiences to develop new solutions to problems.

For the past several years, the home economics

curriculum has placed a major emphasis on teaching higher order thinking skills. When Marjorie Brown (1980), a home economics philosopher, presented her position on home economics education, an emphasis was placed not only on the content of home economics, but also on the educational processes which foster development of "the student's cognitive modes of thinking" (p. 102).

Home Economics leader Kinsey Green (1988) stated,

"The important concept is to teach critical thinking, and not to tolerate or accept students' development being arrested at the lowest levels of cognitive development. That is an injustice to learners and presents them with a false picture of the kinds of decisions and learning required throughout their lives."

Throughout home economics textbooks published for high school classes, emphasis is placed on critical thinking. A major publisher, Glencoe Publishing, has included critical thinking activities in its textbooks for teacher usage in class organization (i. e., Brisbane, 1988, Kowtaluk and Kopan, 1990, and Mehas and Rogers, 1989).

When comparing the new class (Food Science) to the

existing classes in nutrition, the comparison addressed a major nationwide issue in home economics, which is

". . .to become skilled in using the practical reasoning process to solve the problems of the family as a family. In this critical thinking approach, students are encouraged to examine the underlying issues for themselves and for society as they look for meanings rather than memorize facts." (Southers, 1990, p. 14)

Davis and Gill (1989) point out that the home economics curricula provided an ideal environment to incorporate questioning skills and develop decision-making abilities in the classroom. The two home economics classes used in this research (Food Science and Nutrition and Food Preparation) have similar course content (see Appendices A and B).

Many issues central to a holistic education must be considered as public schools make curricular changes. The Anchorage School District has reported that the major goal for its students was to develop critical thinking, but there has been a lack of empirical data to substantiate whether or not students have been taught to think critically or whether they are able to apply what they have been taught. The public that

supports American (and Anchorage) education has the right to know if students are gaining skills which have been purportedly taught (LeMahieu and Wallace, 1985).

The ability to think critically and independently has been a longstanding concern in education (Sternberg and Baron, 1985). Anchorage School District and the home economics profession have incorporated these concerns into their goals, but, are the students actually developing critical thinking skills? That is one of the questions this research sought to answer.

Researchers, such as Stephen Norris (1988), call for more research in critical thinking to establish the critical thinking capabilities of children at various levels of cognitive development. Dick (1991) suggested that there is a need to determine the frequency and occurrence of critical thinking exhibited by students, and to determine the influence which teachers have on the students' critical thinking skills.

One of the debates which exists in the critical thinking movement is the determination of the best way to develop

critical thinking abilities. The question is whether critical thinking should be a stand alone course which teaches students metacognition as a subject in itself? Or, is the better way to include critical thinking in subject areas, and teach students to think using course content. Ennis (1990) makes a convincing case for studying metacognition, with the emphasis being the generalization of skills; while McPeck (1990a) argues that the only rationale for knowing how to think is being able to apply it in a useful manner, thus it must be taught as a component of all courses, using course content for the thinking material.

The Association for Supervision and Curriculum Development (Marzano et al., 1988) stated that there was a need to integrate the teaching of critical thinking into each content area, if true gains are to be made in students' abilities to apply critical thinking skills to practical problems. Anchorage School District (Anchorage School District, 1991-1992), presently has no single course which specifically teaches critical thinking. They tend to subscribe to the

philosophy that all courses should teach critical thinking in the context of the course content.

Anchorage School District has developed curriculum which includes critical thinking for several courses. This curricula was similar to a model suggested by a team of authors, lead by Robert Marzano of the Mid-continent Regional Educational Laboratory through work with the Association for Supervision and Curriculum Development. The model suggests that there are practical ways of transforming traditional schooling into a learning-centered approach where critical thinking and problem solving skills are taught and applied (ASCD, 1992; Marzano & Arredondo, 1986). Anchorage School District's curriculum plans included language which reflects the need to teach students how to think, but there was no follow-through to determine if learning to think had occurred, or, if teachers were trained to carry out the stated curricular goals. This lack of assessment was unfortunate and inhibited the development of critical thinking skills because no one was checking various curricula to determine if critical thinking

skills were included, taught, or learned by students.

Research has shown that one major factor in developing critical thinking skills is the relationship between group activity and the enhancement of student critical thinking skills (Craver, 1989). Group activities and critical thinking were of interest to this study because of the nature of the three classes being tested.

The three teachers who participated in this research organized their classes into groups for instructional purposes throughout the semester. In each (Food Science and Nutrition and Food Preparation) of the home economics classes the students were grouped for all lab work, spending at least forty (40) percent of their time working in groups. The language arts class (Intermediate Composition) was one which emphasized group work involvement by the students. The language arts teacher estimated approximately thirty (30) percent of the class time was spent in group activities, primarily engaged in a cooperative learning format. Cooperative learning is an instructional strategy that utilizes

grouping of students to reach established goals, where each of the group's members is responsible for others' learning in the group (Johnson et al. , 1984).

