THE RELATIONSHIP OF APTITUDES, LENGTH OF SERVICE, POSITION RANK, AND EDUCATIONAL LEVEL TO LEARNING FROM A FOOD PRODUCTION TRAINING PROGRAM

by

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Thesis submitted to the Graduate Faculty of the

Virginia Polytechnic Institute and State University

in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

in

Human Nutrition and Foods

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July, 1973

Blacksburg, Virginia

ACKNOWLEDGEMENTS

Sincere appreciation is expressed to Dr. Mary E. Quam, advisor, for her friendly and expert guidance throughout the entire course of graduate study, and for her untiring support and assistance during the research and preparation of this manuscript.

Sincere appreciation is expressed to
Director of Food Services at Virginia Polytechnic Institute and State University, for his endless patience, support, cooperation, and participation during the preparation and execution of the training program.

Appreciation is expressed to Dr. S. J. Ritchey, Dr. R. P. Abernathy, Dr. Mary Korslund for their consultation and review of this manuscript. A special collective note of thanks is expressed to all the Staff of the Food Service Department of Virginia Polytechnic Institute and State University for their suggestions, support, and participation in the preparation and execution of the training program. Also special thanks to all the many friends who participated so willingly as subjects in this project.

Sincere appreciation is extended to CCTV Director, for sharing his talents, and for his many hours of time, enthusiasm and interest in this project.

Appreciation is expressed to Dr. Ralph K. Roberts, Counseling Psychologist, at Virginia Polytechnic Institute and State University, for his guidance and assistance in selecting and administering the Aptitude tests, and to Dr. Charles R. Holloman, Associate Professor of Business Administration, for his interest and participation in the

training program.

To who is affiliated with Learning Resources, goes a special note of praise for his patience during the long editing sessions, and many thanks for his technical guidance.

Recognition is made to the Department of Human Nutrition and Foods at the Virginia Polytechnic Institute and State University.

extends many thanks to her family and friends, whose interest, support, and assistance made the completion of this project possible.

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INTRODUCTION

The current labor market available to the food service industry has been reduced as a result of changing times. The worker himself wants more job satisfaction, reward systems equal to those in other industries, a better job environment, both physical and social, as well as an opportunity to advance in a clearly defined career ladder.

The industry is faced with changing skill requirements as a result of consumer demands. The number of meals per person eaten in a commercial establishment is increasing annually. The desire for quality food and fast service has led to the development of new products, changing production methods and sophisticated equipment. These technological innovations have created a situation in which traditional recruitment, induction, training and job placement techniques are no longer adequate.

The resultant manpower shortage in the food service industry prompted a cooperative investigation among the National Restaurant Association, the U. S. Department of Labor, and the School of Hotel Administration, Cornell University (1). Recommendations based on the results from the investigation identified a need for the expansion and development of the current labor market available to the food service industry. Training programs were suggested as one alternative for increasing efficiency and effectiveness of non-management food service personnel.

A training function must be evaluated on an economic base, the assets must be greater than the training expenses (2). To obtain

optimum benefits from a training program, the following questions need to be answered, and used as criteria for trainer selection and program development:

1. Are some teaching methods more effective than others?
2. What are the individual characteristics that influence the amount of learning and retention of learning from a training program?
3. How can the results of a training experience be measured?

REVIEW OF LITERATURE

The food service industry is the fourth largest industry in the United States (3). Projections indicate that there will be a personnel requirement of nearly four million persons by the end of the 1970's to produce and serve a potential sales from meals eaten away-from-home of $75 billion (4).

The National Restaurant Association estimates that 225,000 new non-management workers must enter the field annually to keep pace with consumer demands (5). Job vacancies in May of 1968 exceeded 65,000 positions, 40 per cent of which were positions for kitchen and related workers. Currently kitchen and related workers compose 16 per cent of the total food service industry's personnel (1).

The current manpower shortage in the food service industry has been evidenced by delay in utilization and/or poor service at new facilities, reduction and delays in expansion programs, and curtailment of investments (3). Until 1968 few positive steps had been taken to identify the sources of the manpower shortage or to suggest possible solutions to it. In 1968, through the cooperative efforts of the School of Hotel Administration at Cornell University, the Manpower Administration of the United States Department of Labor, and the National Restaurant Association, industry-wide inadequacies were identified in the areas of recruitment, development, and retention, of non-management personnel. These inadequacies were a result of a number of factors, summarized briefly in a report published by the National

Technical Information Service (3):

> The food service industry is easily entered and easily left, due in general to a questionable image, relatively low wages, minimal benefits, the absence of uniform standards, obfuscation of a career potential, poor if any on-the-job training, and the lack of an upward orientation in which economic and social needs can be met.

The need for training programs in all aspects of the industry's occupations of non-management personnel was a key recommendation to the industry. To be of long-term value, and conducive to improving the image of the industry and the individual employee the following factors were identified as important in developing a formalized training function for food service employees:

1. Purpose and benefits of training should be identified to trainees.
2. Human relations training and development should pervade the entire organization.
3. Training should communicate the goals of the organization, the unit in which the employee is working and detailed instructions of his specific task assignments.
4. Quantitative measures of human resources are needed (3).

Training is a practical and specialized form of education. Three phases of learning are involved: knowledge for selecting a course of action, change of attitudes, and development of skills for carrying out prescribed tasks.

Learning, by definition is a change in behavior and is an active process (6). Establishing the proper conditions for learning is the

responsibility of the instructor who must be aware of the fundamental individual differences of the learners.

Relationship of Aptitudes and Learning

Dunnette (7) provided a brief review of the historical recognition that individual differences are related to learning ability. Early philosophers speculated about the nature of man and his differing abilities. Plato suggested that accurate assignment of individuals to particular occupations for which they were physically suited was needed. Sir Francis Galton in 1869 presented a method for classifying men according to their abilities, which he called "eminences". In 1895 Alfred Binet developed a technique for classifying and comparing the mental abilities of children according to age. In 1916, Lewis Terman of Stanford University, translated and revised the Binet test and developed the intelligence quotient for expressing an individual's "mental age" versus his chronological age. Terman's work led to the development of the concept that intelligence appears to be a combination of independent aptitudes. Later, following the development of the factor analysis method for summarizing correlations of large numbers of measures and expressing them as smaller clusters of factors, L. L. Thurstone suggested that cognitive learning abilities could be grouped under seven categories: verbal comprehension, word fluency, number aptitude, inductive reasoning, memory, spatial aptitude, and perceptual speed.

