Labor in school meal programs:

Measurement of direct costs and their influence on menu planning

by

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DEDICATION

For Denise, with all my love.

CHAPTER 1. INTRODUCTION

Introduction

Feeding programs for low income school-aged children in Europe and the United States were first operated in the 1700s, and they have functioned both as charities and at public expense. Expectations for payment by parents varied among the programs; if parents of children were expected to make payment for the meals, the payment amount was based on the parents' ability to pay and the cost of food provided (Gunderson, 1971). There appears to be no indication that the cost of labor, if any, was of any consideration in the early European or U.S. feeding efforts. In the U.S., the cost of labor to prepare meals for children in publicly funded programs was almost entirely the responsibility of local governments, with the exception of brief periods during the Great Depression (Gunderson, 1971). In 1970, U.S. federal funding for meals programs, through the National School Lunch Program (NSLP), was permitted to be used for expenses other than food for the first time (Gunderson, 1971; National School Lunch Act [NSLA], 1970). The thrust, however, of federal support for child-feeding programs has been on the provision of food (Gunderson, 1971; Martin, 2008).

Menu planning in the NSLP has been regulated from the program's beginning, focusing on the two-pronged mission to improve the nutritional status of children and to support agricultural markets (NSLA, 1946). In 2010, the menu planning requirements were changed for the first time in fifteen years, increasing the quantity and variety of vegetables and the proportion of grains required to be predominantly whole, among other changes; additionally, upper and lower limits were established for many nutrients (Healthy Hunger Free-Kids Act of 2010 [HHFKA], 2010; National School Lunch Program, 2012). These changes aligned the NSLP meal requirements more closely to the 2010 Dietary Guidelines for Americans, but were

expected to increase food costs for a lunch by ten cents (HHFKA, 2010; U. S. Department of Agriculture [USDA] & U.S. Department of Health and Human Services [HHS], 2010). A stipend of six cents per meal was made available to school meals programs that met the new requirements (HHFKA, 2010). No estimate of changes in labor needs, if any, has been made.

Additionally, changes in pricing of school meals were mandated, increasing paid meal prices to approximate the level of support provided by federal free meal reimbursement; this change, and other related changes required in the pricing of foods sold in addition to reimbursable meals, was expected to increase total revenue to school meals programs (National School Lunch Program: School Food Service Account Revenue Amendments Related to the Healthy, Hunger-Free Kids Act of 2010, 2011). However, program-wide funding changes in the 1980s that resulted in increased paid meal prices brought about significant, years-long reductions in participation (USDA, 2012).

In the NSLP, accounting practices in school meals programs have been found to be quite accurate in determining the cost of food, but much less adept at recognizing labor and other costs of a meal (United States Department of Agriculture, Food and Nutrition Services, Special Nutrition Programs, 2008). Allocation methods have been the recommended process to determine costs per meal, resulting in the inability to differentiate between meals that are higher in cost and those that are lower in cost (Cater, Conklin, & Cross, 2005). No known method other than allocation is employed to determine the costs other than food, associated with individual menu items (an entrée, as opposed to a portion of vegetables).

Oakley (2008) recommended developing a menu for NSLP with a "careful mix of higher-priced items with lower-priced ones," to "help balance" the cost of the menu (p. 377). In the NSLP, there is no known research or resource that explains how to develop this "careful

mix." And given the findings that school meal programs in general lack the skill or ability to identify costs other than food costs (United States Department of Agriculture, Food and Nutrition Services, Special Nutrition Programs, 2008), determining what menu items are higher-priced versus lower-priced, when all costs are considered, must be based to some extent on estimations, assumptions, or guessing.

In restaurants, the question of menu mix, to optimize profit, has been studied, employing various combinations of factors such as food cost, contribution toward overall restaurant profitability, item popularity, and menu interest. The studies resulted in recommendations for menu analysis processes based on profitability calculations (Bayou & Bennett, 1992; Hayes & Huffman, 1985; LeBruto, Ashley, & Quain, 1995; 1997; Pavesic, 1983), matrix-based ranking (Kasavana & Smith, 1982; Miller, 1980, reported in Morrison, 1997; Morrison, 1997), and others (Reynolds & Taylor, 2010; Taylor, Reynolds, & Brown, 2009). Labor has been included in these methods, but usually as an allocated overhead cost.

Activity Based Costing (ABC), a method to measure costs based on resource consumption (Cooper & Kaplan, 1990; Cooper & Slagmulder, 2000; Kaplan, 2000; Kaplan & Anderson, 2007a, 2007b), has been employed successfully in a variety of industries, including manufacturing (Everaert, Bruggeman, & De Creus, 2008; Greeson & Kocakulah, 2000), government (Vazakidis, Karagiannis, & Tsialta, 2010; Weiss, 1997), banking (Hicks, 1999), and medical services (DeMeere, Stouthuysen, & Roodhooft, 2009). It has been applied in restaurants to measure labor costs of individual menu items (Raab, 2003; Raab & Mayer, 2007; Raab, Mayer, Shoemaker, & Ng, 2009; Vaughn, Raab, & Nelson, 2010); it has also been utilized in matrix-based menu analysis processes to optimize profits in restaurants in a

modification of ABC based on time, Time Driven Activity Based Costing, or TDABC (Annaraud, Raab & Schrock, 2008; Vaughn, et al., 2010).

Statement of the Problem

Changes to the meal program, requiring the preparation and service of more items per meal, more variety in the menu items, close attention to nutrient content, and pricing restrictions are converging to change the face of school meals programs. The required changes in pricing are expected to increase revenue, but history indicates otherwise. Stipend payments will fall short of anticipated increases in food costs. Increasing the number and complexity of menu items will probably increase the labor needed to produce them. Cost measurement processes in school districts have been found lacking in the ability to identify labor costs associated with meals programs. No method to develop menus in the school meals program exists that addresses the need to balance all costs against revenue. Schools will be faced with increased food costs and probably increased labor costs; they possess skills and systems inadequate to identify or measure costs, in an uncertain revenue environment. It is not known if student-customers will be interested in a menu compliant with the mandated changes, a concern related to possibly falling participation and resultant revenue reductions. School meals program managers will need to be very attentive to all costs, participation rates, and revenue changes to chart a successful course through this challenge.

Purpose of the Study

This study sought to determine if direct labor costs of food production in school meals programs can be quantified, utilizing ABC methods similar to those applied in restaurant foodservice (Raab, 2003; Raab & Mayer, 2007; Raab, et al., 2009; Vaughn, et al., 2010). Further, it focused on utilizing menu analysis processes to optimize profits in restaurants

(Annaraud, Raab & Schrock, 2008; Raab, Hertzman, Mayer & Bell, 2006; Raab & Mayer, 2007). This research focused on direct labor expended as part of production of specific food items prepared on site and offered for sale as part of a reimbursable lunch meal and as additional sales under a la carte processes. The field of inquiry was further narrowed to include only that labor considered "value adding;" specifically, this will include labor expended to prepare meats through production to the point at which the product is ready for service, but not receiving, storing, assembling ingredients from storage, opening packages, measuring, or cleaning up. This study investigated whether menu planning tools frequently utilized in restaurant foodservice can be adapted and applied to assist school meals menu planners in achieving Oakley's careful mix and balanced cost (2008), and appealing to student customers.

The implications are many. School meals programs able to identify direct labor costs associated with individual menu items will be able to plan menus within available labor resources or quantify the changed levels of labor needed. The school meals program managers will be able to plan menus for which the total cost does not exceed available revenue. Menus appealing to students will help counter any reduction in participation related to increasing prices.

Research Questions

Following are the questions to be answered:

1. Can Time Driven Activity Based Costing (TDABC) be applied in school meals programs to measure direct labor associated with production?
2. Does TDABC-based measurements of labor costs differ from allocated labor costs in school meals programs?

3. Are TDABC-based measurements of labor costs for specific food products sufficiently sensitive to discriminate between the food products?
4. Can menu analysis processes be applied to school meals programs?
5. Does inclusion of costs of direct labor in menu analysis improve the usefulness of the process in school meals programs?
6. Does the cost associated with conducting TDABC justify its use, as demonstrated by cost benefit analysis?

Definition of Terms

Terms used in this study are defined thus:

Activity Based Costing (ABC): A method to trace costs back to the actual products being produced (Cooper & Kaplan, 1990; Cooper & Slagmulder, 2000; Kaplan, 2000).

A la carte: Foods sold in competition with reimbursable meals in the National School Lunch Program, also called competitive foods (NSLP, 2012).

Bill of activity: A list of the activities and their costs associated with a specific cost object (Raab, 2003).

Capacity: The level of a resource available to do work, make a product or provide a service (Turney, 2005). For this study, the resource of interest is labor required to prepare school meals.

Commodities: Foods donated by the United States Department of Agriculture to Child Nutrition Programs (Donation of Foods For Use in The United States, Its Territories and Possessions and Areas Under Its Jurisdiction, 7 C.F.R. 250.3, 2008)

Direct labor: Labor that is traceable to the goods and services produced (Hansen & Mowen, 2006).

Equity pricing: A requirement that prices charged for paid meals in the National School Lunch Program be equivalent to the reimbursement received for free meals (National School Lunch Program: School Food Service Account Revenue Amendments Related to the Healthy, Hunger-Free Kids Act of 2010, 2011).

Excess capacity: The portion of practical capacity that is not expended doing work, also called unused capacity (Hansen & Mowen, 2006).

Labor value units: Labor measured in dollars per unit of time.

Menu analysis: A method to evaluate menus, based on costs, product mix, profitability and other factors, to identify most successful or desirable menu items (Hayes & Huffman, 1985).

Meal equivalent (ME): The single unit of measure utilized in school meals programs, to permit comparison between meals of different types (breakfast, lunch, snacks) and cash sales (including a la carte sales, catering, contracted sales) (Cater, et al., 2005).

National School Lunch Program (NSLP): The child feeding program authorized by the Richard B. Russell National School Lunch Act, 42 U.S.C.§ 1751, et seq. (2010).

Offer versus serve (OVS): A program instituted by USDA to reduce food waste, allowing students to take less than a full meal still have the meal earn sales revenue or reimbursement at full rates (National School Lunch Program, 2004).

Practical capacity: The portion of theoretical capacity remaining after deducting all paid time off, time needed for meetings or training, and similar kinds of claims on work time, during which products are not made and services not delivered (DeMeere, et al., 2009). For purposes of this study, the resource of interest is labor required to prepare school meals.

Reimbursable lunch: A meal meeting the nutritional requirements of 7C.F.R. 210, offered and available in full portions to eligible children.

Reimbursement: Federal cash assistance including advances paid or payable to participating schools for reimbursable lunches served to eligible children (The National School Lunch Program, 2010).

School food authority (SFA): The entity at the school district level that operates a school meal program under the National School Lunch Program.

Theoretical capacity: The sum of all paid labor hours (Turney, 2005). For purposes of this study, the resource of interest is labor required to prepare school meals.

Time Driven Activity Based Costing (TDABC): A simplification of Activity Based Costing based on measuring time associated with the cost (Kaplan & Anderson, 2007a, 2007b).

Unit pricing: A requirement that school meals served under the National School Lunch Program be priced as a unit, with no price adjustments based on students' taking less than the full amount.

Value-adding labor: Labor associated with activities that contribute to customer value. For example, cooking a hamburger adds value.

Organization of Dissertation

Five additional chapters follow. Chapter 2 presents the Review of Literature, and Chapter 3, the Methodology. Chapter 4 is a journal article prepared for submission to the *Journal of Child Nutrition & Management.* Writing and referencing formats follow the journal's requirements. I was involved in all research stages, including conception of ideas, data collection, data analysis, and manuscript preparation. Dr. Arendt served as major professor, and she contributed at every stage of the research process including data analysis.

Dr. Gerrie du Rand, University of Pretoria, South Africa, contributed to data analysis. Chapter 5 is a journal article prepared for submission to *The Journal of Foodservice Business Research.* Writing and referencing formats follow the journal's requirements. I was involved in all research stages, including conception of ideas, data collection, data analysis, and manuscript preparation. Dr. Arendt served as major professor, and she contributed at every stage of the research process including data analysis. Chapter 6 presents conclusions. References are listed at the end of each chapter.

