

A WORK SAMPLING STUDY OF FIVE POSITIONS IN A
RESIDENCE HALL KITCHEN

by

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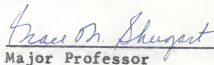
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INTRODUCTION

Rising labor costs in the food service industry have increased management's emphasis on efficient use of personnel. A first step in approaching this problem is to determine how employees spend their work time. An over-all view of the situation aids proper identification of inefficient areas. Once these have been located, a thorough analysis can be made and corrective action taken. However, the diversity of activity involved in the preparation of a variety of food items and the lack of uniformity from day to day create a problem in obtaining representative work days and/or menu items on which to base a study. A primary work measurement tool in the past has been the continuous time study. Recently, the industrial technique of work sampling has been applied in various food service facilities to measure time distributions of both direct and indirect labor.

The basis for work sampling, according to Heiland and Richardson (1957, p. 69), is the law of large numbers and the normal curve of error. This law states that if samples are drawn at random from an unchanging mass of items, successive samples will distribute themselves according to an approximately repeatable pattern, the normal frequency distribution curve. Sampling indicates the process of drawing inferences about the characteristics of this mass by close examination of a smaller number of items drawn from the entire mass. Information is obtained by numerous instantaneous observations made at randomly selected times.

This study was conducted in the men's residence hall kitchen at Kansas State University. Objectives were: (1) to determine the division of labor time of five positions in the main cooking area; (2) to investigate the effectiveness of work sampling as a technique for use in residence hall food service.

REVIEW OF LITERATURE

A basic premise of the law of large numbers is that the mass of items from which samples are drawn be unchanging. This aspect of work sampling has been ignored in its application to the food service business where situations, and consequently activities, are constantly changing. Users of the technique, however, have declared it a satisfactory means of determining percentage distribution of labor time.

Work Sampling Studies in Food Service

Direct Labor. Personnel whose activities produce tangible products or service for the customer represent direct labor. The first reported application of the work sampling technique to a food service enterprise was a study of direct student labor at Purdue University (Wilson, 1955). Comparison of student work loads in two residence hall kitchens for seated service dinner meals revealed payroll differences were due to dissimilarities in assignment of duties, attitude of students, kitchen layout, and major equipment, rather than to discrepancies in percentage of productive labor time.

Data collected by work sampling in the Food Service Division of Brooke Army Medical Center were used to set performance standards for each organizational unit in terms of rations served (U. S. Army Hospital Management Research Unit, 1958). Of total duty hours studied, 87.8 per cent were spent on productive and productive-support activities. Average non-productive time of 12.2 per cent was considered reasonable but varied from a high of 23.3 per cent in the Food Supply Branch to a low of 3.4 per cent in the Ward Service Branch.

Preliminary findings after work sampling analysis of food service activities in six Veterans Administration hospitals revealed a low percentage of non-productive time (Schell, 1962). Small hospitals were found to require more minutes per ration served than larger units. Decentralization of serving and dish-washing activities also required more minutes per ration.

Wise and Donaldson (1961) found that employees with higher classification performed more supervisory and clerical work than others with lower rank. As classification decreased, cleaning activities increased. Percentage of personal time was greatest for the highest employee classification and least for the lowest employee classification in a study of seven full-time hospital dietary employees with different classifications.

Information from work sampling studies of 36 cafeteria employees at the University Hospital and Hillman Clinic of the University of Alabama Medical Center was used to pinpoint activities needing further investigation (Mastin and Ferrell, 1964).

Data revealed areas requiring increased supervision and re-scheduling of employees.

Indirect Labor. Personnel whose activities do not directly benefit the customer but are necessary to the operation of an enterprise represent indirect labor. Food service personnel working at the middle management level are essentially indirect labor and have been studied by means of work sampling. Johnson (1960) reported management functions occupied a low of 71.3 per cent to a high of 85.1 per cent of four food production managers' time. Average data revealed controlling as the most time-consuming management task while planning and organizing represented the least proportion of management time. Activity percentages in various categories revealed differences due to the type of food service unit. A similar study was made of three food service managers in the Home Economics Cafeteria of the New York College of Home Economics at Cornell University (Sanford and Cutlar, 1964). Management activities occupied 30.5, 57.3, and 60.7 per cent of these managers' time. Direct labor varied from a low of 14.4 per cent by one manager to a high of 47.4 per cent by another.

Functions performed in the dietary department of Doctors Hospital, Seattle, Washington were studied by Fajardo (1963). Percentage of time spent by each of three dietitians and the director in these activities was determined. Marteney (1963) conducted a limited study of 41 dietary department staff members at the State University of Iowa Hospitals representing four personnel classifications.

A work sampling study was designed by the Diet Therapy Section of the American Dietetic Association for use during 1962-63 in any hospital to determine activities of therapeutic dietitians and the effect of various factors in the hospital environment on these activities (Noland, 1964). Results are not yet available.

Industrial Work Sampling

Recommended Procedures. Several writers offered procedural recommendations for work sampling studies (Barnes, 1963, p. 542; Close, 1960, p. 166; Heiland and Richardson, 1957, p. 50; Krick, 1962, p. 292; Morrow, 1957, p. 318). Summarized, these steps are:

1. Define the problem and state the main objectives of the study.
2. Obtain approval for the study and solicit cooperation of people to be studied and others in the department.
3. Define, in detail, each element or activity to be measured, which must be easily recognized by visual observation.
4. Design the study:
 - a. Determine the number of observations to be made, based on desired accuracy. This may require a preliminary study.
 - b. Determine the number of days or shifts needed for the study.
 - c. Develop properly randomized times of observation.
 - d. Decide upon and train the number of observers needed.
 - e. Make detailed plans for taking observations.
 - f. Design necessary forms for data collection.

5. Observe activity and record data.
6. Analyze and summarize data by means of control charts.
7. Check accuracy of data.
8. Prepare report and state conclusions.

Types of Error. According to Krick (1962, p. 293), a work sampling study is subject to three types of error. Sampling error arises when a generalization is made about some characteristic of a population on the basis of measurements of less than the whole population. Number of observations is a controlling factor. Bias exists when the probability of observing a certain state of activity is different from the actual proportion of time applied to that activity. A non-random schedule of observations contributes to this. However, if nonhomogeneity of activity distribution is suspected, stratifying the sampling periods may give a smaller estimate of variability. Bias may exist on the part of the observer when activity categories are ambiguously defined and judgment is required, or when latitude is allowed as to the exact instant at which observations are made. Change in behavior of the observed person when observations are made also produces bias. Non-representativeness, the third type of error, exists when the period being studied is not characteristic of circumstances prevailing in the long run. Periods of abnormal activity and unusual conditions, therefore, should be avoided.

Variations in Food Service Work Sampling Procedures

Selection of Observation Periods. In most food service studies, random numbers were used to determine observation times.

A total equal to the number of daily observations was taken from a table of random numbers, or selected by an equivalent method, and converted to clock times. Not all researchers randomized observation periods over the working day or period but stratified them by the hour or half-hour (Johnson, 1960; Sanford and Cutlar, 1964; Wilson, 1955). Random observation times no closer than 15 minutes were specified in the American Dietetic Association study (Noland, 1964). Regular interval observations were employed by Pajardo (1963) and Mastin and Ferrell (1964). An attempt was made to vary the sequence of observations when regular interval observation periods were used. Mastin and Ferrell reported starting observations a different time each day. Marteney (1963) used two observation routes, alternating them every other day. The same number, representing an observation time, drawn more than once for any one day, received weight equal to the number of times it was drawn, although only a single observation was made in the U. S. Army Hospital Management Research study (1958).

Number of Observation Periods and Length of Studies. The number of observation periods per day, or specified segment of time, varied as did the total length of studies. Wise and Donaldson (1961) conducted a two-month study with 40 observation periods for each $12\frac{1}{2}$ -hour day, or approximately 24 per $8\frac{1}{2}$ -hour shift. Observation periods stratified three per hour and later four per hour for each manager were used by Sanford and Cutlar (1964) in an eight-week study. The American Dietetic Association study specified 30 observations per day for each dietitian for a total of seven days or 14 half-days (Noland, 1964). A requirement

that these days be within a 90-day period was made. Days of interrupted observation were to be resumed on the same day of another week. Johnson (1960) collected three observations per manager per hour for approximately two months on three managers and one month on a fourth manager. Schell (1962) reported 50 to 60 observation periods each day in Veterans Administration studies, but length of investigations was not indicated. A specific study presented by Schell and Korstad (1964) was conducted during a three-week period in which approximately 1,800 total observations were collected in each of two hospitals. The Army made 50 to 60 observations daily of each employee for periods ranging from three to six days, depending upon the functional unit (U. S. Army Hospital Management Research Unit, 1958). Fajardo (1963) conducted regular interval observations every 12 minutes over a $12\frac{1}{4}$ -hour day for three five-day periods. Mastin and Ferrell (1964) reported data collected at six-minute intervals covering 18 hours daily for two weeks. Three-hour periods with five one-minute observations per half-hour four days a week were studied by Wilson (1955) for two weeks in each residence hall. Marteney (1963) made one observation tour each 12-hour day for six weeks.

Number of Categories. The number of categories into which activities were classified varied according to the situation being studied. In many cases, major divisions were determined and a number of specific activities comprising these categories were measured.

Classifications of defined work activity were generally determined before studies began. Johnson (1960) identified 17 specific activities grouped under seven major headings. Sanford and Cutlar (1964) adapted these same classes but designated 13 activities under six categories. The American Dietetic Association study (1964) used 10 general activity categories, whereas Marteney (1963) used 11. Forty work categories summarized under 12 major headings were developed by Pajardo (1963) from descriptions of activities collected as data.

Measurement of direct labor also demonstrated variation in degree of generalization of activities. Wilson (1955) measured 37 tasks later grouped into five categories, whereas Mastin and Ferrell (1964) classified work under 179 specific activities observed in nine cafeteria work areas. Wise and Donaldson (1961) measured them in nine general categories, and Schell (1962) reported the use of 16 classes in Veterans Administration studies. These 16 were arranged for analysis in five major groups, with the remaining smaller categories combined under one heading (Schell and Korstad, 1964). Number of specific activities measured in the Army study (1958) varied with the work area, but each was placed under one of the major headings of productive, productive-support, and non-productive functions.

Recording Data. All observations were made and recorded by one person in some studies, while others utilized several persons, including the study subjects. In some cases, the observed activity was categorized immediately; in others, the activity was described and classified later.

Wilson (1955) and Fajardo (1963) each made and recorded all observations in their respective studies. Marteney (1963) utilized a single staff member. The American Dietetic Association (1964), Army (1958), Veterans Administration (1962 and 1964) studies, and the Mastin and Ferrell investigation (1964) each utilized several non-participating observers trained to use the work sampling technique. The subjects under investigation recorded some observations of their own activities in studies conducted by Johnson (1960), Sanford and Cutlar (1964), and Wise and Donaldson (1961). In a majority of cases, however, data were collected by the respective researchers. Additional non-participating observers were used by Johnson and by Wise and Donaldson. These investigators felt evidence of bias was not apparent, but Sanford and Cutlar suggested this possibility would be reduced if observations were made by someone other than the subjects.

Observed activities, in the majority of food service studies, were categorized at the time of observation. However, Fajardo (1963), Johnson (1960), and Sanford and Cutlar (1964) wrote brief descriptions of all activities observed and classified these activities afterwards. Observations not made by Wise (1961) were described in writing by another and categorized later by her.

Accuracy of Data. Statistical analysis of data for accuracy at the 95 per cent level of confidence with a sampling error of ± 3 per cent was done by Johnson (1960), Sanford and Cutlar (1964), and Wise and Donaldson (1961). Wise and Donaldson reported results indicating the percentage of time spent in any one activity, as determined by work sampling, varied greatly among

the one-day, one-week, and one-month cumulative totals and to a lesser extent after two months. None of the data were comparable to activity percentages obtained during one-day continuous time studies. Johnson tested data in major categories between first and second month work cycles for significant differences. At the 95 per cent level, a total of six activity percentages among the three managers, representing three management and three non-management categories, exhibited significant differences. Three of these percentages remained significantly different beyond the 99 per cent level.

Fajardo (1963) computed sampling error on only one major category at 80 per cent level of confidence. Finding the sampling error small, the assumption was made that an 80 per cent confidence level had been obtained on all data. Only the Ward Service Branch data were analyzed statistically in the Army study (1958). Total observations were noted to have a 90 per cent degree of accuracy with a possible sampling error of ± 10.5 per cent.

Mastin and Ferrell (1964) and Schell and Korstad (1964) did not indicate degree of data accuracy or how length of study was determined. However, Schell (1962) did state the number of observations required for a given precision was determined in advance of making Veterans Administration studies. The Marteney study (1963) was limited in length, resulting in insufficient data for analysis. Among the six weekly data summaries, percentages of observations within categories showed variations from 3 to 13 per cent for total staff. In this particular study, data

were not available for all hours of the working day. Three hours were not represented at all, whereas another single hourly period was observed as many as six times.

Wilson (1955) analyzed data by combining detailed tasks according to similarity in performance to establish homogeneous groups. Differences between average ranges of data for each kitchen-task-day combination were compared. Observations of some tasks, contrasted within the same kitchen on the same day but different weeks, exhibited considerable variation. Greatest dissimilarity in time observed to complete a single task was 252 minutes, a difference between 78 and 330 minutes. Within each homogeneous group, analysis of variance at the 1 per cent level of significance was computed for kitchen, task, and day, each alone and in combination.