The greatest lack of information appears to be in the area of divergent thinking or creativeness and originality when classifying

factors involved in human intelligence. The concept of convergent thinking or selecting one right answer to a problem has been expressed in ratings of school performance, teachers' ratings, and learning ability measures (7).

In the development of most intelligence tests, the categories of Verbal Reasoning and Numerical Ability are often used for a measure of general intelligence, according to the Differential Aptitude Test Manual (8). Verbal Reasoning and Numerical Ability scores have been used as a predictive measure of academic success and for career counseling. As a result of the success experienced in predicting academic success in children and adolescents, the use of aptitude tests in industry for prediction of success from a training program has been suggested (8).

Denova (2) suggested that a training program could be justified only if classroom learning could produce desired effects in the out-of-classroom behavior. McGeoch and Irion (9) stated:

> Transfer of training occurs whenever the existence of previously established habit has an influence upon the acquisition, performance, or relearning of a second habit. It is one of the most general phenomena of learning and, by means of its influence, almost all learned behavior is interrelated in various complex ways. Transfer serves to determine, in part, the ease of learning of a particular habit, and indeed, every new learning takes place in the context of all previously established habits.

Adult Learning

If training is to be effective certain conditions of learning must be favorable (2). Curiosity must be aroused and motivation to learn

must be present. Intelligence alone does not assure that learning will take place. The subject matter information provided must be relevant, and the trainee must be able to see application of the information given to the performance of his tasks. Finally, satisfying practice conditions must be provided. The learner must feel a sense of accomplishment or success.

Rogers (10) suggested that several basic factors are important when dealing with adults in a learning situation. Adults learn best when the instructor keeps in mind that short term memory declines with aging. Activity is one of the preferred methods for teaching adults. Altering the pace of learning can be beneficial. People over 45 tend to substitute accuracy for speed. Time pressures and competition can interfere with learning in adults. Learning by adults must be accomplished through realistic and relevant material. Experience can be a valuable asset when teaching adults as they are able to fit new information into a more complex perceptual framework. Adults also find it difficult to recognize their own mistakes. Finally, it is important to give adults an immediate evaluation of results.

Planning and Executing Training Programs

Ninemeier (11), in an experimental training program for food service personnel when using a subject matter pre-test post-test, found a significant and positive correlation between verbal, numerical, clerical perception, and spacial aptitudes, and the amount of job knowledge measured by the pre-test. There was no significant correlation between aptitudes and gain in job knowledge following training. In a

later study using the same subjects, Hutchcroft (12) conducted a retest to determine the relationship between aptitudes and retention of learning over time. Aptitude tests of general intelligence, verbal, and clerical perception, were readministered with the retest in this investigation. No significant correlation was found between aptitudes and retention of learning two years after the original experimental training program.

Other empirical studies designed to examine various aspects of the effects of training have been conducted at Iowa State University. Miller (13) found concentrated training completed during one summer was as beneficial as three courses over a three-year period. However, there was some evidence that the training over the three-year period was particularly beneficial to those with Grade 11 or less education.

An instrument to measure on-the-job performance by observation, interview, and inspection, following a training course, to determine the transfer of knowledge to job behavior was used in a study conducted by Simons (14). Subjects were selected on the basis of their post-test scores in the training experiment conducted at Iowa State University. Those subjects in managerial positions exhibited transfer of training in the subject matter area of Type-A lunch superior to those subjects who had not participated in the training program. On-the-job performance in subject matter areas other than the Type-A lunch indicated there was no significant difference between the two groups.

Thomas-Moore (15) used three instructional tools consisting of a series of 35 mm slides, a super 8 mm film production, and a videotape

to determine which method was superior for instructional purposes in a training program. Results were determined on the basis of a pre-test, post-test measure. Analysis of data indicated all three methods were adaptable for use as instructional tools for food service training programs.

Welch (16) developed a Task Unit Concept for on-the-job training of food service personnel. The method systematizes and applies basic food production concepts in actual working situations and emphasizes the one-to-one approach rather than a classroom technique.

The Society for the Advancement of Food Service Research, in the 1972-1973 Proceedings for the 26th Conference reported on several developments in the area of training for the food service worker. Use of television as an instructional tool for training food service personnel was reported by Ebro (17). North Carolina University Television System aired a training course concerning basic nutrition and menu planning to 1600 students who were employed by the North Carolina School Food Services. A questionnaire was completed by the students at the end of the training program to evaluate their interest in participation in the program and its effectiveness. Results indicated that educational television was acceptable to the class participants. The use of training machines for food service personnel was reported on by Hunter (18). This tool has been used by Marriott Corporation for training all levels of employees. It was found to be especially effective as an indoctrination tool.

Training programs for food service personnel have been developed and implemented by numerous agencies. Educational material presented in a training program is usually skill and/or task-oriented, therefore personal characteristics which influence adult learning in a training situation may differ from those involved in academic achievement. Identification of these characteristics may be helpful in the selection of personnel who would benefit most from training.

MATERIALS AND METHODS

The materials and methods used for this study were designed to meet three major objectives:

1. To develop a training program using techniques and materials planned for food production employees in a college food service with a high school level of education or less.
2. To determine the relationship of aptitudes and educational level of the food production employee with learning achieved from a training program.
3. To measure the learning achieved and retained over a specified time period as a result of the training program.

Situation

Through the cooperation of the Food Service Director and the food service employees, this project was carried out in the residence hall food services of Virginia Polytechnic Institute and State University. The residence hall food service system maintains five dining operations serving the students on a contract basis and preparing over 18,000 meals daily for the breakfast, lunch, and dinner meals. The operations are typical institutional food service facilities managed on a self-sustaining budget.

Cycle menus are planned for the five operations and produced with a combination of traditional and ready food production methods. There

are four position classifications for food production employees; cook's helper, the lowest in rank and cooks A, B, and C. The C position is highest in rank and serves as the shift leader. The employees are both male and female, many of them native to the Blacksburg area. The range of education is from sixth grade to four years of college with an average education level of ninth grade. Length of service with the department ranged from less than one month to 25 years. The age range was from 18 to 65 years.