Laboratory activities and cooperative learning settings are similar to those studied and reported by Plihal & Copa (1986), who determined that students in vocational classes were more likely to encounter problems arising in workplace or family simulations because of the laboratory activities and cooperative group activities. The classroom group experiences caused the students to be concerned about other students' functioning and well being. In those situations, as was the case in the two home economics classes in this research, interdependence was more encouraged than was independence. Thus, environmental considerations were designed to promote critical thinking because students had to identify problems confronting them and work together to solve the problems. Even with environmental considerations designed to promote critical thinking, were the students actually able to think critically and use practical problem solving skills? That

question needed to be answered.

The literature written about critical thinking by recognized leaders, such as McPeck (1990), Ennis (1990), Paul (1984) , Costa (1985), de Bono (1986), and Glaser (1985), reflects the importance that problem solving skills have in our society.

As part of the educational reform movement which erupted across America in the eighties and continues in the nineties, critical thinking was a topic which had many associated terms. These included higher order thinking, problem solving, integrative thinking, creative thinking, and metacognition, to name a few. Because of the many "experts" in the field, each with his or her own definition, a definition of critical thinking has been selected which reflects many of the critical thinking leaders' main points.

For purposes of this study, critical thinking will be defined using the definition established by the Delphi panel facilitated by Peter Facione for the American Philosophical Association. This Delphi panel worked toward a consensus of

opinion through anonymous interaction facilitated by the project director (Facione). The panel's work commenced in 1987 and was completed in 1989. Early in the research the panelists decided their most worthwhile contribution could be the articulation of a clear and correct conceptualization of critical thinking (Facione, 1990d, p. 6). The purpose of the Delphi panel was to place their concept of critical thinking before the educational community to serve as a rich and worthy goal guiding critical thinking assessment and curriculum development at all educational levels. Their definition was included in the following section.

When determining what skills were part of critical thinking, the Center for Critical Thinking and Moral Critique at Sonoma State University, California, established a comprehensive list of 35 strategies (Paul, Binker, Martin & Adamson, 1989). Within the 35 dimensions, two areas of concern emerged, the affective strategies and the cognitive strategies. The affective strategies included items such as (S-1) thinking independently, and (S-3) exercising

fairmindedness, as well as 7 other similar dimensions. Within the 25 cognitive strategies, two divisions were organized, including macro-abilities (16 strategies) and micro-skills (9 strategies). Items presented as part of the macro-abilities included (S-10) refining generalizations and avoiding oversimplifications and (S-23) making interdisciplinary connections. Examples of items grouped under micro-skills were (S-27) comparing and contrasting ideals with actual practice and (S-34) recognizing contradictions. (Paul, Binker, Martin & Adamson, 1989)

To help those concerned about critical thinking and its relationship to thought, Paul, Binker, Martin & Adamson (1989) referred to the elements of thought as

"All thought has a universal set of elements, each one of which can be monitored for possible problems: Are we clear about our purpose or goal? about the problem or question at issue? about our point of view or frame of reference? about our assumptions? about the claims we are making? about the reasons or evidence upon which we are basing our claims? about our inferences and line of reasoning? about the implications and consequences that follow from our reasoning? Critical thinkers develop skills of identifying and assessing

these elements in their thinking and in the thinking of others." (p. 363)

Definition of Terms

It seems prudent to define selected terms which have been used in this research.

ASCD: Association for Supervision and Curriculum Development (ASCD). Large professional education organization in the United States. Its interest is in the improvement of education, primarily in elementary and secondary education (Dejnozka, 1983).

CCTST: California Critical Iinking Skills Iest (CCTST). An English language multiple-choice educational assessment tool, designed to assess selected core critical thinking skills, targeting the cognitive skills of interpretation, analysis, evaluation, explanation, and inference (Facione, 1990e).

Cognitive development: The mental or intellectual abilities involved in perception, knowing, and abstract thinking (Ellington & Harris, 1986).

Consumer homemaking: Home economics curriculum that focuses on home management, consumerism, family life and

areas of life related to the role of homemaking (Dejnozka, 1983).

Cooperative learning: An organizational method for student learning promoting behavioral changes which result from shared experiences of two or more persons (Good, 1973).

CT: Critical thinking (CT). Thinking that proceeds on the basis of careful evaluation of premises and comes to conclusions as objectively as possible through the consideration of all pertinent factors and the use of valid procedures from logic. The Facione Delphi panel articulated its understanding of critical thinking as follows:

"We understand CT to be purposeful, self-regulatory judgement which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgement is based. (Facione, 1990e)"

Critical thinking skills: The necessary abilities possessed by an individual to apply critical thinking to

appropriate situations with ease and precision (Good, 1973, p 536).