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CHAPTER 2. REVIEW OF LITERATURE

Introduction

History of School Meals Programs

The earliest known feeding programs for low income school-aged children were operated in Munich, Germany, in the late 1700s, as a private endeavor; in France by the late 1800s, at public expense; and by the early 1900s, in England, as a charity (Gunderson, 1971). Parents could be assessed a fee if they were determined able to pay, but after a few years of operation, each program served large proportions of the children being fed at no charge (Gunderson, 1971; United States Department of Agriculture, 1941, in Gunderson, 1971). Organized school feeding programs were available in the United States as early as the mid-1850s. A combination of charities and local governments began operating more extensive school meals programs in the United States in the first half of the 1900s (Gunderson, 1971).

In 1936, in an effort to bolster agriculture and prevent widespread hunger and malnutrition during the Great Depression, Congress authorized the United States Department of Agriculture (USDA) to distribute surplus foods to the needy, including school meals and other mass feeding programs (Agricultural Adjustment Act of 1933, 1936). School feeding increased from 3,800 programs feeding 342,000 children in 1937 to 78,000 programs feeding 5.25 million children in 1942 (Gunderson, 1971).

In 1946, the National School Lunch Act (NSLA) was passed (1946), implementing the National School Lunch program (NSLP), and noting

> it is hereby declared to be the policy of Congress, as a measure of national security, to safeguard the health and well-being of the Nation's children and to encourage the domestic consumption of nutritious agricultural

> commodities and other food, by assisting the States, through grants-in aid and other means, in providing an adequate supply of food and other facilities for the establishment, maintenance, operation and expansion of nonprofit school lunch programs. (NSLA, 1946, Section 2).

Funding in School Meals Programs

Funding of Early School Meals Programs

As noted above, early European efforts to feed school aged children were often charities, and focused on feeding indigent and poor children (Bryant, 1913, cited by Gunderson, 1971; Gunderson, 1971; USDA, 1941, cited by Gunderson, 1971). If payment was expected, the fee charged covered the cost of food only (Gunderson, 1971). Early programs operated by U.S. schools and municipalities fed school children with varying degrees of success and with varying levels and types of support. As in Europe, if parents were expected to pay for the meals, the charge was based on the cost of food (Gunderson, 1971).

U.S. federal funding for labor associated with preparing meals for school children was provided only briefly. Beginning in the 1930s, through the Works Progress Administration (WPA), the funding for labor was provided without cost or requirement for matching and resulted in assistance to over 23,000 school districts by 1941 (Gunderson, 1971). The Works Progress Administration (the name was later changed to the Works Projects Administration) was disbanded in the early 1940s, and replacements for the labor funding streams were not established in any other agency (National Archives and Records Administration, n.d.).

Direct federal cash payments began in 1943, earmarked for the purchase of only food in mass feeding programs not necessarily directed exclusively toward children (Agricultural

Adjustment Act of 1933, 1943). To this day, surplus foodstuffs continue to be provided in the form of commodity donations and/or cash (Gunderson, 1971; J. Martin, 2008).

From its inception, the NSLP was intended to provide seed money to states, to purchase food and to implement and operate the NSLP locally. It was not intended for the federal government to be the principal source of funding, but rather that states and schools ensure the provision of matching or supplemental funds, whether from tax revenues, payments from families able to afford them, or in-kind sources, to augment the federal funding (DeGiuseppe, 1975; NSLA, 1946). The focus of federal spending, both cash payments and the commodity distribution program, was on the provision of food (Gunderson, 1971; J. Martin, 2008). It was not until 1971, for the first time, that federal payments were permitted to be used for expenses other than food (Gunderson, 1971; NSLA, 1970).

Current Funding of the National School Lunch Program

Operating funds from several sources are available to fund a school meals program. The most significant of these, for many school food authorities (SFAs, the entity responsible for administering the NSLP at the school or school district level), is reimbursement, the federal cash assistance payable to participating schools for reimbursable lunches served to eligible children. Other sources include payments made by parents and sales of a la carte items. The Healthy Hunger Free-Kids Act of 2010 (HHFKA)(2010) makes several changes in funding, including setting minimum prices for meals served to children not eligible for free or reduced price meal benefits, minimum mark-up rates for a la carte sales, and performance payments.

Federal reimbursement. Federal reimbursement is provided by the United States Department of Agriculture (USDA) to states, to distribute to SFAs. USDA annually sets the National Average Payment (NAP) and the maximum reimbursement rate for meals served to

eligible children, adjusting them each July based on the Food Away From Home series of the Consumer Price Index for All Urban Consumers. Higher payments are made to Alaska and Hawaii than are made in the 48 contiguous states, the District of Columbia, U.S. Virgin Islands, Puerto Rico, and Guam, to reflect higher costs of living (National School Lunch, Special Milk, and School Breakfast Programs, National Average Payments/Maximum Reimbursement Rates, 2013).

The NAP is broken into two parts, Section 4 factors and Section 11 factors, named according to the sections describing and authorizing them in the NSLP enabling legislation, the Richard B. Russell National School Lunch Act (2010). Section 4 payments are provided for food assistance, while Section 11 payments are to assist SFAs in providing free or reduced price lunches to eligible children.

Two payment levels are provided under Section 4, a lower level for lunches served by SFAs in programs in which less than 60% of meals are served to children eligible for free or reduced price meal benefits and a higher level for SFAs serving a higher proportion of children eligible for free or reduced price meals. The higher payment is a few cents more than the lower payment. Both higher and lower payment levels are uniformly set for all lunches without regard to the eligibility for free or reduced price meal benefits of the individual children, or the geographic location of the program. Section 4 also provides for an additional six cents per meal in assistance paid to SFAs that have demonstrated compliance with menu planning requirements of the HHFKA (National School Lunch, Special Milk, and School Breakfast Programs, National Average Payments/Maximum Reimbursement Rates, 2013). See Table 1, below, for a summary of NAP funding in school year 2013-14

Section 11 payments are also higher for meals provided in Alaska and Hawaii. Because these payments are to support the provision of meals to children who qualify for free or reduced price benefits, payments are only made for meals served to these children, and nothing for meals served to other children. Children are eligible for free meals if their household income does not exceed 130% of the federal poverty level (Child Nutrition Programs, 2012) or if they qualify under other provisions (United States Department of Agriculture, Food and Nutrition Services, Child Nutrition Programs, 2011). Children are eligible for reduced price meal benefits if their household income exceeds 130% but falls at or below 185% of federal poverty levels and they do not qualify under other provisions (Child Nutrition Programs, 2012; United States Department of Agriculture, Food and Nutrition Services, Child Nutrition Programs, 2011). Payment for meals provided to children who are eligible for free meal benefits are 40 cents per meal higher than for meals provided to children who are eligible for reduced price benefits (National School Lunch, Special Milk, and School Breakfast Programs, National Average Payments/Maximum Reimbursement Rates, 2013). See Table 2-1, below, for a summary.

Insert Table 2-1 here.

Commodity support. SFAs may receive commodities (donated foods), or cash in lieu of commodities, through USDA for all reimbursable lunches served. The value of the donated foods for which an SFA is eligible in the current year, called entitlement, is based on the number of reimbursable lunches served in prior years, multiplied by a rate set annually by USDA. SFAs may receive additional foods, over and above the entitlement, as additional foods come available through other USDA actions (Food Distribution Program: Value of Donated Foods From July 1, 2013 through June 30, 2014, 2031; United States Department of

Agriculture, Food and Nutrition Services, 2012b). In school year 2013-14, the entitlement was $0.2325 per lunch.

State support. States are required to provide matching funds, no less than 30% of federal money received under Section 4, but several conditions and exemptions based on situations such as participation rates, or state-level prohibitions against financial support of non-public schools, for example, may reduce state matching requirements or exempt the state altogether (National School Lunch Program [NSLP], 2012b). In 2010, 29 states provided state support of school meals (M. C. Martin, 2010).

Payments for Meals by Families and Students

Payments for reduced price meals. Students are eligible for reduced price meal benefits if their household completes an application and the total household gross income ranges between 130% and 185% of the federal poverty level (Child Nutrition Programs, 2012). The maximum charge for a lunch provided to a student who is eligible for reduced price meal benefits is set by Congress (Healthy Hunger Free-Kids Act of 2010, 2010), currently 40 cents. SFAs may charge less. When the 40 cents is added to Sections 4 and 11 reimbursements, total revenue for a reduced price meal is the same as a free meal.

Payments for paid meals. Prior to the reauthorization legislation of the HHFKA (2010), SFAs were free to set prices as they wished for meals served to students not eligible for free or reduced price meal benefits. New rules, however, require schools to raise prices for meals served to students who were not eligible for free or reduced price meal benefits, until the "level of financial support" (payments and other non-federal funding plus federal reimbursement) for paid meals is approximately the same as that of free and reduced meals (The National School Lunch Program: School Food Service Account Revenue Amendments

Related to the Healthy, Hunger-Free Kids Act of 2010, 2011, p. 35,301). The rule, termed the equity pricing rule, requires SFAs to raise prices by at least five cents annually until their paid meal price, plus any other non-federal sources of support, approximates Section 11 reimbursement for free meals.

Some SFA administrators, prior to the HHFKA (2010) requirements, purposefully kept prices low to make the program more accessible to families (Becknell, 2012; School lunch price increase, 2012). Others used careful management practices to maintain prices that covered costs (Barrett, 2012); still others purposefully chose to subsidize the cost of meals programs from the school district's general fund (Domke, 2012). Many school districts seem to have thoughtfully considered such issues as the effect of price increases on families, the effect of making repeated small increases over several years instead of one substantial increase, program solvency, or improvements possible with projected revenue increases (Arndt, 2012; District fills positions; increases meal prices, 2012; Fehr-Snyder, 2012; Hanson, 2012; Mayer, 2012; Schultz, 2012).

There currently is no central repository of information about the prices charged for paid meals in the nation's schools. Reporting and publishing these data will be an outcome of the equity pricing rule (The National School Lunch Program: School Food Service Account Revenue Amendments Related to the Healthy, Hunger-Free Kids Act of 2010, 2011).A convenient sampling of school lunch prices for school year 2012-13, from around the U.S and including several schools in Iowa, is presented at Table 2-2. It should be noted that school districts are not uniform in their designations of grades in elementary, middle, and high schools, but the range of paid prices, from $1.75 at Gothenburg NE, to $3.00 at Chandler AZ, is an indication that revenues per paid meal are far from uniform across the nation. SFAs must

sell reimbursable meals as a unit, with no discount "if the student does not take a food item or requests smaller portions" (NSLP, 2012a, §210.10(a)(2)).

Insert Table 2-2 here.

Of interest is the decision and method employed by Lonedell MO, to keep its prices for paid meals low. The district utilizes a foodservice management company, which charges the district a specific price for each meal. The district sets the price charged to students, and then pays from the school general fund the difference between the meal price charged by the management company and the price paid by students (Domke, 2012).

A la carte and similar sales. Food items other than those available as part of a reimbursable meal may be offered for sale. When made available for sale during meal periods in the meal service and dining areas, these foods, called competitive foods, are regulated to some extent by USDA. Some foods, called foods of minimal nutritional value, are prohibited during meal times in the service and dining areas (NSLP, 1994). USDA had required that sales of competitive foods be regulated by SFAs or states, to control what is served and to ensure that income from the sale "accrues to the benefit of the nonprofit school foodservice or the school or student organizations approved by the school" (NSLP 1994, §210.11(b)). Vending operations have been governed by the same rules as a la carte sales. In late 2013, however, USDA published guidance that required all revenue from non-program food sold anywhere on the school campus at any time to accrue to the school meals fund); non-program food was defined as any food purchased with program funds and sold not as part of a reimbursable meal (USDA, 2013).