The training program subject matter was planned to include topics suggested by the food service unit managers and the Director of Food Services. Topics selected included work improvement methods for efficiency, use and care of equipment, and interpersonal relationships. Other areas determined as important included proper cooking methods for meats and other protein foods, vegetable preparation, work safety and sanitation and the proper use of standardized recipes including commonly used weights and measures.

The training program was organized into four five-hour sessions scheduled during the spring quarter break of 1973. All personnel, who were currently employed in the food services in one of the food production job classifications, participated as subjects. Two groups of subjects, an experimental group of 23 and a control group of 24 were selected to participate on the basis of aptitude and subject matter tests. The experimental group attended classes as scheduled and the control group was free during the instructional period after completion of the aptitude and subject matter pre-test. All subjects were paid their

regular wages for the time spent in participation. They were advised that the results of the tests would have no effect on their job security and that their scores would be confidential. The data collection, including pre-test and two post-tests, covered a two month period of time.

The subjects were assigned to the experimental and control groups through the use of a table of random numbers. Kerlinger (19) suggested random assignment of a total population group to control for unidentified variables which might affect the relative equality of the two groups.

Following the assignment of subjects to their respective groups during the first week of February 1973, a visit was made to the five dining facilities by the Food Service Director and the principal investigator. The food production personnel and their unit managers were informed of the purpose of the training program and they were requested to give it their support and cooperation.

Characteristics of Experimental and Control Groups

Factors which were identified as possible sources of influence on learning from the review of literature were age (10), aptitudes (11), level of education (13), length of service (14), and position rank (14). Data on these factors, with the exception of aptitude measures, were taken from the employment application forms of all 47 subjects.

Observed frequencies of the characteristics of age, educational level, length of service, and position rank were recorded, grouped, and

converted to proportions, for both the experimental and control groups. Between groups comparisons of the interval proportions were made by the use of the Lawshe-Baker Nomograph (20). No significant differences were found.

The selection of the aptitude tests to be administered to the subjects in the experimental and control groups were made based on the advice of a Counseling Psychologist, and from suggestion for use in the Differential Aptitude Test (DAT) Manual published by the Psychological Corporation (8). Three subtests from the DAT were selected and included the Verbal Reasoning Test (VR), Numerical Ability Test (NA), and the Abstract Reasoning Test (AR). The combined scores of the Verbal Reasoning and Numerical Ability Tests should provide a measure of general intelligence and the Abstract Reasoning Test should serve as a check on the Verbal Reasoning score for those people with reading handicaps, language problems, and lower educational levels. Because of a scheduling problem the DAT tests were not administered to the subjects at the time of their assignments to the experimental or control groups. Therefore, the relative equality between the two groups on the basis of aptitude scores was not determined before the actual training program began.

Training Program Content

The subject matter, training materials, and teaching methods were developed to include content needs suggested by the food service unit managers and the Food Service Director. Provisions were made for the

development of video tapes for training aids using closed circuit television equipment for filming eight work processes in three of the five dining facilities.

The video tapes were prepared by the CCTV Director, with emphasis on the following principles: work efficiency methods and motion economy, proper use and care of small and large equipment, sequential work flow, rotation or batch cookery, proper cooking methods of meats, vegetables and gravy. The tapes were edited and narrations were recorded. Both positive and negative aspects in each of the work processes were discussed.

The Unit Managers were notified in advance of the scheduled taping, and were asked to request cooperation and participation from the food production personnel in the preparation of the tapes. Instructions were given to the personnel regarding the processes which were to be taped, what the camera could and could not do, what was expected of each person, and how to proceed with their work as normally as possible during the taping sessions.

Training films were also selected from the National Educational Media Library to be used in presentation of the various training program topics. Other training aids were developed using flannel board displays, a collection of institutional cutting equipment, overhead projector transparencies, and a display of the commonly used institutional can sizes.

Subject Matter Pre-test, Post-tests

A subject matter test consisting of 40 questions was developed for use as a paper and pencil achievement test. It was designed to measure learning, achieved as a result of training, and retained over a specified period of time. The test contained multiple choice type questions, each with a correct or preferred answer, a distractor, and one or two other answer choices. The number of questions on each subject matter topic was proportionate to the length of time spent on that topic in the training program, with two questions allotted to each hour of instruction.

Care was exercised in developing the testing instrument to use terminology that would not exceed the lowest educational level of the selected subjects. A copy of the test was checked for format with an educational advisor from the College of Education before it was administered.

Written instructions given on the test directed the participants to select the one best answer. The test was administered to both the experimental and control groups prior to and two times after the training program. A copy of the subject matter test may be found in Appendix (A).

Experimental Training Program

Approximately two weeks prior to the study, all subjects were again notified by letter of the date, time and place of the testing session and training program. Three monitors of the testing session

were provided with written instructions for the administration of the aptitude tests and subject matter test. They reviewed the DAT Manual, the tests, answer sheets with the principal investigator and were given additional verbal instructions on the importance of controlling the testing environment. The pre-test session was held one day prior to the training program in one of the dining rooms on campus. Generous space was allowed for each subject, and the dining room provided a familiar environment in which to take the pre-tests.

Copies of the subject matter pre-test and pencils were provided for each subject. Verbal instructions were given directing each subject to select the one best answer to each question and to circle the corresponding letter by the answer on the test paper. Reassurance was again given that all scores would be confidential and that the results would have no adverse effect on employment status. The subject matter pre-test time allotment was 30 minutes, after which instructions to stop were given and the test papers were collected.

The verbal reasoning portion of the DAT was administered immediately after the subject matter test. Subjects were given copies of Form L of the DAT, answer sheets, and scratch paper. Verbal instructions were given from the manual, and the time allowed to complete the test was determined by use of a stop watch. Fifteen minute break periods were scheduled between administration of the various tests.

The same instructional procedures were followed for the remaining subtests of the DAT, the Numerical Ability test and the Abstract Reasoning test. Throughout the testing session, the monitors circulated

quietly about the room, to ensure that subjects followed instructions, and to answer any questions regarding procedures for marking answer sheets. Upon completion of the testing period, the booklets, pencils, answer sheets, and scratch paper were collected.

Before being dismissed the subjects were requested not to discuss between groups the content of the training program which was to begin the next day. They were again told the purpose of the division of the group and that any discussion of the subject matter covered in the training program could influence the responses of the control group to the post-test measures.

