

OCCURRENCE SAMPLING TECHNIQUE TO DEVELOP
A PATTERN FOR STAFFING A UNIVERSITY
RESIDENCE HALL FOODSERVICE

by

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CHAPTER I

INTRODUCTION

The purpose of this study was to ascertain the activity of cooks in a university residence hall foodservice. Definitive results of this study could lead to establishment of a staffing pattern. Of the several available study methods, the work sampling technique was selected for use. The most sophisticated work sampling methods as applied to foodservice were those developed at the University of Wisconsin for hospitals and published as a Methodology Manual for Work Sampling Productivity of Dietary Personnel (1). It was postulated that this technique would be equally applicable to a residence hall foodservice, it therefore was chosen for the study.

Work sampling was developed by industrial engineers and has been used widely enough to validate the method. Essentially it is a measurement of activity of workers by random observation throughout the work cycle.

The specific objective for the study, using this technique, was to analyze the time distribution between direct labor (actual food production), indirect labor (transportation, etc.), and delays in the production area of a university foodservice. A corollary to this objective was the provision of data usable in evaluating the productivity of this area and to indicate any need for a different staffing pattern.

The importance of studies by sampling cannot be overemphasized. Donaldson and Ostenso have emphasized (2) that effective utilization of available resources is necessary to maintain an optimum balance between expenditures for food and labor. The knowledge that human resources are the most expensive commodity in the foodservice industry justifies an emphasis on

staffing. The concept of foodservice as a system affected by changes in equipment, introduction of new food types, budgetary constraints, and energy conservation definitely indicate needs for frequent staffing analysis.

This work sampling study was made on personnel occupying cook's positions in the Production Area of the Derby Food Center at The Kansas State University. In the food center, approximately 5,000 meals are prepared and served daily. This study was conducted over a seven day period with specially trained observers taking data. The method of collecting, tabulating, and analyzing data followed the model of the Wisconsin Manual with modification to fit the work site and situation.

CHAPTER II

REVIEW OF LITERATURE

In the last several years there has been a considerable volume of literature concerning available techniques for the improvement of the utilization of human resources. This review of literature will be concerned with methods of determining staffing needs in foodservice with special emphasis on work sampling.

According to Kotschevar (3), finding adequate labor and controlling its cost have been and will continue to be the major problems of foodservice management. A recent survey by the federal government has indicated that, as health care facilities increase in size and number, the shortage of foodservice workers is increasing. Kotschevar suggested that reducing the turnover of supervisors, cooks, and other foodservice workers and increasing the productivity of labor are means of reducing this labor shortage. He said also that in foodservice labor produces about 47 per cent during working time in comparison with 80 to 85 per cent in other industries.

Pope stated (4) that the foodservice industry was being troubled by the idleness of its workers. He said that better utilization of labor was more important than increased automation in the foodservice industry. He also stated that proper design of a work area was important but its efficient utilization by the labor force is the responsibility of management. Regardless of how well an area is designed, the manager must still utilize the current employees. Pope cited one reason for idle employees as the failure of management to forecast production or to relate the forecast to labor schedules. Standards of productivity needed to be established because they

constituted a very important part of labor utilization together with control of waiting time. Analysis and investigation of workers' time spent on the job was essential for attainment of the goal of equality between the sum of task times and job hours.

Gleiser stated (5) that the United States Department of Labor reported steady gains of about 3 per cent a year in productivity, which was defined as the output of a worker for one hour. In the steel industry, productivity increased 11 per cent in 1955. He pointed out that the foodservice industry in the past lagged behind most others with respect to output per man-hour. Over the years, labor costs in foodservice operations have risen more rapidly than man-hour production.

In 1956 Stumpf and Donaldson wrote (6) the following: "In the foodservice industry, many attempts have been made to control labor costs in all phases of operation. With increasing labor costs and decreasing availability of qualified, effective employees, managers have had to be concerned with the need to decrease production cost to balance the budget."

Stumpf and Donaldson also stated that various methods had been used to estimate the numbers of workers required, the type of equipment to be installed, and the optimal floor space needed for all production activities whenever foodservice units were being established or remodeled. Little data were available to justify these estimates. Stumpf and Donaldson cited a definite trend in the foodservice industry for use of ready-to-cook food items in an effort to reduce the requirements for labor, expensive equipment, and floor space. There was a definite need to identify and analyze direct labor costs for all types of food produced and served in order to control costs effectively.

Labor costs were almost equal to raw food costs, according to Donaldson (6) in 1956, and it was becoming increasingly important to standardize and identify direct labor costs with the calculated food costs. If it was important for the foodservice manager to measure raw food ingredients and yields to insure a satisfactory product, then it was equally important to measure the units of labor.

Hart reported (7) that for every scheduled eight-hour workday in the foodservice industry about six and two-thirds were spent in actual production work. His recommendation was that the manager should study the work schedule to ascertain whether the wisest use was being made of the payroll dollar.

Work Sampling

The work sampling technique was described by Heiland and Richardson (8) as a measurement technique for the quantitative analysis, in terms of time, of the activity of men, machines, or any observable state or condition of operation. Work sampling was based on the probability theory that a sample taken at random from a large group tended to show the same pattern of distribution as the large group.

The following procedures for work sampling have been recommended by several authors, notably, Barnes (9), Richardson (8), and Krick (10):

1. Define the problem and state the main objective of the study.
2. Obtain approval for the study and solicit cooperation of the people to be studied.
3. In detail, define each element or activity to be measured.
4. Design the study:
 - a. Determine the number of observations to be made, based on desired accuracy. A preliminary study may be required.

- b. Determine the number of days and/or shifts needed for the study.
 - c. Develop randomized times of observations.
 - d. Decide upon and train the number of observers to be used.
 - 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.

Krick stated (10) that there were three types of error that can occur in a work sampling study: sampling error, bias, and non-representativeness. Sampling error occurs when a generalization was made about some characteristic of a population on the basis of a sample. Bias error exists when the proportionality of time observed in a certain state of activity was different from the actual proportion of time applied to that activity in the total population. Non-representativeness occurs when the situation being studied is not characteristic to circumstances prevailing in the long run.

Work Sampling in Foodservice

Blaker stated (11) that work sampling permitted determination of time spent by dietetic department employees in productive and in non-productive labor. The results of these studies enabled isolation of the causes of non-productive work whether due to forced delay or idle time. The results can be used as the basis for pinpointing problem areas.

Donaldson suggested (12) that the findings in a work sampling study could be used to determine: (a) cost of labor expended in various work function activities in the department, (b) performance standards, (c) nature

of the work of the professional staff, and (d) diversification of personnel. The data obtained also could be used for classification of jobs, staffing the department, and determining how well objectives were being met and how effectively resources were being utilized.

One of the earliest reported applications of work sampling studies in the foodservice industry was that by Wilson (13) in 1956, in the residence hall foodservice operation at Purdue University. This study was undertaken to determine why the payroll of students in one unit differed from that of other units. With the application of the work sampling technique, a direct relationship was shown between the student payroll and the assignment of duties. As a result, she recommended a reevaluation of the jobs. Wilson also indicated that the redistribution of the work load could result in more efficient use of full-time labor, thus reducing the number of work hours required by the students. Another significant factor indicated in the study was the variation in the time spent by the student employees in eating. This was due partly to the attitude of the students and to the amount of supervision. In addition, the results of the study were affected by dissimilar kitchen layout and equipment in the various residence halls.

Mastin and Ferrell analyzed (14) staff requirements for a hospital cafeteria using work sampling. The fixed time interval approach was used with different routes being taken through the cafeteria and with different starting times. Observations were recorded every six minutes between 5:00 am and 11:00 pm for two weeks. The data provided information concerning the total time in minutes by specific activity and hour of day of each employee. The data also revealed areas that required increased supervision, activities needing further analysis, and necessity for rescheduling employees.

Stanford and Cutlar utilized (15) the work sampling technique in a study to measure the time distribution of activities of college foodservice managers. Over 1,000 random observations were made of the three managers and recorded during a forty-five day working period. Results of this study provided evidence that work sampling could be applied effectively to analyze the work of college foodservice managers.

For the purpose of obtaining data for a more effective classification system, Wise and Donaldson used (16) work sampling to study seven full-time hospital dietetic department employees over a period of three months. Each employee had a different classification which was based on job descriptions. It was found that employees with higher classifications performed more supervisory and clerical work than others with lower rank. As classifications decreased, cleaning activities increased. Percentage of personal time was greatest for the highest employee classification and least for the lowest.

Schell stated (17) that it is increasingly important to know how man-hours are being expended if human resources are to be utilized most effectively. A standard against which actual performance could be compared was considered essential in this study. Work sampling was chosen as the observation method. Collected data were used as a basis for standards of the minutes required in each function performed by dietetic employees. The purpose was to develop standards for dietitians and managers to use in analyzing their own operations and comparing them with others. Schell has said that a more realistic comparison could be made on the basis of manhours used than on numbers of workers employed. She stressed that if it was known in which category of work manhour requirements differed, then justifying these differences, forecasting future needs, and defining areas for improvement becomes possible.

Schell and Korstad studied (18) two Veterans Administration Hospitals of approximately similar workload for three weeks. The work activities of all the employees of the dietetic department were analyzed using work sampling. The two conclusions from the studies were: (a) measurement of the work of foodservice personnel in hospitals was feasible and second, (b) the collected data could provide the hospital dietitian with information for efficient scheduling, controlling, and forecasting manpower and also work-load requirements.

Hansen used (19) the work sampling technique to study labor utilization of a dietetic department in a 300-bed hospital for the purpose of reducing total staff and reorganizing duties. Results after seven days of observation showed that more than 30 per cent of the total activities in the department were in the non-productive activities. Twenty per cent of the total time had been assessed for personal and delay time. The researchers concluded from this study that a staff reduction of 10 per cent could be made without changing any procedure or altering the current level of productivity. The data provided a basis from which to analyze staffing patterns and work methods, make changes, verify changes with additional work sampling, institute position requirements and develop new staffing schedules. As a result of the study, the total number of staff in the dietetic department was reduced from sixty full-time staff to thirty-three full-time and twenty-two part-time with an overall savings of \$40,000 per year.