USDA has promulgated an interim final rule regulating foods sold in competition with reimbursable meals, to take effect July 1, 2014. The rule includes standards for calories,

sodium, fat, *trans* fat, sugar, caffeine, whole grain content, and portion size. The financial effect of this rule is not known (National School Lunch Program and School Breakfast Program: Nutrition Standards for All Foods Sold in School as Required by the Healthy, Hunger-Free Kids Act of 2010, 2013). In Iowa, the Healthy Kids Act (2007) places additional restrictions on sales of food in competition with reimbursable meals, during the school day. Restrictions are placed on total calories, fat, saturated fat, trans fats, sugars, and sodium; however, additional portions of food items served as part of a reimbursable meal may be served as an a la carte offering as frequently as they are offered in a reimbursable meal, and are generally exempt from any additional restrictions. Additional exemptions are extended to foods with nuts and seeds, reduced fat cheese, fruit, yogurt (Healthy Kids Act, 2007). Local school wellness policies may place further restrictions on a la carte sales. USDA notes that no state or local rule meets the requirement of the interim final rule, implying that all schools will require some degree of adjustment in their program offerings (National School Lunch Program and School Breakfast Program: Nutrition Standards for All Foods Sold in School as Required by the Healthy, Hunger-Free Kids Act of 2010, 2013).

USDA (2013) recently published policy guidance regarding the sale of non-program food on school campuses, and cautioned schools that all costs, including labor, must be included in the sale price. USDA acknowledged that estimating those costs can be difficult for schools. Schools may also enter into relationships with other feeding programs, such as Meals on Wheels, off-site day care programs, and senior dining centers, to provide meals under contract. Costs of these services must be covered in the prices charged; discounts are not allowable costs to the meals program (Cost Principles for State, Local, and Indian Tribal Governments, 2005).

Effects of increasing prices. The level of participation in reimbursable meals due to the requirements in the area of pricing is expected to change: increased prices of a la carte items is expected to increase participation, but the increased price of paid meals is expected to reduce participation, and the combined effect remains to be seen (NSLP, 2010; United States Department of Agriculture, Food and Nutrition Services, Special Nutrition Programs, 2010).

While the pricing requirement is expected to yield increased revenue to school meals programs (National School Lunch Program: School Food Service Account Revenue Amendments Related to the Healthy, Hunger-Free Kids Act of 2010, 2011), program-wide funding changes in the 1980s that resulted in increased paid meal prices brought about significant, years-long reductions in participation (Lutz, Hirschman, & Smallwood, 1999; USDA, 2012).

Costs in School Foodservice

Allocation Methods of Measuring Costs

Cater, Conklin, and Cross (2005) developed a manual based on best practices, to guide SFAs in managing the financial operation of the NSLP. Cost, both total cost and the discrete costs of food, labor, equipment or other expenditures, is "determined by dividing total expenditures for a given reporting period (day, week, month, quarter, year) by total meal equivalents during the same period" (Cater, et al., 2005, p. 68). This method, called allocation, was used in the USDA cost study (2008).

In for-profit applications such as restaurants, food costs are considered variable costs and selling price is strongly affected by food cost (Keiser, DeMicco, Cobanoglu, & Grimes, 2008; Schmidgall, 1997). In school meals programs, because reimbursable meals must be priced for sale as a unit (NSLP, 2012a), adjusting prices for food items in a meal, based on

food cost, is not possible. Cross and Watkins (2008) recommend basing prices of items sold a la carte on factors including cost to prepare, demand, competition, perception of value by the customer, and nutrient contribution. However, the method provided by them is based on raw food cost and a markup percentage, and the difference between selling price and food cost is described as available "to cover labor and other costs" (p. 321). No method to determine labor per item is discussed. When applied to labor costs, the allocation method is similar to labor analyses calculated as cost or hours of labor per meal; it is common in restaurants and other commercial for-profit operations (Keiser, et al., 2008), and is sometimes called average cost (Schmidgall, 1997). The allocation method assumes that every meal requires the same level of resource expenditure and that total production labor is essentially fixed. In menus with similar products each requiring different amounts of labor to prepare, this method will result in some menu items allocated the right amount of labor, others labor in excess of their actual use, and others less labor than is required. This will be discussed in more detail below, under the heading Activity Based Costing.

In school meals programs in Iowa, foodservice workers are generally employed under a contract, with the number of hours worked daily and the number of days per year specified. There is very little variation in labor from one day to the next. Labor is a fixed cost per day or year.

Meal equivalents. The cost allocation formula proposed by Cater, et al., (2005) requires the SFA to convert all meals and sales (a la carte and similar) to a single unit, meal equivalents (ME). Each ME is presumed to be approximately the same in resource consumption as a reimbursable lunch. In this application, <u>all</u> costs, including food, are allocated, and cash sales (including a la carte sales, vending, catering, contracted sales, etc.) are

converted to MEs. Cross and Watkins (2008), in reference to the conversion formula, describe it as "a statistical tool to allocate costs based on a unit of production" (p. 325). However, NFSMI's financial management training manual (2010) clearly describes the formula as "only recommendations," having been reviewed by "a nationwide panel" prior to its inclusion in the manual (p. 82), but not based on research. The conversion factors for breakfasts, reimbursable snacks, and cash sales are thus: 1 ME = 1 lunch = (3 breakfasts/2) = 3 snacks = [cash sales/(free reimbursement + commodity support)] (Cater, et al., 2005).

The faults of the formula are easily apparent and intuitive. For example a meal with school made lasagna, school made bread roll, fresh mixed vegetable salad, an assortment of cut-up fresh fruit, and milk will differ in both food and labor costs from a meal with hot dog on a bun, canned baked beans, carrot sticks, canned applesauce, raisins, and milk. Three breakfasts of cold cereal, toast, juice and milk are not the same as two of the above-described lunches of lasagna, in either food cost or labor.

Further complicating the issue is offer versus serve, a program instituted by USDA to reduce food waste; under this program, mandatory in senior high schools and optional in all other grades, students may take as few as three items from a lunch menu but still have the meal earn sales revenue or reimbursement at full rates (NSLP, 2011). This adds another level of variability to the ME conversion calculation: students served the lasagna meal may take any three of the components, so long as one is fruit or vegetable (NSLP, 2010b). For example, mixed salad, bread roll, and milk would be considered equivalent to a meal including all the menu items. A meal of baked beans, raisins and milk would also be considered equivalent to the full lasagna meal.

The conversion of cash sales to ME is also problematic, but for different reasons. The denominator, free reimbursement plus commodity support, changes from one year to the next at the discretion of USDA, with the NAP usually but not always increasing and the value of commodity support varying (Food Distribution Program: Value of Donated Foods From July 1, 2013 through June 30, 2014, 2013; National School Lunch, Special Milk, and School Breakfast Programs, National Average Payments/Maximum Reimbursement Rates, 2013). Because minimum prices for items sold outside the reimbursable meal are now subject to regulation by USDA, if prices of a la carte items increase more rapidly than the NAP plus commodity rate, and sales volume does not change, it will appear that the SFA is producing more MEs (National School Lunch Program: School Food Service Account Revenue Amendments Related to the Healthy, Hunger-Free Kids Act of 2010, 2011).

School foodservice is not the only foodservice operation struggling with meal equivalents. Hospital-based foodservice has similar issues with defining a meal for both inpatient service and cafeteria sales (Puckett, 2005).

School Meals Cost Study

In a study released in 2008, the cost of operating school meals programs in the U.S. was investigated. It was based on school year 2005-06 costs, and was the second study of a series, the first having been completed in 1994. The study broke costs into food, labor and other costs; it evaluated costs recognized by the SFA and charged off to the meals program (reported costs), those incurred by the district to support and manage the school meals program but not charged to the meals program (unreported costs), and full costs, the sum of reported and unreported costs. Working from a nationally representative sample of SFAs, the study was designed to determine if reimbursement rates were sufficient to cover cost (USDA, 2008).

The districts' own records and practices were studied, to identify the costs the school districts expected to be covered by revenue generated by the program (reported costs), and those costs associated with operating the program but not charged to it (unreported costs). The report of findings was made on two bases. The first, with the unit of analysis the SFA, compares the mean cost to produce a meal in each SFA, without weighting for volume of meals produced (USDA, 2008). This means that the cost of producing a meal in the Los Angeles Unified School District (LAUSD), enrollment of about 660,000 in 2011-12 (Los Angeles Unified School District fingertip facts 2011-2012, n.d.) would be considered comparable and of equal weight to the cost of producing a meal in LuVerne Community School District, LuVerne IA, with 68 students enrolled in 2011-12 (Iowa Department of Education, 2012). This analysis provides information about the experience of the average SFA, and the average cost per meal is strongly influenced by the large number of smaller operations each serving relatively few meals per day.

The second unit of analysis is a meal, across all SFAs studied. In this analysis, the per-meal costs of each SFA was weighted by the number of meals served, the weighted costs of all SFAs were summed, then divided by the total number of meals served by all the SFAs (USDA, 2008). This analysis provides information about the average cost of meals across many districts; the average meal cost is strongly influenced by a few very large districts that each serves many meals daily. An example is presented in Table 2-3, assuming the participation rate is 100% for both districts, LAUSD's meal cost is $2.00 and LuVerne Community School District's cost is $2.10, comparing the two analyses methods.

Insert Table 2-3 here.

The study used weighted allocation methods to estimate the proportion of costs associated with breakfasts, lunches, and other meals. For food, the measure was based on costs of ingredients, menus, recipes, production records of amounts produced, and inventory records. For labor, the director and/or manager of the food production estimated the proportion of time spent by workers on each meal. Other costs were allocated to meals based on food plus labor costs, resulting in meals using greater proportions of the resources of food and labor charged with a higher proportion of other costs; other costs will vary based on food and labor costs (USDA, 2008).

The mean reported cost of a reimbursable lunch, when the unit of analysis was the SFA, was $2.36; when the unit of analysis was a lunch, it was $2.28. Full costs (reported plus unreported) of a reimbursable lunch, when the unit of analysis was the SFA, was $2.91; when the unit of analysis was a lunch, it was $2.79. During the period of the study, the level of reimbursement for a free lunch was $2.51, and 72 % of reimbursable lunches had a full cost greater than the free lunch reimbursement rate (USDA, 2008).

This study found schools to be quite accurate in identifying food costs and charging them to the meals program. Table 2-4 shows a comparison of reported costs and full (reported plus unreported) costs, divided into the three categories studied (food, labor, other), and presented both per meal and per SFA. The reported and full costs of food are the same, whether the calculations are based on a per-meal basis or a per-SFA basis (USDA, 2008).
Insert Table 2-4 here.

There are several issues, however, with interpreting labor costs in this study. An average of 19% of full costs is unreported, with a range up to 40%. Sixty-one percent of all unreported costs are labor; of all labor costs, a mean of about a quarter are unreported. There is

a wide degree of variation between school districts in this area: 4.5% of the participating school districts had less than 10% of their unreported costs as labor, but 7.5% were found to have at least 90% of their unreported costs as labor (USDA, 2008).

The study included in full costs of labor such things as student supervision at meal time; this would be a cost to the school district whose school day extended over the lunch period whether the district participated in the NSLP or not. But some SFAs included this cost in reported costs, all school districts experience it to some degree, and it is an allowable cost (Cost Principles for State, Local, and Indian Tribal Governments, 2005; USDA, 2008).

Some of the full cost labor attributed to school meals programs is administrative labor associated with managing the program, which in many schools is charged to the school general fund; the practice of including or excluding this administrative labor from reported costs varied from SFA to SFA. Over half of schools reported administrative labor contributing less than 20% of total labor costs. Complicating this, though, is the inclusion of equipment maintenance in administrative labor (USDA, 2008).

A more striking comparison in differences in labor occurs when SFAs are compared based on school size, as shown in Table 2-5. The percentage difference between reported cost- and full cost-labor is highest among medium sized schools, about 6%, compared to about 3% for small and large SFAs (USDA, 2008).

Insert Table 2-5 here.