The experimental training program sessions shown in Appendix (B) were held in a classroom on campus. It consisted of four five-hour sessions, with two ten-minute breaks plus a one-hour lunch break. The instructors for the program included the Food Service Director, Assistant Food Service Director, the principal investigator, one unit manager, an assistant unit manager, and an associate professor of Business Administration.

Various methods of presentation were used during the training sessions to generate active participation from the experimental group. Presentation methods included lecture-discussion, a modified T-group, demonstrations, video tapes, and films. Care was exercised by all instructors to cover that material which had been determined as important subject matter content and which was a part of the subject-matter test. A brief review of all material covered during the training program was presented during the last class period and the subjects were thanked

for their cooperation and support.

During the week following the conclusion of the training program, post-test I was administered to all experimental and control subjects to measure the learning which had occurred as a result of the training program. Since the spring quarter break had ended and all employees had returned to their respective units, it was not possible to have one inclusive testing session as had been scheduled for the pre-test. Because of days off and shift assignments, two testing sessions were necessary to obtain measures on all subjects in each of the five units. The principal investigator gave instructions and administered all post-tests to the subjects within their respective units of employment.

After data were collected from all subjects, the pre-tests, post-test I, and aptitude tests were scored manually. Scoring of aptitude tests was done according to scoring instructions in the DAT Manual. All test measures were recorded as raw scores. Raw scores were defined as the number of items which were correct for each test measure. No deduction was made for incorrect answers.

A second post-test, (post-test II) was administered following a six-week time lapse after the conclusion of the training program. The same procedures described for post-test I were followed. Post-test II was obtained to determine the learning retention from the time of post-test I to post-test II. The six-week time period was selected in preference of a more extended period. Miller (13) suggested that retention of learning may be altered by environmental interraction on the job, and new learning may alter the retention score.

The total number of subjects in both experimental and control groups had decreased to 19 as a result of an approaching summer reduction in work force. As a result, complete data were available on only 38 of the original 47 subjects.

Selected Methods for Data Analysis

Student's T-tests were used for comparisons of the difference between score means. The T-test for correlated measures or paired analysis was used for all within group comparisons of two scores achieved by the same individual. A T-ratio of 2.1 or greater, at 17 degrees of freedom was identified as significant at the 0.05 probability level, and a T-ratio of 3.9 or greater was identified as highly significant at the 0.001 probability level. The Student's T-test for uncorrelated measures or unpaired analysis, was used for all between group mean comparisons of the experimental and control groups on identical tests or measures. A T-ratio of 2.0 or greater at 36 degrees of freedom indicated significance at the 0.05 probability level.

Pearson-r correlations coefficients were computed to examine the relationship between variables. The significance of r was tested by using a technique when N is less than 30, described by Downie and Heath (20). It was assumed that a correlation coefficient of 0.45 or greater was necessary for significance at the 0.05 probability level.

Determination of Learning as a Result of Training

The difference between the means of the pre-test and post-test I was computed to measure the learning resulting from the training exercises, and was expressed as a difference score. The T-test for correlated measures was employed for within group analysis to determine the significance of the difference between the pre-test and post-test I scores in both experimental and control groups. The T-test for uncorrelated measures was used for between group comparisons to determine whether or not there was a significant difference between the mean difference scores for learning of the experimental and control groups.

Determination of Amount of Retention

After a time lapse of six weeks, both the experimental and control groups were given post-test II which was identical to post-test I. The difference score obtained from post-test II minus post-test I was used to measure learning retention six weeks following an experimental training program. Difference scores for retention were computed and tabulated for the experimental and control groups and were reported as percentage differences from post-test I to post-test II.

Relationship of Aptitude Tests and Learning

Verbal Reasoning and Numerical Ability scores are recorded for each subject, first, as separate scores and then as combined scores.

The combined score for each subject was used as a measure of general intelligence. The Student's T-test for uncorrelated measures was used for a comparison of general intelligence between the experimental and control groups.

The T-test for uncorrelated measures was computed to determine if a significant difference existed between the experimental and control group means of the Abstract Reasoning scores and the Verbal Reasoning scores.

The Student's T-test for correlated measures was computed for within group comparisons between Verbal Reasoning scores and Abstract Reasoning scores. An assumption was made that the Abstract Reasoning score could provide a check on the Verbal Reasoning score for those individuals with reading handicaps. Therefore, the T-test was used to determine whether or not there was a significant difference between the score means in both the experimental and control groups.

Pearson-r correlation coefficients were used to examine the relationship between learning and aptitude scores. The numerical value for learning was the difference score obtained from pre-test and post-test I measures. The relationships of learning to general intelligence and learning to Abstract Reasoning aptitudes for both experimental and control groups were computed by correlation coefficients.

Data in the experimental and control groups were also examined for relationships of learning, to position rank, length of service, and level of education by correlation coefficients. Numerical values

were assigned to position ranks, and values for educational level were expressed as number of years of school completed.

Correlation coefficients were also computed to determine whether or not position rank was related to scores achieved on the pre-test by the experimental and control groups. Those persons holding the highest position ranks would be expected to score higher in the pre-test, and therefore may not have as great a gain in knowledge as a result of training.

The significance of all correlation coefficients were tested at the 0.05 level. It was assumed that to establish a relationship between variables, the correlation coefficient must be equal to or greater than 0.45.

RESULTS AND DISCUSSION

The results of the study are presented in the order of the objectives stated:

1. The determination of learning as result of training.
2. The determination of retention of learning six weeks after an experimental training program.
3. The relationship of aptitudes, position rank, length of service and educational level to learning.

Determination of Learning as a Result of Training

The means ± standard deviations were computed on the pre-test and post-test I for comparison of mean differences between and within the experimental and control groups. (Table I).

The T-test for uncorrelated measures produced a T-ratio of 0.91 when the pre-test scores between the two groups were compared. These data were not significant indicating that there was no significant difference in job knowledge between the two groups at the time of the pre-test.

The difference scores for learning were computed as post-test I minus the pre-test score and averaged 3.89 ± 3.09 and 1.11 ± 3.63 for the experimental and control groups, respectively. Between group comparisons of the mean difference scores resulted in a T-ratio of 2.54, which was significant, thus the null hypothesis was rejected, and the hypothesis that training produced an increase in knowledge was supported.