Marteney and Ohlson reported (20) a study analyzing and measuring the activities of professional dietitians. Results of this study showed that half the time of professional staff members was involved with patient factors and supervision. The data indicated that the non-professional staff members were doing routine tasks and meeting responsibilities delegated to them.

Brown (21) in a study of a cookery unit in a university men's residence hall found that approximately 74.2 per cent of the cooks' time was spent in productive work, 13.7 per cent in non-productive work, and 12.1 per cent in personal time. It was also found that the level of presumed responsibility represented by position did not appear to influence the proportion of time spent in major activities.

Ostenso and Donaldson conducted (2) a research study in a hospital dietetic department to: (a) categorize the functional areas of management and operation, (b) develop measures of effectiveness and productivity indexes as guidelines for establishing productivity standards, and (c) test the hypothesis that productivity relationships of dietetic departments with homogeneous characteristics were similar. This study was done on labor time in the dietetic departments of ten Wisconsin hospitals with similar characteristics. They found that these departments had similar productivity relationships and standards of productivity in one could be interchanged with minimum modification. This study contributed to the development of the work sampling methodology manual published by the University of Wisconsin (1).

Kent and Ostenso in a work sampling study of ten Wisconsin hospitals of similar characteristics ascertained (23) that minutes per meal in total direct labor, indirect labor, and delay time were similar among the hospitals with functional relationships between work categories. These data supported the research hypothesis that productivity relationships of dietetic departments in hospitals with specific homogeneous characteristics were similar.

Bonini utilized (24) work sampling and electronic data processing in a study which was designed to assist a foodservice director of a hospital dietetic department in evaluation of labor cost. The demonstrated advantages of work sampling were: the relative simplicity of the study design, ease of

gathering data, and adaptability of the data to electronic processing.

As summary, the literature has revealed that work sampling could be used in foodservice to:

1. provide basic data for determination of a productivity index
2. evaluate manpower effectiveness
3. provide measures for setting performance standards
4. provide quantitative information for change to a new foodservice system
5. determine work habits and experience of personnel
6. determine kind and amount of supervision needed
7. analyze physical layout
8. provide a guide to selection and training of management personnel.

Other Methods for Determining Staffing Patterns

Using the staffing standards established by the American Association of Mental Deficiency in 1964, Kotschevar, Saylor, and Owens (25) surveyed 118 state mental hospitals in twenty-nine states to obtain data that could be used in comparing the operational efficiency of dietetic departments. The survey generated data on labor, food, and supply costs.

The number of employees required in a dietetic department according to the American Association of Mental Deficiency was based on the formula: The average daily census multiplied by 365 multiplied by 2.5 divided by 10,000. This formula allowed $91\frac{1}{4}$ employees, or about sixty-two positions for every 1,000 residents, or about forty-eight positions to be covered seven days a week plus about fourteen to be covered five days per week.

In the survey, 11.6 meals per manhour were used as the mean productivity rate. The study also indicated from the mean productivity rate that one

foodservice employee was needed for every twenty-five patients. It was stressed (25) by the researchers that such standards could be misleading and misinforming because there were too many variations between units and states to apply a strict standard.

Welch reported (26) that the development of a productivity index could be used as a tool in determining the amount of staff needed for university dining halls. He stated that this index could only be meaningful when both the input and output could be unambiguously identified and the data upon which the ratio was based were reliable, consistent, and relevant to the purposes for which the index was constructed.

In this study Welch gave a procedure for the development of a gross dining hall productivity index which reflected the ratio of meals served per man-hour. From this procedure the number of meals served and labor hours required were determined.

Henderson reported (27) that minutes per meal was the basic standard used in the staffing of long-term care facilities of the Health Care Division of Hillhaven, Inc. It was determined that a staffing level of eight to ten minutes was sufficient for a safe and efficient operation and for the desired level of quality food preparation and service for the dietetic department. The larger the facility, the lower the figure should be. The formula used to derive the staffing pattern (labor minutes per meal) in the dietetic department of these facilities was:

$$\text{Labor min/meal} = \frac{(\text{kitchen hrs/day}) (60)}{\text{patient meals/day}}$$

CHAPTER III

METHODOLOGY

In this study, a methodology for work sampling was used that had been developed by Donaldson et al (1) at the University of Wisconsin in 1967. Although the methodology was designed specifically for a study of foodservice in hospitals, others have applied it to school foodservice.

This specific methodology has not been reported in any labor studies of college or university foodservice. This study of staffing in university foodservice utilized the Wisconsin method. To adapt this method to a specific area within a university residence hall foodservice required some modifications. The modified procedure used in this study follows.

Procedure

Objective

The first required step in the Wisconsin procedure was accomplished by the decision to restrict the study to the production area of a university residence hall foodservice. The level of activity for direct labor of cooks was measured.

Work Function Categories

The three work function categories remained the same as in the Wisconsin model (Appendix A), namely Direct Work, Indirect Work, and Delay. However, the components of the categories were modified for the purpose of this study by the deletion and addition of certain functions. The total number of functions for this study was thirteen as opposed to twenty in the Wisconsin model.

DIRECT WORK FUNCTIONS

Direct work is any essential activity contributing directly to the production of the end product:

1. Prepreparation or preliminary processing.

(Preliminary act or process of making ready for preparation, distribution, or service.)

blanching	measuring	thawing
breeding	mixing	washing
chopping	opening containers	weighing
coring	paring	looking in cupboards,
cracking eggs	peeling	drawer, refrigerator,
cutting	shaping	freezer
dicing	shelling	making salad dressing,
eyeing	shredding	sauce, or gravy
grinding	sorting	turning on oven, range,
		steam kettle, fryer,
		steamer, griddle, mixer,
		chopper, deep fat fryer
		placing food into con-
		tainer for cooking
		taking food out of cooler,
		refrigerator, or freezer

2. Preparation or cooking.

(Final act or process of making ready for distribution or service.)

braising	slicing
broiling	toasting
frying	tossing salad
grilling	putting ingredients in steam kettle
roasting	putting product into cooking equipment
seasoning	checking for doneness
stirring	manipulating pans in oven
panning food	removing product from cooking equipment
	preparing leftovers for storage
	putting food into cooler, refrigerator, or freezer

3. Service.

(Act of preparing facilities for distribution and of portioning and assembling prepared food for distribution.)

portioning the finished product
loading carts with food
putting food into holding units

4. Transportation of food.

(Act of moving food from a location in one functional area to a designated location in another area within the department.)

moving food out of storage
delivery of food within the department

INDIRECT WORK FUNCTIONS

Indirect work is any catalytic activity which contributes to production of the end product. These are operations which precede, follow, or complement food production activities:

5. Transportation of equipment, supplies, and other.

(Act of moving equipment, supplies, and other items from a location in one functional area to a designated location in another area within the department.)

moving soiled equipment to washing area
return of clean equipment to preparation or service area
moving paper goods and other supplies
moving garbage or trash

6. Transportation empty.

(Act of moving without carrying or guiding anything from a location in one functional area to a designated location in another area within the department.)

walking
unladen locomotion

7. Pot and pan washing.

(Act of scraping, washing, or rinsing quantity food containers and cooking utensils.)

running water into sink
washing pots and pans
putting away clean pots and pans
draining water from sink

8. Housekeeping.

(Act of removing soil or dirt to provide sanitary conditions for use of installed and mobile equipment and facilities.)

mopping and washing floors	using garbage disposal
preparing mop	oiling equipment
cleaning walls	adjusting equipment
cleaning carts and food trucks	sharpening equipment and tools
cleaning installed equipment	swatting flies
cleaning work counters	locking or unlocking doors and
turning lights on or off	refrigerators, freezers
sweeping floors	wringing water from cleaning cloths
	washing or rinsing cleaning cloths

9. Instruction or teaching.

(Act of directing or receiving direction by oral or written communication in a training or classroom situation or job.)

on the job training	teaching staff or professional group
giving instructions	in classroom
receiving instructions	reading journals
teaching personnel in	reading directives from administra-
classroom	tion
	reading menu
	reading schedule
	reading production sheet
	trying out new equipment
	writing

10. Appraisal.

(Act of judging or estimating the value or amount of work in order to make decisions for future planning.)

checking dishes for cleanliness
 inspection of area--sanitation and safety
 inspection of food preparation
 inspection of leftovers
 tasting food

DELAYS

Delays included all time when an employee is scheduled to be working and is not engaged in either direct or an indirect work function:

11. Forced delay.

(The time an employee is not working due to an interruption beyond his/her control in the performance of a direct or an indirect work function.)

broken machine
power failure
faulty equipment

assembly belt stops
slow cafeteria line

12. Personal delays.

(The time an employee is not working due to time permitted from his/her work area.)

coffee breaks
rest room
adjusting hairnet
putting on apron

drinking fountain
health and related activities such
as washing hands

13. Idle time.

(Any avoidable delay, other than forced or personal delay, that occurs for which the employee is responsible.)

conversation not pertaining to business
reading newspaper
loafing

Select and Train Observers

The stipulations of the Wisconsin model were followed by selecting reliable observers who were familiar with the employees, the area, and the work performed. The observers were oriented in the work sampling technique and the observation and recording method.

Orient Employees

The model was followed. Employees were acquainted with the purpose of the study, cooperation was solicited, and assurance was given that the study was unrelated to job security.

One Day Test Observation

In compliance with the model, observations were made for one day to determine the approximate percentage of total working time expended in the direct work category.