Measuring Labor Costs of Individual Menu Items

There is no recent research available that determines the labor cost of individual menu items in school meals programs. Morrison (1997) estimated labor needs from recipe difficulty in upscale restaurants. Hayes and Huffman (1985) included average fixed cost, including labor,

when assessing contribution to profit of individual menu items. Taylor, Reynolds, and Brown (2009) recommended that restaurant operators look beyond food cost to recognize labor as a variable cost controllable by careful menu planning.

Raab (2003) studied the use of a cost accounting approach, called Activity Based Costing (ABC) for individual menu items in a casino buffet. The method was successful in identifying the labor costs of production of buffet entrees. Further work in a Hong Kong buffet (Raab & Mayer, 2007; Raab, Mayer, Shoemaker, & Ng, 2009), a central production bakery (Vaughn, Raab, & Nelson, 2010), a full service restaurant (Raab, Hertzman, Mayer, & Bell, 2006) and a quick service restaurant (Annaraud, Raab, & Schrock, 2008) demonstrate its applicability to different kinds of food production operations. However, Chan and Au (1998) earlier tried to apply a similar method in a traditional Chinese restaurant without success.

ABC and a variation, Time Driven ABC (TDABC) will be discussed below in detail.

Activity Based Costing

Introduction

In contrast to allocation methods of distributing costs, Activity Based Costing (ABC) is a method to trace costs other than direct costs back to the actual products being produced (Cooper & Kaplan, 1990; Cooper & Slagmulder, 2000; Hicks, 1999; Kaplan, 2000; Kaplan & Anderson, 2007a, 2007b). In doing so, it will help identify high profit products that may have been carrying more than their fair share of indirect and overhead costs and therefore may be overpriced or under-emphasized in the product mix (Cooper & Slagmulder, 2000; DeMeere, Stouthuysen, & Roodhooft, 2009).

ABC has been used in manufacturing (Everaert, Bruggeman, & De Creus, 2008; Greeson & Kocakulah, 2000), government (Vazakidis, Karagiannis, & Tsialta, 2010; Weiss,

1997), banking (Hicks, 1999), and medical services (DeMeere, et al., 2009). It is recognized as capable of accurately discriminating indirect and overhead costs associated with producing similar but not identical products or services, or providing similar services to customers with different needs. The cost discrimination property enables manufacturers, selling and service-providing organizations to identify products that are highly profitable, those that are break even, and those that are losing money (Everaert, et al., 2008; DeMeere, et al., 2009; Greeson & Kocakulah, 2000).

For example, a manufacturer may have a product line of identical items, differing from each other only in color. One color is much more popular than the others, and because it is a predominant part of the business, the production demand for the popular-colored product requires the dedication of one manufacturing line to meet customer needs. The total production demand for all the other colors approximates the demand for the popular color. Another manufacturing line is used to produce all the other colors. In all aspects, the raw material costs for the popular color and the other colors are identical, as are the operating costs of the two manufacturing lines and the pay rates of the workers assigned to each. Under allocation methods, it would be assumed that the cost of producing the items is the same, regardless of color, and that cost of any one of the items is simply total cost divided by number of items produced. Cooper and Kaplan (1990) noted that under a cost system that distributes costs on a straight-line basis; high volume/low cost items are assigned the same cost per item as low volume/high cost products.

However, a careful application of an ABC system would find that these apparently identical items encompassed different costs and different contributions to company profit. While the manufacturing line producing the popular color ran more or less without stopping,

each time color was changed on the other line, there was a period of non-productivity while the old color was cleaned out of the machine and the new color was loaded; this resulted in fewer units produced than on the popular color line. The inventory level of the popular color could be maintained at a lower level than the other colors, because the constantly-running line ensured there would be enough products to fulfill orders in a short period of time; therefore, storage costs for the popular product were lower per item than for all the other. Taking an order for an unpopular color requires more steps because the inventory level must be checked before committing to a delivery date.

If all the products are sold at the same price, the profit per unit for the popularly-colored product is underestimated because the true cost per unit is overestimated using allocation to determine cost. A plan to increase profit based on an across-the-board increase in sales of all products regardless of color will yield less of an increase than a plan to increase sales only of the popularly-colored product. Substituting sales of products in unpopular colors with sales of the popular color, even if sales price and total sales remain constant, will increase profit. However, only by knowing the true cost of manufacturing the products will this be apparent.

ABC is also helpful in make-versus-buy decisions (Cooper & Slagmulder, 2000; Hicks, 1999; Vaughn, et al., 2010), product mix decisions (Cooper & Kaplan, 1990; DeMeere, et al., 2009; Maccarrone, 1998), comparisons of alternate processes (Cooper & Kaplan, 1990; DeMeere, et al., 2009; Morrison, 1997; Vazakidis, et al., 2010; Weiss, 1997), and pricing decisions (Keiser, et al., 2008). ABC may also be helpful in detecting variations from preferred or required processes, in that work flow must be mapped and control charts developed (Brimson & Antos, 2004). Deciding if outsourcing will improve profitability cannot

be based on allocated costs. In the example above, it may be more profitable to remove the most unpopular colors from regular production, and offer them only on a special order or high minimum order basis, which will cause the purchasing customers to carry the cost of production, rather than subsidizing the cost of the more expensive product by all customers.

Implementation

Implementing an ABC system of cost tracing is a labor intensive task, and there is some skepticism in product and service industries about whether the labor to implement the system is returned in cost savings or increased profit (DeMeere, et al., 2009; Everaert, et al, 2008; Greeson & Kocakulah, 2000; Major & Hopper, 2005). Cooper, Kaplan, Maisel, Morrissey, and Oehm (1992) noted that even in large, motivated manufacturing operations, putting too much focus on measurement and too little on implementation will result in disinterest. Hicks (1999) notes that in order to be effective, a cost information system must identify and measure costs properly, costs (inputs) must be well linked by cause and effect relationships with products (output), the information must be used in appropriate ways.

A modification of ABC, called time-driven ABC (TDABC), simplifies ABC by measuring time units of labor, machine use, and the cost associated with each time unit (Kaplan & Anderson, 2007a, 2007b). This significantly increased the usefulness of the process because relevant costs could be easily measured in time units, costs of time units were easy to calculate, the cause and effect linkage was easily apparent, and the information could be applied to operational processes even in relatively unsophisticated companies.

Capacity

Capacity is the level of a resource available to do work, make a product or provide a service (Turney, 2005). Theoretical labor capacity is the sum of all paid labor hours.

However, employees may take vacations or other paid time off; this time is included in maximum capacity but is not available for work. Deducting from theoretical capacity all paid time off, time needed for meetings or training, and similar kinds of claims on work time, during which products are not made and services not delivered, results in practical capacity (DeMeere, et al., 2009). The portion of practical capacity that is not expended doing work is called excess or unused capacity (Hansen & Mowen, 2006). A rule of thumb is that practical capacity is about 75% of theoretical capacity (DeMeere, et al., 2009; Turney, 2005).

Manufacturing processes typically have long runs of producing identical products that can move into inventory for eventual sale. Restaurant foodservice has peaks and valleys of production based on customer demand, resulting in periodic excess capacity (Keiser, et al., 2008). School foodservice operates in a realm between manufacturing and restaurant foodservice, making several relatively large batches of product each day, but different products from day to day, and subject to customer demand; additionally, the products are perishable and cannot be stored for eventual sale. To my knowledge, capacity has not been studied in school foodservice.

ABC in Hospitality

Few applications of ABC or TDABC have been conducted in the hospitality field. A series of articles describe the implementation of ABC or TDABC in a casino buffet(Raab, 2003), a central bakery (Vaughn, Raab, & Nelson, 2010), a hotel buffet (Raab & Mayer, 2007; Raab, Mayer, Shoemaker, & Ng, 2009), a full service restaurant (Raab, Hertzman, Mayer, & Bell, 2006), and a quick service restaurant (Annaraud, Raab, & Schrock, 2008) have demonstrated the usefulness of ABC or TDABC in tracing costs in foodservice operations. Most significantly, it has been applied to make-versus-buy decisions (Vaughn, et al, 2010) and

to the identification of costs of individual items served on a buffet (Raab & Mayer, 2007); these are critical questions in school meals programs, as SFAs must decide whether site preparation of products is desirable or even possible (as opposed to purchasing heat-and-serve products). The school meals cost study (USDA, 2008) indicates there is quite a bit of variation between labor costs the school districts recognize and the full labor costs of operating a program, and there is no information to my knowledge about the time required to prepare specific products. In earlier research, however, Chan and Au (1998) did not succeed in applying cost tracing methods in a Chinese restaurant.

Menu Planning

Menu Planning in the National School Lunch Program

Oakley (2008) recommended developing a menu for NSLP with a "careful mix of higher-priced items with lower-priced ones," to "help balance" the cost of the menu (p. 377). There is no known research or resource that explains how to develop this careful mix in the NSLP, though there are some general guidelines about menu development that are instructive (McCaffree, 2009). Research data about acceptability of products to student customers in NSLP are also available (Condon, Crepinski, & Fox, 2009; Marlette, Templeton, & Panemangalore, 2005).

In NSLP, menus must be planned within the production capacity of equipment and the availability of labor, keeping in mind that large numbers of student customers must be fed in short periods of time, sometimes in successive groups. Given the unit pricing requirement of the NSLP (NSLP, 2012a), SFAs may not "price" individual meal items separately. It is apparent from the context that Oakley is referring to a mix of items, some with higher costs of production and others with lower costs of production. Basing this decision on food cost alone

masks the impact of labor on production. Oakley does not describe how to achieve this cost balance.

Menu planning in the NSLP has been regulated from the program's beginning, focusing on the two-pronged mission to improve the nutritional status of children and to support agricultural markets (NSLA, 1946). In 2010, the menu planning requirements were changed for the first time in fifteen years, increasing the quantity and variety of vegetables and the proportion of grains required to be predominantly whole; additionally, upper and/or lower limits were established for many nutrients (HHFKA, 2010; NSLP, 2012a). These changes aligned the NSLP meal requirements more closely to the 2010 Dietary Guidelines for Americans, but were expected to increase food costs for a lunch by ten cents (U. S. Department of Agriculture [USDA] & U.S. Department of Health and Human Services [HHS], 2010; HHFKA, 2010).

Menu Planning in Restaurants

In restaurant foodservice, as a comparison, menu analysis and menu engineering have been employed to classify menu items by their contribution to restaurant profit and financial success, utilizing various combinations of food cost, sales volume, fixed and variable costs, and other factors (Bayou & Bennett, 1992; Hayes & Huffman, 1985; Kasavana & Smith, 1982; LeBruto, Ashley, & Quain, 1995; 1997; Morrison, 1997; Pavesic, 1983; Taylor, et al., 2009). Some (LeBruto, et al., 1995; Morrison, 1997; Taylor, et al., 2009) considered estimates of labor as factors in their analyses.

Some of these processes utilized a four-celled matrix-based analysis (Kasavana & Smith, 1982; LeBruto, et al., 1995; Miller, 1980; Pavesic, 1983), with menu items categorized as worth keeping on the menu or not worth keeping. The matrices varied in how the elements

were measured, with some using gross dollars of profit, percentage of profit over food costs, or contribution to overall restaurant profit, for example. Generally, one matrix cell identified menu items that were both profitable and popular, and one cell identified menu items that were below acceptable levels of both profitability and popularity. Each matrix, however, also included two other cells that required the operator to make subjective judgments about keeping the items on the menu. The items in these cells were either not particularly profitable but popular or were they profitable but unpopular, but did their inclusion on the menu add to the over-all experience the operator sought? Did their exclusion improve the profitability of the restaurant? The position of an individual menu item in the matrices varied somewhat depending on the method; a menu item could fall from "desirable on the menu" to a position in need of subjective review without changing in price, cost, or popularity if other items on the menu had been changed and the basis of evaluation was a comparative ranking or average costs (Hayes & Huffman, 1985). Morrison (1997), in particular, recommended including barely-profitable menu items in an effort to add interest and the artistry of the chef to the menu. Raab and her associates (Annaraud, et al., 2008; Raab, 2003; Raab, & Mayer, 2007; Raab, et al., 2006; Raab, et al., 2009; Vaughn, et al., 2010), took more direct measurements of labor, and incorporated menu analysis and engineering techniques in identifying menu items that contributed to profitability (Raab & Mayer, 2007). When menu analysis processes included food costs and labor as direct costs, the contribution of each menu item to restaurant profitability resulted in identifying menu items that appeared to be profitable when food costs alone were considered but were not profitable when the labor costs of production were considered (Annaraud, et al., 2008; Raab, & Mayer, 2007; Raab, et al., 2006; Raab, et al., 2009).