PROCEDURE

The men's residence hall kitchen, located in the Men's Food Center, is the largest of five residence hall food service units at Kansas State University. At the time of this investigation, approximately 750 students were fed from the kitchen, which is being expanded to serve 1,350 in the Fall of 1964.

A large food service operation was considered desirable for the study in line with the trend in residence hall planning toward increased size of units. This also permitted activity analysis of employees involved in only one phase of food production, which simplified collection of data and provided consolidated information.

Five positions in meat and vegetable cookery were selected for study. Three were from the early shift, 5:30 A.M. to 1:50 P.M.; the remaining two were scheduled from 10:30 A.M. to 6:50 P.M. Non-professional residence hall food service personnel at Kansas State University are employed under state civil service regulations. In this group of five positions, three different civil service classifications were represented. In decreasing order of skills required for the job, these were Cook II, Cook I, and Institutional Worker classifications. In charge of meat and vegetable cookery on each shift was a Cook II, each with a Cook I assisting. An Institutional Worker was employed on the early shift only.

A major portion of breakfast and lunch preparation was the responsibility of the three morning employees. For breakfast, they prepared hot cereal; eggs or a substitute item, as French toast or pancakes; occasionally supplemented by bacon, sausage, ham, or potatoes. Two entrees were prepared for the luncheon meal. Salad or sandwich plates, frequently served as a main course, were arranged on individual plates by the cooks. An option between main dishes always was maintained at lunch, and if a scheduled item was exhausted, a substitute was prepared. A choice was offered between two vegetables, soup or a vegetable, or juice or a vegetable. In general, soups were those prepared by the cooks rather than commercially made.

Under the direction of dinner Cook II, the two positions on the late shift were responsible for preparation of dinner meats, a potato or substitute, gravies or sauces, and one or two

vegetables. A single meat item was prepared for dinner meals Monday through Thursday and on Sunday to correspond with the menu pattern used for seated service meals at the women's halls. A choice of two entrees was given the other two days. Special meats were cooked for the athletic training table at the dinner meal.

Storage of left-over foods, advanced preparation for the next day, and maintenance of clean, sanitary equipment in the cooks' unit were additional responsibilities of the five employees in meat and vegetable cookery.

To better utilize production personnel, all raw vegetables and fruits for the meat and vegetable cookery unit were cleaned in a separately staffed vegetable preparation room. Except for those foods to be finely chopped by machine or requiring hand chopping for a specific menu item, these raw materials were prepared and ready for cooking on arrival in the kitchen.

All employees were scheduled to work 91 hours, including meal periods, every two weeks. On days off, the Institutional Worker was relieved by a salad helper. Cook I duties were assumed by a relief worker in both the cook and bakery units. In the absence of a Cook II, the Cook I on that shift assumed her responsibilities.

Twenty meals were served weekly with no Sunday evening meal provided. Meal service at the Men's Food Center was cafeteria style except on special occasions. Two lines were opened for residents at breakfast from 7:00 to 7:45 A.M., at lunch from 11:00 A.M. to 12:30 P.M., and at dinner from 5:00 to 6:10 P.M. Athletes were scheduled from 6:15 to 6:35 P.M. for training table. Staff was

served a half hour before the resident lines opened at breakfast and dinner.

Permission to conduct the work sampling study in the men's residence hall kitchen was obtained from the Director of Residence Hall Food Service. Plans were discussed with the two dietitians responsible for food service operation in the Men's Food Center. The purpose and procedure of the investigation were explained in detail to participating employees, and other full-time kitchen workers in the unit were informed of the project.

Activities

Selection and Definition of Activities. Activities in the meat and vegetable cookery unit were observed for 12 days during a preliminary study. To avoid invalidating a general category of grouped activities due to those fluctuating or occurring irregularly, general categories were separated into specific activities. This also permitted flexibility in combining data for analysis. Activities were listed, defined, and assigned code numbers. A one-day work sampling study was made to test completeness of the list. Corrections were made, and as the actual investigation progressed, the list was augmented as needed. A few activities were combined because of similarity and for ease of identification. The final list is included in the Appendix (Table 1).

Grouping of Activities. For analysis of data, the 107 activities were combined under three major headings:

- I. Food Production Activities (defined as handling or traveling with food, operating equipment, and checking food products).
 1. Handling food was defined as picking up food or putting it down; loading food into equipment; manually mixing, chopping, or slicing; manipulating food, as shaping, weighing completely or partially finished items, manipulating food in equipment; and placing food into containers, individual plates, or glasses.
 2. Operating equipment included manipulating temperature and operating controls, turning water or steam on or off, and mechanically raising or lowering equipment or parts.
 3. Traveling with food.
 4. Checking food products included testing for doneness, manipulating pans in the oven, and tasting food for seasoning or tenderness.
- II. Food Production Support Activities (defined as those operations which precede, follow, or complement food production activities. This included handling, traveling with or cleaning equipment; wrapping or unwrapping food; necessary consultation; and clerical activities).
 1. Handling and traveling with equipment included picking up, putting down, or traveling with equipment, utensils, and dishes; assembling or disassembling equipment.
 2. Cleaning consisted of picking up, putting down, or traveling with cleaning supplies; scrubbing or wiping equipment and fixtures; washing or rinsing cleaning cloths; sweeping or mopping the floor.
 3. Ingredient room activities were defined as weighing, measuring, checking, or cleaning raw material; opening cans and other containers.
 4. Covering food consisted of picking up, putting down, or traveling with wrapping supplies; wrapping food; and covering pans containing food.
 5. Clerical activities were reading recipes, menus, or labels; writing; and counting.

6. Necessary consultation was talking or listening to a dietitian or an employee working in the meat and vegetable cookery unit; checking food supply on the serving line.
7. Other activities included opening or closing doors or drawers, and being in the walk-in refrigerator or on an errand.

III. Unproductive Activities (defined as unavoidable and avoidable delays, meal breaks, and personal time).

1. Unavoidable delays included observation of food being processed by equipment; waiting for equipment to attain a specific operational level; delay in assembly of salad main plates, sandwiches, or layered casseroles where one step is dependent upon another; searching for equipment or food items; traveling about the kitchen empty-handed; and washing or wiping hands.
2. Avoidable delays were unoccupied time spent in the kitchen and time occupied by talking with or listening to an employee from a unit other than meat and vegetable cookery.
3. Meal breaks included time spent in the dining room, going along the cafeteria line, and traveling to and from the dining room with tray.
4. Personal time was that spent outside the kitchen and dining room areas, presumably in the rest room or locker room.

Observation Periods

Selection and Number of Observation Periods. Numbers within the range one to 800 were selected daily from a table of random numbers to obtain observation times. These were converted to corresponding clock times in the working day, 5:30 A.M. to 6:50 P.M. Observations randomized daily over the entire work period might not balance out to give uniform hourly coverage in a short-term investigation of this nature. Therefore, observation periods

were stratified 12 per hour to assure equal representation of each hour at conclusion of the study. The 20 minutes at the end of the first and second shifts each were stratified to provide four observation periods. These 100 daily observations per job position permitted easy calculation of activity percentages. Frequent observations were made to permit recording of irregularly occurring activities more nearly in proportion to the amount of time they represented than if fewer daily observations were made.

No observation period was allowed closer than two minutes from a preceding one. Numbers not fitting this requirement or in excess of 12 for any one hour were discarded. A number drawn more than once was counted for a single observation period.

Length of Study. Data were collected for 10 days over a three-week period between April 20 and May 8, 1964. Sundays were not included because they were not typical work days.

Observation and Data Recording

Recording Form. A worksheet with three equal columns for 30 observation periods each was developed for recording observation data (Form 1, Appendix). On the left side of each column, labeled "time," was space to list observation times in sequence. The second space, "set," was provided to record the number of minutes between observation periods. The third column gave a cumulative total of the number of observation periods listed on the sheet. Four blank columns followed, in which activity code numbers were recorded at the time of observation. Alphabetical

letters corresponding to job positions in meat and vegetable cookery were written above these columns. The alphabetical code was:

- A - Morning Cook II position
- B - Morning Cook I position
- C - Morning Institutional Worker position
- D - Dinner Cook II position
- E - Dinner Cook I position
- X - Any extra persons helping in the meat and vegetable cookery unit

Separate sheets of the same form were used for recording data on early and late meat and vegetable cookery positions.

Procedure. No one location existed in the kitchen from which all observations could be made, so observation tours were made of the kitchen. A minute timer was used as a reminder for observation times. The number of minutes for setting the timer for each consecutive observation was obtained from the "set" column on the worksheet. When an observation period was signalled, the observer set the timer for the next period and entered the kitchen. Activity, noted at the time an employee became visible, was recorded by codenumber on the worksheet by the observer. All observations were made and recorded by the writer. In general, one observation route (Figure 1, Appendix) was followed to avoid interfering with production. View was sometimes obstructed by equipment and other features of the physical layout, which necessitated an extended observation route.

Data were recorded on the basis of position held each observation day by individual employees working in the meat and

vegetable cookery unit. For example, if morning Cook II had a day off, her duties were assumed by morning Cook I, whose regular position was filled by a relief cook. Activities of morning Cook I were recorded under Cook II position, and activities of the relief cook were recorded under Cook I position. Activities of workers in excess of three early and two late shift employees scheduled in the meat and vegetable cookery unit were recorded under "X" position. If early shift employees worked over-time or late shift employees reported on duty early, their activities during these unscheduled periods were recorded under this position. Observations were not made before 5:30 A.M. or after 6:50 P.M.

Data Analysis

Collected data were grouped into three major activity categories, each of the five positions studied being considered separately. Percentage of daily observations and cumulative percentage of total observations of these activities were calculated and charted in graphic form. Two sigma variance limits were computed for activity groups of each position from the 10-day means of daily observations to establish 95 per cent confidence limits for data control charts.

RESULTS AND DISCUSSION

Data from activity observations collected by work sampling were compiled by position under three major headings: food production activities, food production support activities, and

unproductive activities (Table 2, Appendix). Daily percentage of observations and daily cumulative percentage of total observations were computed for individual positions by major activity groups (Tables 3, 4, and 5, Appendix).

Stability of Data

Food Production Activities. Daily observation percentages of food production activities are shown in Figure 2. Fluctuation among observation days was considerable for all except position D (dinner Cook II). All observations, except those of dinner Cook I (position E) on the fifth day, were within two sigma control limits of individual means. On this day, dinner Cook I was observed in food production activities less frequently than usual. The fifth observation day was a Saturday when meal count had dropped noticeably from the usual weekday, yet the same number of employees were scheduled to work (Table 6, Appendix).

Cumulative averages of observations as percentages of the total were calculated for each day and are presented in graphic form in Figure 3. Observation percentages of food production activities did not appear to reach stability at the end of 10 days, with the possible exception of position D (dinner Cook II). Since observations of employees in this position fluctuated little from day to day, apparent stability was obtained within this period of time.

Food Production Support Activities. Data on daily observed food production support activities are presented graphically in Figure 4. As with food production activities, daily fluctuation

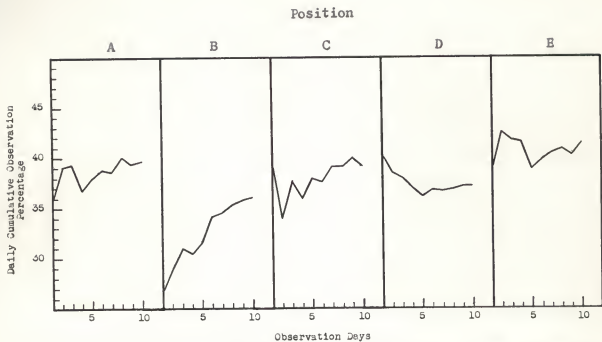


Figure 3. Food Production Activities. Observations of meat and vegetable cookery employees expressed as daily cumulative percentage of total observations of each position.

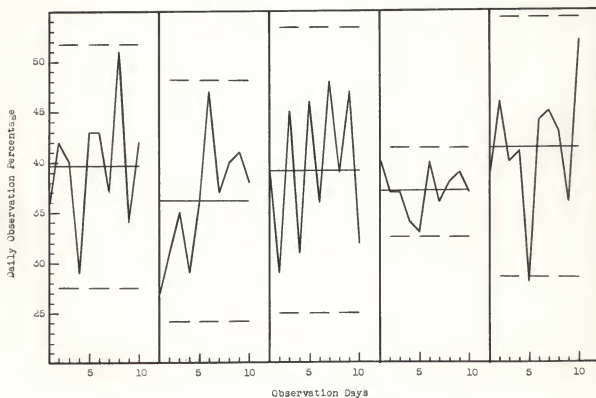


Figure 2. Food Production Activities. Daily observations of meat and vegetable cookery employees expressed as percentage of total daily observations of each position. Data are shown with two sigma variance limits.