Preliminary Study

The forms from the Wisconsin Manual which were applicable and used in the study were (Appendix B):

Number	Name
4	Observation Times Arranged in Sequential Order--A.M.
5	Observation Times Arranged in Sequential Order--P.M.
6	Daily Observation Schedule
7	(Revised for the study) Summary of Daily Work Functions Activity--Preliminary Study
8	Daily Number of Observations Required
9	(Revised for the study) Summary of Daily Work Function Activities
12	(Revised for the study) Total Observation Record

The steps for the preliminary study were:

1. Determine the time of observation. The observations were randomized by selection from a random time table. The random times were arranged chronologically on Form 6, the Daily Observation Schedule (Appendix C).
2. Observe work activities. Observations were made at appropriate times and recorded on Revised Form 6 (Appendix C). The work

function of each employee constituted a reading, i.e., the number readings obtained during one observation equaled the number of employees observed in the area at the specified time.

3. Determine percentage of total activities devoted to the direct work function. Observations recorded on Form 6 were summarized on Revised Form 7 (Appendix C). The summarization consisted in a count of the number of readings in each work function. Form 7 of the Wisconsin Manual was modified for this study because only thirteen functions were needed of the twenty on the original form. The distribution of function with the three major categories follows:

<u>Function Numbers</u>	<u>Categories</u>
1-4	Direct Work
5-10	Indirect Work
10-13	Delays

Form 7 as revised is shown in Appendix B.

From these data, the percentage of time devoted to direct work was computed. Also the observations per sample were determined. The observations per sample are the number of readings per observation.

The Work Sampling Study

The preliminary study provided initial information for the actual sampling study. The unmodified procedure for the sampling study follows:

1. Determine the total number of readings "N" required. A confidence coefficient and a confidence interval were selected. The percentage of total time devoted to direct work taken from Revised Form 7 and expressed as a decimal was used on Figure 2 (Appendix A) with the

selected confidence items to determine the number of readings required. (The other Figures in the Manual were not appropriate for this study.) The decimal representing the time devoted to direct work and the required number of readings were recorded on Revised Form 8 (Appendix C) which was the major form for the study.

2. Determine the number of observations for the first day only. The number of total observations required as an entry on line 6 of Revised Form 8 for the first day was found by dividing the observations per sample from Revised Form 7 into the number of readings required as taken from Figure 2.

Data Collection

The Wisconsin Manual was followed for the data collection and calculations. Revised Form 8 became the essential document for the recording and summarization of readings and computation for the bases for the succeeding days' observations.

Control Chart

The percentages of total activities used by the various direct work functions was plotted on a control chart for each day of the study.

Total Observation Record

The mean percentages of the total activities devoted to the work functions and the minutes of labor expended per meal were recorded on Form 12 as revised.

The Study Site

The study was conducted in the Derby Food Center which is the largest residence hall foodservice unit at Kansas State University. An average of 4,500 meals per day were being served at the time of the study.

In conference with the unit director of Derby Food Center, the Production Area was chosen as the site for the study because there were a definite number of workers, no student employees, and the man-hours were scheduled according to a pre-set pattern. This selection permitted activity analysis of the employees involved in the production subsystem of the foodservice system.

There were thirteen cook positions assigned to the area chosen for study. One position was held by a foodservice worker who performed duties of a cook. The twelve remaining positions consisted of Cook II's and Cook I's. However, one position was vacant because of a leave of absence. Thus twelve positions were the total number observed.

Five cooks were on the early shift and six on the late shift. The foodservice worker also was scheduled on the late shift. The early shift was from 5:30 am to 2:10 pm and the late shift was from 10:40 am to 7:20 pm. Between 11:00 am and 2:00 pm there was an overlapping of shifts. The positions observed were, in decreasing order, Cook II, Cook I, and Foodservice Worker II in accordance with civil service classification titles. The higher the level of classification the more responsibility involved.

The cooks on the early shift in the Production Area were responsible for the preparation of breakfast and lunch. The workers on the late shift were responsible for the dinner meal. Prepreparation for future meals, storage of leftovers, and cleaning of equipment and area were also responsibilities of workers on both shifts. All employees in this area were scheduled to work

eighty hours during a two-week cycle with fifty minutes allowed daily for rest periods and changing clothing.

Meal service at Derby was cafeteria style. Three meals were served daily except for Sunday on which only two were served. The schedule of meals was as follows:

Meal	Meal Times		
	Monday-Friday	Saturday	Sunday
Breakfast	6:30 am to 8:30 am	7:45 am to 8:30 am	7:45 am to 8:30 am
Lunch	10:45 am to 1:00 pm	11:00 am to 1:00 pm	11:45 am to 1:00 pm
Dinner	4:50 pm to 6:10 pm	4:50 pm to 6:10 pm	

Selection and Training Observers

Observers were selected and trained for the work sampling procedure. In order to cover the entire day from 5:30 am to 7:20 pm, four observers were needed. All observers were trained by the researcher. These observers consisted of a Production Dietitian, senior dietetic student, graduate research assistant who was familiar with the technique and the research. Each observer did practice observations with the researcher to ensure that there was one hundred per cent agreement in the observing and recording procedures.

Employee Orientation

An orientation session was conducted with all employees, supervisors in the area, and the two Production Dietitians who would be involved in the study. This session was intended to assure the employees that this was an academic study unrelated to job security. The purpose of the study was

explained and cooperation was solicited. All employees attended the session except one who was briefed later.

The researcher also explained the work function categories which would be used and the work sampling technique. It was stressed to the participants that they were to perform assigned tasks at a normal pace. It was explained that the data would not be representative of the actual situation if they worked more rapidly than normal. The employees were also told the period of time during which the study would be made. A question and answer period followed the orientation.

One Day Investigation

Before beginning the preliminary study, a one day investigative observation was made to estimate the percentage of time devoted to the direct work function which was the primary concern of the study. During this time period, the revised work function categories were checked for applicability to the situation. It was determined that these functions required approximately 65 per cent of the total working time.

Preliminary Study

For the preliminary data collection, the observers first familiarized themselves with the production area and the work function categories. Observations were made at the selected times as determined from random time tables and recorded on Form 6 (Appendix C). The activity of each employee in the area was recorded.

To calculate the percentage of total activities devoted to the category of primary interest (direct work), the data were summarized on Revised Form 7 (Appendix C). The number of times each activity was recorded was tallied and

totaled for each function. The total number of readings was obtained. The percentage of total activity time devoted to direct work was calculated.

The number of readings was determined through the use of a chart developed for a confidence level of .90 which is a graphic representation of a standard formula. The standard formula used is shown in Appendix A. Figure 2 (Appendix A) shows the number of readings required for this study with a confidence coefficient of .90 and various confidence intervals. For a confidence level of .90 and an accuracy $\pm .05$, the 66 per cent of direct work required 950 readings.

The next step was to determine the number of observations required to yield the number of readings. On Revised Form 8 (Appendix C) the percentage of total time in the category of primary interest was recorded. The required number of readings for the total study as determined from the graph was recorded. The grand total of accumulated readings was subtracted from the required number of readings and divided by the new observation area to obtain the number of total observations. For this study 211 was the indicated number of observations required.

In order to determine the length of the study, the total number of observations and the typical production cycle of the operation was considered. The Derby Food Center operates seven days per week, therefore at least seven consecutive days were needed for a representative sample. To determine how many observations had to be taken each day, the required total number (211) was divided by the predicted length of the study (seven days). On Revised Form 8 (Appendix C) the number of observations required for the first day only was obtained by dividing the number of days remaining in the study into the number of total observations required. For the first day, the number of observations required was thirty.

Data Collection

Data collection for the work sampling study began on March 4, 1977, for seven consecutive days. Because of the layout of the kitchen, placement of equipment, and carts and supplies being in the aisles during production in the Production Area at Derby Food Center, there were no definite routes followed for the observations.

The data were collected in the same manner as in the preliminary study. The number of observations required for the first day, using the preliminary study day as basis for the number of observations required, was calculated on Revised Form 8 (Appendix C). The observation times were determined from a table of random times. These random times were listed and arranged in chronological order using Forms 4, 5, and 6 (Appendix B).

At the end of each day the daily work function activities were summarized using Forms 6 and 7 (Appendix B). Steps in the summarization followed the Wisconsin Manual and were:

1. The number of times each work function was recorded was tallied on Revised Form 9 (Appendix B).
2. Each work function category was totaled.
3. The grand total of readings of all the activities were calculated.
4. The previous day's totals for each work function category was entered.
5. The present and previous day's totals were added to find the accumulated totals to date.
6. The accumulated total of the category of primary interest was divided by the grand total of all accumulated activities to determine the percentage distribution of this category. This percentage was entered as a decimal in the last column.

7. The decimal value was transferred to Revised Form 8, Line 1 (Appendix B) for the next day's study.

The value of "N" ("N" is defined as readings or number of recordings of activities in each work area) was recalculated for the following day. The number of remaining readings to be taken during the study were calculated on Revised Form 8 (Appendix B), to assure the desired degree of accuracy. The observed data were recorded in the following steps:

1. Using the most recent percentages for the category of primary interest, the value of "N" was determined from Figure 2 (Appendix A) and entered on Line 2.
2. The grand total of accumulated number of readings to date are entered on Line 3. A zero had been printed on this line for the first day because previous data were not available.
3. On Line 4, the accumulated number of readings was subtracted from the new "N" to determine the number of readings required for the remainder of the study.
4. On Line 6, the number of observations per day required for the remainder of the study was calculated.
5. On Line 8, the number of total observations remaining in the study was calculated.

This numerical analysis was done each day to define the data base for the succeeding day. Table 1 is Revised Form 8 as completed during this study.