Summary

The NSLP has grown more than four-fold from the Depression-era 23,000 schools (Gunderson, 1971) to the 2011 program, with over 5 billion lunches served annually and over 100,000 participating schools (United States Department of Agriculture, Food and Nutrition Services, Financial Management, 2012). Changes in school meals programs, due to the provisions of the Healthy Hunger Free Kids Act (2010), have had and continue to have far-reaching consequences. Changes in food requirements, such as increasing the number, kind and variety of vegetables, is expected to increase costs at lunch by ten cents but reimbursement payments will only increase six cents (NSLP, 2010). Raising paid meal prices and requiring mark-up percentages of a la carte items to replicate the food cost percentage of reimbursable meals will probably change the participation level and revenue, but historical indicators contradict USDA simulations (Lutz, et al., 1999; The National School Lunch Program: School Food Service Account Revenue Amendments Related to the Healthy, Hunger-Free Kids Act of 2010, 2011; USDA, 2012). Changes in a la carte offerings will have an unknown impact on sales and revenue (National School Lunch Program and School Breakfast Program: Nutrition Standards for All Foods Sold in School as Required by the Healthy, Hunger-Free Kids Act of 2010, 2013).

Schools have demonstrated in the cost study conducted by USDA (2008) that they are capable of recognizing and charging to the school meals account the cost of food. Costs of labor, however, showed variation of more than thirty cents per meal between full and reported costs. Recommended methods to determine labor costs per meal involve straight-line allocations, without regard to menu complexity or composition (Cater, et al., 2005).

Costs of labor associated with individual menu items are not well measured in for-profit (restaurant) hospitality applications, or in school meals programs. This lack of data complicates menu-planning decisions, because labor and other costs are allocated either on the straight-line basis as part of fixed cost or in proportion to other variables such as food cost and popularity of the item (Bayou & Bennett, 1992; Hayes & Huffman, 1985; Kasavana & Smith, 1982; LeBruto, et al., 1995; 1997; Morrison, 1997; Pavesic, 1983). No method is known to exist in school meals programs to determine suitability of particular menu items based on cost, though achieving a balance is recommended (Oakley, 2008).

Activity based costing has been found to be helpful in tracing costs to product, and determining the full cost of a product (Cooper & Kaplan, 1990; Cooper & Slagmulder, 2000; Hicks, 1999; Kaplan, 2000; Kaplan & Anderson, 2007a, 2007b). It has been applied in a modified format, based on time units, to for-profit foodservice operations (Annaraud, et al., 2008; Raab, 2003; Raab, & Mayer, 2007; Raab, et al., 2006; Raab, et al., 2009; Vaughn, et al., 2010). The applicability of this method to school foodservice is untested.

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Table 2-1.

Summary of NAP Funding in the Contiguous States under the National School Lunch Program

Meal Eligibility Level	Section 4, < 60% Free/Reduced Price Served	Section 4, ≥ 60% Free/Reduced Price Served	Section 4, additional assistance	Section 11	Total NAP, < 60% Free/Reduced Price Served	Total NAP, ≥ 60% Free/Reduced Price Served
Free Meals	$0.28	$0.30	$0.06	$2.65	$2.99	$3.01
Reduced Price Meals	$0.28	$0.30	$0.06	$2.25	$2.59	$2.61
Paid Meals	$0.28	$0.30	$0.06	$0.00	$0.34	$0.36

National School Lunch, Special Milk, and School Breakfast Programs, National Average Payments/Maximum Reimbursement Rates, 2013

Table 2-2.

Selected Paid School Lunch Prices for School Year 2012-13

School District Name, State	Elementary School	Middle School	High School
Section 11 NAP[a]	2.59	2.59	2.59
Braintree, MA[b]	2.25		2.75
Bushland, TX[c]	2.30	2.45	2.45
Chandler, AZ[d]	2.50	2.75	3.00
Clover, SC[e]	2.00	2.25	2.25
Des Moines, IA[f]	2.45	2.50	2.55
Dexter, MI[g]	2.50	2.75	2.75
Gothenberg, NE[h]	1.75		2.20
Janesville, WI[i]	2.10	2.35	2.45
Lonedell, MO[j]	1.75	1.75	1.75
Mason City, IA[k]	2.20	2.45	2.45
Quitman, TX[l]	2.25	2.25	2.25
Red Oak, IA[m]	1.90	2.05	2.05
St. Clair, MO[n]	2.15	2.25	2.25
Turkey Valley, IA[o]	1.85	2.10	2.10
Wilkes County, NC[p]	1.85	2.10	2.10

[a] National School Lunch, Special Milk, and School Breakfast Programs, National Average Payments/Maximum Reimbursement Rates, 2012; [b]Hanson, 2012; [c]Mayer, 2012; [d]Fehr-Snyder, 2012; [e]Becknell, 2012; [f]Meal rates, loan program & procedures (n.d.); [g]Arndt, 2012; [h]Barrett, 2012; [i]Schultz, 2012; [j]Domke, 2012; [k]Lunch menu/cafeteria (n.d.); [l] District fills positions; increases meal prices, 2012; [m] Red Oak Community School Registration, n.d.; [n]Domke, 2012; [o] Welcome to Turkey Valley School District, 2012; [p] School lunch price increase, 2012.

Table 2-3.

Comparison of Analytic Methods

District	Number of students	Unit of analysis is SFA	Unit of analysis is a meal
LAUSD	660,000	$2.00	$1,320,000
LuVerne Community School District	68	$2.10	$142.80
Mean cost per meal		$2.05	$2.01

Table 2-4

Comparison of Mean Reported and Full Costs in School Meals Programs

Unit of Analysis	All Costs		Food Costs		Labor Costs		Other Costs	
	Reported	Full	Reported	Full	Reported	Full	Reported	Full
Per SFA	$2.36	$2.91	$1.09	$1.09	$1.05	$1.39	$0.23	$0.43
Per meal	$2.28	$2.79	$0.98	$0.98	$1.04	$1.36	$0.25	$0.45

USDA, 2008

Table 2-5

Food, Labor, Other Costs as a Percentage of All Costs, by District Enrollment

	Food Costs		Labor Costs		Other Costs	
	Reported	Full	Reported	Full	Reported	Full
Small SFA (<1k students)	46.0	37.1	46.3	49.0	7.7	13.9
Medium SFA (1k≤5k students)	46.6	37.3	41.9	47.5	11.5	15.3
Large SFA (≥5k students)	42.8	35.0	45.8	48.7	11.4	16.3

USDA, 2008

CHAPTER 3. METHODOLOGY

Introduction

Many changes to school meals programs have been required in recent years, not the least of which is the preparation and service of more items per meal, more variety in the menu items, closer attention to nutrient content, and pricing restrictions. Increasing the number and complexity of menu items probably increases the labor needed to produce them. Menu planning methods in school meals programs do not address the need to balance costs against revenue. While schools are able to identify food costs with accuracy, they exhibit wide variation in their abilities to identify labor costs associated with meals programs (United States Department of Agriculture, Food and Nutrition Services, Special Nutrition Programs [USDA], 2008). The common cost accounting methods utilized in school meals programs is a straight-line allocation of all costs per meal (Cater, Conklin, & Cross, 2005), which does not equip schools to differentiate the costs for particular items on the menu.

This study sought to determine if direct labor costs of food production in school meals programs can be quantified, utilizing activity based costing methods similar to those applied in restaurant foodservice by Raab and her associates (Annaraud, Raab, & Schrock, 2008; Raab, 2003; Raab & Mayer, 2007; Raab, Mayer, Shoemaker, & Ng, 2009; Vaughn, Raab & Nelson, 2010). Further, it focused on utilizing menu analysis processes such as those used to optimize profits in restaurants (Annaraud, 2007; Hayes & Huffman, 1985; Kasavana & Smith, 1982; Miller, 1980; Pavesic, 1983; Raab & Mayer, 2007; Raab, Hertzman, Mayer, & Bell, 2006) to determine if particular menu items can be prepared within existing resources or if changed levels of labor are needed.

This research focused on direct, value-adding labor expended as part of production of specific food items prepared on site and offered for sale as part of a reimbursable lunch meal and as additional sales under a la carte processes. The study was limited to direct, value-adding labor for several reasons. Firstly, it was assumed that direct, value-adding labor comprised a substantial portion of the labor expended in a meals program. Secondly, work adding value to the products studied tended to be done in a limited number of locations in a kitchen and by few employees; this contributed to being able to observe the work in its entirety.

Eight entrees were analyzed in this study; they are discussed in more detail below. These are the research questions:

1. Can Time Driven Activity Based Costing (TDABC) be applied in school meals programs to measure direct labor associated with production?
2. Do TDABC-based measurements of labor costs differ from allocated labor costs in school meals programs?
3. Are TDABC-based measurements of labor costs for specific food products sufficiently sensitive to discriminate between the food products?
4. Can menu analysis processes be applied to school meals programs?
5. Does inclusion of costs of direct labor in menu analysis improve the usefulness of the menu analysis process in school meals programs?
6. Does the cost associated with conducting TDABC justify its use, as demonstrated by cost benefit analysis?

Human Subjects

The Iowa State University (ISU) Institutional Review Board (IRB) reviewed and approved the proposal for this study, to guarantee the health, safety, and rights of the

participants: the approval and amendments are attached as Appendix A. The researcher and all persons assisting the researcher in data gathering or analysis completed the Human Subject Research Assurance Training by Iowa State University.

Selection of School Sites

The USDA cost study (2008) indicated that medium sized schools demonstrated a wider gap between reported and full labor costs. Iowa schools are predominantly of the size designated as "medium" in the cost study, or enrolling 1000 to 5000 students, or "small," with fewer than 1000 students; very few Iowa schools meet the definition of "large," enrolling more than 5000 students (Iowa Department of Education, 2012; USDA, 2008). See Figure 3-1 for a breakdown of Iowa public school district enrollment characteristics at the inception of the study.

Insert Figure 3-1 here.

Three central Iowa school districts meeting the definition of small (less than 1000 students) or medium (1000 to 4999 students), as defined in the cost study (USDA, 2008), agreed to act as participating sites for the research. Tables 3-1 through 3-6 describe the three districts.

District A

District A was formed in the 1980s through the merger of two small districts (district website, December 30, 2013). District A is comprised of three small towns plus the rural areas surrounding these towns, with a school building located in each town. It is the smallest of six public school districts located in the county (Iowa Department of Education, 2012); a non-public school is also located within the county (Iowa Department of Education, 2013a). Total population of the three towns is about 1,750 persons, but demographic data such as

race/ethnicity, age, and gender for these towns are not yet available from the 2010 census (United States Census Bureau, 2010). Total district enrollment in school year 2011-12 was about 460 students from pre-kindergarten through twelfth grade, almost all white/Caucasian and not of Hispanic ethnicity. Approximately 31.5 % of students qualified for free or reduced price meal benefits (personal communication, District A superintendent, January 18, 2014; Iowa Department of Education, 2013a). This district has been undergoing a multi-year process to address serious financial issues; several capitalization bonds recently have received voter approval, enabling the district to upgrade buildings, infrastructure, and class offerings. Sharing agreements are in place between the district and the local community college to provide vocational and advanced academic courses (district website, December 30, 2013). Table 3-1 provides available demographic details about the area and Table 3-2 more details about this district's meals program and facilities.