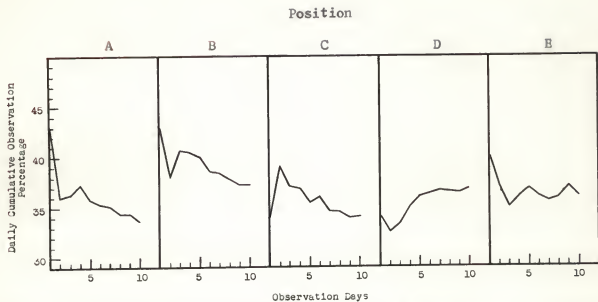


Figure 5. Food Production Support Activities. Observations of meat and vegetable cookery employees expressed as daily cumulative percentage of total observations of each position.

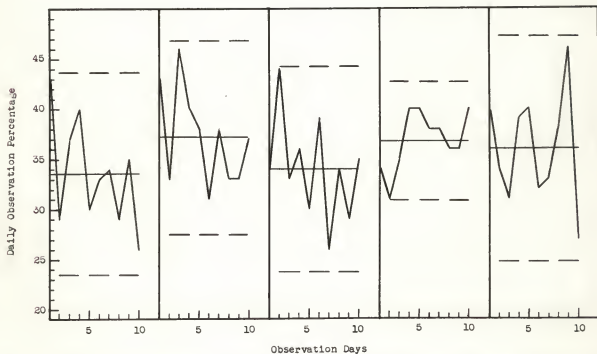


Figure 4. Food Production Support Activities. Daily observations of meat and vegetable cookery employees expressed as percentage of total daily observations of each position. Data are shown with two sigma variance limits.

was apparent; the least occurred in activities of dinner Cook II (position D). All daily observations were included within two sigma variance limits computed for each position in meat and vegetable cookery.

Daily cumulative percentages of total observations for each position are presented in Figure 5. Observations of positions A, B, and C indicated gradual, but irregular, decreases in food production support activities as the study progressed. Activities of position D, after rising gradually at the beginning, appeared to stabilize but rose slightly on the tenth, and final, day of the investigation. Fluctuation of dinner Cook I activity (position E) was evident in cumulative observation percentages.

Unproductive Activities. Observations of unproductive activities for each position are presented in Figure 6 as percentages of daily observations. Observations of dinner Cook II (position D) on the second day and dinner Cook I (position E) on the fifth day of study exceeded the two sigma limits computed from the activity mean of each position. These observations indicated a greater amount of unproductive activity than usual. On the second observation day, position D was held by dinner Cook I whose activity pattern probably varied from dinner Cook II and might account for this discrepancy (Table 7, Appendix). More observations of unproductive activity for position E on the fifth observation day corresponded to fewer observations of food production activities on that day.

In Figure 7 are shown cumulative daily percentages of unproductive activities for each position. Observations of positions

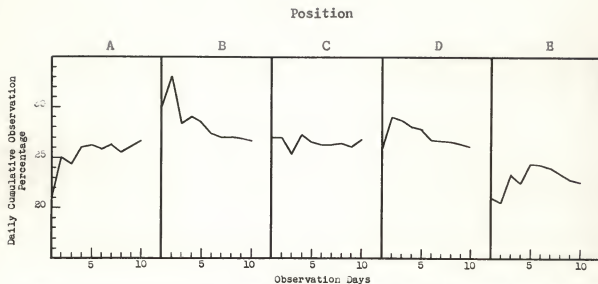


Figure 7. Unproductive Activities. Observations of meat and vegetable cookery employees expressed as daily cumulative percentage of total observations of each position.

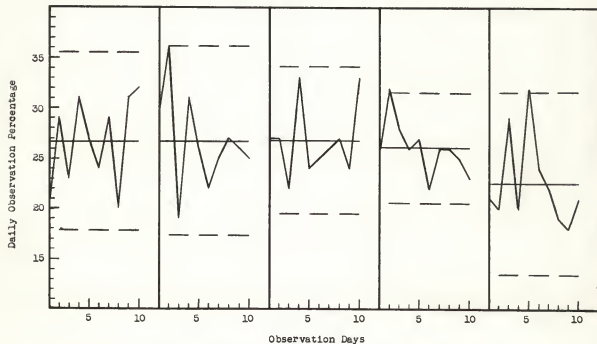


Figure 6. Unproductive Activities. Daily observations of meat and vegetable cookery employees expressed as percentage of total daily observations of each position. Data are shown with two sigma variance limits.

B, C, and D remained quite stable after the sixth day, although those of B and D continued to show a slight decrease in activity while observations of position C increased slightly. Unproductive activities of position A (morning Cook II) continued to fluctuate slightly in both directions throughout the investigation. Activities of position E (dinner Cook I) appeared to begin stabilization.

Observations of Activities

Cook II positions are filled by employees possessing greater skill than those with Cook I or Institutional Worker classifications. Higher pay accompanies the higher classification, and skilled employees are expected to perform those tasks utilizing their abilities. Therefore, one would expect to find increasing percentages of time spent on food production activities and less on food production support activities as employee classification increases from Institutional Worker to Cook II.

Figure 8 shows graphically the 10-day cumulative observation percentages in three major activity categories for five positions in meat and vegetable cookery. Final cumulative observation percentages of these major categories and their components are presented in Table 8.

Food Production Activities. Food production activities varied from 36.1 per cent to 41.4 per cent of total observations between morning Cook I (position B) and dinner Cook I (position E), respectively. Morning Cook II (position A) spent the greatest amount of time on production activities, 39.7 per cent, of the

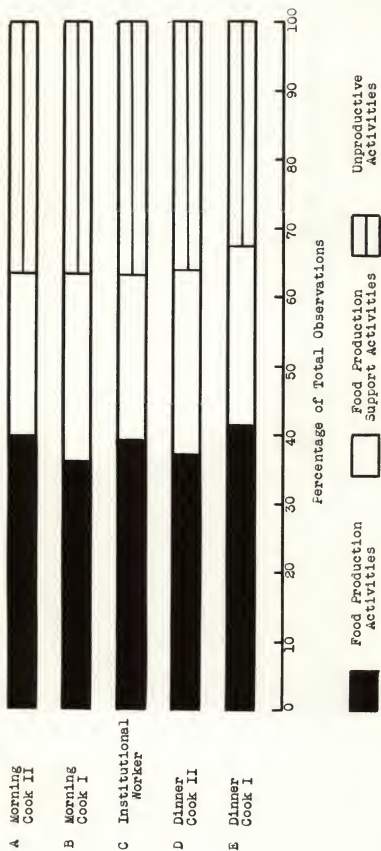


Figure 8. Cumulative percentages of employee activities from 10 days of observation.

Table 8. Cumulative observation percentages of grouped activities for five positions in meat and vegetable cookery obtained from a 10-day work sampling study.

Activities	Position				
	A	B	C	D	E
FOOD PRODUCTION ACTIVITIES	39.7	36.1	39.2	37.1	41.4
<u>Handle Food</u>					
Load equipment	3.7	2.7	1.8	2.5	1.0
Pick up or put down food	10.4	11.0	12.8	11.3	13.1
Manual operations	10.5	5.2	5.9	4.4	4.3
Manipulate food	3.5	6.2	6.0	4.9	5.5
Arrange food	5.4	6.5	8.0	6.0	10.3
	33.5	31.6	34.5	29.1	34.2
<u>Operate Equipment</u>	1.9	1.5	1.7	2.7	2.0
<u>Travel with Food</u>	3.2	2.8	2.8	3.7	4.9
<u>Control</u>	1.1	0.2	0.2	1.6	0.3
FOOD PRODUCTION SUPPORT ACTIVITIES	33.6	37.2	34.0	36.8	36.0
<u>Handle Equipment</u>					
Pick up or put down	4.7	6.2	5.8	5.6	5.9
Travel	3.0	3.5	3.3	7.3	5.1
Assemble	0.8	1.7	1.7	0.1	2.1
Disassemble	0.1	0.0	0.1	0.0	0.3
	8.6	11.4	10.9	13.0	13.4
<u>Cleaning</u>					
Preparation	2.2	1.4	1.8	1.7	2.2
Activities	4.0	12.6	5.8	4.5	8.1
	6.2	14.0	7.6	6.2	10.3
<u>Ingredient Room</u>	1.8	2.6	3.8	2.6	2.6
<u>Cover Food</u>	1.0	0.6	1.0	0.7	0.6
<u>Clerical</u>	1.9	0.8	1.0	2.9	1.3
<u>Necessary Consultation</u>	10.6	6.0	6.9	8.3	5.3
<u>Other</u>	3.5	1.8	2.8	3.1	2.5
UNPRODUCTIVE ACTIVITIES	26.7	26.7	26.8	26.1	22.6
<u>Unavoidable Delay</u>	10.4	10.8	9.5	11.5	9.1
<u>Avoidable Delay</u>	3.4	3.4	3.6	4.3	2.6
<u>Meals</u>	11.5	11.5	11.1	7.9	9.0
<u>Personal Time</u>	1.4	1.0	2.6	2.4	1.9

early shift positions but only slightly more than the Institutional Worker, 39.2 per cent. Dinner Cook II (position D) spent less time on these activities than her assistant (dinner Cook I). Dinner Cook II was observed handling food a lower percentage of

the time than other meat and vegetable cookery unit employees. The Institutional Worker (position C) on the early shift and dinner Cook I on the late shift were observed the least number of times loading equipment. Early shift employees utilized manual operations more extensively than late shift employees, and the reverse was true for operating equipment. Morning Cook II was observed using manual operations most frequently. Cook II employees, in positions A and D, spent less observed time manipulating and arranging food than did their assistants. Total time occupied by two employees on the late shift traveling with food and raw materials, 8.6 per cent, nearly equaled that spent by the three morning employees, 8.8 per cent. Control activities were observed more frequently being performed by Cook II employees.

Food Production Support Activities. Food production support activities exhibited less variation, from 33.6 per cent for morning Cook II to 37.2 per cent for morning Cook I, than food production activities. Morning Cook II (position A) was observed least frequently of all employees handling equipment. This corresponded with greater use of manual operations. Employees in both Cook II positions spent less observed time assembling equipment than their assistants. Lower classification employees were observed more frequently in cleaning activities than were those in Cook II positions. Clerical, necessary consultation, and other activities occupied more observed time of Cook II positions than others.

Unproductive Activities. With the exception of dinner Cook I (position E), who was observed 22.6 per cent of the time in unproductive activities, these activities occupied approximately 26.7 per cent of the working time of employees in the other four positions. Less unproductive activity was observed on the late shift than early. Fifty minutes or 12.5 per cent of the working day was allowed for meal and coffee breaks. All employees were within this limit but spent additional personal time outside the kitchen and dining room area. Unavoidable delays occupied about the same percentage of time as meal and coffee breaks.

Consultation Activities. Final cumulative percentages of all consultation activities for each employee position are listed in Table 9.

Table 9. Final cumulative percentages of total consultation observations for each position in meat and vegetable cookery.

Code No.	Consultation with:	Position				
		A	B	C	D	E
93.	Employee(s) involved in meat and vegetable cookery	6.5	5.1	4.8	4.5	3.7
94.	Employee(s) not involved in meat and vegetable cookery	2.9	1.4	2.1	2.4	1.0
95.	Dietitian(s)	3.9	0.7	1.8	3.8	1.9
	Total	13.3	7.2	8.7	10.7	6.6

Talking or listening to fellow employees or dietitians occupied a greater proportion of Cook II observed time for each shift than other employee classifications. More time was occupied by each of the three morning shift meat and vegetable cookery employees

in talking or listening than by the two employees on the late shift. Cook II employees spent more time with the dietitians than did other classifications of employees. As head cooks, they were expected to relate information back to their assistants. A greater proportion of time also was spent by Cook II employees in talking or listening to employees not involved in meat and vegetable cookery. This activity was classified as avoidable delay under unproductive activities. It was assumed that all talking among employees involved in meat and vegetable cookery and with the dietitians pertained to the job, whereas all talking with employees not involved in meat and vegetable cookery was not applicable to the work situation. This grouping may have been a disadvantage to those in Cook II positions, who in certain instances needed to consult with the line supervisor or busboy about number of customers and supply of food or arrange for use of equipment with an employee in another unit. However, all talking among employees involved in meat and vegetable cookery was not related to the job.

Travel Activities. Total cumulative percentages of traveling observations were compiled in Table 10. These activities were lowest for position C (15.0 per cent) and highest for position D (21.6 per cent). Employees on the late shift individually spent more time walking about the kitchen than those on the early shift. All three employees on the early shift, however, spent slightly more than half this time traveling empty-handed. Dinner Cook II (position D) spent considerably more time transporting trash and soiled utensils than did her assistant in position E.

Table 10. Final cumulative percentages of travel activities for each position in meat and vegetable cookery.

Code No.	Travel activity	Position				
		A	B	C	D	E
2.	Empty-handed	8.9	8.5	7.9	9.6	7.1
3.	Empty cart or rack	0.1	0.0	0.6	0.3	0.9
4.	Food, raw material, recipe	3.2	2.8	2.8	3.7	4.9
5.	Clean utensils, equipment	1.0	1.6	0.6	2.2	2.1
6.	Current use utensils, equipment	1.2	0.5	0.2	1.4	1.3
7.	Soiled utensils, equipment; trash	0.6	1.1	1.4	3.4	0.8
8.	Clean dishes, glasses	0.1	0.2	0.3	0.0	0.0
9.	Wrapping supplies	0.0	0.1	0.1	0.0	0.0
10.	Cleaning supplies	1.0	0.9	1.1	1.0	1.4
Total		16.1	15.6	15.0	21.6	18.5

Observations of Extra Persons. Observations of extra persons working in meat and vegetable cookery were totaled daily (Table 11, Appendix). The greatest amount of additional help was observed on the first day of the study and the least amount on the third day, a difference between 70 and zero observations. Total observations represented 4.76 per cent additional time spent in the meat and vegetable cookery unit than scheduled for the 10 days during which the investigation was conducted.