G.P.A. (Grade Point Average): The measure of average scholastic success in all school subjects taken by a student during a certain term or semester, or accumulated for several terms or semesters; obtained by divided grade points by hours of course work taken, A = 4.00, B = 3.00, C = 2.00, D = 1.00, F = 0 (Good, 1973, p. 53).

Higher order thinking (skills): A widely used term for which there are multiple meanings including reasoning, problem solving, decision making, critical thinking; in addition there is an assumption of specific processes such as hypothesizing, estimating, judging or predicting.

Pilot program: A new class which is being tested to determine its relevance to the school curriculum.

Practical reasoning process: The act of applying reason or the reasoning powers to make inferences and derive conclusions to every-day situations and problems (Hawes & Hawes, 1982).

Scientific method: The method for developing new knowledge used primarily in the natural sciences; generally considered to include definition of the phenomenon to be investigated, collection of initial data, use of the data in the formulation of a theory or hypothesis explaining the phenomenon, and verifying or modifying the hypothesis through actual observation and experiment (Hawes & Hawes, 1982, p. 201).

Scientific principle: A general law or truth; a general statement describing some particular mode of behavior, process, or property relating to natural phenomena (Dejnozka, 1983, p. 127).

Seminar style discussions: A method of conducting a class by discussion among the students. This method requires the teacher to play less of a leadership role than in the lecture method. Much responsibility for discussion and analysis is vested in the students with the teacher functioning as a resource person (Hawes & Hawes, 1982, p. 205).

Statement of Objectives

The central goal of this research was to determine gain in critical thinking skills among three classes; a pilot class (Food Science), a traditional consumer homemaking nutrition class (Nutrition and Food Preparation), and an eleventh grade elective language arts class (Intermediate Composition). The specific objectives of this study were to:

1.) determine any gain in critical thinking skills among selected classes in a semester (18 weeks)

2.) determine if significant differences in gains in critical thinking skills occur among students with various grade point averages.

Summary

It seems essential that critical thinking skills be emphasized in the education of America's children. The curricular changes toward a holistic education have been emphasized throughout this nation. The home economics profession is part of the determined effort to teach students to apply their knowledge in a meaningful manner to solve life's

challenges. The Anchorage School District has made a commitment to this cause by including critical thinking skills in district goals and in curricular plans. Anchorage School District had established the need for the students to possess these abilities; but empirical data, which shows whether students have critical thinking skills or if there was any gain in critical thinking during a course, was lacking. This study was designed to assess the gain in critical thinking skills among selected classes with consideration of grade point averages.

Chapter 2

METHODOLOGY

Introduction to the Design

The study was conducted by administering the California Critical Thinking Skills Test: College Level (CCTST) as a pretest and a posttest to students in three classes: Food Science (grades 10 - 12), Nutrition and Food Preparation (grades 10 - 12), and Intermediate Composition (eleventh grade). The assumption was made that all three classes had components of critical thinking in their structures, but none deliberately planned the instruction of critical thinking skills.

The Food Science class was designed to teach students scientific principles using common food substances as the chemical compounds. This course approached the study of science using human nutrition and how food was utilized physiologically. In addition, the reactions of food to such elements as temperature and other chemicals were studied. These activities were designed to use scientific practices, which included the use of scientific equipment, such as test

tubes, balance beam scales, and metric measurements (see Appendix A). This class was open to students who had completed one year of high school science and were in grades 10 - 12. Science credit was offered which could be utilized to fulfill part of the required credits in science needed to satisfy high school graduation requirements.

The Nutrition and Food Preparation course also studied food, but from a different viewpoint. In this class, the students were introduced to food as a necessary part of human nutrition. The emphasis was on consumer choice of food appropriate for nutritional well-being, preparation of food for maximization of nutritional qualities, as well as enjoyable flavors and aesthetic qualities. The class was taught in a traditional home-kitchen type of classroom environment, which included standard household appliances, household measuring devices and standard American measurements (see Appendix B). This class consisted of students from grade levels 10 - 12. Elective credit was earned toward total graduation requirements.

The Language Arts department at the selected high school taught courses which emphasized communication skills. The classes in the department included topics such as reading and literature, writing, and speech. The language arts course included in the study (Intermediate Composition) was one which included writing, reading and discussion (see Appendix C). It was taught by a teacher who emphasized the seminar-style discussion method to learn the course content. This class included the teaching of basic composition as a major part of the curriculum. Credit for this class satisfied part of the language arts requirement for high school graduation.

The present study did not change the curriculum or the pedagogy for any of the participating courses. The data were collected to establish the baseline gain in critical thinking skills in all three classes. In none of the tested classes was critical thinking explicitly taught as a specific set of skills.

The Dependent Variable

The major intent of this study was to determine if there was growth in the students' critical thinking skills during a

semester's exposure to the three selected classes. The dependent variable was a multiple-choice adjusted test score encompassing critical thinking skills.