Insert Table 3-1 here

Insert Table 3-2 here

District B

District B is the largest district in its county and has been in merger and whole grade sharing relationships with other smaller districts (personal communication, District B superintendent, December 31, 2013). All school buildings at the time of the study were located within one incorporated town. There are no non-public schools in the county. County population was about 9,300 in the 2010 census, and was predominantly white/Caucasian and not Hispanic (United States Census Bureau, 2010). Total district enrollment in school year 2011-12 was about 1,600 students from pre-kindergarten through twelfth grade including those participating in whole grade sharing; about 9.4% of students reported their race as non-

white/Caucasian and 6.7% reported their ethnicity as Hispanic (personal communication, District B superintendent, December 31, 2013; Iowa Department of Education, 2012). Approximately 48% of students qualified for free or reduced price meal benefits (personal communication, District B superintendent, December 31, 2013; Iowa Department of Education, 2013a). Table 3-3 provides demographic details about the district, the area and the state of Iowa; Table 3-4 provides further details about this district's meals program and facilities.

Insert Table 3-3 here

Insert Table 3-4 here

District C

District C is one of several public districts and non-public schools in the county (Iowa Department of Education, 2012, 2013a). District C is the largest of the three districts studied (Iowa Department of Education, 2012), is located in the largest, most ethnically diverse town (United States Census Bureau, 2010) , and is the most ethnically diverse district of the three districts studied (Iowa Department of Education, 2013a). Greater than 60% of District C students, at every school, qualify for free or reduced price meal benefits (Iowa Department of Education, 2013c). The district has not met annual yearly progress under the federal No Child Left Behind program (district website, January 1, 2014); one school earned an award under the USDA program Healthier US School Challenge prior to the commencement of this study (School district C, personal communication, May, 2012). Table 3-5 provides demographic details about the district, the area and the state of Iowa; Table 3-6 provides further details about this district's meals program and facilities.

Insert Table 3-5 here

Insert Table 3-6 here

Equipment

The kitchens are generally equipped with usual, common commercial production and holding equipment (ranges, convection ovens, hot holding cabinets, steam tables, refrigerators, freezers, countertop food processors), but only some sites are equipped with floor mixers, table mixers, combination steamer/ovens, steam jacketed kettles, or tilting skillets/braziers. No site is equipped with a mechanical vegetable peeler, vertical cutter mixer, or buffalo chopper. An equipment inventory appears as Table 3-7, below. Floor plan sketches of kitchens are included as Appendix B.

Insert Table 3-7 here

Selection of Participants

Staff employed in the production of school meals at each of the districts was asked to participate. All regularly scheduled employees were contacted and asked to participate; staff who work as substitutes were not included because no substitute worked at least one day each week. Staff involved in sanitation activities only were not included.

Consent

The school boards of each district met the researcher, were apprised of the nature of the research, and agreed by motion to act as host sites for the research; redacted copies of relevant sections of the minutes, to preserve confidentiality of the participants, are included as Appendix C. Recruitment letters to participants clearly explained the purposes of this research, described the methods to be employed, and assured confidentiality of their responses; a copy is included as Appendix D. These letters were distributed to workers at the school district

foodservice work sites, as a recruitment tool. Workers were also given a $10 gift card to local grocery stores as a token of appreciation.

Individual employee-participants were provided consent forms approved by the Iowa State University IRB, describing the study, their role in the study, and the use of data gathered through direct observations and video recording of work, examination of payroll and benefit records, and focus group participation, as part of the study. A copy of the consent form is included as Appendix E. Consent was voluntary on the parts of individual employees, employees were permitted to withdraw consent at any time, and no compensation was provided.

Confidentiality

The names of the school districts and the identities of individual employees are confidential and will remain confidential in this publication Districts have been referenced using single letter identifiers. Each participating employee selected a four digit number identifier using a random number-generator die; the number was used to manage data associated with individual participants. Electronic data were stored on a password-protected external hard drive and uploaded to a secure ISU server. Paper records and the external hard drive were stored under lock and key; access to the ISU server was restricted.

Participant demographics

Study participants were asked to provide demographic information during the interviews designed to gather information about capacity. The interview process is described in more detail under capacity, below. The interview questions are included as Appendices F and G; manager and employee questions, respectively. A summary of the demographic characteristics of the participants is included at Appendix H.

Method

Selection of Products

In consultation with the managers of each district's meals program, entrees were selected for study. As much as possible, the same entrees using the same or very similar standardized recipes and comparable ingredients were used throughout the study at all sites. Final entrée choices included pasta meat sauce casseroles, cheese macaroni beef casseroles, meat and noodle casseroles, and chili. All districts employed cycle menus; with the cooperation of the districts, the entrees selected for evaluation were positioned in the rotation of food items to facilitate the researcher or an assistant being physically present when the items were being produced, to the extent practicable. Observations were conducted during spring semester, school year 2012-13; due to weather conditions necessitating school closures, fewer observation opportunities were available than were planned. Table 3-8, below, summarizes the entrees studied, the districts and sites where the entrees were prepared, and the number of observations.

Insert Table 3-8 here

Not all entrees were observed at all schools. More than one of the four entree types was observed at each site, with the exceptions of District A and District B site 1, where only one entrée type was observed. In all cases except one, at least two observations were made at each site; the exception was the noodle casserole at District B site 1. At least two observations were made of each entrée over the five sites and a total of 22 observations were completed.

Bills of Activity

For each entrée, a bill of activity was developed. A bill of activity is a list of the activities and their costs associated with a specific cost objective (Raab, 2003). In this study,

the cost objectives are the entrees selected for study, and the costs are restricted to direct, value adding labor. Value adding labor includes washing, trimming, and cutting vegetables; cooking raw meat, pasta or noodles, vegetables, and sandwiches; preparing site-made sauces; assembling casseroles in pans for baking, heating, or serving; or assembling and wrapping individual sandwiches. It does not include receiving, storing, gathering ingredients from storage, or cleaning up.

Beginning with the recipes for each product, each production step was analyzed in collaboration with the managers of each program, to develop a single bill of activity applicable to all districts for each entrée item, as much as was possible. There was expected to be some variation in these bills of activity due to the differences in equipment; these variations were noted in the bills. A summary of the production methods and equipment used for studied entrees is included as Appendix I, along with photos of selected techniques and equipment. Initial bills of activity were developed for each of the four entrée types. They are included as Appendix J.

When observations commenced, it was apparent that the written recipes and bills of activity were not representative of actual practices and that common bills of activity were not possible. Therefore, the common bills of activity were modified to address the differences in product used, equipment employed, and techniques. The final bills of activity are included as Appendix K. More details about modifying bills of activity are included in the discussion on labor demand, below.

Determining Capacities

Theoretical and practical capacities of labor of each school district were determined. These were based on interviews with managers and employees, review of work schedules, and observations made on site.

Theoretical capacity. Theoretical capacity is the sum of all paid labor time. A test period of 20 consecutive school days was identified by comparing school district calendars, and the test period was selected so that all school districts were attending school and serving lunch every day of the period. Utilizing work unit schedules, the number of minutes each employee was scheduled to work during the test period was determined, as recommended by Turney (2005). Employees at every site worked as scheduled during the test period and the test period schedule was confirmed by managers and workers to be reflective of actual work times throughout a typical school year. Employees and managers were interviewed to determine the duration and frequency of scheduled time when workers were not working and were also uncompensated, such as unpaid breaks.

A practice not uncommon in smaller districts' meals programs is sick time or personal time, for which the employee is not replaced. In these situations, the work unit simply works short-handed or understaffed. How frequently this occurs and how many hours of labor are involved was estimated by the manager for each employee on an annual basis. To verify this, individual employees were asked to provide an estimate of their own experience of working short-handed or taking unpaid leave. For each employee, employees' and managers' estimates were averaged.

Weather emergencies and other factors may cause schools to delay school start times, dismiss school early, or cancel school. School districts vary in their practices about schools

employees' pay status or work expectations in these situations. Managers were interviewed to determine what the district policy is regarding each situation, when employees are expected to report to work, whether they are paid, and whether they are allowed to "make up" the time. Managers were also asked to estimate the frequency of unplanned school closings. To verify, individual employees were asked to estimate their own experience of unpaid time off for unplanned school closings. For each employee, employees' and managers' estimates were averaged. Interestingly, the frequency of delayed school start times, early dismissal, and school cancellation during the study period exceeded the estimates provided by managers and employees in all categories. Interview guides combining all aspects of interview questions in this study are included as Appendix F for managers and Appendix G for employees.

Iowa school districts typically are in attendance for 180 days of instruction. The sum of estimates of managers and employees for unpaid work time due to illness, personal leave, and weather for each employee was divided by 9 (180 days per year/20 days in the test period = 9), as representative of usual time unpaid. The sum of the unpaid portions was deducted from scheduled time to yield theoretical capacity.

From payroll records, the number of minutes each employee actually worked in the same 20 day period was determined. While the researcher was prepared to identify any scheduled or unscheduled paid days off in the period and to determine whether the worker was replaced, in no situation was a worker absent during the test period. Therefore, the average of reported unpaid time off and frequency of absent workers not being replaced was used. Theoretical capacity values were annualized. A Microsoft Excel spreadsheet, recording employees' and managers' estimates of time off and the calculations of theoretical capacity is included as Appendix L.

Practical capacity. Practical capacity is the time actually available for work. By interviewing the manager, the number of minutes each employee is involved in scheduled meetings, paid breaks, or other claims on time that renders the employee unavailable for work was determined for the test period. The manager was also asked to estimate the number of meetings, paid breaks and other claims on time; paid breaks were estimated in minutes for the test period, and meetings and other claims on average during the year. To verify, employees were asked to identify the number of minutes involved in meetings, breaks, and other claims on time, in the same time frames as asked of managers. There was very little difference between reports of employees and managers; therefore the values were averaged and interpolated for a typical 20 day period for each employee. This was subtracted from theoretical capacity to yield practical capacity.

Smaller school meals programs often employ working managers, people who are responsible for oversight and management but who also participate in the preparation and service of food. For working managers, estimates were sought from the managers to determine what proportion of time, in a representative 20 day period, is spent on production. All data utilized to determine capacity was interpolated based on this proportion.

A Microsoft Excel spreadsheet was employed to record these data and to complete the calculations for practical capacity; it is included as Appendix M. The proportion of theoretical capacity available for work was calculated.

Determining Labor Value Units

Labor value units are simply the cost of labor per time unit of practical capacity. The hourly rate, including wages or salary and the value of employer-paid benefits, was determined based on school district records and the number of hours on each employee's contract. Labor

value units were determined as dollars per minute and dollars per second. A Microsoft Excel spreadsheet was used to complete the calculations for each employee. It is included as Appendix N.

Determining Labor Demand

For each entrée, the labor required to produce the product was determined. The methods used included employees' estimates and direct observations, as described below.

Workers' estimates. At some sites, the work was expected to be divided among several employees, while at other sites relatively few employees were expected to be involved. However, in every circumstance, only one or two employees were involved in producing the entrée during the study. Employees were asked to review the initial bills of activity and estimate the time required for each step. At all sites and for most entrees, this proved to be very difficult; the recipes provided by the districts as standardized were generally not followed, and they were adjusted for quantity, nature of ingredients, and for process. For example, a recipe calling for pre-cooked beef crumbles was adjusted to use raw ground beef, which was cooked and cooled a day earlier than the day the item was to be served. A Microsoft Excel spreadsheet, attached as Appendix O, records the time required based on workers' estimates.

Direct observation data collection. To the extent possible, direct observation data were collected when a selected entree was produced. Due to the above-mentioned weather-related changes in school schedules, some opportunities for observation were not captured. However, adequate observations were made of all menu items; the use of cycle menus and the need to drop a day's menu from a week's planned menu when school was cancelled made rescheduling impossible. Video recording was utilized by the researcher or trained assistants. Operators of the video equipment completed training for researchers required by the ISU IRB.

See Appendix A for IRB approval of video assistants. Particular attention was paid to avoid recording persons not participating in the study, any children, and the faces of participants.