TABLE I

Comparison of Learning Difference Scores from Pre-test and Post-test I Scores Between Experimental and Control Groups

Experimental Group				Control Group			
Subject Number	Pre-test Score	Post-test I Score	Diff. Score	Subject Number	Pre-test Score	Post-test I Score	Diff. Score
1	33	34	1	20	33	33	0
2	32	36	4	21	33	28	-5
3	30	33	3	22	32	32	0
4	29	34	5	23	32	33	1
5	29	32	3	24	31	28	-3
6	29	32	3	25	30	30	0
7	28	25	-3	26	29	32	3
8	28	32	4	27	27	28	1
9	27	29	2	28	26	25	-1
10	26	32	6	29	26	28	2
11	25	33	9	30	26	29	3
12	25	27	2	31	26	27	1
13	24	28	4	32	25	30	5
14	24	26	2	33	24	26	2
15	23	28	5	34	24	24	0
16	21	31	10	35	24	23	-1
17	20	20	0	36	23	22	-1
18	14	22	8	37	22	23	1
19	13	20	7	38	15	23	8
Mean	25.26	29.16	3.89[a]	Mean	26.74	27.58	1.11
± SD	±5.37	±4.79	±3.09	± SD	±4.53	±3.56	±3.63
T-ratio within group on diff. scores			5.49[a]	T-ratio within group on diff. scores			1.30
T-ratio between experimental and control groups on difference scores			2.54[b]	T-ratio within groups on pre-test scores			0.91

a highly significant $P \leq 0.001$
b significant $P \leq 0.05$

Paired analysis for correlated measures within each group resulted in a T-ratio between pre-test and post-test I scores of 5.49 for the experimental group, which was highly significant, and 1.30 for the control group which was not significant.

All subjects in the experimental group, with the exception of two, showed a gain in score from pre-test to post-test I. Gain in knowledge or improvement ranged from one to ten points on individual scores. Therefore, the training program produced a gain in knowledge in the experimental group when compared to the control group which did not participate in the training program, according to these data.

No pilot study was conducted to determine the validity of the subject matter pre-test post-test measures due to scheduling problems.

Determination of Amount of Retention

A score for retention of learning was obtained by computing the difference between post-test I and post-test II. Individual scores for experimental and control groups are shown in Table II. These scores were expressed as percent of difference. In the experimental group, four subjects achieved the same scores on both post-test measures, seven subjects had a decrease from post-test I to post-test II, which ranged from one to three points, and eight subjects had an increase in score, which ranged from one to four points.

In the control group, three subjects obtained the same score on both post-test measures, eight subjects had a decrease of one to eleven

TABLE II

Difference Between Post-test I and Post-test II of Experimental and Control Group Indicating Retention of Learning by Percent Difference

Experimental Group Subjects	Post Test I Score	Post Test II Score	Percent Difference	Control Group Subjects	Post Test I Score	Post Test II Score	Percent Difference
1	34	34	0.0	20	33	32	-3.0
2	36	37	2.7	21	28	29	3.6
3	33	30	-9.0	22	32	33	3.1
4	34	37	8.8	23	29	29	0.0
5	32	30	-6.2	24	33	29	-12.1
6	32	36	12.5	25	30	27	-10.0
7	25	25	0.0	26	32	20	-6.3
8	32	33	3.1	27	28	28	0.0
9	29	28	-3.4	28	25	30	20.0
10	32	31	-3.1	29	28	23	-17.8
11	33	32	-3.0	30	29	33	13.8
12	27	29	6.8	31	27	24	-11.1
13	28	28	0.0	32	30	22	-26.6
14	26	25	-7.6	33	26	28	7.7
15	28	26	-7.1	34	24	24	0.0
16	31	32	3.2	35	23	25	8.7
17	20	20	0.0	36	22	23	4.5
18	22	26	5.8	37	23	30	30.4
19	20	20	0.0	38	28	17	-39.3
Mean	29.16	29.42	0.18	Mean	27.58	27.15	- 1.81
± SD	±4.79	±5.01	±5.76	±SD	±3.56	±4.19	±16.01

Range of Percent Difference

Range of Percent Difference

points in score and seven subjects showed an increase of one to seven points in score. There was very little difference between the means of post-test I and post-test II for the experimental group and the control group, indicating that what was learned or known was retained. The ranges of percentage differences, -9 to 12.5 and -39.3 to 30.0 for the experimental and control groups respectively, indicated that there was a wider range of score variation in the control group than in the experimental group.

Relationship of Aptitudes to Learning

The mean ± standard deviation of the Verbal Reasoning aptitude test for the experimental group was 19.26 ± 7.25 as compared to the control group means of 21.15 ± 11.62 as shown in Table III. These data were not significantly different. The computed means and standard deviations on the Abstract Reasoning Aptitude test were 16.31 ± 7.22 for the experimental group and 21.42 ± 11.09 for the control group (Table III). These differences were not significant. The Numerical Ability test score was combined with the Verbal Reasoning score for each individual to provide a score for general intelligence. Group means ± standard deviations are shown in Table III. The mean test scores of 28.95 ± 9.48 and 34.90 ± 20.55 for the experimental and control groups, respectively, were not significantly different at the 0.05 level and indicated that the experimental and control groups were similar in general intelligence.

TABLE III

Comparison of Aptitude Scores Between Experimental and Control Groups

Aptitude Tests	No. of Subjects Each Group	Experimental Group Score Mean	Control Group Score Mean
Verbal Reasoning Mean Score	19	19.26 ± 7.22[a]	21.15 ± 11.62
Abstract Reasoning Mean Score	19	16.31 ± 8.53	21.42 ± 11.09
Verbal Reasoning + Numerical Ability (general intelligence)	19	28.95 ± 9.48	34.89 ± 20.55

[a] Mean ± SD

Within group comparisons for the difference between the means of the Verbal Reasoning and Abstract Reasoning scores for the experimental and control groups were made by paired analysis, as shown in Table IV. There were no significant differences between these two scores even though the mean ± standard deviation for the Abstract Reasoning test was 16.31 ± 8.53 compared to 19.26 ± 7.22 for the Verbal Reasoning test for the experimental group. Means ± standard deviations for the control group were 21.42 ± 11.09 and 21.15 ± 11.62 for the Abstract Reasoning and Verbal Reasoning tests, respectively. No significant difference was found between the score means for the control group. These results indicated that the Abstract Reasoning score would not necessarily serve as a check on the Verbal Reasoning score since they were so nearly the same value.