Test Instrument

The test utilized for the study was The California Critical Thinking Skills Test: College Level (CCTST), (Facione, 1990). The CCTST is an English language multiple-choice educational assessment specifically designed to assess selected, core critical thinking skills. The test targets the cognitive skills of interpretation, analysis, evaluation, explanation, and inference (see Appendix D).

This test met the study's criteria for an assessment instrument which was objective, easy to administer and score, and able to fit the time available for the high school class period of 50 minutes.

The CCTST was suited to the present research because of its contemporary conceptualization of critical thinking, and its non-discipline specificity (Facione, 1991c). Initially, this instrument was compared to three other leading critical

thinking tests (Watson-Glaser, 1980; Cornell, 1985; Ennis-Weir, 1985) and found to be the best commercially available critical thinking assessment instrument (Carter-Wells, 1991). A compelling argument to use the CCTST was Michael Scriven's (1991) endorsement of the CCTST as the example of an instrument with items of their kind (multiple-choice items, multiple-rating items, essay test items) for accessing higher order thinking skills.

A limitation of the test (CCTST) was its level, since the test was designed for college students (College Level). In the development of the test, students as young as sixteen were part of those included for group norming (Facione, 1990c). Considering the sample population had students in grades 10 - 12, the majority of those tested for this research would have been 16 or older (most tenth grade students turn 16 during the school term).

All groups were pretested and posttested using the CCTST.

Construct Validity of Test Instrument

In Technical Report #1 (Facione, 1990a), the experimental findings assured that the CCTST succeeded in detecting the growth in critical thinking skills. The report described the findings of four different experiments which determined construct validity. These four experiments, which involved 1169 college students, five courses, three departments, 20 instructors, and 45 sections, indicated that the CCTST had construct validity.

The first of Facione's experiments (Facione, 1990a, p. 9) to determine construct validity compared the pretest and posttest means for two independent groups of critical thinking students enrolled in 39 sections of four different campus approved critical thinking courses. The CCTST succeeded in detecting the statistically significant growth in CT skills hypothesized to have resulted from CT instruction. As a control, the second simultaneous experiment (Facione, 1990a, p. 14) related CCTST scores of two independent groups enrolled in six sections of Introduction to Philosophy. The null

hypothesis was retained. In the third experiment (Facione, 1990a, p. 15), using paired pretest/posttest scores, the CCTST measured the growth in critical thinking skills assumed to have occurred as a result of one semester of approved critical thinking instruction. The fourth experiment (Facione, 1990a, p. 16) retained the null hypothesis for the control group using paired pretest/posttest CCTST scores. All experiments demonstrated the claim that critical thinking is not a naturally occurring by-product of good instruction.

The theoretical construct grounding the CCTST is the consensus conceptualization of critical thinking articulated by the panel of 46 national experts who participated in a Delphi research effort conducted from 1987 through 1989 for the American Philosophical Association (Facione, 1990e). Some of the critical thinking leaders participating in this panel included Jonathan Adler (Brooklyn College), Arthur Costa (Sacramento State University), Robert Ennis (University of Illinois), Stephen Norris (Memorial University of Newfoundland), Richard Paul (Sonoma State University),

Richard Stiggins (Northwest Regional Educational Laboratory), Robert Swartz (U. Massachusetts, Boston), and Wayne Neuberger (Oregon Department of Education).

The Delphi panelists began their analysis of critical thinking by identifying the core elements of critical thinking.

The Delphi panel articulated its understanding of critical thinking as follows:

"We understand CT to be purposeful, self-regulatory judgement which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgement is based. (Facione, 1990e)"

This up-to-date conceptualization assured that this test, based on the panel's findings, was content valid.

The Sample

Students used for the study were assigned to classes according to a computerized scheme. Each student was able to select classes, but had no choice in selection of teacher. The classes included Food Science, a home economics pilot class of

one section with 15 students. A second class was a basic foods and nutrition class (Nutrition and Food Preparation) taught in the home economics department, with 60 students enrolled in three sections. The third class was an eleventh grade language arts class (Intermediate Composition), of 26 students, in one section. The total sample size was 101.

Smith (1990) emphasized the possibility that low aptitude and high aptitude students respond differently in problem-solving situations. The concern tested in this research was whether academically successful students (assumed to be those with g.p.a.'s equal to or above 2.75 for the purposes of this study) either had critical thinking skills, or gained these skills at a significantly higher level than students with g.p.a.'s below 2.75. The students' scores on both the CCTST pretest and CCTST posttests were grouped, not only by class, but by cumulative grade point averages of 2.750 and above and 2.749 or below (on a 4.0 scale) to test this study question.

The sampling matrix for the present study is shown below.

TABLE 1. SAMPLING MATRIX

		Treatment					
		A		B		C	
		Pre	Post	Pre	Post	Pre	Post
G.P.A	≥ 2.750	11	12	31	33	11	11
	< 2.750	4	5	29	30	15	18

Each individual's pretest score was utilized as the covariate in the analysis.