Measuring time for each step. Each video was evaluated to measure the time for each step. Working from the final bills of activity for each product, and based on the action observed in the videos, first a standard definition was determined for each step. The definitions describe what specific activities are included in each step. For example, stirring using a hand utensil begins with the first touch of the utensil to the product and concludes with the last touch of utensil to product. Secondly, utilizing the timer embedded in the video and based on the definitions, each video was evaluated to measure the time spent for each step. In most observations, each step was completed more than one time during the preparation for one entrée, resulting in more than one measurement for each step-entrée combination. Microsoft Excel spreadsheets, based on the bills of activity, were maintained to record the time measurements. However, in some instances action was observed that was not part of a step; a preliminary name was given to the action, a working definition was developed, and measurements were recorded on the Microsoft Excel spreadsheet.

Steps were divided into six broad categories based on the final definitions: moving product around the work area, either by workers carrying pans or using carts; covering and uncovering hotel pans, with plastic film, foil, or flat lids; adding ingredients to the cooking utensil; stirring the product, using a utensil or the workers' hands; measuring temperatures; and a miscellaneous category. The final definitions, grouped by category, are included as Appendix P.

In some situations, a critical element of the definition could not be determined from observing the video. These incomplete measurements were usually the result of either the

moment the step began or ended not being observable. In these circumstances, the missing time measurement was noted on the Microsoft Excel spreadsheet as "NO" (not observed); these were not included in analysis of mean times required for each step. In other situations, the worker was interrupted while completing a step; for these, repeated measurements were taken of each partial step, which were then summed for analysis. A summary of completed and incomplete measurements for each product is included as Appendix Q.

The workers' four digit identifiers, assigned to each participant to maintain confidentiality, were included for each partial or full step measurement. An example of a completed spreadsheet is included as Appendix R.

Determining Allocated Costs per Meal Equivalent

Financial records, meal claims and sales records, purchasing records, payroll records, production records, and menus, for each district, from the year prior to the study were used to determine program costs and revenues. Using the formula of Cater, et al., (2005), the allocated food and labor costs per meal equivalent were calculated. A summary of total costs; total revenue; food, labor, and total costs per meal equivalent; food and labor costs as percentages of total cost; and food and labor costs as percentages of total revenue is included as Appendix S.

Determining Actual Food Costs of Each Entrée

Working with purchasing records, values of donated foods, and recipes, the actual food cost for each entrée was determined (Iowa Department of Education, 2013d; personal communication D. Dreyer, 2013; personal communication, District C manager, 2014). For these calculations, the market value of donated foods, as determined by USDA, plus the storage and delivery costs assessed for each case were used as the cost of donated foods (Iowa

Department of Education, 2013d). Actual food costs for each entrée are summarized at Appendix T.

Determining Allocated and Direct Labor Cost of Each Entrée

Allocated and direct labor costs for each entrée in each district were determined.

Determining allocated labor costs per entree. The methods utilized in the USDA (2008) cost study, to allocate labor and other costs to breakfast and lunch, were used to distribute a portion of the calculated, allocated labor costs per meal equivalent to each studied entrée. Labor costs were distributed to the entrees in relation to the total food cost in the entire meal served, in this manner:

$$\left(\frac{actual\ food\ cost\ per\ entree}{allocated\ food\ cost\ per\ meal\ equivlent}\right) * allocated\ labor\ cost\ per\ entree$$

The results of this allocation are included as Appendix U.

Determining measured direct labor costs per entrée. Measured direct value-adding labor cost was determined for each entrée. First, the times for each observed step were determined for each entrée, for each employee participating in the production of that entree. For some steps, the observation was insufficient to result in a measurement; usually this was due to a person or object obstructing the view; simultaneous activity by several employees, only one of which could be filmed; or mechanical problems with the camera. A summary of complete and incomplete measurements is included as Appendix Q. For each incomplete or missed time measurement, the value was replaced according to this paradigm:

1. When several measurements of the same step had been observed successfully, but a few of the same steps completed at the same time were not observed, the mean of the observed steps was substituted for the missing data values;

2. When several measurements of the same step were not successfully observed, but a few of the same steps completed at the same time were observed, the mean of the observed steps was calculated. The mean of the measurements of the same step taken at another time, on the same day, in the production of the affected entrée was calculated. The lesser of the two means was substituted for the missing data values.
3. When one or several measurements of a step were not successfully observed, and no or one observation was completed, the mean of the measurements of the same step taken at another time, on the same day, in the production of the affected entrée was substituted for the missing data values.
4. When one or several measurements of a step were not successfully observed, and no or one observation was completed, and no measurements of the same step were taken at another time on the same day, the mean of all measurements for that step was substituted for the missing data values.

In most situations it was clear which employee completed the step for which the time measurement was substituted, either because the employee could be clearly seen though the action associated with the step, or because only one employee was involved in the production of the entrée. When it could not be determined which employee completed the step for which the time measurement was substituted, the time was assigned to all employees involved in production equally.

Next, all the times for all the steps were summed for each employee, separately for each entree observation event. Labor value units (calculated on the spreadsheets included at Appendix N) for each employee were multiplied by the total time each employee was engaged in direct value-adding labor for each entrée production event. These values were divided by the

number of portions of each entrée prepared, resulting in direct value-adding labor costs per meal. A spreadsheet comparing allocated labor costs and measured direct value –adding labor costs is included as Appendix V.

Validating time measurements

Nine trained individuals who had completed human subjects training reviewed a sample of ten video segments. The video segments were selected to be representative of filming done at each site, for each product type, and of each of the six broad steps. Table 3-9 summarizes the video segments evaluated.

Insert Table 3-9 here.

Menu analysis

Menu analysis was completed for each entrée and at each site, generally using the methods employed by Raab and her associates (Annaraud, et al., 2008; Raab, & Mayer, 2007; Raab, et al., 2006; Raab, et al., 2009). However, one purpose of the current study was to compare the effects of allocated labor costs to directly measured labor costs. The results are displayed at Figures 3-2 for District A, 3-3 for District B, and 3-4 for District C.

Insert Figure 3-2 here

Insert Figure 3-3 here

Insert Figure 3-4 here

Determining Cost of Conducting Time-Driven Activity-Based Costing Process

To the extent possible, the time spent by the researcher on each step was recorded. This process was compromised because of interruptions, need to reschedule due to weather emergencies, changes in recipe or procedure by the schools to address staffing issues or to use a particular ingredient, and similar issues. An estimation of time for each interview, the time

spent filming, time spent reviewing the video recordings, and the time spent conducting focus groups is included as Appendix W. For each district, the total minutes spent were determined. This was used to determine if the cost of conducting the study is justified based on cost-benefit analysis.

Analysis

Subjective Evaluation

Subjective evaluations were made by the researcher, managers and supervisors, and employees to evaluate the ease with which data was collected. In this process, the discomfort and difficulty experienced by observed participants to gather the data was assessed. The interview protocol and questions are included as Appendix X. This helps answer research question 1, whether TDABC can be applied in school meals programs and question 6, whether the cost associated with the process justifies its use.

Descriptive Statistics

Descriptive statistics, using Microsoft Excel, were calculated for the labor demand data collected for each entrée, at each school district, for the broad categories of steps.

Inferential statistics

Inferential statistical analysis (*t*-tests) was conducted using Microsoft Excel. Analysis focused on determining if the time demand data, based on observation, can be used in a prediction model that is able to discriminate between the entrees.

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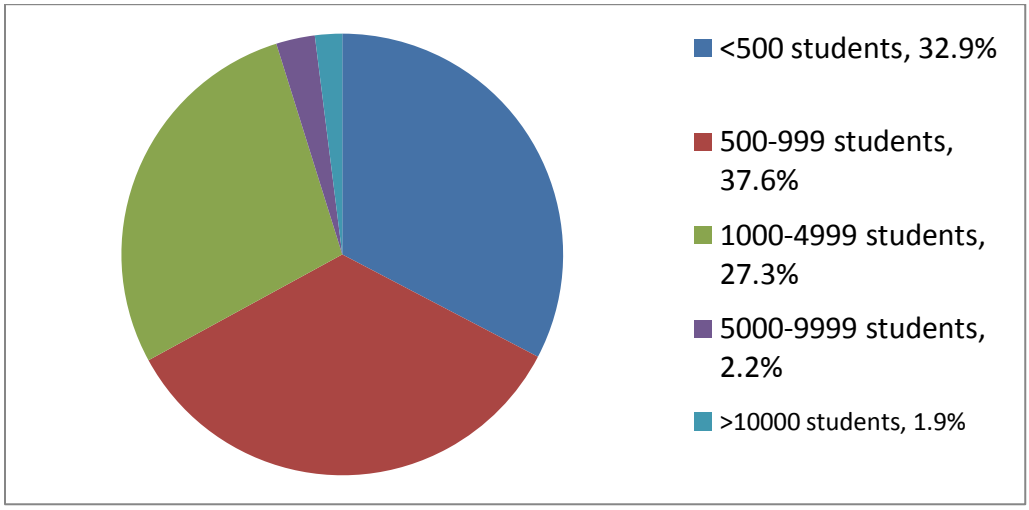
Figure 3-1.

Iowa Public School District Enrollment, 2011-12



Iowa Department of Education, 2012

Figure 3-2.

Comparison of Allocated and Directly-Measured Costs for Selected Entrees, District A

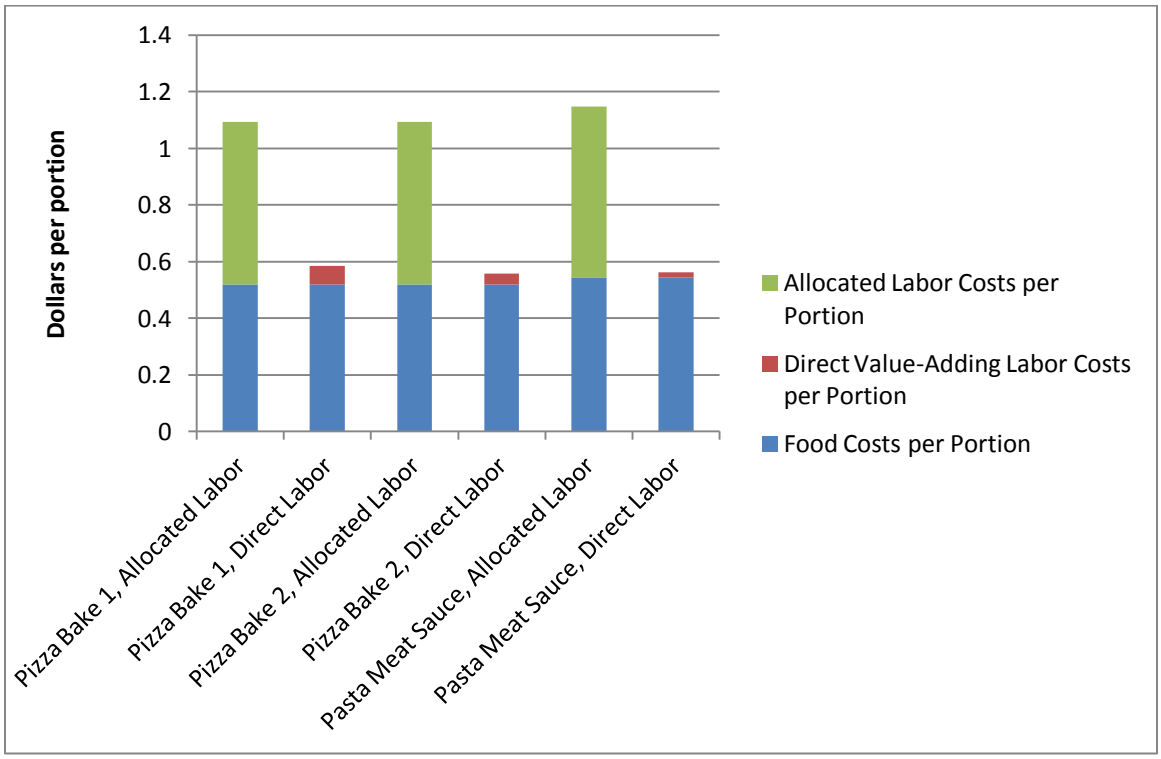


Figure 3-3.