Influences on Activities

This study was conducted near the end of Spring semester, and a decrease in meal census was noticed almost daily as the end of school approached (Table 6, Appendix). Athletic training table, which was served most of the year, had been discontinued. Both of these factors would contribute to non-representativeness if data were applied to another segment of the school year.

Data did not indicate activities of only a single employee in each position. Observations were made of two employees although the regular occupant in a position was observed a majority of the time. On two to four days during the study, observations for each position were made of employees assuming responsibilities different from their customary assignments (Table 7, Appendix). This gave a composite picture of activities performed by all those responsible for specific positions in meal and vegetable cookery.

Day-to-day fluctuations in the various activity observations probably were due partly to variation in complexity of daily food preparation, depending upon the items served. Menus for the study period are given in Table 12 (Appendix).

SUMMARY

Rising labor costs in the food service industry have increased management's emphasis on efficient use of personnel. Problems in measuring activities of food service workers arise from the diversity of activity involved in the preparation of a variety of menu items and the lack of uniformity from day to day.

Work sampling, a technique developed in industry, has been adapted and used in some food service facilities to measure time distributions of both direct and indirect labor. This method of time study, based on the law of large numbers and normal curve of error, consists of many instantaneous random observations of activity. The number of observations controls data accuracy in approximating the actual proportion of time spent on those

activities. Users of the technique have declared it a satisfactory means of determining percentage distribution of labor time.

A 10-day work sampling study of five positions in the meat and vegetable cookery unit of a men's residence hall kitchen was conducted at Kansas State University over a three-week period. One hundred seven activities observed during a preliminary study were listed, defined, and coded. Random observation times were stratified to provide 12 observation periods each hour of the working day from 5:30 A.M. to 6:50 P.M. Activity of each employee was noted at the time she became visible to the investigator making a tour of the kitchen at designated observation times. Activity was recorded by code number under position held by individual employees on each specific day. One hundred daily observations were made of each position.

Activities were combined into three major categories: food production activities, food production support activities, and unproductive activities. Data were compiled by position in each of these categories as percentage of daily observations and cumulative percentage of total observations. Only three of these combined observations were not within the two sigma variance limits. These confidence limits were calculated for each position from the 10-day means of daily observations in the major categories. However, stability of data, determined by the regularity of cumulative averages of major activity observations for each position, was not attained during the period of investigation.

From data collected, little difference was noted among positions as to the amount of time expended in the three major categories. Food production activities represented from 36.1 to 41.4 per cent of the observations among the five positions. A range from 33.6 to 37.2 per cent of employees' time was observed in food production support activities. Unproductive activities varied from 22.6 per cent of total observations for one position to 26.8 per cent for another.

A few activity patterns for employees in Cook II positions were noted in analyzing sub-category data. They were observed less frequently manipulating and arranging food than their assistants but were observed more frequently in control activities. Employees in Cook II positions spent less time assembling equipment and cleaning than did the others. Clerical, necessary consultation, and other activities, however, occupied more observed time for Cook II positions than for lower classification employees.

CONCLUDING STATEMENTS AND RECOMMENDATIONS

Ten days of work sampling, which yielded 1,000 observations of each position in the meat and vegetable cookery unit, were inadequate to attain stability of data in the majority of activity categories. Performance differences between employees who assumed responsibilities of a specific position and the variation in the work load, as determined by menu and number of customers, probably were contributing factors. Final observation percentages in the three major activity categories indicated little difference among positions as to the amount of time expended in food production,

food production support, and unproductive activities. The level of assumed responsibility represented by a position did not appear to influence the proportion of time spent in the major activities.

Further investigation seems warranted to determine whether rearrangement of equipment, utensils, or supplies; or change in work procedures could reduce the amount of time consumed by travel activities. With expansion of services anticipated, "ingredient room activities" in addition to some food handling procedures might be studied to determine feasibility of assigning these support functions to one employee with specific responsibility for their performance.

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APPENDIX

Table 1. Definitions of coded activities performed by employees in the meat and vegetable cookery unit as grouped for data analysis under major headings and sub-categories.

FOOD PRODUCTION ACTIVITIES

Handle Food

Load Equipment

- 25. Load mixer with food.
- 32. Load chopper with food; apply pressure on lever.
- 39. Place food on or remove from slicer platform.
- 46. Load or unload pans of food from oven.
- 50. Load or unload pans of food from steamer.
- 52. Load steam-jacketed kettle with food.
- 56. Load fryer basket with food.
- 60. Load grill with food.

Pick Up or Put Down Food

- 11. Pick up or put down food, raw material, recipe.

Manual Operations

- 30. Mix, shake, knead food manually.
- 37. Chop, cut, grind, break, or peel food manually.
- 42. Slice food manually.
- 68. Break eggs.

Manipulate Food

- 23. Weigh or measure partially prepared or finished products.
- 28. Scrape food from sides of mixer bowls or attachments.
- 35. Scrape food from chopper bowl, blades, or attachments.
- 57. Manipulate loaded fryer basket.
- 62. Manipulate food on grill.
- 72. Drain juice or grease from food.
- 105. Scrape food from container.
- 108. Unload fryer when food is not placed directly into serving pan.
- 109. Shape food, as press into dipper, mold by hand, roll dough.

Arrange Food

- 64. Arrange food on salad plates.
- 66. Arrange sandwiches on bun sheets or individual plates.
- 70. Place, arrange, or spread food in pan or other container; add seasoning to pan of food; pour juice into glasses; place sherbet in souffle cups.

Table 1 (cont.).

Operate Equipment

- 26. Operate mixer.
- 33. Operate chopper, as turn on or off; raise or lower lid.
- 40. Operate slicer.
- 43. Check or set temperature of ovens; check presence of deflector pans.
- 48. Turn steam or water on or off at steamers or steam-jacketed kettles; turn water on or off at sink.
- 54. Raise or lower steam-jacketed kettle; raise or lower lid.
- 55. Operate fryer or grill controls.

Travel with Food

- 4. Travel with food, raw material, recipe, pencil.

Control

- 44. Check food in oven or manipulate pans.
- 96. Taste food; test for doneness.

FOOD PRODUCTION SUPPORT ACTIVITIES

Handle EquipmentPick Up or Put Down:

- 12. Clean pans, utensils, equipment.
- 13. Current-use pans, utensils, equipment, pot holders.
- 14. Soiled pans, utensils, equipment, dishes; trash.
- 15. Clean dishes, glasses, paper cups.

Travel with:

- 3. Empty cart or rack.
- 5. Clean pans, utensils, equipment.
- 6. Current-use pans, utensils, equipment, pot holders.
- 7. Soiled pans, utensils, equipment, dishes; trash.
- 8. Clean dishes, glasses, paper cups.

Assemble Equipment

- 21. Grease or foil pans before use.
- 24. Assemble mechanical mixing equipment.
- 31. Assemble mechanical chopper, grinder, or cutter.
- 38. Assemble mechanical slicing equipment.
- 61. Scrape or wipe grill before or during use.
- 107. Assemble fryer; add frying fat.

Table 1 (cont.).

Disassemble:

- 29. Mixer.
- 36. Chopper.
- 41. Slicer.
- 59. Fryer.
- 111. Grease drainers from grill.

CleaningPreparation

- 10. Travel with cleaning supplies, as cloths, cleanser, scrub water, ladder, mop.
- 17. Pick up or put down cleaning supplies.

Activities

- 77. Scrub or wipe mixer.
- 78. Scrub or wipe chopper or grinding attachments to other equipment.
- 80. Scrub or wipe slicer.
- 81. Scrub or wipe oven.
- 82. Scrub or wipe steam-jacketed kettle.
- 83. Scrub or wipe steamer.
- 84. Scrub or wipe grill.
- 85. Scrub or wipe fryer; strain frying fat.
- 86. Scrub or wipe utensils; rinse scoop in water during food preparation; wipe edges of pan containing food.
- 87. Scrub or wipe counter, carts, racks, sink.
- 88. Scrub or wipe walls behind equipment.
- 89. Mop or sweep floor.
- 92. Wash or rinse cleaning cloths.

Ingredient Room Activities

- 19. Open cans, boxes, bags; cut string; unwrap packages.
- 22. Weigh or measure raw material or empty pans.
- 69. Check or clean raw material, as chicken, navy beans.

Cover Food

- 9. Travel with wrapping supplies, as foil, wax paper.
- 16. Pick up or put down wrapping supplies.
- 74. Wrap raw material or prepared food, as sliced meat or cheese, sandwiches.
- 75. Cover pans, jars, cans.

Clerical Activities

- 1. Read recipe, menu, label.
- 106. Write, label, make computations.
- 110. Count pans, pieces of food.

Table 1 (concl.).

Necessary Consultation

- 93. Talk or listen to employee(s) involved with meat and vegetable cookery.
- 95. Talk or listen to dietitian(s).
- 97. Check supply of food on serving line.

Other Activities

- 18. In walk-in refrigerator or freezer.
- 20. Open or close drawers of counters, doors to refrigerators.
- 45. Open or close oven doors.
- 49. Open or close steamer doors.
- 104. On an errand.

UNPRODUCTIVE ACTIVITIES

Unavoidable Delay

- 2. Travel empty-handed.
- 27. Watch food in mixer.
- 34. Watch food in chopper.
- 47. Wait for level to change in rotary oven.
- 51. Wait for release of steam from steamer or steam-jacketed kettle.
- 53. Watch food or liquid in steam-jacketed kettle.
- 58. Watch food in fryer.
- 63. Watch food on grill.
- 65. Assembly delay in making salad plates, sandwiches, or layered casseroles.
- 91. Wash or wipe hands; put on or remove plastic coverings for hands.
- 112. Search for pan or food item while standing still.

Avoidable Delay

- 94. Talk or listen to employee(s) not involved in meat and vegetable cookery.
- 98. Unoccupied.

Meals

- 99. Coffee or meal break in dining room.
- 100. Travel along cafeteria line.
- 101. Travel toward dining room with tray of food.
- 102. Travel toward conveyor belt with soiled dishes from coffee or meal break.

Personal Time

- 103. Not able to locate and presumed to be in locker room or rest room.

EXPLANATION OF FIGURE 1

The floor plan pictured is the original layout of the men's residence hall kitchen. Since the operation began in 1960, several changes have been made affecting traffic flow of employees in the meat and vegetable cookery unit. The pot and pan washing unit has been moved from the lower right, as pictured, to the location labeled "milk refrigerator," shown center left. Pot and pan washing is now adjacent to dishwashing facilities. The fruit and vegetable walk-in refrigerator, pictured at right center, is presently the dairy refrigerator. Only one end of the cafeteria line is pictured, in the upper left section of the floor plan.

Observation route from the employee dining room into the kitchen is shown in white. Employee activities were viewed primarily from the side traffic aisle although occasional tours into the meat cookery section were necessary. A major difficulty in making observations was presence of a half-wall between the salad preparation and vegetable cookery units. Employees working in the latter unit could be viewed by the observer upon entering the kitchen, but activity was impossible to identify until the vegetable cookery aisle was reached.

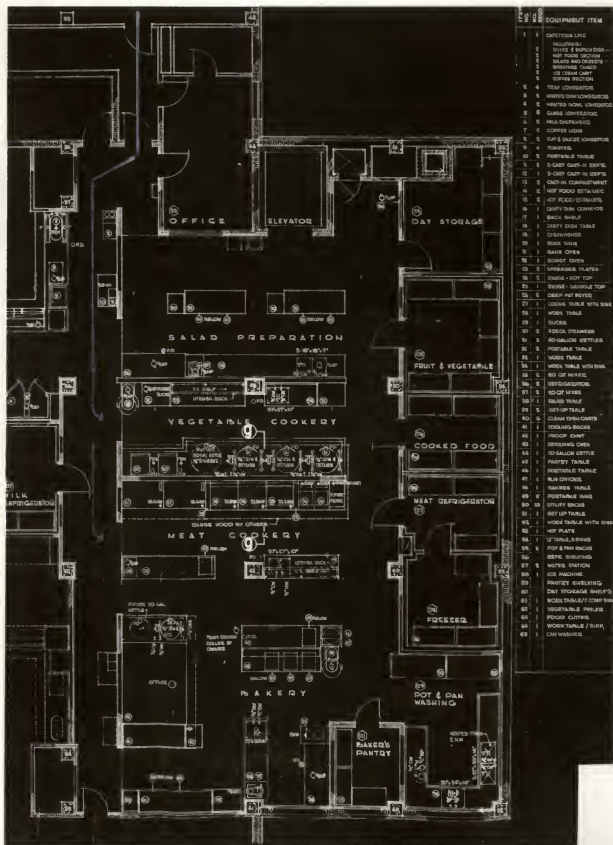


Figure 1. Floor diagram of men's residence hall kitchen at Kansas State University.

Table 2. Daily observation data collected for each of five positions in meat and vegetable cookery presented by code number and organized under major headings and sub-categories.