The Experimental Design

The study design utilized a two-way fixed analysis of covariance model. Courtney (1988a) explained analysis of covariance as a statistic which combines analysis of variance

and regression to handle situations where the researcher cannot completely control all of the variables in a study. It is a procedure to test for significant differences between means of final experimental data by taking into account and adjusting for initial differences in the data.

The two-way arrangement for analysis of covariance utilized the pretest score as the covariate. The mathematical components of the model consist of the following:

$$\Psi_{ijk} = \mu + \alpha_i + T_j + \alpha T_{ij} + \beta(x - \bar{x}) + \epsilon_{ijk}$$

Where, α_i is the first factor effect (G.P.A)

T_j is the second factor (treatment) effect, and

αT_{ij} is the interaction (G.P.A. x Treatment) effect

ϵ_{ijk} is the residual effect (Courtney, 1988a, p. 124).

Three (3) hypotheses were tested for the dependent variable. These were:

H1: $\mu_1 = \mu_2$ (G.P.A.)

H2: $\mu_A = \mu_B = \mu_C$ (treatment)

H3: There is no significant interaction effect between levels of G.P.A. and treatment.

All hypotheses used the .05 level for significance testing.

Collection of Data

All groups were pretested, using the CCTST, during the first week of the semester, in September, 1991. The CCTST was administered during regular class periods, with the classroom teacher present. The students were informed that the scores from the test would not influence their class grades, and would remain anonymous.

Students were allowed to see their scores, if they requested. Machine scoring answer sheets were used.

The posttest was administered in the same manner during Week 18 of the semester, which was the second week in

January, 1992. The second test also used machine scored forms. Anonymity was assured, as well as assurance that CCTST scores would have no affect on their class grade.

Service High School's principal approved the administration of the CCTST and assured anonymity to the students. The administration provided students' cumulative grade point averages after the CCTST posttests were administered.

Summary

The design for this research follows the traditional model for analysis of covariance. The samples consisted of students placed in three (3) high school classes at Robert Service High School in Anchorage. Data were collected using the CCTST, which was considered to possess construct and content validity. Three hypotheses were tested for the dependent variable; $H_1: \mu_1 = \mu_2$ (G.P.A.); $H_2: \mu_A = \mu_B = \mu_C$ (treatment); and, H_3 : There is no significant interaction effect between levels of G.P.A. and treatment.

Chapter 3

RESULTS

A two-way fixed design analysis of covariance was performed on critical thinking skills as reflected by adjusted posttest scores on the CCTST. Independent variables consisted of grade point averages (two levels with those students having a grade point average of 2.75 or above and those with a grade point average below 2.75) and class groupings (three, including Food Science, Intermediate Composition and Nutrition and Food Preparation). The covariate was the CCTST pretest score. Analyses were performed by SPSS/PC+ (Statistical Package for the Social Sciences/Personal Computer enhanced edition), with covariate adjustment using the pretest as an influence on posttest scores.

The evaluation of the assumptions of normality of sampling distributions, within-cell linearity, homogeneity of variance, homogeneity of regression, and reliability of the covariate were satisfied through data analysis. The original sample of

109 was reduced to 101, due to a lack of pretest scores for eight (8) of the CCTST posttests.

Significance testing was completed for pretest-posttest data using the t-test. These results are displayed in Table 2. No significant differences were found when these data were compared.

TABLE 2. T-TEST RESULTS FOR
PRETEST-POSTTEST PAIRED SAMPLES BY CLASS

Class	Means		SD		T- Value	d.f.	Significance Conclusion
	Pre	Post	Pre	Post			
Food Science	13.67	14.40	5.178	4.188	.81	14	Not Significant
Nutrition & Food Prep.	12.70	12.87	4.200	4.830	.34	59	Not Significant
Intermediate Comp.	10.92	11.35	3.080	4.140	.62	25	Not Significant

After adjustment by the covariate (pretest score), findings indicated that the grade point factor was significantly different for the adjusted posttest means. These data are summarized in Table 3, with $F = 4.096$, and $p = .046$.

TABLE 3. ANALYSIS OF COVARIANCE
POSTTEST SCORES BY CLASS & GPA
ADJUSTED FOR THE CCTST PRETEST SCORES

Source of Significance Variation	Sum of Squares	DF	Mean Square	F	Significance of F
Pretest	960.248	1	960.248	81.338	.000
Main Effects	59.207	3	19.735	1.672	.178
CLASS	3.529	2	1.764	.149	.861
GPA	48.353	1	48.353	4.096	.046*
2-Way Interactions (Class & GPA)	15.910	2	7.955	.674	.512
Residual	1109.725	94	11.806		
Total	2145.089	100	21.451		

*Significant at the .05 level.

No statistically significant main effect was found for levels of class group. In addition, no statistically significant interaction was observed between levels of class groups and grade point average.