Data Evaluation

To fulfill the objectives of this study, the mean percentages of total activities devoted to the work function categories and the labor minutes expended per meal served were determined. The mean percentages of total

TABLE 1: Daily number of observations required

Revised Form 8

INSTRUCTIONS	DAYS							
	PRELIM.	FRI.	SAT.	SUN.	MON.	TUES.	WED.	THURS.
1. Per cent of Total Time in Category of Primary Interest (Preliminary Study from Form 7; Days 1-7 from Form 9)	.66	.65	.65	.62	.62	.63	.63	.62
2. Required Number of Readings "N" (From Figure 2)	950	955	955	1000	1000	1005	1005	1000
3. Grand Total of Accumulated Number of Readings (From Form 9)	0	156	267	438	661	793	901	1040
4. Number of Readings Required to Date (Line 2 Minus Line 3)	950	799	688	562	339	213	104	--
5. Observations Per Sample Size (Preliminary Day from Form 7; Days 1-7 from Form 9)	4.5	5.2	4.8	5.2	5.9	6.0	6.0	6.2
6. Number of Total Observations Required (Line 4 Divided by Line 5)	211	154	143	108	58	35	17	--
7. Number of Days Remaining in the Study --	7	6	5	4	3	2	1	0
8. Observations Required Per Day (Line 6 Divided by Line 7)	30	26	29	27	19	18	17	--

activities devoted to each of the work functions were determined by dividing the accumulated total number of readings in each work function by the grand total and were recorded on Revised Form 12 (Appendix C) columns 2 and 3.

The labor minutes expended per meal served were calculated by multiplying the percentage of each work function by the total man hours utilized during the study and entered on Revised Form 12 (Appendix C) in column 4 under "Calculated Hours per Period." The calculated number of hours per period for each work function was divided by the number of total meals served during the study period to determine the percentage of hours utilized per meal and entered in Column 5 on Revised Form 12 (Appendix C). The per cent of hours utilized per meal was multiplied by sixty to calculate the minutes of labor expended per meal served and entered in Column 6.

CHAPTER IV

RESULTS AND DISCUSSION

Productivity expressed as mean minutes of work per meal in each function category provides an evaluation measure of the effectiveness of manpower utilization. The percentage distribution of total labor permits identification of the work functions utilizing the greatest time, thus indicating activities in which analysis of work methods and operational procedures might result in greater efficiency (1). Work sampling was used in this seven-day study in the production area of a university residence hall foodservice to ascertain if the method was applicable and could provide a basis for possible restaffing.

A total of fourteen employees were on duty at various times in the production area during the seven-day study. Some workers were scheduled extra hours to compensate for the time they would lose in the following week of spring break. This gave a total of 550 labor hours worked compared to 480 in the normal schedule.

Findings From the Study

The preliminary study served as a separate day from the study. In the observations on that day, it was found that 66 per cent of the total working time was devoted to direct labor, 26 per cent to indirect labor, and 8 per cent to delay time. A summary of these data can be found on Revised Form 7 (Appendix C).

For each observation, the activities of all persons in the production area were noted. The activity of each person was called a reading. There

were differences in the number of observations made each day because they were dependent upon the variable daily observations per sample. Observations per sample has been defined as an approximation of the average number of employees that may be located and observed in a functional work area. It must be emphasized that observations per sample does not necessarily relate to physical dimensions.

In the preliminary study, the observations per sample was calculated to be 4.5 by dividing the number of readings by the number of observations. However, during the remainder of the study, the observations per sample varied from 4.5 to 6.2.

The number of readings required for this study was obtained from the chart in Appendix A (Figure 2). It was found that 950 was the number required to maintain a confidence level of 0.90 with an accuracy of ± 0.05 when 66 per cent of work time is in the category of primary interest. The daily calculation of the number of readings required produced numbers higher than the 950. A total of 1,040 readings were actually made during the study.

Percentage Distribution of Work Function Categories

The distribution of work functions in the three categories is reported as the percentage of total readings devoted to each category. The final cumulative percentage for all work function categories is recorded in Table 2. The cumulative percentage devoted to direct work was 62 per cent; indirect work 32 per cent; and delay time, 6 per cent.

Of the total time, 25.5 per cent was spent in prepreparation or preliminary processing. This represented the time spent in preparing products from basic recipes. It also reflects time spent in ingredient room activities. The actual preparation of the food items accounted for 31.1 per cent of the

TABLE 2: Distribution of readings in work function categories for a production area in a residence hall foodservice

<u>work function categories</u>	<u>readings</u>	
	<u>N</u>	<u>%</u>
<u>direct work functions</u>		
1. prepreparation	265	25.5
2. preparation	324	31.1
3. service	7	.7
4. transportation-food	<u>49</u>	<u>4.7</u>
<u>total</u>	645	62.0
<u>indirect work functions</u>		
5. transportation-equipment	85	8.2
6. transportation-empty	78	7.5
7. pot and pan washing	6	.6
8. housekeeping	105	10.0
9. instruction or teaching	45	4.3
10. appraisal	<u>11</u>	<u>1.1</u>
<u>total</u>	330	31.7
<u>delays</u>		
11. forced delays	13	1.3
12. personal	18	1.7
13. idle time	<u>34</u>	<u>3.3</u>
<u>total</u>	65	6.3
<u>grand total</u>	1,040	100.0

total time. Only 0.7 per cent of cumulative total time was spent in service and 4.7 per cent was spent in transportation of food. Most of the food was transported in large quantity, thus reducing the number of trips required.

Total labor time devoted to the indirect category was 31.7 per cent. This included the functions of transportation of supplies, equipment, and empty; clerical; cleaning; receiving; instruction or teaching; appraisal; and conferences. Of these functions, the highest per cent of time, 10 per cent was spent in housekeeping which is a part of the cleaning function. Cleaning the equipment and area after use was one of the responsibilities of a cook. Of the total time, 7.5 per cent was devoted to transportation empty. This was attributed to the size of the production area of the foodservice and the distance the workers had to travel from one area to another. The low percentages of time devoted to the other areas of indirect work was attributed to the fact that these functions were primarily performed by workers in other functional areas.

Delay time indicated that an employee was scheduled on duty but for some reason was not engaged in either direct or indirect work. The total delay time was 6.3 per cent with 1.7 per cent in personal delay time, 3.3 per cent in idle time, and 1.3 per cent in forced delays. The low percentage of time in forced delays demonstrated the good communication and coordination between the production area and the other functional areas. The 3.3 per cent spent in idle time during the period of the study could be attributed to the extra scheduled workers in the area in compensation for the reduced staffing during the spring break beginning the following week. The distribution of time spent in direct work, indirect work, and delay time is shown in Figure 1.

Figure 2 graphically depicts the relationship between direct work, indirect work, and delay time during the seven-day study. During the first

FIGURE 1: Distribution of total work activities among direct work, indirect work, and delays for a seven day period in a production area of a residence hall foodservice

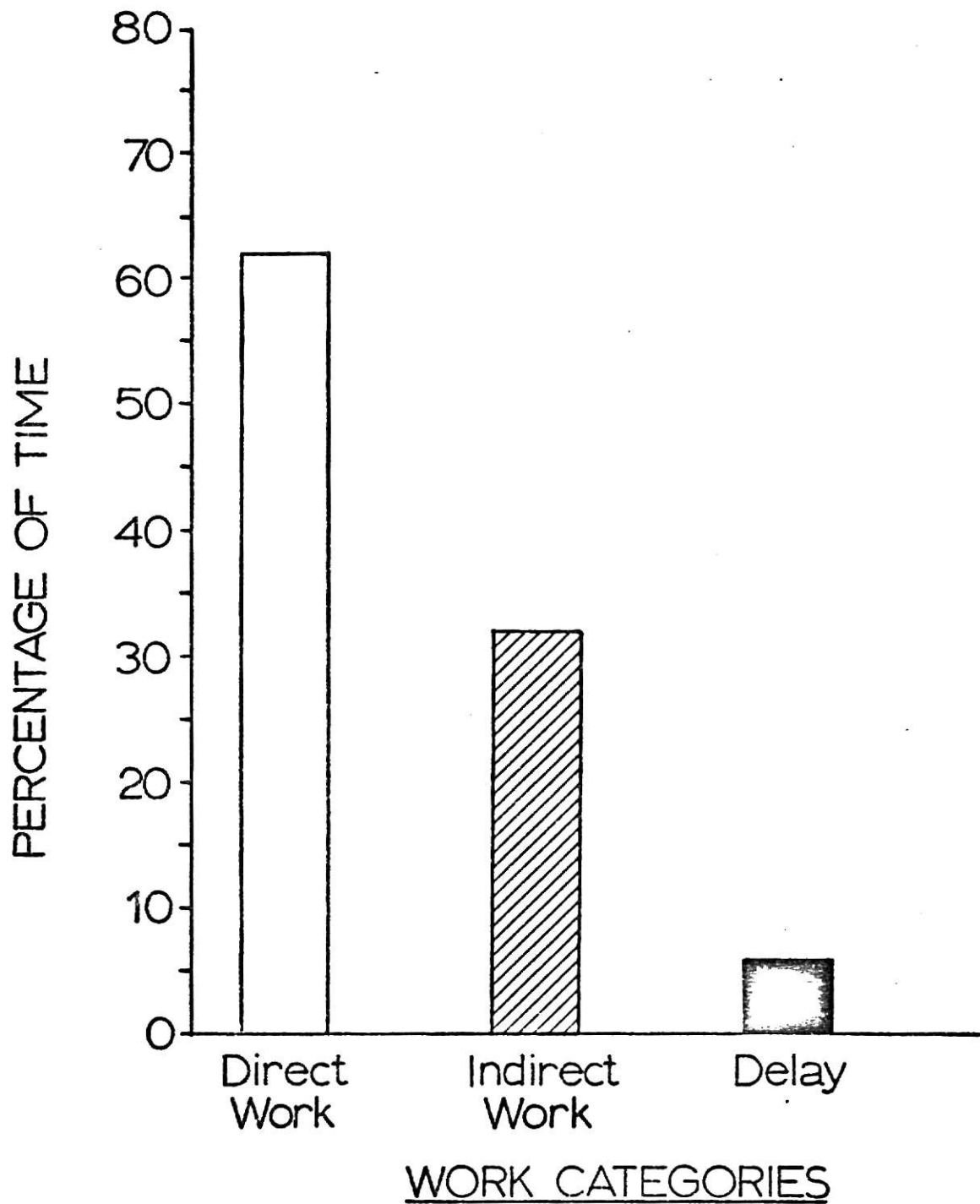


Figure 1: Percentage of time spent in direct work, indirect work, and delay time for a seven day study in a university residence hall foodservice.