Position A	:Code:	Observation days									
	: No.:	1	2	3	4	5	6	7	8	9	10
FOOD PRODUCTION											
ACTIVITIES											
Handle Food											
Load equipment	25.	-	-	-	-	-	-	1	1	-	-
	32.	-	1	-	-	-	-	-	-	1	-
	39.	-	-	1	-	2	-	-	-	-	-
	46.	-	-	1	-	-	1	-	-	-	-
	50.	2	-	2	-	-	-	-	1	1	-
	52.	-	3	2	1	-	-	-	-	4	2
	56.	-	-	-	-	-	-	-	8	-	1
	60.	-	-	-	-	-	-	-	1	-	-
		2	4	6	1	2	1	1	11	6	3
Pick up or put down food											
	11.	11	13	4	9	12	23	8	18	3	3
Manual operations											
	30.	4	3	8	6	-	1	2	5	12	3
	37.	6	7	11	2	6	-	6	1	-	10
	42.	4	-	-	-	2	-	-	-	-	-
	68.	-	1	-	-	-	-	4	-	-	1
		14	11	19	8	8	1	12	6	12	14
Manipulate food											
	23.	1	1	-	-	2	-	-	-	-	1
	28.	-	-	-	-	-	-	-	1	-	2
	35.	-	2	2	-	-	-	-	-	1	-
	57.	-	-	-	-	-	1	-	5	-	-
	62.	-	-	-	-	-	1	-	-	-	-
	67.	-	-	-	-	-	1	-	-	-	3
	72.	-	-	-	2	1	-	-	-	-	-
	105.	-	-	4	-	-	-	-	-	-	-
	108.	-	-	-	-	-	-	-	1	-	-
	109.	-	-	-	-	1	-	-	-	-	2
		1	3	6	2	4	3	-	7	1	8
Arrange food											
	64.	-	-	-	-	2	-	5	-	2	-
	66.	-	-	-	-	8	-	-	-	-	1
	70.	2	6	1	1	2	6	4	5	-	9
		2	6	1	1	12	6	9	5	2	10
		30	37	36	21	38	34	30	47	24	38
Operate Equipment											
	26.	-	-	-	-	-	-	-	-	-	1
	33.	-	-	-	-	-	-	-	-	-	-
	40.	-	-	1	-	2	-	1	-	-	-
	43.	-	-	-	-	-	-	-	-	-	-
	48.	1	1	1	4	-	-	-	-	5	1
	54.	-	-	-	1	-	-	-	-	-	-
	55.	-	-	-	-	-	-	-	-	-	-
		1	1	2	5	2	-	1	-	5	2

Table 2 (cont.).

Position A	:Code:	Observation days									
	: No.:	1	2	3	4	5	6	7	8	9	10
<u>Travel with Food</u>	4.	4	4	2	3	2	4	4	4	3	2
<u>Control</u>	44.	-	-	-	-	-	2	1	-	-	-
	96.	1	-	-	-	1	3	1	-	2	-
		1	-	-	-	1	5	2	-	2	-
FOOD PRODUCTION SUPPORT											
ACTIVITIES											
<u>Handle Equipment</u>											
<u>Pick up or put down</u>	12.	2	1	4	1	3	2	1	3	3	1
	13.	1	-	1	1	2	2	1	2	-	2
	14.	-	2	-	1	1	2	3	-	3	-
	15.	-	-	-	-	1	-	1	-	-	-
		3	3	5	3	7	6	6	5	6	3
<u>Travel</u>	3.	-	-	1	-	-	-	-	-	-	-
	5.	1	-	2	2	-	-	1	-	3	1
	6.	-	-	3	1	-	2	1	2	1	2
	7.	2	-	1	-	-	1	2	-	-	-
	8.	-	-	-	1	-	-	-	-	-	-
		3	-	7	4	-	3	4	2	4	3
<u>Assemble</u>	21.	1	-	-	1	-	-	-	-	-	1
	24.	-	-	-	-	-	-	-	-	-	2
	31.	-	-	-	-	-	-	-	-	1	-
	38.	-	-	-	-	-	-	-	-	-	-
	61.	-	1	-	-	-	1	-	-	-	-
	107.	-	-	-	-	-	-	-	-	-	-
		1	1	-	1	-	1	-	-	1	3
<u>Disassemble</u>	29.	-	-	-	-	-	-	-	-	-	-
	36.	-	-	-	1	-	-	-	-	-	-
	41.	-	-	-	-	-	-	-	-	-	-
	59.	-	-	-	-	-	-	-	-	-	-
		-	-	-	1	-	-	-	-	-	-
		7	4	12	9	7	10	10	7	11	9
<u>Cleaning</u>											
<u>Preparation</u>	10.	1	-	1	3	1	1	2	-	-	1
	17.	1	-	1	1	3	1	-	2	1	2
		2	-	2	4	4	2	2	2	1	3

Table 2 (cont.).

Position A	:Code: : No.:	Observation days									
		1	2	3	4	5	6	7	8	9	10
<u>Activities</u>											
	77.	-	-	-	-	-	-	-	-	-	-
	78.	-	1	-	-	-	-	-	-	-	-
	80.	-	-	3	-	-	-	-	-	-	-
	81.	-	-	-	-	-	-	-	-	-	-
	82.	-	-	-	6	-	-	-	-	1	-
	83.	-	-	1	-	-	-	-	-	-	-
	84.	-	-	-	-	-	-	-	-	-	-
	85.	-	-	-	-	-	-	2	-	-	-
	86.	2	2	2	-	-	3	1	-	-	-
	87.	2	1	-	-	-	1	-	1	5	-
	88.	-	-	-	-	-	-	-	-	-	-
	89.	-	-	-	-	-	-	-	-	-	-
	92.	1	1	-	1	-	-	-	1	1	-
		5	5	6	7	-	4	1	4	7	1
		7	5	8	11	4	6	3	6	8	4
<u>Ingredient Room</u>											
	19.	4	1	3	-	-	-	1	-	2	-
	22.	1	1	-	2	-	-	-	2	1	-
	69.	-	-	-	-	-	-	-	-	-	-
		5	2	3	2	-	-	1	2	3	-
<u>Cover Food</u>											
	9.	-	-	-	-	-	-	-	-	-	-
	16.	2	1	-	-	-	-	-	-	-	1
	74.	-	-	-	-	-	-	-	-	-	-
	75.	2	-	1	-	2	-	-	-	-	-
		4	1	1	-	2	-	-	-	-	1
<u>Clerical</u>											
	1.	3	2	1	1	1	1	2	-	1	1
	106.	-	1	1	-	1	-	1	-	1	-
	110.	-	-	-	-	-	-	1	-	-	-
		3	3	2	1	2	1	4	-	2	1
<u>Necessary Consultation</u>											
	93.	8	4	2	14	10	7	5	8	5	2
	95.	4	5	5	2	4	4	5	2	2	6
	97.	-	-	-	-	-	-	2	-	-	-
		12	9	7	16	14	11	12	10	7	8
<u>Other</u>											
	18.	3	3	2	1	-	1	3	3	3	1
	20.	1	1	1	-	1	1	1	-	1	-
	45.	-	-	-	-	-	3	-	-	-	1
	49.	1	-	1	-	-	-	-	1	-	-
	104.	-	1	-	-	-	-	-	-	-	-
		5	5	4	1	1	5	4	4	4	2

Table 2 (cont.).

Position A	:Code:	Observation days									
	: No.:	1	2	3	4	5	6	7	8	9	10
UNPRODUCTIVE ACTIVITIES											
<u>Unavoidable Delay</u>	2.	5	10	8	6	13	6	9	5	13	14
	27.	-	-	-	-	1	-	-	-	-	2
	34.	-	-	-	-	-	-	-	-	-	-
	47.	-	-	-	-	-	-	-	-	-	-
	51.	-	-	-	-	-	-	-	-	-	-
	53.	-	-	-	-	-	-	1	-	-	-
	58.	-	-	-	-	-	-	-	-	-	-
	63.	-	-	-	-	-	-	-	-	-	-
	65.	-	1	1	-	-	-	-	-	-	-
	91.	-	-	-	3	1	2	1	-	1	1
	112.	-	-	-	-	-	-	-	-	-	-
		5	11	9	9	15	8	11	5	14	17
<u>Avoidable Delay</u>	94.	2	3	1	6	2	4	4	2	2	3
	98.	-	-	2	1	-	-	-	1	1	-
		2	3	3	7	2	4	4	3	3	3
<u>Meals</u>	99.	12	12	8	12	5	9	12	11	10	11
	100.	-	-	-	1	-	2	-	-	2	-
	101.	1	1	-	-	2	-	-	-	-	-
	102.	-	-	-	1	-	1	1	-	1	-
		13	13	8	14	7	12	13	11	13	11
<u>Personal Time</u>	103.	1	2	3	1	3	-	1	1	1	1
Position B											
FOOD PRODUCTION ACTIVITIES											
<u>Handle Food</u>											
<u>Load equipment</u>	25.	-	-	-	-	1	-	-	-	-	-
	32.	-	-	-	-	-	-	-	-	-	-
	39.	-	-	-	-	-	-	-	-	-	-
	46.	-	-	-	-	-	-	-	-	-	-
	50.	-	-	-	-	-	-	-	-	-	-
	52.	-	1	3	3	-	-	-	1	-	-
	56.	-	-	-	-	-	7	-	-	-	2
	60.	-	-	2	-	2	-	3	-	2	-
		-	1	5	3	3	7	3	1	2	2
<u>Pick up or put down food</u>	11.	4	9	9	7	13	9	14	14	19	12

Table 2 (cont.).

Position B	:Code: : No.:	Observation days									
		1	2	3	4	5	6	7	8	9	10
Manual operations	30.	4	5	-	4	-	6	1	7	3	-
	37.	5	-	-	4	-	6	1	-	-	-
	42.	-	-	-	-	-	-	-	-	-	-
	68.	3	1	-	-	-	-	-	-	-	2
		12	6	-	8	-	12	2	7	3	2
Manipulate food	23.	-	-	-	-	-	-	-	-	-	-
	28.	-	-	-	-	-	-	-	1	-	-
	35.	-	-	-	1	-	-	1	-	-	-
	57.	-	-	-	-	-	3	-	1	-	2
	62.	2	4	8	5	6	2	1	2	5	-
	67.	-	-	3	-	-	-	-	1	-	2
	72.	-	-	-	-	1	1	-	-	-	-
	105.	1	-	1	-	-	1	-	-	-	-
	108.	-	-	-	-	-	-	-	-	-	-
	109.	-	-	-	-	-	-	-	-	-	6
		3	4	12	6	7	7	2	5	6	10
Arrange food	64.	-	-	-	-	1	-	-	-	2	-
	66.	-	-	-	-	-	1	-	-	-	-
	70.	2	8	3	3	8	6	12	8	4	7
		2	8	3	3	9	7	12	8	6	7
		21	28	29	27	32	42	33	35	36	33
<u>Operate Equipment</u>	26.	-	-	-	-	-	-	-	-	-	-
	33.	-	-	1	-	-	-	-	-	-	-
	40.	-	-	-	-	-	-	-	-	-	-
	43.	-	-	-	-	-	-	-	-	-	-
	48.	2	-	-	-	-	1	-	1	2	-
	54.	3	-	1	-	1	-	-	1	-	-
	55.	-	-	-	-	-	1	1	-	-	-
		5	-	2	-	1	2	1	2	2	-
<u>Travel with Food</u>	4.	1	2	3	2	3	3	3	3	3	5
<u>Control</u>	44.	-	-	1	-	-	-	-	-	-	-
	96.	-	1	-	-	-	-	-	-	-	-
		-	1	1	-	-	-	-	-	-	-
FOOD PRODUCTION SUPPORT											
ACTIVITIES											
<u>Handle Equipment</u>											
Pick up or put down											
	12.	2	-	3	2	2	3	2	3	2	-
	13.	5	2	-	1	1	1	3	3	1	1
	14.	2	1	2	3	1	1	2	1	-	2
	15.	4	-	2	-	-	-	3	-	1	-
		13	3	7	6	4	5	10	7	4	3

Table 2 (cont.).