Mean scores of the dependent variable (adjusted posttest scores) among the class groupings, as separated by grade point average, indicated that students had higher mean CCTST scores if their g.p.a.'s were 2.75 and above (see Table 4). There was a statistically significant relationship between students with g.p.a.'s 2.75 or above and higher scores on the CCTST posttest.

TABLE 4. MEANS FOR CCTST POSTTEST SCORES

Total Population	12.70	n = 101
Class		
Food Science	14.40	n = 15
Language Arts	11.35	n = 26
Nutrition & Food Preparation	12.87	n = 60
GPA		
Below 2.75	11.46	n = 61
2.75 & Above	14.60	n = 40

	GPA Below 2.75	GPA 2.75 & Above
CLASS		
Food Science	13.60 (n=5)	14.80 (n=10)
Language Arts	10.28 (n=18)	13.75 (n=8)
Nutrition & Food Preparation	11.74 (n=38)	14.82 (n=22)

Table 5 summarizes the results of hypothesis testing. H_1 was rejected, and H_2 and H_3 were not rejected.

TABLE 5. RESULTS OF HYPOTHESIS TESTING

Hypothesis	Decision	Conclusion
$H_1: \mu_1 = \mu_2$ (G.P.A.)	Reject	$\mu_1 > \mu_2$
$H_2: \mu_A = \mu_B = \mu_C$	Not Rejected	$\mu_A = \mu_B = \mu_C$
H_3 : There is no significant interaction effect between levels of G.P.A. and treatment.	Not Rejected	There is no significant interaction effect between levels of G.P.A. and treatment.

SUMMARY

Pretest and posttest means were found to be not significant. The data analysis indicated that there were no significant differences between the adjusted CCTST score based on course of enrollment. Those students with grade point averages above 2.749 were found to have significantly

higher CCTST scores than those with lower grade point averages. No significant interaction effects were found in the data between g.p.a. and course of enrollment.

Chapter 4

DISCUSSION

Research completed by the Alaska Department of Labor (Goforth & Keith, 1993) indicates that the state's citizens are convinced that Alaskan students entering the work world are unable to perform critical thinking or practical problem solving. The students (n = 101) from the tested Service High School classes did not show significant increase in their CT abilities in a semester's time, which would indicate a similar plight. Glaser (1985), also emphasized the legitimacy of the public's concern for an educated American populous which is unable to think critically. This fundamental process of critical thinking and practical problem solving has somehow been passed over in the educational system. So, how does the educational system deal with this situation?

Several research projects have shown that critical thinking can be improved by providing certain kinds of instruction and guidance woven into the regular school

curriculum (Glaser, 1985; Pierce, Lemke & Smith, 1988; Wooldridge & Weber, 1990). These studies showed that actual steps in thinking must be taught and practiced regularly if students are to gain mastery of critical thinking and problem solving. Glaser's (1985) studies indicated that, even in the fields of science, logic, and social studies, subject content is not likely to develop a generalized ability to reason logically and productively. In order to think critically, the skills of critical thinking must be explicitly taught to the students. Collins, Brown and Holum (1991) proposed that thinking be made visible through a cognitive apprenticeship model. For the home economics curriculum, or perhaps in any vocational setting, apprenticeship is something which is understood by practitioners. Making the leap to modeling good thinking by making thinking visible is an example of apprenticeship in thinking. This synthesis of schooling and apprenticeship is already present in vocational education (Evans & Herr, 1978, p. 11). Perhaps a similar model should be used for the synthesis of modeling thinking and practical problem solving.

The literature has many references to the general debate which centers around whether critical thinking should be taught as a subject in itself, or as a part of other subjects. Representative studies include those exemplified by McPeck(1990a), Ennis (1990) and de Bono (1986). The argument is one which will continue among the leaders in the field, long after curricular decisions are made at the school level. It is proposed that the possibility of developing a new course, which would be general in nature, to teach critical thinking is unlikely in the traditional high school. Because of this reality for high school curricular development, critical thinking will need to be taught within subjects. Further study and training for teachers will be necessary to bring the staff in line with the public cry for the improvement of students' critical thinking abilities.

According to Dunn (1988), a home economics teacher, it is possible to incorporate critical thinking skills into the home economics curriculum. Home economists can, with training, incorporate critical thinking skills into their lesson plans.

Falivene (1987) points out that home economics classes are environments which force students to face problems and that the answers are of a practical, although not simple, nature. Critical thinking is a necessary part of good teaching. But, in order for this to occur, the teachers must set up tasks that include these activities and skills (Marzano and Ewy, 1989). Barton (1990) calls for the responsibility to fall upon the principals of high schools who are involved in training teachers, to incorporate critical thinking into their curricula. Teachers who are in an environment supported by principals who provide opportunities for training, could learn to use their classrooms to encourage students to develop critical thinking skills.