FIGURE 2: Percentage of time spent in direct work, indirect work, and delay time for a seven day study in a university residence hall foodservice

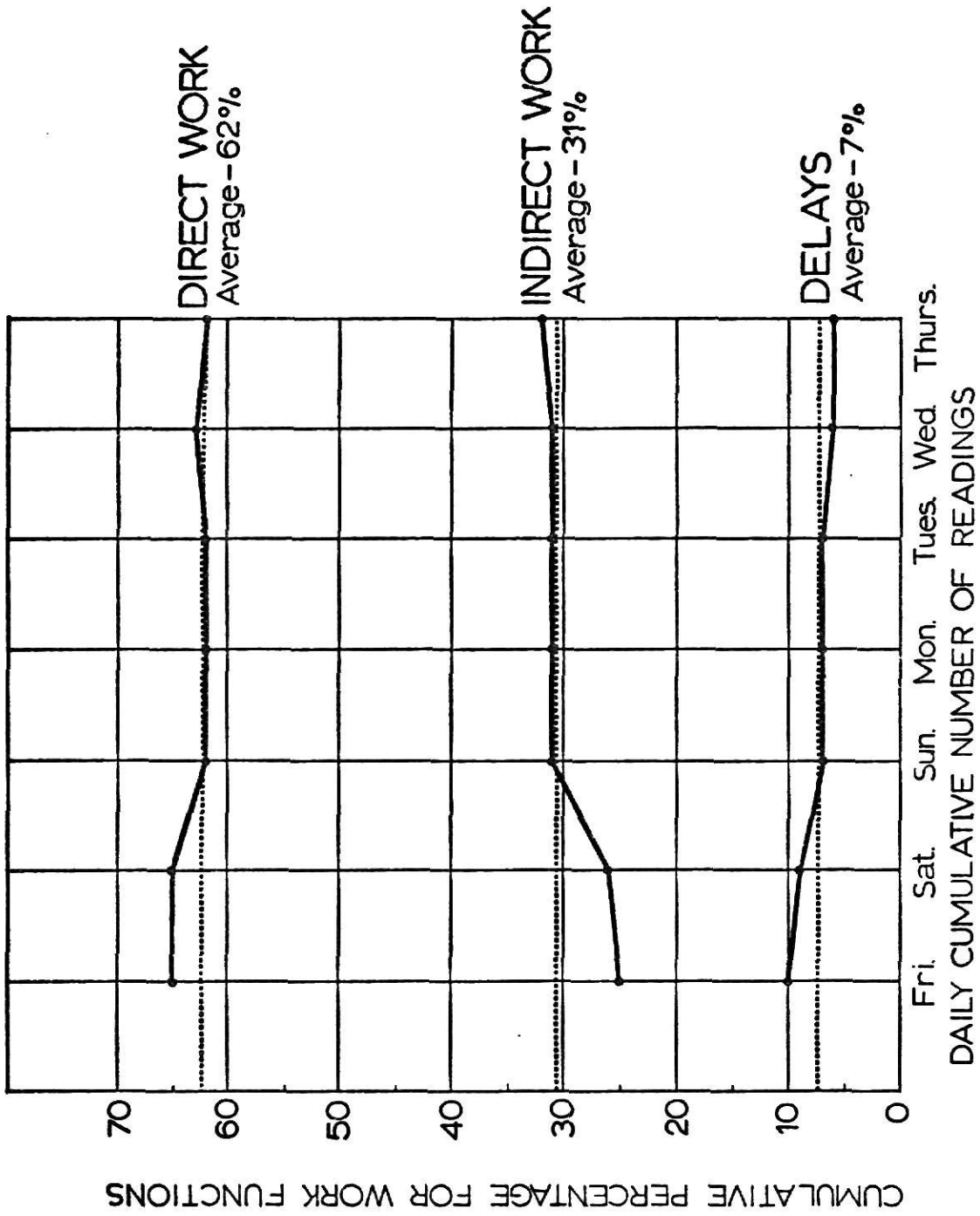


Fig. 2: Distribution of total work activities among direct work, indirect work, and delays for a seven day period in a production area in a residence hall foodservice.

two days of the study, the cumulative percentages of the three major work categories showed little fluctuation. There was a marked change from these respective levels to new fairly constant values during the remaining five days. The changes were a decrease in the amount of direct work and delay time with an increase in the indirect work.

The marked change in the distribution of time between the three major work categories as indicated by the percentages of readings in the observations is the most meaningful element of the study. The change in the relative distribution at the end of the third day perfectly illustrates the effect of an influx of extra workers on Sunday and preceding the spring break. The change in the direct work percentages does not indicate a lessening of the amount of direct work being accomplished but only that overstaffing produces an increase in indirect work. It might be assumed that overstaffing could cause an increase in the delay time. However, this was not true because the additional workers apparently were making a conscientious effort to be doing something when the observations were being made. The decreased amount in delay time could be attributed also to the fact that only one area was studied in the foodservice rather than the entire foodservice.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

Over 1,000 random readings were made on cooks in the production area of a university residence hall foodservice during a seven-day work sampling study. The study followed the Methodology Manual developed by Donaldson et al at the University of Wisconsin. Modifications were made in the model to alter it from a hospital foodservice to a production area of a University residence hall foodservice.

Random observations were recorded and classified into the predefined categories of direct work, indirect work, and delay time. The data were collected and evaluated following the guidelines of the work sampling manual.

Before the study began, an orientation was conducted to insure that the employees would understand the purpose of the study. At this time, cooperation was solicited for participation in the study. The technique of making work sampling observations was demonstrated. A staff of observers was specially trained in the appropriate observation techniques.

The first day of the study yielded an estimate of the percentage of time spent by the cooks in direct work activities. From this estimate of 66 per cent a determination of the number of readings required to maintain a confidence coefficient of 0.90, confidence interval of ± 0.05 was made. The seven days of the actual study followed the techniques of the Manual with a daily check on the number of readings required to maintain the selected confidence factors.

Sixty-two per cent of the activities were devoted to the direct category, 32 per cent to indirect, and 6 per cent to delay time. A graph of the percentage of time devoted to direct and indirect work functions and delays was maintained throughout the study. It was significant that due to the staffing situation, an increase in the percentage of indirect work was accompanied by a decrease in both the direct work and the delay time. The study which was made immediately preceding the spring break dramatically disclosed the effects of staffing policies in a pre-holiday period.

The conclusion was that this work sampling technique was quite adaptable to a university residence hall foodservice and had direct value as an indication of staffing effectiveness. It was recommended that subsequent studies be made during a stable period of staffing.

Conclusions

The work sampling methodology as developed by Donaldson et al with slight modifications were necessary because the model procedure was designed for a complete hospital foodservice. The results of this study indicate that work sampling can be applied to a production unit in a university residence hall foodservice.

It was found that the sampling time period selected was not a true representation of the normal staffing pattern in the production unit. However, there were some benefits to studying the unit at this time because this type of staffing occurs more than once per school year.

The extra labor scheduled during the period of investigation had a direct relationship on the percentage of time spent by the workers in direct labor. Since the comparison was made in percentages, it cannot be concluded that there was a change in the direct labor time.

It was observed that the additional workers were conscientiously engaged in miscellaneous activities in the category of indirect work and were not putting in idle time. It was concluded that this study technique very effectively demonstrated staffing relationships.

Recommendations

Based on the results of this study, it is recommended that subsequent studies be made at times when staffing is static and not affected by any impending holidays. If the personnel policies of the university induce over-staffing numerous times during the year, perhaps a critical analysis including both normal and pre-holiday times could be made. It is recommended that useful work be generated for the additional staff in these pre-holiday periods.