To compute correlation coefficients to determine the relationship of learning to aptitudes, a numerical value was assigned to learning. The individual difference scores obtained from post-test I minus the pre-test, were used in all correlation coefficients as the value for learning. Correlation coefficients computed to determine the relationship of learning to general intelligence were -0.25 and -0.24 for the experimental and control groups, respectively, and are shown in Table V. These data were not significant indicating that general intelligence was not related to the amount learned from the training program.

TABLE IV

Comparison of Verbal Reasoning Scores with Abstract Reasoning Scores Within Experimental and Control Groups

Experimental Group Subjects	Verbal Reasoning Score	Abstract Reasoning Score	Control Group Subjects	Verbal Reasoning Score	Abstract Reasoning Score
1	31	7	20	46	45
2	30	27	21	45	28
3	28	29	22	44	46
4	24	18	23	28	28
5	24	33	24	23	14
6	23	13	25	22	9
7	23	13	26	21	28
8	22	12	27	21	25
9	21	30	28	19	17
10	28	12	29	17	20
11	18	23	30	17	9
12	18	14	31	15	17
13	17	18	32	13	26
14	16	5	33	13	12
15	15	20	34	13	12
16	12	8	35	12	5
17	12	7	36	12	12
18	10	9	37	11	15
19	2	12	38	10	19
Mean	19.26	16.31	Mean	21.15	21.42
± SD	±7.22	±8.53	± SD	±11.62	±11.09
T-ratio within group		1.50	T-ratio within group		0.46

TABLE V

Relationship of General Intelligence Score
to Learning Difference in Experimental and Control Groups

Variable X and Y	No. of Subjects Each Group	Experimental Group Score Means	Control Group Score Means
General Intelligence Scores	19	28.95 ± 9.48[a]	34.89 ± 20.55
Post-test I - Pre-test Difference Scores	19	3.89 ± 3.09	1.11 ± 3.63
r=		-0.25	-0.24

[a] Mean ± SD

Correlation coefficients computed to determine the relationship between the Abstract Reasoning aptitude scores and the difference scores for learning (post-test I minus pre-test), were reported in Table VI. A significant correlation coefficient of -0.50 was obtained for the experimental group, while the correlation coefficient of -0.01 for the control group was not significant. Thus it appeared that those subjects with low Abstract Reasoning scores in the experimental group, had a greater gain in knowledge as a result of the training program. Although the difference between the score means of the experimental and control group were not statistically significant for the Abstract Reasoning scores, the individual scores did tend to be lower in the experimental group. When the Abstract Reasoning scores were correlated with the difference scores for learning, which were much higher in the experimental group, it appeared that a correlation did exist. When all other tests of significance on the Abstract Reasoning scores were considered, it was suggested that this occurred as a result of the trends of the data, in the experimental group, rather than the functioning of a true correlation.

Relationship of Position Rank, Length of Service and Educational Level to Learning

To determine the extent to which each of the two groups might have gained from a training program as related to specified characteristics of the participants, correlation coefficients were computed

TABLE VI

Relationship of Abstract Reasoning Scores to Learning Difference Scores in Experimental and Control Groups

Variables X and Y	No. of Subjects Each Group	Experimental Group Score Means	Control Group Score Means
Abstract Reasoning Scores	19	16.31 ± 8.53[a]	21.42 ± 11.09
Post-test I-Pre-test Difference Scores	19	3.89 ± 3.09	1.11 ± 3.63
r=		-0.50[b]	-0.01

[a] Mean ± SD

[b] Significant $P \leq 0.05$

between the difference score from pre-test to post-test I, and position rank, length of service, and educational level (Table VII). A significant correlation coefficient of -0.54 was obtained between the difference score and length of service for the experimental group. This indicated that those in the experimental group who had been employed for the shortest period of time gained the most from participating in the training program. Position rank and educational level did not show a significant correlation with difference scores for learning in either experimental or control groups.

Correlation coefficients were computed to determine whether or not the position rank might be a factor in determining how much the subjects in the two groups knew at the time of the pre-test (Table VIII). A significant correlation coefficient of 0.49 was obtained for the experimental group, indicating that those subjects with higher position ranks achieved higher scores on the pre-test. Position rank and the pre-test scores of the control group were not significantly correlated. This difference between the experimental and control groups might be the result of fewer control group subjects in the two highest position rank categories.

TABLE VII

Correlation Coefficients Between (Pre-test and Post-test I) Learning Difference Scores and Position Rank, Length of Service, and Educational Level for Experimental and Control Groups

Learning Difference Score, Correlated with Position Rank, Length of Service, and Educational Level	Correlation Coefficients	
	Experimental	Control
Position rank and learning difference score	r = 0.27	r = -0.03
Length of service and learning difference score	r = -0.54[a]	r = -0.42
Education level and learning difference score	r = 0.07	r = -0.09

[a] Significant $P \leq 0.05$

TABLE VIII

Relationship of Pre-test Score to Position Rank in Experimental and Control Groups

Experimental Group Subjects	Pre-test Score	Position Rank	Control Group Subjects	Pre-test Score	Position Rank
2	32	4	20	33	4
6	32	4	23	32	4
7	25	4	21	33	3
8	28	4	24	31	3
1	33	3	32	24	3
9	27	3	34	23	3
10	26	3	36	15	3
16	21	3	22	32	2
3	30	2	26	29	2
5	32	2	30	25	2
12	25	2	35	22	2
13	24	2	25	30	1
19	13	2	27	27	1
4	29	1	28	26	1
11	25	1	29	26	1
14	24	1	31	24	1
15	23	1	33	24	1
17	20	1	37	26	1
18	14	1	38	26	1
Mean ±SD	25.26 ±5.97		Mean ±SD	26.74 ±4.53	
	r = 0.49[a]			r - 0.23	

[a] Significant $P \leq 0.05$

SUMMARY AND CONCLUSIONS

An experimental training program was developed using methods and instructional aids designed for food personnel with high school education or less. Videotapes were filmed in the food production area in three large dining facilities at the Virginia Polytechnic Institute and State University.