David Perkins summarized his attitudes toward teaching general thinking skills during an interview with Brandt (1990) by saying, "To me, it all boils down to the interconnectedness of subject matter and general thinking skills and to the culture of the classroom." (p. 51) This statement is in agreement with Bonstetter (1989), who believes that teacher behavior is

the primary influence in the development of a world in which there are heightened critical thinking skills. But, as Sternberg (1987) proposes, let's first determine what our goal is in critical thinking, then go about determining a plan to accomplish that goal. This seems especially relevant to the teachers involved in the present research. The goals are in place, but there is no plan to carry out these goals. There seems to be no relationship between the critical thinking goals and mission of the school district and the outcomes for the students. Perhaps there needs to be a plan to train teachers to accomplish the established goals, so that student achievement is more likely to occur.

Critical thinking is not a new topic. There is a great deal already known about the topic, so schools do not have to reinvent the model. Sound foundations have been laid, so the main requirement is to think critically about the selection of critical thinking materials (Norris, 1985). Perhaps this is a message which can be carried beyond the present research effort.

The pilot course, Food Science, is currently being evaluated for its position in the Anchorage School District curriculum. The knowledge gain indicated by the district's subject-specific course assessment, as measured by pretests and posttests indicated that students had gained knowledge in the subject matter, but as the present study shows, the same cannot be said for gains in critical thinking skills.

Current knowledge about higher order thinking skills suggests that it is important for home economics to teach these intellectual process skills, because the context in which thinking skills are learned is related to students' ability to use their thinking skills. Consequently, if students are to be able to use these skills in relation to the home and family context or in a home economics-related employment context, the skills need to be taught in relation to concepts relevant to those contexts (Thomas, 1987).

Richard Paul, of the modern critical thinking movement, stated that ". . . most school systems and most teachers are not well prepared for this transformation of emphasis." (Paul,

1984, p. 12) The present study reflects the same concern nine years later.

Conclusions

In this research, the following conclusions were determined. As a result of a two-way fixed design analysis of covariance, no statistically significant main effect was found for levels of class group. In addition, no statistically significant interaction was observed between levels of class groups and grade point average.

After adjustment by the pretest score, findings indicated that the grade point factor was significantly different for the adjusted posttest score. Students with grade point averages greater than 2.749 had significant gain in mean scores on the posttest.

Significant testing was completed for paired pretest and posttest data using the t-test. Results indicated no significant differences were found.

Implications and Recommendations

As a result of this research, it is recommended that critical thinking skills be taught so that everyone learns them. These skills must be the focus of instruction (explicitly taught). Cooperative learning classes and laboratory classes provide an environment conducive to critical thinking, but specific lessons must be developed so all students will be aware of metacognition.

Suggestions for Further Study

The following suggestions for expanding the present research are made on the basis of the findings and conclusions of this study:

1. There is a need to expand this research to other grade levels in the same school district to determine if students experience an increase in critical thinking skills at any point, from the time of entering school in kindergarten to the point of graduation from high school.
2. There is a need to study the differences in teachers and programs in the high schools to determine if there are

environments which are more conducive to developing critical thinking skills.

3. Other demographic information should be collected to determine if such characteristics as gender, age, or number of years in various programs or classes influence the ability to think critically.

4. The sample should be expanded to determine if any teachers teach critical thinking and if critical thinking is a natural outcome of a high school education.

5. A study covering more than an 18-week period of time might show a greater relationship between critical thinking skills and grade level.

6. There is a need to determine if the relationship between high grade point averages and critical thinking skills is related to the way the teacher presents the material or to the innate abilities of the academically oriented students.

7. The CCTST is developed as a college level test. A test which measures critical thinking needs to be developed and normed for secondary level students.

8. Research should be conducted to determine the patterns of grading for Anchorage high school students in order to establish the most favorable G.P.A. break point for studies of this type.

9. A study to determine the relationship between learning styles and the development of critical thinking skills should be conducted.

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APPENDICES

Appendix A

Program: Consumer Homemaking (Home Economics)

Course Title: Food Science

Course Overview:

This 18-week course presents the science of food and its implications on humans and their well-being. Its approach is that of a science laboratory, using scientific methodology for understanding foods' impact on the being. This course is a laboratory course which does not include food consumption, but uses experimental methods for hands-on learning. Prerequisite - one year of high school science; grades 10 - 12.

Course Outline:

1. What is Food Science?
2. Scientific Evaluation of Food
3. Basic Food Science for Scientists
4. Energy
5. Acid & Bases
6. Water
7. Carbohydrates
8. Lipids
9. Protein
10. Vitamins & Minerals
11. Metabolism
12. Enzymes
13. Solutions, Colloidal Dispersions and Emulsions
14. Leavening Agents
15. Fermentation
16. Dairy Products & Processing
17. Additives
18. Careers in Food Science

Textbook: Food Science & You

Mehas & Rogers, Glencoe Publishing Co., 1989.