Position B	:Code:	Observation days									
	: No.:	1	2	3	4	5	6	7	8	9	10
Travel	3.	-	-	1	-	-	-	-	-	-	-
	5.	1	2	1	-	4	1	1	1	2	3
	6.	-	-	1	1	-	1	1	-	-	1
	7.	2	-	1	-	2	1	1	-	1	3
	8.	-	-	2	-	-	-	-	-	-	-
		3	2	6	1	6	3	3	1	3	7
Assemble	21.	-	-	-	-	-	-	-	1	-	-
	24.	-	-	-	1	-	-	-	-	-	-
	31.	-	-	1	-	-	1	-	-	-	-
	38.	-	-	-	-	-	-	-	-	-	-
	61.	1	2	2	1	1	1	2	3	-	-
	107.	-	-	-	-	-	-	-	-	-	-
		1	2	3	2	1	2	2	4	-	-
Disassemble	29.	-	-	-	-	-	-	-	-	-	-
	36.	-	-	-	-	-	-	-	-	-	-
	41.	-	-	-	-	-	-	-	-	-	-
	59.	-	-	-	-	-	-	-	-	-	-
	111.	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-
		17	7	16	9	11	10	15	12	7	10
<u>Cleaning</u> Preparation	10.	2	1	1	1	-	-	-	1	1	2
	17.	-	-	1	-	-	-	1	1	-	2
		2	1	2	1	-	-	1	2	1	4
Activities	77.	-	-	-	-	-	-	-	-	-	-
	78.	-	-	3	2	-	-	-	-	-	-
	80.	-	-	-	-	-	-	-	1	-	-
	81.	-	-	-	-	-	-	-	-	-	-
	82.	3	1	3	1	4	-	-	1	5	-
	83.	-	-	4	-	-	-	-	-	-	-
	84.	1	3	5	2	6	-	3	1	3	-
	85.	-	-	-	-	-	3	-	-	-	5
	86.	3	2	2	2	6	1	1	4	4	5
	87.	1	1	4	1	5	4	1	-	-	2
	88.	-	-	-	-	-	-	-	-	-	-
	89.	-	1	-	-	-	-	-	1	1	1
	92.	1	3	4	1	-	2	1	-	-	1
		9	11	25	9	21	10	6	8	13	14
		11	12	27	10	21	10	7	10	14	18
<u>Ingredient Room</u>	19.	2	2	2	3	-	3	2	1	4	-
	22.	1	4	-	1	-	-	1	-	-	-
	69.	-	-	-	-	-	-	-	-	-	-
		3	6	2	4	-	3	3	1	4	-

Table 2 (cont.).

Position B	:Code: : No.:	Observation days									
		1	2	3	4	5	6	7	8	9	10
<u>Cover Food</u>	9.	-	-	-	-	-	1	-	-	-	-
	16.	1	-	-	-	-	-	-	-	-	1
	74.	-	-	-	1	-	-	-	-	-	-
	75.	1	1	-	-	-	-	-	-	-	-
		2	1	-	1	-	1	-	-	-	1
<u>Clerical</u>	1.	1	1	-	1	-	1	1	-	-	-
	106.	-	-	-	-	-	-	1	-	-	1
	110.	-	-	-	-	-	-	1	-	-	-
		1	1	-	1	-	1	3	-	-	1
<u>Necessary Consultation</u>	93.	8	3	-	14	4	5	4	7	1	5
	95.	1	1	1	-	1	-	1	1	1	-
	97.	-	-	-	-	-	-	1	-	1	-
		9	4	1	14	5	5	6	8	3	5
<u>Other</u>	18.	-	1	-	1	-	-	2	-	3	1
	20.	-	-	-	-	1	1	1	2	1	-
	45.	-	-	-	-	-	-	1	-	-	1
	49.	-	-	-	-	-	-	-	-	1	-
	104.	-	1	-	-	-	-	-	-	-	-
		-	2	-	1	1	1	4	2	5	2
UNPRODUCTIVE ACTIVITIES											
<u>Unavoidable Delay</u>	2.	10	13	7	12	6	7	6	12	6	6
	27.	-	-	-	-	-	-	-	-	-	-
	34.	-	-	-	1	-	-	-	-	-	-
	47.	-	-	-	-	-	-	-	-	-	-
	51.	-	-	-	-	-	-	-	-	-	-
	53.	-	1	1	-	2	-	-	-	-	-
	58.	-	-	-	-	-	-	-	-	-	2
	63.	1	-	-	-	3	-	-	-	-	-
	65.	-	-	-	-	-	2	-	-	-	1
	91.	2	-	-	1	-	-	2	1	1	-
	112.	-	-	-	-	-	-	-	-	2	-
		13	14	8	14	11	9	8	13	9	9
<u>Avoidable Delay</u>	94.	2	3	1	1	1	1	2	-	1	2
	98.	-	4	2	1	2	1	2	2	4	2
		2	7	3	2	3	2	4	2	5	4
<u>Meals</u>	99.	13	13	8	12	7	9	11	12	9	11
	100.	-	-	-	1	2	2	-	-	2	-
	101.	-	-	-	-	-	-	-	-	-	-
	102.	-	-	-	-	1	-	1	-	1	-
		13	13	8	13	10	11	12	12	12	11
<u>Personal Time</u>	103.	2	2	-	2	2	-	1	-	-	1

Table 2 (cont.).

Position C	:Code:	Observation days									
	: No.:	1	2	3	4	5	6	7	8	9	10
FOOD PRODUCTION ACTIVITIES											
<u>Handle Food</u>											
Load equipment	25.	-	-	-	-	2	-	-	-	1	-
	32.	-	-	-	-	-	-	-	1	1	-
	39.	-	-	-	-	-	-	-	-	-	-
	46.	-	-	-	-	-	-	-	-	-	-
	50.	-	-	-	-	-	-	-	-	-	-
	52.	2	-	-	-	-	-	-	1	-	-
	56.	-	-	-	-	-	-	-	-	-	-
	60.	-	-	1	3	2	-	1	2	1	-
		2	-	1	3	4	-	1	4	3	-
Pick up or put down food	11.	12	5	16	11	19	17	14	8	20	6
Manual operations	30.	1	2	2	1	2	-	-	1	1	3
	37.	-	7	-	3	10	1	10	1	1	-
	42.	-	-	-	-	-	-	-	-	-	-
	68.	4	-	6	-	-	2	1	-	-	-
		5	9	8	4	12	3	11	2	2	3
Manipulate food	23.	-	-	-	-	2	-	-	-	-	-
	28.	-	-	-	-	-	-	-	-	-	-
	35.	-	-	-	-	-	-	-	-	-	-
	57.	-	-	-	-	-	-	-	-	-	-
	62.	4	2	9	5	4	-	4	5	5	-
	67.	-	-	2	-	-	-	-	-	3	-
	72.	1	-	-	-	-	-	-	2	-	1
	105.	1	1	-	-	1	-	-	-	-	-
	108.	-	-	-	-	-	-	-	-	-	-
	109.	-	3	-	-	1	-	-	-	-	4
		6	6	11	5	8	-	4	7	8	5
Arrange food	64.	4	-	2	-	1	4	5	-	10	-
	66.	-	-	-	4	-	-	-	-	-	3
	70.	5	7	3	-	-	4	11	7	1	9
		9	7	5	4	1	8	16	7	11	12
		34	27	41	27	44	28	46	28	44	26
<u>Operate Equipment</u>											
	26.	-	-	-	-	-	-	-	-	-	-
	33.	2	-	1	-	-	-	-	-	-	-
	40.	-	-	-	-	-	2	-	2	-	1
	43.	-	-	-	-	-	-	-	-	-	-
	48.	-	-	-	-	1	1	-	1	-	1
	54.	-	1	-	-	1	1	-	1	-	-
	55.	1	-	-	-	-	-	-	-	-	-
		3	1	1	-	2	3	1	4	-	2

Table 2 (cont.).

Position C	:Code: : No.:	Observation days									
		1	2	3	4	5	6	7	8	9	10
<u>Travel with Food</u>	4.	2	1	3	4	-	5	1	5	3	4
<u>Control</u>	44.	-	-	-	-	-	-	-	1	-	-
	96.	-	-	-	-	-	-	-	1	-	-
		-	-	-	-	-	-	-	2	-	-
FOOD PRODUCTION SUPPORT ACTIVITIES											
<u>Handle Equipment</u>											
<u>Pick up or put down</u>	12.	3	2	2	1	1	-	-	2	1	-
	13.	-	1	1	1	1	1	1	1	-	1
	14.	5	3	-	2	2	2	2	2	1	-
	15.	5	-	1	-	2	5	2	-	4	-
		13	6	4	4	6	8	5	5	6	1
<u>Travel</u>	3.	-	-	-	1	-	3	-	1	-	1
	5.	1	-	1	-	1	1	-	2	-	-
	6.	-	1	-	-	-	-	-	1	-	-
	7.	1	2	3	-	1	2	-	1	2	4
	8.	1	-	1	-	-	1	-	-	-	-
		3	3	5	1	2	7	-	5	2	5
<u>Assemble</u>	21.	-	-	-	-	-	-	-	-	-	-
	24.	-	-	-	-	-	-	-	-	-	-
	31.	-	-	1	-	-	-	-	-	-	-
	38.	-	-	-	-	-	-	-	-	-	-
	61.	1	4	2	2	2	-	1	3	1	-
	107.	-	-	-	-	-	-	-	-	-	-
		1	4	3	2	2	-	1	3	1	-
<u>Disassemble</u>	29.	-	-	-	-	-	-	-	-	-	-
	36.	-	-	-	-	-	-	-	-	-	-
	41.	-	-	-	-	-	-	-	-	-	-
	59.	-	-	-	-	-	-	-	-	-	-
	111.	-	-	-	-	-	-	-	1	-	-
		-	-	-	-	-	-	-	1	-	-
		17	13	12	7	10	15	6	14	9	6
<u>Cleaning</u>											
<u>Preparation</u>	10.	-	-	2	-	-	1	3	1	2	2
	17.	1	1	-	-	-	-	1	1	-	3
		1	1	2	-	-	1	4	2	2	5

Table 2 (cont.).

Position C	:Code: : No.:	Observation days									
		1	2	3	4	5	6	7	8	9	10
<u>Activities</u>	77.	-	-	-	-	-	-	-	-	-	-
	78.	-	-	-	-	-	-	-	-	-	-
	80.	-	-	-	-	-	-	-	-	-	1
	81.	-	-	-	-	-	-	-	-	-	-
	82.	-	5	-	-	-	-	-	-	-	1
	83.	-	-	-	-	-	-	-	-	-	-
	84.	1	4	2	1	-	1	3	2	1	-
	85.	-	-	-	-	-	-	-	-	-	-
	86.	-	-	-	1	1	-	1	1	1	-
	87.	1	4	-	1	1	2	1	4	1	1
	88.	-	-	-	1	-	-	-	-	-	-
	89.	2	1	-	-	-	1	-	-	-	1
	92.	-	-	1	1	-	3	-	1	2	1
		4	14	3	5	2	7	5	8	5	5
		5	15	5	5	2	8	9	10	7	10
<u>Ingredient Room</u>	19.	3	10	3	2	-	4	4	2	1	1
	22.	1	2	-	1	1	1	-	-	1	1
	69.	-	-	-	-	-	-	-	-	-	-
		4	12	3	3	1	5	4	2	2	2
<u>Cover Food</u>	9.	-	-	-	-	-	-	-	-	-	1
	16.	-	-	1	1	-	-	2	-	1	-
	74.	-	-	-	-	-	-	-	-	1	1
	75.	-	1	-	-	1	-	-	-	-	-
		-	1	1	1	1	-	2	-	2	2
<u>Clerical</u>	1.	1	-	-	-	1	-	-	3	-	2
	106.	1	-	-	-	-	-	-	-	-	-
	110.	-	-	1	1	-	-	-	-	-	-
		2	-	1	1	1	-	-	3	-	2
<u>Necessary Consultation</u>	93.	4	2	1	11	7	4	4	3	5	7
	95.	-	-	3	3	6	2	-	1	1	2
	97.	-	-	-	1	-	1	-	-	-	1
		4	2	4	15	13	7	4	4	6	10
<u>Other</u>	18.	2	1	3	2	2	2	1	1	3	1
	20.	-	-	2	1	-	-	-	-	-	1
	45.	-	-	1	-	-	-	-	-	-	-
	49.	-	-	1	1	-	1	-	-	-	1
	104.	-	-	-	-	-	1	-	-	-	-
		2	1	7	4	2	4	1	1	3	3

Table 2 (cont.).

Position C	:Code:	Observation days									
	: No.:	1	2	3	4	5	6	7	8	9	10
UNPRODUCTIVE ACTIVITIES											
<u>Unavoidable Delay</u>	2.	9	1	7	10	8	10	5	12	5	12
	27.	-	-	-	-	2	-	-	-	-	-
	34.	-	-	-	-	-	-	-	-	-	-
	47.	-	-	-	-	-	-	-	-	-	-
	51.	-	-	-	-	-	-	-	-	-	3
	53.	-	2	-	-	-	-	-	-	-	-
	58.	-	-	-	-	-	-	-	-	-	-
	63.	-	-	-	-	-	-	-	-	-	-
	65.	-	-	1	-	-	-	-	-	-	-
	91.	-	-	1	2	-	-	1	1	1	1
	112.	-	-	-	-	-	-	-	-	-	1
		9	3	9	12	10	10	6	13	6	17
<u>Avoidable Delay</u>	94.	2	2	-	3	4	2	3	-	3	2
	98.	-	2	2	2	-	-	4	2	1	2
		2	4	2	5	4	2	7	2	4	4
<u>Meals</u>	99.	13	11	8	12	5	9	8	12	11	10
	100.	-	-	-	-	-	2	-	-	-	-
	101.	1	2	-	-	2	-	-	-	1	1
	102.	-	1	-	1	-	1	-	-	-	-
		14	14	8	13	7	12	8	12	12	11
<u>Personal Time</u>	103.	2	6	3	3	3	1	5	-	2	1
<hr/>											
Position D											
<hr/>											
FOOD PRODUCTION ACTIVITIES											
<u>Handle Food</u>											
<u>Load equipment</u>	25.	-	2	-	-	-	-	1	-	-	-
	32.	-	-	-	-	-	-	-	-	-	-
	39.	-	-	1	-	-	-	-	-	-	1
	46.	3	1	1	-	-	-	1	1	1	1
	50.	-	1	-	-	-	-	-	-	-	-
	52.	1	1	-	1	1	1	-	2	1	-
	56.	-	-	-	-	-	-	1	-	1	-
	60.	-	-	-	-	-	-	-	-	-	-
		4	5	2	1	1	1	3	3	3	2
<u>Pick up or put down food</u>	11.	7	12	11	10	13	13	9	12	13	13

Table 2 (cont.).