The subjects for the experimental training project were food production personnel randomly divided into an experimental and control group. They were employed in five student dining facilities on the Virginia Polytechnic Institute and State University campus.

Effectiveness of the training program was evaluated by the use of a paper and pencil subject matter pre-test post-test measure. The relationship of the aptitudes of general intelligence and Abstract Reasoning to gain in knowledge were examined by use of the correlation coefficient. Data from both groups, experimental and control, were also examined by correlation coefficient to determine the relationship between gain in knowledge as a result of training to position rank, length of service, and educational level of the subjects participating in the study.

The analysis of the data obtained from the training experiment revealed that there was a highly significant gain in knowledge at the 0.001 level in the experimental group who participated in the training program. Correlation coefficients computed to determine the relationship of length of service to gain in knowledge as a result of the training program, were significant at the 0.05 level of significance.

Correlation coefficient computed to determine the relationship of pre-test scores to position rank was significantly higher at the 0.05 level in the experimental group than in the control group.

There was no significant difference between the aptitude scores of the experimental and control groups. There was no significant correlation of the aptitude scores to the gain in knowledge as a result of training, in either the experimental or control group. There was no significant correlation of the characteristics positon rank, and educational level, to gain in knowledge as a result of training, in either the experimental or control groups.

Because of scheduling problems, it was not possible to conduct a pilot study to evaluate the validity of the subject matter testing instrument. Employee work schedules also prevented administration of the post-test measures simultaneously to all subjects thereby reducing some control of the testing environment in the post-test measures.

With the above limitations of the study, the following conclusions are presented on the basis of the findings. Training programs can be a means of increasing job knowledge in food production personnel. It appears that the aptitude of general intelligence does not have any significant effect on the ability of the employees to learn from a training program. The greatest gain in knowledge was achieved in those employees with less than four years of service in the food production area, therefore it appears that the more recent the person is within a position, the more he will benefit from a training program.

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APPENDICES

APPENDIX A

SUBJECT MATTER TEST

Instructions: Please select the one best answer and circle the corresponding letter. Please write your name on the top of the test paper. Thank you.

1. As a food production employee, the most important part of your job is:

   a. To get along with other workers
   b. To prepare food properly
   c. To keep the kitchen clean
   d. All of the above

2. Meat which becomes dry after cooking is usually due to:

   a. A cooking time which is too short
   b. A cooking temeprature which is too low
   c. Use of improper cooking methods
   d. Cooking it with too much fat

3. When preparing frozen vegetables, the 15 lb. pressure steamers should, if preheated:

   a. Shorten the cooking time
   b. Lengthen the cooking
   c. Make no difference in the cooking time

4. The most important reason for cooking foods in smaller batches is:

   a. To keep everybody busy
   b. To shorten the holding time
   c. To lengthen the holding time

5. Macaroni and cheese becomes very brown and hard when:

   a. The cooking temperature is too low
   b. The cooking temperature is too high
   c. The cooking time is too short

6. A cheese sauce will sometimes curdle because the:

   a. Cooking temperature is too low
   b. Cooking temperature is too high
   c. Cooking time is too long
   d. Cooking time is too short

7. When preparing scrambled eggs, to prevent them from becoming dry and tough, one should:

   a. Avoid cooking at a low temperature
   b. Add milk before cooking
   c. Avoid cooking too long

8. Application of heat to eggs causes them to:

   a. Become more liquid
   b. Become more solid
   c. Turn green
   d. None of the above

9. Eggs are frequently used in what is called an "egg wash." The purpose of their use in preparing deep fried items is:

   a. To hold the product and the coating together
   b. To cause the product to brown
   c. To add flavor
   d. None of the above

10. Eggs are sometimes used in sauces. If the sauce curdles or separates it is probably because:

    a. The cooking temperature is too low
    b. The cooking temperature is too high
    c. The cooking time is too long
    d. The cooking time is too short

11. When cooking frozen vegetables in the steamer, more even cooking results in a better product when:

    a. They are cooked in a frozen mass
    b. They are allowed to thaw slightly
    c. Low pressure steamers are used
    d. None of the above

12. A deck oven pre-heats to a selected temperature in approximately:

    a. 10 - 15 minutes
    b. 15 - 30 minutes
    c. 30 - 45 minutes
    d. 45 - 60 minutes

13. On a 15 pound pressure steamer, the door remains closed briefly after it has been turned off and the handle released due to:

    a. The gasket
    b. The weight of the door
    c. Accumulated steam pressure

14. When preheating electrical equipment, the desired temperature will be reached <u>faster</u> if:

    a. It is turned up to the highest temperature
    b. It is started on slow heat and then adjusted to the desired temperature
    c. It is set on the desired temperature
    d. None of the above will make it heat any faster

15. The basic thickening agent for a cream or white sauce is:

    a. Eggs and flour
    b. Flour and fat
    c. Cornstarch and water
    d. Salt and sugar

16. Less tender cuts of meat such as stew beef are made more tender by:

    a. Cooking at a high temperature with added fat
    b. Cooking at a low temperature with added fat
    c. Cooking at a high temperature with added moisture
    d. Cooking at a low temperature with added moisture

17. The <u>major</u> reason for cooking meat is to:

    a. Improve its flavor and make it more digestible
    b. Improve its appearance
    c. Cook off some of the fat

18. Meat becomes tough and dry when:

    a. The temperature is too high
    b. The temperature is too low

c. The cooking period is too short
d. It is cooked without added salt

19. Meat shrinks during cooking when:

a. Cooking temperature is too low
b. Cooking temperature is too high
c. Neither of these

20. Meat which is prepared too far in advance of serving time usually:

a. Improves in flavor
b. Becomes dry
c. Improves in appearance
d. None of the above

21. Work can become easier if:

a. You plan your day before starting
b. You take each task as it comes up and do it
c. You work faster and harder

22. A dull knife is dangerous because:

a. It is hard to sharpen
b. It will not do the job
c. More pressure must be put on it and it may slip
d. Less pressure must be used and a sawing motion is required

23. When cleaning a slicing machine you should:

a. Wipe from the outside edge of the blade to the center
b. Wipe around the blade
c. Wipe from the center of the blade to the outside edge
d. None of the above

24. When using a deep fryer, overloading the basket causes:

a. The food to burn
b. The fryer to smoke
c. Uneven cooking of the product
d. The fat to become dirty