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APPENDIX A

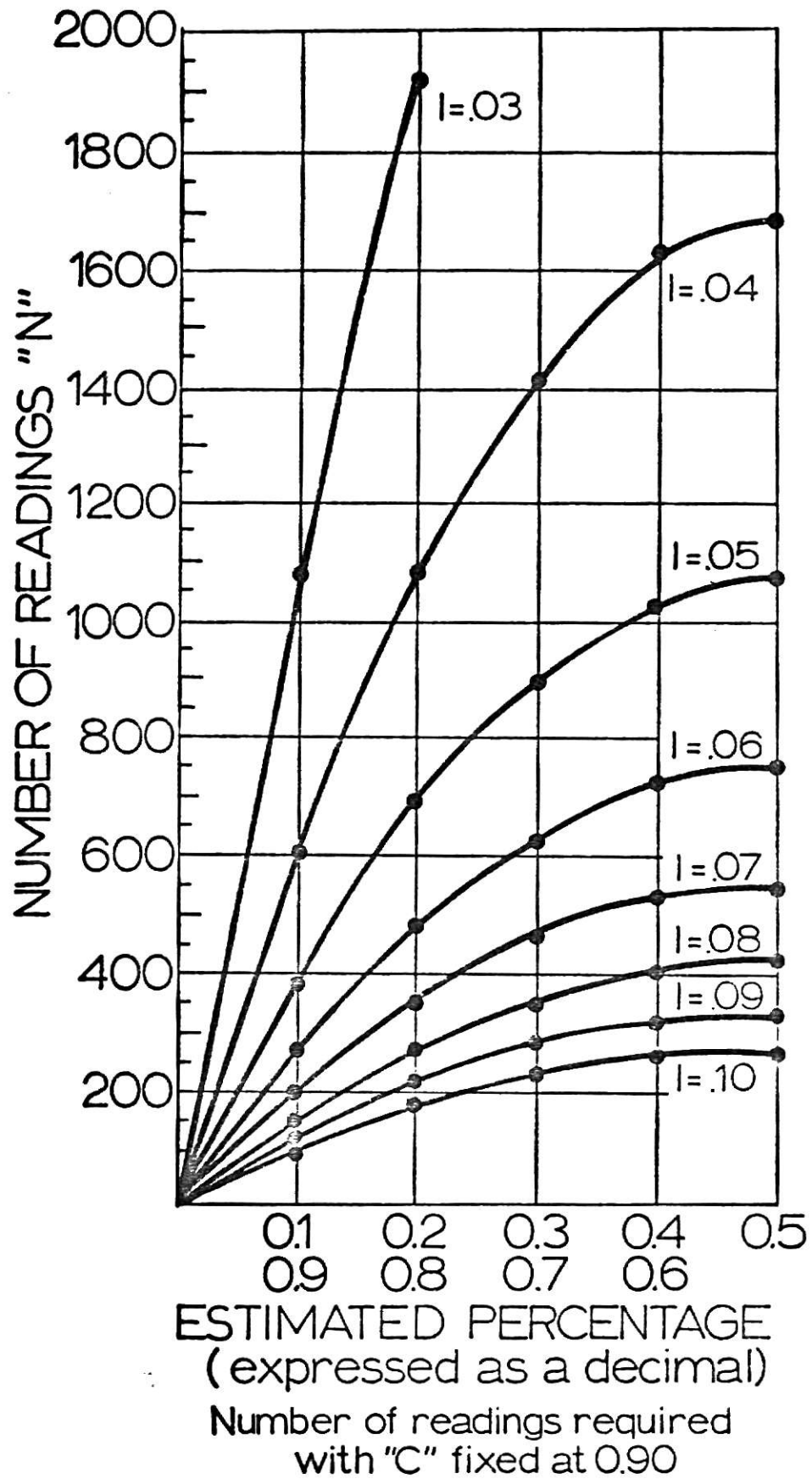


Fig. 2

Formula Used to Establish the Number of Readings
Required for Figure 2

The number of observations required for work sampling may be determined with this formula:

$$N = \frac{4\alpha\bar{P}i(1-\bar{P})}{I^2}$$

where

\bar{P} = estimate of proportion of total activities devoted to work function of primary interest

I = confidence interval

α = factor obtained from a table of probabilities for the normal distribution, for the value chosen for C ;

$C = .90, \quad = 1.65$

WORK FUNCTION CLASSIFICATION AND DEFINITIONS

I. DIRECT WORK FUNCTIONS

Any essential activity contributing directly to the production of the end product (end product is total number of meals served per day).

A. Processing

Act of changing the appearance of a foodstuff by physical or chemical means.

1. Prepreparation or preliminary processing

Preliminary act or process of making ready for preparation, distribution, or service.

blanching	measuring	thawing
breeding	mixing	washing
chopping	opening	weighing
coring	containers	looking in storage areas,
cracking eggs	paring	refrigerator
cutting	peeling	making salad dressing
dicing	shaping	portioning before preparation
eyeing	shelling	preparing milk container for
grinding	shredding	dispenser
mashing	sorting	turning on coffee urn, steam
		table, or cooking equipment

2. Preparation or cooking

Final act or process of making ready for distribution or service.

braising	toasting
broiling	tossing salad
coffee making	putting ingredients in steam kettle
frying	putting product in cooking equipment
grilling	such as: oven, steamer, steam kettles
roasting	removing product from cooking equipment
seasoning	preparing leftovers for storage
stirring	

B. 3. Service

Act of preparing facilities for distribution and of portioning and assembling prepared food for distribution to cafeteria customers.

setting up steam tables, cold counters, carts, trays,
nourishment
portioning the finished product; carving
assembling trays
serving in cafeteria
loading milk dispenser

C. Transportation

Act of transporting food, supplies, or equipment from a location in one functional area to a designated location in another area within the department.

4. Transportation of food

Act of moving food from a location in one functional area to a designated location in another area within the department.

delivery of food within the department

5. Transportation of equipment, supplies, and other

Act of moving equipment, supplies, and other items from a location in one functional area to a designated location in another area within the department.

moving soiled equipment to washing area
removing dishes from tables in cafeteria
return of clean equipment to preparation or service area
moving paper goods and other supplies
moving garbage or trash

6. Delivery of trays to patients (if this function is performed by dietary)

Act of removing patients' trays from food trucks, dumbwaiter or trayveyor, and carrying to patients' bedside.

delivery of tray to patients' room

7. Return of trays from patients (if this function is performed by dietary)

Act of removing trays from patients' bedside to food trucks; dumb-waiter on the ward.

return of tray from patients' rooms

8. Transportation empty

Act of moving without carrying or guiding anything from a location in one functional area to a designated location in another area within the department.

walking
unladen locomotion

- D. 9. Clerical (routine)

Act of receiving, compiling, distributing, and storing of routine records of data and information necessary for operation of the department.

copy work	recording time on time cards
filing	(signing in or out)
maintenance request	taking census
payroll	taking inventory
posting	taking money in cafeteria
typewriting; use of	telephone calls (possibility
other business machines	of classification 14 or 20,
receiving messages by tube	if observer has some knowl-
	edge of conversation)

E. Cleaning

Act of removing soil or dirt to provide sanitary conditions
for the use of equipment, facilities, and supplies.

10. Pot and pan washing

Act of scraping, washing, or rinsing quantity food
containers and cooking utensils.

running water into pot and pan sink or machine
washing pots and pans
putting away clean pots and pans
draining water from pot and pan machine or sink

11. Dishwashing

Act of preparing for or removal of soil or dirt to
provide sanitary conditions for use of tableware
(china, silverware, glassware, and trays).

filling dish machine	stacking dishes from dishrack
stripping food trucks	washing or rinsing glassware
scraping dishes	washing trays
washing or rinsing	draining dish machine
silverware	
operating dish machine	

12. Housekeeping

Act of removing soil or dirt to provide sanitary
conditions for the use of installed and mobile
equipment and facilities.

mopping and washing floors
 preparing mop
 cleaning walls
 cleaning carts and food trucks
 cleaning installed equipment
 cleaning work counters
 cleaning tables and chairs in
 dining rooms
 dusting furniture
 turning lights on or off
 washing windows

sweeping floors
 using garbage disposal (if
 separate from dishwashing
 procedure)
 oiling equipment
 adjusting equipment
 sharpening equipment and tools
 opening and closing windows
 swatting flies
 locking or unlocking doors
 and refrigerators

F. 13. Receiving

Act of acquiring, inspecting, and storing food and/or supplies
 from an area outside the department.

inspection on delivery
 storing
 unpacking

reading bread orders
 sorting and consolidating
 supplies

II. INDIRECT WORK FUNCTIONS

Any catalytic activity which contributes to production of the end
 product.

G. 14. Instruction or teaching

Act of directing or receiving direction by oral or written
 communication in a training or classroom situation or on the job.

on the job training
 giving instructions
 receiving instructions
 teaching personnel in
 classroom
 teaching staff or profes-
 sional group in classroom

reading journals
 reading directive from
 administration
 reading menu
 reading schedule
 trying out new equipment

H. 15. Appraisal

Act of judging or estimating the value or amount of work in
 order to make decisions for future planning.

checking dishes for cleanliness
 inspection of area--sanitation and safety
 inspection of food preparation
 inspection of leftovers
 researching for methods improvement
 tasting food

I. 16. Conference

Act of oral communication with one or more persons in the form of a scheduled meeting.

counseling	meetings
interviews	meetings with salesmen

J. 17. Clerical (original or non-delegable)

Act of compiling and formulating management control records of data and information necessary for the operation of the department.

budget accounting	ordering food and supplies
menu changes	time schedules
menu writing	writing specifications

III. DELAYS

All time when an employee is scheduled to be working and is not engaged in either a direct or an indirect work function.

K. 18. Forced delay

The time an employee is not working due to an interruption beyond his control in the performance of a direct or an indirect work function.

broken machine	assembly belt stops
power failure	wait for elevator
faulty equipment	ward service--wait for
slow cafeteria line	assembling of trays

L. Personal and Idle Delays

The time an employee is not working due to personal delays or avoidable delays.

19. Personal delays

The time an employee is not working due to time permitted away from his work area.

coffee breaks	drinking fountain
rest room	health and related activities
adjusting hairnet	such as washing hands
putting on apron	

20. Idle time

Any avoidable delay (other than forced or personal delay) that occurs for which the employee is responsible.

conversation not pertaining to business
reading newspaper
loafing

APPENDIX B

Form 3

RANDOMLY SELECTED OBSERVATION AREA - TIME PERIODS

Date:

No.	Random No.	Area	Time	No.	Random No.	Area	Time
1				45			
2				46			
3				47			
4				48			
5				49			
6				50			
7				51			
8				52			
9				53			
10				54			
11				55			
12				56			
13				57			
14				58			
15				59			
16				60			
17				61			
18				62			
19				63			
20				64			
21				65			
22				66			
23				67			
24				68			
25				69			
26				70			
27				71			
28				72			
29				73			
30				74			
31				75			
32				76			
33				77			
34				78			
35				79			
36				80			
37				81			
38				82			
39				83			
40				84			
41				85			
42				86			
43				87			
44				88			

Form 4

OBSERVATION TIMES ARRANGED IN SEQUENTIAL ORDER - A.M.

Date:

Minutes	5:00AM 5:59AM	6:00AM 6:59AM	7:00AM 7:59AM	8:00AM 8:59AM	9:00AM 9:59AM	10:00AM 10:59AM	11:00AM 11:59AM
00 - 01							
02 - 03							
04 - 05							
06 - 07							
08 - 09							
10 - 11							
12 - 13							
14 - 15							
16 - 17							
18 - 19							
20 - 21							
22 - 23							
24 - 25							
26 - 27							
28 - 29							
30 - 31							
32 - 33							
34 - 35							
36 - 37							
38 - 39							
40 - 41							
42 - 43							
44 - 45							
46 - 47							
48 - 49							
50 - 51							
52 - 53							
54 - 55							
56 - 57							
58 - 59							

Form 5

OBSERVATION TIMES ARRANGED IN SEQUENTIAL ORDER - P.M.