Position D	:Code:		Observation days									
	: No.:		1	2	3	4	5	6	7	8	9	10
Manual operations	30.	10	1	1	5	3	-	1	5	3	-	
	37.	-	-	4	-	-	-	2	1	2	3	
	42.	-	-	-	-	-	-	-	-	-	-	
	68.	-	-	-	-	-	1	-	-	2	-	
		10	1	5	5	3	1	3	6	7	3	
Manipulate food	23.	-	-	-	-	-	-	-	-	-	2	
	28.	-	-	-	-	-	-	-	-	-	-	
	35.	-	-	-	-	-	-	-	-	-	-	
	57.	-	-	-	-	-	-	-	-	1	-	
	62.	-	-	-	-	-	-	-	-	-	-	
	67.	8	1	-	-	-	-	10	3	2	-	
	72.	-	1	-	-	2	1	-	-	-	-	
	105.	-	-	-	-	-	-	1	-	-	-	
	108.	-	-	-	-	-	-	-	-	-	-	
	109.	-	8	-	-	-	7	-	-	-	2	
		8	10	-	-	2	8	11	3	3	4	
Arrange food	64.	-	-	-	-	-	-	-	-	-	-	
	66.	-	-	-	-	-	-	-	-	-	-	
	70.	5	2	7	9	2	9	4	7	2	13	
		5	2	7	9	2	9	4	7	2	13	
		34	30	25	25	21	32	30	31	28	35	
<u>Operate Equipment</u>	26.	-	1	1	-	-	2	1	-	-	-	
	33.	-	-	-	-	-	-	-	-	-	-	
	40.	-	-	3	-	-	-	-	-	-	-	
	43.	1	1	1	-	2	2	1	-	1	-	
	48.	1	1	1	2	2	1	-	-	-	-	
	54.	-	-	-	-	1	-	-	1	-	-	
	55.	-	-	-	-	-	-	-	-	-	-	
		2	3	6	2	5	5	2	1	1	-	
<u>Travel with Food</u>	4.	3	4	6	6	3	2	2	4	5	2	
<u>Control</u>	44.	1	-	-	-	3	-	1	1	3	-	
	96.	-	-	-	1	1	1	1	1	2	-	
		1	-	-	1	4	1	2	2	5	-	
FOOD PRODUCTION SUPPORT ACTIVITIES												
<u>Handle Equipment</u>												
Pick up or put down												
	12.	2	-	3	1	4	-	3	1	-	3	
	13.	-	3	-	1	1	2	4	2	-	6	
	14.	2	-	1	5	2	1	3	3	2	1	
	15.	-	-	-	-	-	-	-	-	-	-	
		4	3	4	7	7	3	10	6	2	10	

Table 2 (cont.).

Position D	:Code:	Observation days										
	: No.:	1	2	3	4	5	6	7	8	9	10	
Travel	3.	1	-	-	-	1	-	-	-	1	-	
	5.	5	1	3	1	-	4	4	3	-	1	
	6.	1	1	1	3	1	1	2	1	2	1	
	7.	3	1	1	2	7	9	3	2	4	2	
	8.	-	-	-	-	-	-	-	-	-	-	
		10	3	5	6	9	14	9	6	7	4	
Assemble	21.	-	-	-	-	-	-	-	-	-	1	
	24.	-	-	-	-	-	-	-	-	-	-	
	31.	-	-	-	-	-	-	-	-	-	-	
	38.	-	-	-	-	-	-	-	-	-	-	
	61.	-	-	-	-	-	-	-	-	-	-	
	107.	-	-	-	-	-	-	-	-	-	-	
		-	-	-	-	-	-	-	-	-	1	
Disassemble	29.	-	-	-	-	-	-	-	-	-	-	
	36.	-	-	-	-	-	-	-	-	-	-	
	41.	-	-	-	-	-	-	-	-	-	-	
	59.	-	-	-	-	-	-	-	-	-	-	
	111.	-	-	-	-	-	-	-	-	-	-	
		-	-	-	-	-	-	-	-	-	-	
		14	6	9	13	16	17	19	12	9	15	
<u>Cleaning</u>												
Preparation	10.	-	1	-	2	1	1	1	-	2	2	
	17.	1	2	-	2	1	-	-	-	-	1	
		1	3	-	4	2	1	1	-	2	3	
Activities	77.	-	-	-	-	-	-	-	-	-	-	
	78.	-	-	-	-	-	-	-	-	-	-	
	80.	-	-	-	-	-	-	-	-	-	-	
	81.	-	-	-	-	-	-	-	-	-	-	
	82.	2	-	-	1	-	-	-	-	-	-	
	83.	-	-	-	-	-	-	-	-	-	-	
	84.	-	-	-	-	-	-	-	-	-	-	
	85.	-	-	-	-	-	-	-	-	-	-	
	86.	-	3	-	1	2	1	1	-	1	-	
	87.	2	1	-	3	2	2	2	-	4	5	
	88.	-	1	-	-	-	-	-	-	-	-	
	89.	1	-	2	2	-	2	-	-	1	2	
	92.	-	-	-	-	-	-	-	-	-	1	
			5	5	2	7	4	5	3	-	6	8
			6	8	2	11	6	6	4	-	8	11
<u>Ingredient Room</u>												
	19.	2	-	-	1	2	2	2	2	2	1	
	22.	2	1	2	2	-	1	1	2	-	1	
	69.	-	-	-	-	-	-	-	-	-	-	
		4	1	2	3	2	3	3	4	2	2	

Table 2 (cont.).

Position D	:Code: : No.:	Observation days									
		1	2	3	4	5	6	7	8	9	10
<u>Cover Food</u>	9.	-	-	-	-	-	-	-	-	-	-
	16.	-	1	1	-	-	-	-	1	-	-
	74.	-	-	-	-	1	-	-	-	-	-
	75.	1	1	-	-	-	-	1	-	-	-
		1	2	1	-	1	-	1	1	-	-
<u>Clerical</u>	1.	1	-	1	2	3	4	1	-	-	1
	106.	-	3	3	-	1	2	1	-	1	1
	110.	-	1	-	-	-	-	-	1	1	1
		1	4	4	2	4	6	2	1	2	3
<u>Necessary Consultation</u>	93.	1	8	12	4	2	1	1	8	6	2
	95.	4	1	-	4	5	3	5	6	6	4
	97.	-	-	-	-	-	-	-	-	-	-
		5	9	12	8	7	4	6	14	12	6
<u>Other</u>	18.	-	-	3	1	2	1	2	1	1	1
	20.	-	-	-	-	-	1	-	-	-	1
	45.	3	1	1	1	2	-	1	1	1	1
	49.	-	-	-	1	-	-	-	2	-	-
	104.	-	-	1	-	-	-	-	-	1	-
		3	1	5	3	4	2	3	4	3	3
UNPRODUCTIVE ACTIVITIES											
<u>Unavoidable Delay</u>	2.	7	10	10	8	7	9	13	12	11	9
	27.	-	2	-	-	-	-	-	-	-	2
	34.	-	-	-	-	-	-	-	-	-	-
	47.	2	-	-	-	-	1	-	2	-	3
	51.	-	-	-	-	-	-	-	-	-	-
	53.	-	1	-	1	1	-	-	-	-	-
	58.	-	-	-	-	-	-	1	-	1	-
	63.	-	-	-	-	-	-	-	-	-	-
	65.	-	-	-	-	-	-	-	-	-	-
	91.	-	1	-	-	-	-	-	-	-	-
	112.	-	-	-	-	-	-	-	-	-	1
		9	14	10	9	8	10	14	14	12	15
<u>Avoidable Delay</u>	94.	6	6	2	-	3	1	4	-	1	1
	98.	2	2	3	5	2	1	-	3	1	-
		8	8	5	5	5	2	4	3	2	1
<u>Meals</u>	99.	5	7	9	8	7	7	7	6	7	5
	100.	1	1	1	-	-	1	-	2	-	-
	101.	-	-	-	1	1	-	-	-	1	1
	102.	-	-	-	-	-	-	-	-	-	1
		6	8	10	9	8	8	7	8	8	7
<u>Personal Time</u>	103.	3	2	3	3	6	2	1	1	3	-

Table 2 (cont.).

Position E		:Code: Observation days									
		: No.:	1	2	3	4	5	6	7	8	9
FOOD PRODUCTION ACTIVITIES											
<u>Handle Food</u>											
Load equipment	25.	-	-	-	-	-	-	-	-	-	-
	32.	-	-	-	-	-	-	-	-	-	-
	39.	-	-	1	-	-	-	-	-	-	-
	46.	-	1	-	1	-	-	-	-	1	-
	50.	-	-	-	-	-	-	-	-	1	-
	52.	-	-	-	-	-	-	-	-	-	-
	56.	-	-	-	3	-	2	-	-	-	-
	60.	-	-	-	-	-	-	-	-	-	-
		-	1	1	4	-	2	-	-	2	-
Pick up or put down food											
	11.	10	14	9	6	7	15	22	17	13	18
Manual operations											
	30.	1	3	2	2	1	-	-	2	-	5
	37.	-	-	13	2	1	-	6	-	2	1
	42.	-	-	-	-	-	-	-	-	-	-
	68.	1	-	-	-	-	-	-	-	1	-
		2	3	15	4	2	-	6	2	3	6
Manipulate food											
	23.	-	-	3	-	-	-	-	-	-	-
	28.	-	-	-	-	1	-	-	-	-	-
	35.	-	-	-	-	1	1	-	1	-	-
	57.	-	-	-	2	-	3	-	1	3	-
	62.	-	-	-	-	-	1	-	-	-	-
	67.	4	-	-	-	2	-	1	10	2	-
	72.	-	1	-	2	-	-	-	2	3	-
	105.	1	-	-	-	-	-	-	-	-	-
	108.	-	-	-	-	-	-	-	-	-	-
	109.	-	-	-	-	-	7	-	-	-	3
		5	1	3	4	4	12	1	14	8	3
Arrange food											
	64.	-	-	-	-	-	-	-	-	-	-
	66.	-	-	-	-	-	-	-	-	-	-
	70.	11	18	4	14	6	13	5	7	6	19
		11	18	4	14	6	13	5	7	6	19
		28	37	32	32	19	42	34	40	32	46
<u>Operate Equipment</u>											
	26.	1	-	-	-	-	-	-	-	-	1
	33.	-	-	-	-	1	-	-	-	-	-
	40.	5	-	1	-	-	-	-	-	-	-
	43.	-	-	-	-	-	-	-	-	-	-
	48.	1	2	-	1	-	-	-	-	-	-
	54.	-	3	1	3	-	-	-	-	-	-
	55.	-	-	-	-	-	-	-	-	-	-
		7	5	2	4	1	-	-	-	-	1

Table 2 (concl.).

Position E	:Code:	Observation days									
	: No.:	1	2	3	4	5	6	7	8	9	10
	65.	-	-	1	-	-	-	-	-	-	-
	91.	-	-	-	-	-	-	1	1	1	1
	112.	-	-	-	-	-	-	-	-	-	1
		8	10	9	7	12	8	11	9	5	12
<u>Avoidable Delay</u>	94.	-	-	3	1	2	1	-	-	3	-
	98.	1	2	4	2	2	1	2	-	2	-
		1	2	7	3	4	2	2	-	5	-
<u>Meals</u>	99.	9	8	9	9	8	13	8	6	6	6
	100.	2	-	1	-	-	1	-	2	-	-
	101.	-	-	-	-	-	-	-	-	1	-
	102.	-	-	-	-	-	-	-	-	-	1
		11	8	10	9	8	14	8	8	7	7
<u>Personal Time</u>	103.	1	-	3	1	8	-	1	2	1	2

Table 3. Food Production Activities. Number of observations of each position in meat and vegetable cookery presented as daily percentage of observations and daily cumulative percentage of total observations.

Observation day	Position A		Position B		Position C		Position D		Position E	
	Cumulative		Cumulative		Cumulative		Cumulative		Cumulative	
	Daily	lative	Daily	lative	Daily	lative	Daily	lative	Daily	lative
	Percentage		Percentage		Percentage		Percentage		Percentage	
1	36.0	36.0	27.0	27.0	39.0	39.0	40.0	40.0	39.0	39.0
2	42.0	39.0	31.0	29.0	29.0	34.0	37.0	38.5	46.0	42.5
3	40.0	39.3	35.0	31.0	45.0	37.7	37.0	38.0	40.0	41.7
4	29.0	36.8	29.0	30.5	31.0	36.0	34.0	37.0	41.0	41.5
5	43.0	38.0	36.0	31.6	46.0	38.0	33.0	36.2	28.0	38.8
6	43.0	38.8	47.0	34.2	36.0	37.7	40.0	36.8	44.0	39.7
7	37.0	38.6	37.0	34.6	48.0	39.1	36.0	36.7	45.0	40.4
8	51.0	40.1	40.0	35.3	39.0	39.1	38.0	36.9	43.0	40.8
9	34.0	39.4	41.0	35.9	47.0	40.0	39.0	37.1	36.0	40.2
10	42.0	39.7	38.0	36.1	32.0	39.2	37.0	37.1	52.0	41.4

Table 4. Food Production Support Activities. Number of observations of each position in meat and vegetable cookery presented as daily percentage of observations and daily cumulative percentage of total observations.