25. The best temperature range for deep fat frying is:

a. 200 - 325 degrees
b. 325 - 400 degrees

c. 400 degrees and above
d. Below 200 degrees

26. Canned vegetables require:

a. A long cooking time
b. A short cooking time
c. Added moisture

27. If you are serving a 3-ounce portion as one serving, 5 lbs. of frozen corn will give you:

a. Approximately 10 servings
b. Approximately 20 servings
c. Approximately 25 servings
d. Approximately 30 servings

28. Frozen meats which are to be grilled retain their flavor and natural juices better if:

a. They are cooked in the frozen state
b. They are allowed to thaw at room temperature
c. They are allowed to thaw in the refrigerator for about 12 hours

29. To prevent starchy products such as macaroni, noodles and rice from becoming mushy, you should:

a. Cook them a long time
b. Cook them only until tender
c. Cook them in lots of water

30. The most common kitchen accident is a:

a. Burn
b. Fall
c. Cut
d. Strain

31. Holding vegetables after cooking for long periods results in:

a. Flavor and color change
b. A mushy product
c. A better product
d. None of the above

32. When wiping a table it is easiest and most efficient to:

    a. Wipe in a straight up and down motion
    b. Wipe in a circular motion
    c. Wipe from the center to the outside edges

33. There are many kinds of kitchen knives, but all of them belong to one of:

    a. 2 basic groups
    b. 4 basic groups
    c. 6 basic groups
    d. 8 basic groups

34. A No. 10 can of green beans contains approximately:

    a. 2½ quarts
    b. 3¼ quarts
    c. 1 gallon
    d. 1¼ gallons

35. When preparing pork chops, if one serving is 5-1/3 ounces, from 10 lbs. of chops you would expect to get approximately:

    a. 10 servings
    b. 15 servings
    c. 25 servings
    d. 30 servings

36. The most important reason for refrigerating potato salad immediately after it is made is:

    a. To make it more appetizing
    b. To chill it rapidly
    c. To reduce the chances of food poisoning

37. At the end of the day, after using the pressure steamer, the door should be:

    a. Left slightly ajar
    b. Closed
    c. Closed and tightened

38. If an electrical fire occurs in the wiring of a grill top, while grilling steaks, you should:

    a. Get the steaks off the grill
    b. Put out the fire with water
    c. Use a fire extinguisher
    d. Throw the circuit breaker

39. The most important goal of a food service department is:

    a. To provide a variety of food for customers
    b. To please the customer
    c. To provide foods which are nutritious
    d. All of the above

40. When preparing gravy, the thickening agent should be added gradually and:

    a. The gravy should not be stirred
    b. The gravy should be stirred constantly
    c. The gravy should be cooked at the highest temperature possible

APPENDIX B

TRAINING PROGRAM SCHEDULE AND CONTENT

March 20, 1972

Time:	Lecture-Discussion Topic and Instructional Tools
8:30 - 9:00	Introduction: Importance of the Production Worker and Organization Goals.
9:00 - 11:30	Interpersonal Relations. Modified T - Group Technique
11:30 - 12:30	Lunch Break
12:30 - 1:30	Standardized Recipes. Food Production Methods Film: "Standardized Recipes"
1:30 - 1:40	Coffee Break
1:40 - 2:30	Food Production Terminology. Common Weights and Measures in Quantity Food Production

March 21, 1972

8:30 - 9:30	Avoiding Fatigue Motion Economy T.V. Tapes 1, 2
9:30 - 9:40	Coffee Break
9:40 - 10:40	Planning for Efficiency T.V. Tape 3
10:40 - 11:30	Work Efficiency Methods T. V. Tape 4

March 21, 1972 (continued)

11:30 - 12:30	Lunch Break
12:30 - 1:30	Knives, Their Use and Safety. T.V. Tape 5 Film: "Cuts and Strains"
1:30 - 1:40	Coffee Break
1:40 - 2:30	Use and Care of Small and Large Equipment Film: "Equipment Safety"

March 22, 1972

8:30 - 10:00	Meat Preparation Films: "Braising" "Broiling"
10:30 - 10:10	Coffee Break
10:10 - 11:30	Meat Preparation (continued) Films: "Roasting" "Broiling" T.V. Tape 6: Grilling
11:30 - 12:30	Lunch Break
12:30 - 1:30	Vegetable Preparation Film: "Vegetable Cookery"
1:30 - 1:40	Coffee Break
1:40 - 2:30	Vegetable Preparation T.V. Tape 7

March 23, 1972

8:30 - 9:45	Eggs, Cheese, Sauces and Gravy Film: "Give Your Eggs A Break" T.V. Tape 8 - Gravy
9:45 - 10:00	Coffee Break

March 23 (continued)

10:00 - 11:30	Sanitation and Safety Films: "Why All the Fuss" "Rules Make Sense" "Preventing Burns"
11:30 - 12:30	Lunch Break
12:30 - 2:30	Review

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THE RELATIONSHIP OF APTITUDES, LENGTH OF SERVICE, POSITION RANK, AND EDUCATIONAL LEVEL TO LEARNING FROM A FOOD PRODUCTION TRAINING PROGRAM

by

Valerie G. Langer

(ABSTRACT)

The objectives of this study were to develop a training program designed for food production personnel with a high school education or less; to determine the relationship of aptitudes to learning from training; and to measure the learning achieved and retained as a result of training. Food production personnel at Virginia Polytechnic Institute and State University participated as subjects.

A subject matter pencil and paper test was administered as a pre-test post-test measure to the experimental and control groups to determine the learning achieved as a result of training.

Aptitude tests were administered to the experimental and control groups and correlated with the difference score obtained from the pre-test, post-test I measure. Further correlations were done to determine the relationship of position rank, length of service, and educational level to learning difference score.

Learning achieved as a result of training in the experimental group was significant at the 0.001 level. Correlations of the

aptitudes of general intelligence and Abstract Reasoning to learning were not significant at the 0.05 level.

Position rank correlated positively with pre-test scores in the experimental group. Correlations of educational level and position rank to learning acheived were not significant at the 0.05 level. However, length of service did show a significant correlation to amount of gain from training.

Based on the results of this study, it appears that training can be an effective means for increased job knowledge. Aptitudes do not appear to be related to learning achieved from training. Those persons who have been in a position the shortest period of time, tend to benefit the most from training.