Date:

Minutes	12:00PM 12:59PM	1:00PM 1:59PM	2:00PM 2:59PM	3:00PM 3:59PM	4:00PM 4:59PM	5:00PM 5:59PM	6:00PM 6:59PM	7:00PM 7:59PM
00 - 01								
02 - 03								
04 - 05								
06 - 07								
08 - 09								
10 - 11								
12 - 13								
14 - 15								
16 - 17								
18 - 19								
20 - 21								
22 - 23								
24 - 25								
26 - 27								
28 - 29								
30 - 31								
32 - 33								
34 - 35								
36 - 37								
38 - 39								
40 - 41								
42 - 43								
44 - 45								
46 - 47								
48 - 49								
50 - 51								
52 - 53								
54 - 55								
56 - 57								
58 - 59								

DAILY OBSERVATION SCHEDULE

Date:

Observation			Work Function	Observation			Work Function
No.	Time	Area	Number	No.	Time	Area	Number
1				33			
2				34			
3				35			
4				36			
5				37			
6				38			
7				39			
8				40			
9				41			
10				42			
11				43			
12				44			
13				45			
14				46			
15				47			
16				48			
17				49			
18				50			
19				51			
20				52			
21				53			
22				54			
23				55			
24				56			
25				57			
26				58			
27				59			
28				60			
29				61			
30				62			
31				63			
32				64			

SUMMARY OF DAILY WORK FUNCTION ACTIVITIES - PRELIMINARY STUDY

Date: _____

WORK FUNCTION CATEGORY			
No.	Times Recorded	Total	Percent
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
DIRECT WORK TOTAL (1 - 13)			
14			
15			
16			
17			
INDIRECT WORK TOTAL (14 - 17)			
18			
19			
20			
DELAY TOTAL (18 - 20)			
GRAND TOTAL OF READINGS (All Activities)			
TOTAL NUMBER OF OBSERVATIONS			

PERCENTAGE OF TOTAL ACTIVITIES IN CATEGORY OF PRIMARY INTEREST =

$$\frac{\text{Total of Activities in Category of Primary Interest}}{\text{Grand Total of Readings (All Activities)}} =$$

$$\text{WORK AREA-SIZE} = \frac{\text{Grand Total of Readings (All Activities)}}{\text{Total Number of Observations}} =$$

Form 8

DAILY NUMBER OF OBSERVATIONS REQUIRED

INSTRUCTIONS	DAYS						
	1st	2nd	3rd	4th	5th	6th	7th
1. Percent of Total Time in Category of Primary Interest (Day 1 from Form 7; Days 2-7 from Form 9)							
2. Required Number of Readings "N" (From Figures 2 or 3) (Follow Procedure on p. 16)							
3. Grand Total of Accumulated Number of Readings (From Form 9)							
4. Number of Readings Required to Date (Line 2 minus Line 3)							
5. New Work Area-Size (Day 1 from Form 7; Days 2-7 from Form 9)							
6. Number of Total Observations Required (Line 4 divided by Line 5)							
7. Number of Days Remaining in Study							
8. Observations Required Per Day (Line 6 divided by Line 7)							

SUMMARY OF DAILY WORK FUNCTION ACTIVITIES

Date:

WORK FUNCTION CATEGORY					
No.	Times Recorded	Total	Prev. Total	Accum. Total	Accum. Percent
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
DIRECT WORK TOTAL (1 - 13)					
14					
15					
16					
17					
INDIRECT WORK TOTAL (14 - 17)					
18					
19					
20					
DELAY TOTAL (18 - 20)					
GRAND TOTAL OF READINGS (All Activities)					
TOTAL NUMBER OF OBSERVATIONS					

*as decimal

PERCENTAGE OF TOTAL ACTIVITIES IN CATEGORY OF PRIMARY INTEREST =

$$\frac{\text{Total of Accumulated Activities in Category of Primary Interest}}{\text{Grand Total Accumulated Readings (All Activities)}} =$$

$$\text{NEW WORK AREA-SIZE} = \frac{\text{Grand Total Accumulated Readings (All Activities)}}{\text{Accumulated Total of Observations}} =$$

Form 12

TOTAL OBSERVATION RECORD

Work Functions	Readings		Hours		Minutes
	Number	Calculated Decimal Percentage	Per Period	Per Meal	Per Meal
1					
2					
A					
B 3					
4					
5					
6					
7					
8					
C					
D 9					
10					
11					
12					
E					
F 13					
SUBTOTAL 1					
G 14					
H 15					
I 16					
J 17					
SUBTOTAL 2					
K 18					
19					
20					
L					
SUBTOTAL 3					
GRAND TOTAL					
TOTAL DUTY HOURS:					
TOTAL MEAL EQUIVALENTS:					

APPENDIX C

Revised Form 7

SUMMARY OF DAILY WORK FUNCTION ACTIVITIES - PRELIMINARY STUDY

Date:

WORK FUNCTION CATEGORY			
No.	Times Recorded	Total	Percent
1			
2			
3			
4			
DIRECT WORK TOTAL (1 - 4)			
5			
6			
7			
8			
9			
10			
INDIRECT WORK TOTAL (5 - 10)			
11			
12			
13			
DELAY TOTAL (11 - 13)			
GRAND TOTAL OF READINGS (ALL ACTIVITIES)			
TOTAL NUMBER OF OBSERVATIONS			

PERCENTAGE OF TOTAL ACTIVITIES IN CATEGORY OF PRIMARY INTEREST =

$$\frac{\text{Total of Activities in Category of Primary Interest}}{\text{Grand Total of Readings (All Activities)}} =$$

$$\text{OBSERVATIONS PER SAMPLE SIZE} = \frac{\text{Grand Total of Readings (All Activities)}}{\text{Total Number of Observations}} =$$

Revised Form 8

DAILY NUMBER OF OBSERVATIONS REQUIRED

INSTRUCTIONS	DAYS							
	PRELIM.	FRI.	SAT.	SUN.	MON.	TUES.	WED.	THURS.
1. Per cent of Total Time in Category of Primary Interest (Preliminary Study from Form 7; Days 1-7 from Form 9)								
2. Required Number of Readings "N" (From Figure 2)								
3. Grand Total of Accumulated Number of Readings (From Form 9)								
4. Number of Readings Required to Date (Line 2 Minus Line 3)								
5. Observations Per Sample Size (Preliminary Day from Form 7; Days 1-7 from Form 9)								
6. Number of Total Observations Required (Line 4 Divided by Line 5)								
7. Number of Days Remaining in the Study --								
8. Observations Required Per Day (Line 6 Divided by Line 7)								

Revised Form 9

SUMMARY OF DAILY WORK FUNCTION ACTIVITIES

Date:

WORK FUNCTION CATEGORY					
No.	Times Recorded	Total	Prev. Total	Accum. Total	Accum.* Percent
1					
2					
3					
4					
DIRECT WORK TOTAL (1 - 4)					
5					
6					
7					
8					
9					
10					
INDIRECT WORK TOTAL (5 - 10)					
11					
12					
13					
DELAY WORK TOTAL (11 - 13)					
GRAND TOTAL OF READINGS (ALL ACTIVITIES)					
TOTAL NUMBER OF OBSERVATIONS					

* as decimal

PERCENTAGE OF TOTAL ACTIVITIES IN CATEGORY OF PRIMARY INTEREST =

$$\frac{\text{Total of Accumulated Activities in Category of Primary Interest}}{\text{Grand Total Accumulated Readings (All Activities)}} =$$

OBSERVATIONS PER SAMPLE =

$$\frac{\text{Grand Total Accumulated Readings (All Activities)}}{\text{Accumulated Total of Observations}} =$$

Revised Form 12
TOTAL OBSERVATION RECORD

Work Functions	Readings		Hours		Minutes
	Number	Calculated Decimal Percentage	Per Period	Per Meal	Per Meal
1					
2					
3					
4					
DIRECT WORK TOTAL					
5					
6					
7					
8					
9					
10					
INDIRECT WORK TOTAL					
11					
12					
13					
DELAY WORK TOTAL					
GRAND TOTAL:					

TOTAL DUTY HOURS:

TOTAL MEALS SERVED:

APPENDIX D

Form 3

RANDOMLY SELECTED OBSERVATION AREA - TIME PERIODS

Date:

No.	Random No.	Area	Time	No.	Random No.	Area	Time
1			7:18	45			
2			6:16	46			
3			12:37	47			
4			12:32	48			
5			12:59	49			
6			3:05	50			
7			9:48	51			
8			8:07	52			
9			9:38	53			
10			12:42	54			
11			5:54	55			
12			2:48	56			
13			8:56	57			
14			1:55	58			
15			7:10	59			
16			5:25	60			
17			6:18	61			
18			4:38	62			
19			11:40	63			
20			11:23	64			
21			3:29	65			
22				66			
23				67			
24				68			
25				69			
26				70			
27				71			
28				72			
29				73			
30				74			
31				75			
32				76			
33				77			
34				78			
35				79			
36				80			
37				81			
38				82			
39				83			
40				84			
41				85			
42				86			
43				87			
44				88			

Form 4

OBSERVATION TIMES ARRANGED IN SEQUENTIAL ORDER - A.M.

Date:

Minutes	5:00AM 5:59AM	6:00AM 6:59AM	7:00AM 7:59AM	8:00AM 8:59AM	9:00AM 9:59AM	10:00AM 10:59AM	11:00AM 11:59AM
00 - 01							
02 - 03							
04 - 05							
06 - 07				8:07			
08 - 09							
10 - 11			7:10				
12 - 13							
14 - 15							
16 - 17							
18 - 19			7:18				
20 - 21							
22 - 23							11:23
24 - 25							
26 - 27							
28 - 29							
30 - 31							
32 - 33							
34 - 35							
36 - 37							
38 - 39					9:38		
40 - 41							11:40
42 - 43							
44 - 45	5:44						
46 - 47							
48 - 49					9:48		
50 - 51							
52 - 53							
54 - 55							
56 - 57				8:56			
58 - 59							

Form 5

OBSERVATION TIMES ARRANGED IN SEQUENTIAL ORDER - P.M.