Observation day	Position A		Position B		Position C		Position D		Position E	
	Daily lative	Cumu- :	Daily lative	Cumu- :	Daily lative	Cumu- :	Daily lative	Cumu- :	Daily lative	Cumu- :
	Percentage		Percentage		Percentage		Percentage		Percentage	
1	43.0	43.0	43.0	43.0	34.0	34.0	34.0	34.0	40.0	40.0
2	29.0	36.0	33.0	38.0	44.0	39.0	31.0	32.5	34.0	37.0
3	37.0	36.3	46.0	40.7	33.0	37.0	35.0	33.3	31.0	35.0
4	40.0	37.3	40.0	40.5	36.0	36.8	40.0	35.0	39.0	36.0
5	30.0	35.8	38.0	40.0	30.0	35.4	40.0	36.0	40.0	36.8
6	33.0	35.3	31.0	38.5	39.0	36.0	38.0	36.3	32.0	36.0
7	34.0	35.1	38.0	38.4	26.0	34.6	38.0	36.6	33.0	35.6
8	29.0	34.4	33.0	37.8	34.0	34.5	36.0	36.5	38.0	35.9
9	35.0	34.4	33.0	37.2	29.0	33.9	36.0	36.4	46.0	37.0
10	26.0	33.6	37.0	37.2	35.0	34.0	40.0	36.8	27.0	36.0

Table 5. Unproductive Activities. Number of observations of each position in meat and vegetable cookery presented as daily percentage of observations and daily cumulative percentage of total observations.

Observation day	Position A		Position B		Position C		Position D		Position E	
	Cumulative		Cumulative		Cumulative		Cumulative		Cumulative	
	Daily	lative	Daily	lative	Daily	lative	Daily	lative	Daily	lative
	Percentage									
1	21.0	21.0	30.0	30.0	27.0	27.0	26.0	26.0	21.0	21.0
2	29.0	25.0	36.0	33.0	27.0	27.0	32.0	29.0	20.0	20.5
3	23.0	24.3	19.0	28.3	22.0	25.3	28.0	28.7	29.0	23.3
4	31.0	26.0	31.0	29.0	33.0	27.3	26.0	28.0	20.0	22.5
5	27.0	26.2	26.0	28.4	24.0	26.6	27.0	27.8	32.0	24.4
6	24.0	25.8	22.0	27.3	25.0	26.3	22.0	26.8	24.0	24.3
7	29.0	26.3	25.0	27.0	26.0	26.3	26.0	26.7	22.0	24.0
8	20.0	25.5	27.0	27.0	27.0	26.4	26.0	26.6	19.0	23.4
9	31.0	26.1	26.0	26.9	24.0	26.1	25.0	26.4	18.0	22.8
10	32.0	26.7	25.0	26.7	33.0	26.8	23.0	26.1	21.0	22.6

Table 6. Observation days and meal census for a 10-day work sampling study at Men's Food Center, Kansas State University.

		Meal census			
Observation day and date :		Breakfast	Lunch	Dinner	Total
1	Monday, April 20	440	742	744	1,926
2	Tuesday, April 21	438	732	755	1,925
3	Thursday, April 23	453	735	668	1,856
4	Wednesday, April 29	416	731	667	1,814
5	Saturday, May 2	241	461	392	1,094
6	Monday, May 4	424	735	691	1,850
7	Tuesday, May 5	411	725	670	1,806
8	Wednesday, May 6	440	739	657	1,836
9	Thursday, May 7	385	711	643	1,739
10	Friday, May 8	436	728	491	1,655

Table 7. Daily assignments of employees in meat and vegetable cookery during a 10-day work sampling study at Men's Food Center, Kansas State University.

Observation day	5:30 A.M.-1:50 P.M.			10:30 A.M.-6:50 P.M.	
	Cook II position	Cook I position	Institu- tional Worker position	Cook II position	Cook I position
1	II	I	IW	II	R
2	II	I	S	I	R
3	I	R	IW	II	I
4	II	I	IW	II	I
5	I	R	IW	II	I
6	II	I	IW	II	R
7	II	I	S	I	R
8	II	I	S	II	I
9	I	R	IW	II	I
10	II	I	IW	II	I

Code: II - Employee with Cook II classification

I - Employee with Cook I classification

IW - Employee with Institutional Worker classification

R - Relief worker (Cook I classification)

S - Salad helper (Institutional Worker classification)

Table 11. Total observations of work in the meat and vegetable cookery unit done by extra persons or by regular employees working additional time.

Observation day	:	Number of activity observations
1		70
2		44
3		0
4		2
5		12
6		22
7		39
8		11
9		16
10		22
Total		238

Table 12. Menus for meals served at Men's Food Center, Kansas State University, during a 10-day work sampling study.

Day No. 1 Monday, April 20	Day No. 1 Tuesday, April 21
BREAKFAST	
Grape or blended juice	Orange juice
Assorted cold cereals	Assorted cold cereals
Hot cereal	Hot cereal
Fried egg	Scrambled eggs w/ bacon chips
Cinnamon toast	Toast, jelly
Toast, jelly	
LUNCH	
Creamed chipped beef on toast triangles	Lasagna
...	...
Chicken salad, pear half w/jelly, whole wheat gem	Wieners in bun
Beef bouillon	Seasoned hominy
...	...
Parslied cauliflower	Mixed vegetables
Creamy fresh vegetable salad in lettuce cup	Knight of orange salad
...	...
Pineapple w/prune on Boston lettuce	Celery stuffed w/peanut butter
...	...
Apricot whip w/apricot slice	Caramel pudding w/ crushed peanut brittle topping
...	...
Ice cream sandwich	Fresh fruit
...	
Fresh fruit	
DINNER	
Pork cutlet	Swedish meat balls
Scalloped potatoes	Whipped potatoes w/gravy
Italian green beans	Frozen peas
Apple waldorf	Lettuce cubes w/dressing
...	...
Celery cabbage w/Chilean dressing	Blue plum w/grapefruit sections
Hot rolls	Hot rolls
Strawberry-rhubarb upside down cake	Philadelphia chocolate cake w/ fluffy icing
...	...
Blue plums	Frozen strawberries

Table 12 (cont.).

Day No. 3 Thursday, April 23	Day No. 4 Wednesday, April 29
BREAKFAST	
Tomato juice Assorted cold cereals Hot cereal French toast Toast, jelly	Blended juice Assorted cold cereals Hot cereal Scrambled eggs w/bacon chips Cinnamon toast Toast, jelly
LUNCH	
Tuna and potato chip casserole ... Ham salad, cup of tomato soup, butter flake roll Whole kernel corn Tossed salad w/dressing Fruit cocktail on romaine Heavenly hash ... Vanilla ice cream cup ... Fresh fruit	Creole spaghetti Cold cut sandwich: bologna, salami, p. and p. loaf Orange squash Spinach w/vinegar Carrot coconut salad Blue plum w/grapefruit sections Custard ... Vanilla ice cream cup ... Fresh fruit
DINNER	
Scalloped chicken Asparagus spears Wax beans w/herb butter Orange and berry salad Cucumbers and watercress Hot rolls Frozen peach pie ... Chilled apricots	Veal cutlet Creamed potatoes Frozen green beans Tossed salad w/dressing Cottage cheese w/nut garnish Hot rolls Banana cake w/burnt sugar icing ... Frozen cherries

Table 12 (cont.).

Day No. 5 Saturday, May 2	Day No. 6 Monday, May 6
BREAKFAST	
Stewed prunes or assorted juices	Orange juice
Assorted cold cereals	Assorted cold cereals
Hot cereal	Eggs a la goldenrod
Manhole pancakes	topped w/chicken livers
Toast, jelly	Raisin toast
	Toast, jelly
LUNCH	
Corned beef sandwich	Pork tenderloin on bun
Triple plate: meat salad, golden glow salad, lime sherbet	Cold plate: tuna salad, grape gelatin, pear half
Creamed corn	Fruit punch
Buttered asparagus	French fried onions
Grape slaw	Asparagus tips w/egg slices
Pickled eggs on Boston lettuce	Blue plums w/orange sections
Old fashioned rice pudding w/ cream	Tapioca pudding w/fresh straw- berry
Fresh fruit	Black walnut ice cream cup
	Fresh fruit
DINNER	
Barbecued chicken	Porcupine meat balls
Parsley whipped potatoes	French fried potatoes
Vegetable timbale	Succotash
Tossed salad w/dressing	Peach half w/slau on lettuce
Banana in skin w/apricots	Lettuce wedge w/ tomato soup French dressing
Hot rolls	Hot rolls
Frosted brownie	White cake w/ fluffy maraschino icing
Peach slices	Applesauce

Table 12 (cont.).

Day No. 7 Tuesday, May 5	Day No. 8 Wednesday, May 6
BREAKFAST	
Tomato juice or whole banana Assorted cold cereals Fried egg Cake donut Toast, jelly	Orange juice Assorted cold cereals Scrambled eggs w/bacon chips Toast, jelly
LUNCH	
Wieners on bun ... K. State salad bowl Frozen peas ... Orange delight Carrifruit salad ... Tossed salad w/dressing Peanut butter cookie ... Ice cream sandwich ... Fresh fruit	Creole spaghetti ... Apple fritters w/sausage Toasted carrots ... Celery bouillon Tossed salad w/dressing ... Citrus pinwheel w/date center Apricot betty ... Popcicle ... Fresh fruit
DINNER	
Veal scallopini French fried bananas Italian green beans Cucumbers in sour cream ... Cinnamon apple rings on parsley w/roquefort dressing Poppy seed rolls Neopolitan ice cream ... Green gage plums	Smothered steak Baked potato Seasoned corn ... Seasoned cut okra Cottage cheese on Boston lettuce ... Red gelatin w/applesauce and grapes on red lettuce Hot rolls Peach melba ... Peach half

Table 12 (concl.).

Day No. 9 Thursday, May 7	Day No. 10 Friday, May 8
BREAKFAST	
Apricot nectar or stewed prunes Assorted cold cereals French toast Toast, jelly	Grape juice or whole orange Assorted cold cereals Hard or soft cooked egg Biscuit Toast, jelly
LUNCH	
Neopolitan noodles ... Cold plate: salami, ham, cheese, pear half, apricot half Broccoli ... Carrots and peas Pineapple slice w/cantaloupe ball ... Banana log w/coconut on water- cress Large sugar cookie w/gum drops ... Ice cream bar ... Fresh fruit	Beef biscuit roll w/gravy ... French fried whiting w/ barbecued chips Brussel sprouts ... Mixed vegetables ... Mixed fruit salad ... Pickled beets on spinach Gelatin cubes w/topping ... Banana in orange juice ... Fresh fruit
DINNER	
Southern fried chicken Potato salad Baked beans Assorted relishes Hard rolls Ice cream cup and Frosted brownie	Pizza (some cheese) Lime sherbet in souffle cup Tossed salad w/choice of dress- ings Strawberry pineapple gelatin Bread sticks Cheese cake w/peach glaze ... Apricots

A WORK SAMPLING STUDY OF FIVE POSITIONS IN A
RESIDENCE HALL KITCHEN

by

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B. S., University of Vermont, 1960

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Increased emphasis on employee efficiency in the food service industry has been stimulated by rising labor costs. Work sampling, a technique developed in industry, has been adapted and used in some food service facilities to measure time distributions of both direct and indirect labor. This method of time study, based on the law of large numbers and the normal curve of error, consists of many instantaneous random observations of activity. The number of observations controls data accuracy in approximating the actual proportion of time spent on those activities.

A 10-day work sampling study of five positions in the meat and vegetable cookery unit of a men's residence hall kitchen was conducted at Kansas State University. Objectives were to determine the division of employee labor time in these five positions and to investigate the effectiveness of work sampling as a technique for use in residence hall food service.

One hundred seven activities observed during a preliminary study were listed, defined, and coded. Random observation times were stratified to provide 12 observation periods each hour of the working day from 5:30 A.M. to 6:50 P.M. Activity of each employee was noted at the time she became visible to the investigator making a tour of the kitchen at designated observation times. Activity was recorded by code number under position held by individual employees on each specific day. One hundred daily observations were made of each position.

Activities were combined into three major categories: food production activities, food production support activities, and unproductive activities. Data were compiled by position in each

of these categories as percentage of daily observations and cumulative percentage of total observations.

One thousand observations of each position in the meat and vegetable cookery unit, obtained during 10 days of investigation, were inadequate to attain stability of data in the majority of activity categories. Final observation percentages indicated little difference among positions in the amount of time expended in the three major activity categories. Food production activities represented from 36.1 to 41.4 per cent of observations among the five positions. A range from 33.6 to 37.2 per cent of employees' time was observed in food production support activities. Unproductive activities varied from 22.6 per cent of total observations for one position to 26.8 per cent for another. Level of assumed responsibility represented by a position did not appear to influence proportion of time spent in the major activities.