Appendix B

Program: Consumer Homemaking (Home Economics)

Course Title: Nutrition and Food Preparation

Course Overview:

This 18-week course will address the problem of choosing foods appropriate for physical well being. The study of nutrition offers knowledge needed for food consumption. In addition, techniques for preparing foods in a nutritious and aesthetic manner are also presented. This course is a laboratory course with actual food preparation as an integral part of instruction (grades 9 - 12).

Major Instructional Units with Student Outcomes:

1. Significance of Food and Diet to People
 - a. Explain reasons for differences in food customs among cultures.
 - b. Describe influences on food choices.
 - c. Relationship of technology and food supply.
2. Nutrition for Good Health.
 - a. Recognize links between science, food and health.
 - b. Understand how nutrients work in the human body.
 - c. Identify the best food sources of each nutrient.
 - d. Recognize steps to be able to develop a personal wellness plan.
 - e. Identify food choices for special dietary needs, i.e., age, health, physical conditions.
 - f. Explain basic functions of each nutrient.
 - g. Develop well-balanced menus which are nutritious.

3. Consumer Decisions
 - a. Evaluate kitchen for safety and efficiency.
 - b. Operate and care for appliances and equipment properly.
 - c. Use information on food labels for wise decision making while shopping.
 - d. Choose procedures for correct food storage.
4. Food Handling Skills
 - a. Recognize and prevent food-borne illness.
 - b. Evaluate and use recipes successfully.
 - c. Use basic cooking tools and techniques correctly.
 - d. Use the proper procedures for microwave cooking.
 - e. Use basic management principles while working in the kitchen.
5. Food Preparation
 - a. Understand how cooking affects various foods differently.
 - b. Choose correct cooking methods for the various foods.
 - c. Prepare foods nutritiously and aesthetically in the common foods including:
 - fruits and vegetables
 - dairy foods
 - meats, poultry and fish
 - grains and their products
6. Exploring Careers
 - a. Identify and explore career opportunities in food and nutrition.
 - b. Recognize entry-level jobs available in food and nutrition.

Textbook: Food for Today
Helen Kowtaluk and Alice O. Kopan
Glencoe Publishing, 1990

Appendix C

Program: Language Arts

Course: Intermediate Composition

Course Overview:

This 18-week course concentrates on writing the multi-paragraph paper. It continues the development of writing skills and emphasizes organization, sentence variety, revision skills, and vocabulary.

Course Objectives:

1. To acquire technical skills for writing effective exposition.
2. To stress unity, clarity, and coherence of expression.
3. To review basic grammar, spelling, punctuation, and vocabulary skills.
4. To develop confidence in written expression.
5. To extend the basic paragraph form.
6. To refine organizational techniques.

Appendix D

A Selected Sample of Questions from The California Critical Thinking Skills Test College Level

The California Academic Press
Dr. Peter A. Facione
c. 1990
217 LaCruz Ave., Millbrae, CA 94030

(from page 2.)

DIRECTIONS: Read each question carefully, then select the best choice from among those provided. There are 34 questions. Each test question is of equal value. Remember, you have only 45 minutes to work. You may write in this test booklet if you wish.

1. "Not all the candidates are qualified to serve." expresses the same idea as:
 - A. None of the candidates are qualified to serve.
 - B. Some candidate is not qualified to serve.
 - C. Someone qualified to serve is not a candidate.
 - D. All candidates are not qualified to serve.

2. Suppose "Only those seeking challenge and adventure should join the Army" were true. Which of the following would express the same idea?
 - A. If you seek challenge and adventure, you should join the Army.
 - B. If you join the Army, you should seek challenge and adventure.

- C. You shouldn't seek challenge and adventure except by join the Army.
 - D. You shouldn't join the Army, unless you seek challenge and adventure.
3. Suppose a botanist lecturing about garden plants said, "The rose offers many colors." Which would be the best interpretation of this claim?
- A. There is a rose which is more than one color.
 - B. There is a thing that is more than one color and it is a rose.
 - C. All roses are more than one color.
 - D. Not every rose is the same color.
 - E. All of the above are equally acceptable interpretations.
4. "Azaronians tell lies" means the same thing as:
- A. If anyone is Azaronian, then that person is a liar.
 - B. If anyone is a liar, then that person is Azaronian.
 - C. There is at least one person who is an Azaronian who lies.
 - D. People don't lie unless they are Azaronian.
 - E. All of the above mean the same thing.
5. Which of the following expresses the same idea as: "It is not true that if Jones managed the store, then Webster managed the factory."
- A. Jones did not manage the store unless Webster managed the factory.
 - B. Either Jones managed the store or Webster managed the factory.
 - C. If Webster didn't manage the factory, Jones didn't manage the store.
 - D. Jones managed the store, yet Webster did not manage the factory.
 - E. None of the above express the same idea.