Date:

Minutes	12:00PM 12:59PM	1:00PM 1:59PM	2:00PM 2:59PM	3:00PM 3:59PM	4:00PM 4:59PM	5:00PM 5:59PM	6:00PM 6:59PM	7:00PM 7:59PM
00 - 01								
02 - 03								
04 - 05				3:05				
06 - 07								
08 - 09								
10 - 11								
12 - 13								
14 - 15								
16 - 17							6:16	
18 - 19								
20 - 21								
22 - 23								
24 - 25								
26 - 27								
28 - 29				3:29				
30 - 31								
32 - 33	12:32							
34 - 35								
36 - 37	12:37							
38 - 39					4:38			
40 - 41								
42 - 43	12:42							
44 - 45								
46 - 47								
48 - 49			2:48					
50 - 51								
52 - 53								
54 - 55								
56 - 57								
58 - 59	12:59							

Form 6

DAILY OBSERVATION SCHEDULE

Date: Thursday - March 10, 1977

Observation			Work Function	Observation			Work Function
No.	Time	Area	Number	No.	Time	Area	Number
1	5:44		2,2,2,1,2,1	33			
2	7:10		1,2,12	34			
3	7:18		18,2,2,5,4,8,12	35			
4	8:07		8,5,2,2,2,4	36			
5	8:56		14,14,1,1,1	37			
6	9:38		1,20,14,14,2,4	38			
7	9:48		2,2,1,14,20,5	39			
8	11:23		8,2,8,12	40			
9			2,5,5,5,14,14,2,2	41			
10	11:40		12,2,1,1	42			
11			2,8,8,4,2,2,2,20	43			
12	12:32		1,1,8,1,2,20	44			
13			2,2,2,12,12,1,15	45			
14	12:37		1,1,1,12,2	46			
15			20,20,12,2,1,1,2,1	47			
16	12:42		20,14	48			
17			1,1,1,1,1,1,8,8,12,5	49			
18	12:59		1,12,14	50			
19			5,5,2,2,1,1,2,2,12	51			
20	2:48		2,4,12,12,5	52			
21	3:05		2,2,1,12,5,8	53			
22	3:29		5,2,2,8,8	54			
23	4:38		2,2,4,5,19	55			
24	6:16		12,12,12,12,5	56			
25				57			
26				58			
27				59			
28				60			
29				61			
30				62			
31				63			
32				64			

Revised Form 7

SUMMARY OF DAILY WORK FUNCTION ACTIVITIES - PRELIMINARY STUDY

Date: Wednesday - March 2, 1977

WORK FUNCTION CATEGORY			
No.	Times Recorded	Total	Percent
1		40	.2253
2		45	.3284
3			
4		5	.0364
DIRECT WORK TOTAL (1 - 4)		90	.6569
5		8	.0584
6		13	.0949
7		3	.0219
8		8	.0584
9		5	.0364
10			
INDIRECT WORK TOTAL (5 - 10)		36	.2627
11		2	.0146
12		4	.0292
13		5	.0364
DELAY TOTAL (11 - 13)		11	.0803
GRAND TOTAL OF READINGS (ALL ACTIVITIES)		137	1.0000
TOTAL NUMBER OF OBSERVATIONS		30	

PERCENTAGE OF TOTAL ACTIVITIES IN CATEGORY OF PRIMARY INTEREST =

$$\frac{\text{Total of Activities in Category of Primary Interest}}{\text{Grand Total of Readings (All Activities)}} = \frac{90}{137} = 66\%$$

$$\text{OBSERVATIONS PER SAMPLE SIZE} = \frac{\text{Grand Total of Readings (All Activities)}}{\text{Total Number of Observations}} = \frac{137}{30} = 4.7$$

Revised Form 8

DAILY NUMBER OF OBSERVATIONS REQUIRED

INSTRUCTIONS	DAYS							
	PRELIM.	FRI.	SAT.	SUN.	MON.	TUES.	WED.	THURS.
1. Per cent of Total Time in Category of Primary Interest (Preliminary Study from Form 7; Days 1-7 from Form 9)	.66	.65	.65	.62	.62	.63	.63	.62
2. Required Number of Readings "N" (From Figure 2)	950	955	955	1000	1000	1005	1005	1000
3. Grand Total of Accumulated Number of Readings (From Form 9)	0	156	267	438	661	793	901	1040
4. Number of Readings Required to Date (Line 2 Minus Line 3)	950	799	688	562	339	213	104	--
5. Observations Per Sample Size (Preliminary Day from Form 7; Days 1-7 from Form 9)	4.5	5.2	4.8	5.2	5.9	6.0	6.0	6.2
6. Number of Total Observations Required (Line 4 Divided by Line 5)	211	154	143	108	58	35	17	--
7. Number of Days Remaining in the Study --	7	6	5	4	3	2	1	0
8. Observations Required Per Day (Line 6 Divided by Line 7)	30	26	29	27	19	18	17	--

Revised Form 9

SUMMARY OF DAILY WORK FUNCTION ACTIVITIES

Date: Thursday - March 10, 1977

WORK FUNCTION CATEGORY					
No.	Times Recorded	Total	Prev. Total	Accum. Total	Accum.* Percent
1		30	235	265	.2548
2		40	284	324	.3115
3			7	7	.0067
4		6	43	49	.0471
DIRECT WORK TOTAL (1 - 4)		76	569	645	.6201
5		14	17	85	.0817
6		12	66	78	.0750
7			6	6	.0058
8		18	87	105	.1009
9		9	36	45	.0432
10		1	10	11	.0105
INDIRECT WORK TOTAL (5 - 10)		54	276	330	.3173
11		1	12	13	.0125
12		1	17	18	.0173
13		7	27	34	.0327
DELAY WORK TOTAL (11 - 13)		9	56	65	.0625
GRAND TOTAL OF READINGS (ALL ACTIVITIES)		139	901	1040	1.0000
TOTAL NUMBER OF OBSERVATIONS		18	150	168	

* as decimal

PERCENTAGE OF TOTAL ACTIVITIES IN CATEGORY OF PRIMARY INTEREST =

$$\frac{\text{Total of Accumulated Activities in Category of Primary Interest}}{\text{Grand Total Accumulated Readings (All Activities)}} = \frac{645}{1040} =$$

OBSERVATIONS PER SAMPLE =

62%

$$\frac{\text{Grand Total Accumulated Readings (All Activities)}}{\text{Accumulated Total of Observations}} = \frac{1040}{168} = 6.9$$

Revised Form 12

TOTAL OBSERVATION RECORD

Work Functions	Readings		Hours		Minutes
	Number	Calculated Decimal Percentage	Per Period	Per Meal	Per Meal
1	265	.2548	140.14	.0049	.294
2	324	.3115	171.33	.0060	.36
3	7	.0067	3.685	.0001	.006
4	49	.0471	25.905	.0009	.054
DIRECT WORK TOTAL	645	.6201	341.055	.0119	.714
5	85	.0817	44.935	.0016	.096
6	78	.0750	41.25	.0014	.084
7	6	.0057	3.135	.0001	.006
8	105	.1009	55.495	.0019	.114
9	45	.0433	23.815	.0008	.048
10	11	.0105	5.775	.0002	.012
INDIRECT WORK TOTAL	330	.3173	174.515	.0061	.366
11	13	.0125	6.875	.0002	.012
12	18	.0173	9.515	.0003	.018
13	34	.0327	17.985	.0006	.036
DELAY WORK TOTAL	65	.0625	34.375	.0012	.0072
GRAND TOTAL:	1040	1.000	550.000	.0193	1.158

TOTAL DUTY HOURS: 550

TOTAL MEALS SERVED: 28,523

OCCURRENCE SAMPLING TECHNIQUE TO DEVELOP
A PATTERN FOR STAFFING A UNIVERSITY
RESIDENCE HALL FOODSERVICE

by

JULIA ANN BRYANT

B.S., Bennett College, 1970

AN ABSTRACT OF A MASTER'S REPORT

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Dietetics, Restaurant, and
Institutional Management

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1977

ABSTRACT

The purpose of this study was to test the adaptability of an occurrence sampling methodology developed for a hospital foodservice to the staffing analysis of a university residence hall foodservice. The model used was the Methodology Manual developed at the University of Wisconsin by Donaldson et al. The site selected for the study was the cooks' production area of the Derby Food Center at the Kansas State University.

For this investigation the total work was divided into three major functional categories: direct work, indirect work, and delay time. The category of major interest was the direct work. Each of the major categories contained specific functions which were derived from the model to fit the specifics of the study site. The sample statistic was a "reading" which is the recording of one functional activity of one worker. A number of readings taken at one time constituted an observation.

The critical question was the total number of readings required during the study to qualify the sample as representative. This number was determined from probability theory with a confidence level of 0.90 and a confidence interval of ± 0.05 using the category of direct work expressed as a percentage of the total work. The percentage of direct work readings in the first day of the study was used in the determination of the total number of readings required. Based on the Wisconsin experience, it was considered that a seven day study would be adequate to secure this number and show stability in the daily results.

Prior to the beginning of the study, selected observers were trained by the researcher in the techniques they would be using. Also the employees in the study site were given an orientation presentation to solicit cooperation and to reassure them that the study would not in any manner jeopardize job

security. The study began in midweek in order to encompass a typical weekend. The timing of the study was in one sense unfortunate because it included days immediately preceding the spring break when staffing is not normal. However, this situation did enable the study to illustrate dramatically the effects of staffing policies at such times. Data collection and analysis followed the model procedures and the major result was the demonstration that the total work was divided into 62 per cent direct work, 32 per cent indirect work, and 6 per cent idle time. Further, it was ascertained that the influx of extra workers just before the holiday decreased the direct work and delay time a few percentage points while the indirect work showed a corresponding increase.

It was concluded that the modified Wisconsin work sampling methodology is applicable to a university residence hall foodservice for staffing analysis. It was recommended that further work sampling studies be made at times when no staffing changes would occur because of impending holidays. It was suggested that real work activities could be specifically planned for those times when extra employees are scheduled in the work area.