Comparison of Allocated and Directly-Measured Costs for Selected Entrees, District B

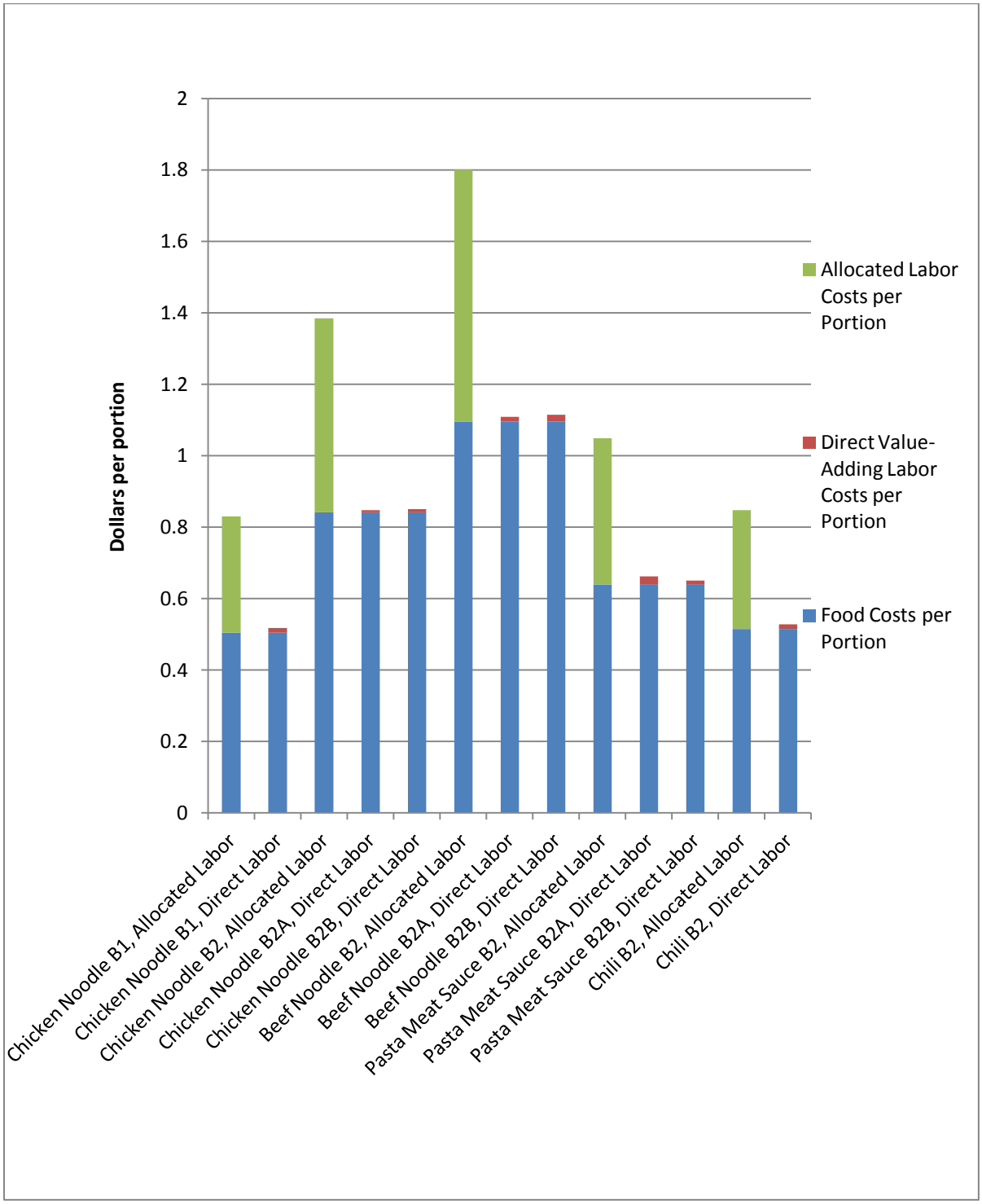


Figure 3-4.

Comparison of Allocated and Directly-Measured Costs for Selected Entrees, District C

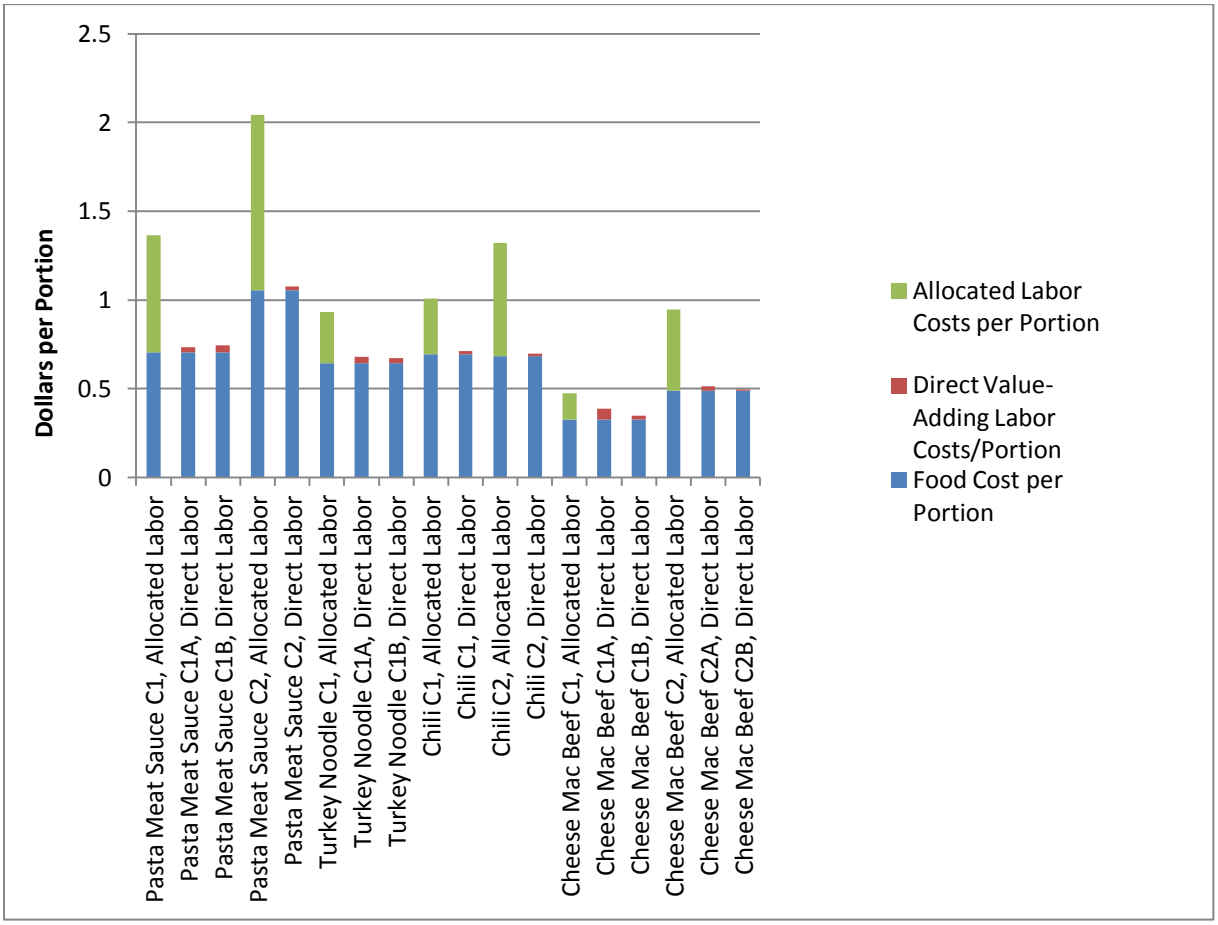


Table 3-1

Demographic Description of School District A, Local Communities, and the State of Iowa

Town/site	Population	Public School Enrollment	% free/reduced price	% non-white/Caucasian	% Hispanic
1/ pK-12	875[b]	280[d]	27.9[f]	9.3[d]	1.8[d]
2/middle school	555[b]	120[d]	37.5[f]	4.1[d]	2.4[d]
3/elementary	330[b]	60[d]	36.7[f]	5.1[d]	3.4[d]
District	Not available	460[a,c]	31.5[a,e]	1.9[c,d]	2.2[c,d]
County	89,542[b]	15,351[c]	24.7[e]	16.1[b]	3.0[b]
Iowa	3,046,355[b]	469,099[c]	39.4[e]	8.7[b]	5.0[b]

[a]Personal communication, District A superintendent, January XX, 2014; [b] United States Census Bureau, 2010; [c]Iowa Department of Education, 2012; [d]Iowa Department of Education, 2013a; [e]Iowa Department of Education, 2013b; [f]Iowa Department of Education, 2013c

Table 3-2.

Description of School District A Meal Program

Site	Site enrollment	Average daily lunch participation	Number of school meals employees	Facility descriptions
1	60 elementary[b]	30[a]	1[a]	100 year old multi-story building with new wing addition. Kitchen/dining area located in old building; equipment and facilities are older but functional[a]. This site was not included in the study.
2	120 middle school[b]	100[a]	2[a]	75 year old multi-story building. Kitchen area is small and crowded; equipment and facilities are older but functional[a]. This site was not included in the study.
3	280 pK-12[b]	210 [a]	4[a]	Newer single story building. Kitchen area is spacious and typically equipped[a].

[a]School district A (personal communication, August 3, 2012) [b] Iowa Department of Education, 2013a

Table 3-3.

Demographic Description of School District B, Local Communities, and the State of Iowa

Site	Population	Public School Enrollment	% free/reduced price	% non-white/Caucasian	% Hispanic
Town	4,345[b]	*	*	2.1 [b]	2.3 [b]
1/Elementary	*	500[d]	54.5 [a,f]	8.5[d]	3.0[d]
2/Middle school	*	310[d]	49.7 [a,f]	11.9[d]	6.4[d]
3/High school	*	330[d]	37.5 [a,f]	8.5[d]	5.1[d]
District	Not available	1,140 [a,c]	48.2 [a,e]	9.4 [a,c]	6.7 [a,c]
County	9,336[b]	1,600[c]	50.7[e]	2.4[b]	1.8[b]
Iowa	3,046,355[b]	469,099[c]	39.4[e]	8.7[b]	5.0[b]

[a]Personal communication, District B superintendent, December 31, 2013; [b] United States Census Bureau, 2010; [c]Iowa Department of Education, 2012; [d]Iowa Department of Education, 2013a; [e]Iowa Department of Education, 2013b; [f]Iowa Department of Education, 2013c

*not applicable

Table 3-4

Description of School District B Meal Program

Site	Site enrollment	Average daily lunch participation	Number of school meals employees	Facility descriptions
1	500 elementary[b]	450[a]	3[a]	Newer single story building. Kitchen converted from satellite receiving site to production site in study year. Spacious and well equipped kitchen[a]. This site was not included in the study.
2	310 middle school[b]	250[a]	2[a]	75 year old multi-story building. Kitchen very small and crowded; equipment is older but functional. Dining area in gymnasium, physically separated from kitchen[a].
3	450 high school[b]	400[a]	6[a]	Newer single story building with spacious and generally well equipped kitchen. Equipment is mixture of new and older, with varying degrees of functionality[a].

[a]School district B (personal communication, August 3, 2012) [b] Iowa Department of Education, 2013a

Table 3-5

Demographic Description of School District C, Local Communities, and the State of Iowa

Site	Population	Public School Enrollment	% free/reduced price (students)	% non-white/Caucasian	% Hispanic
Town	7,700[b]	*	*	20.9[b]	35.0[b]
1/Elementary	*	790[d]	67.7[a, f]	4.2[d]	49.4[d]
2/Middle /High school	*	975[d]	64.3[a,f]	3.7[d]	43.8[d]
District	Not available	1,865[a, c]	62.1[e]	3.7[c]	46.9[c]
County	66,130[b]	14,460[c]	22.0[e]	7.9[b]	6.1[b]
Iowa	3,046,355[b]	469,099[c]	39.4[e]	8.7[b]	5.0[b]

[a]Personal communication, District C superintendent, January 19, 2014; [b]United States Census Bureau, 2010; [c]Iowa Department of Education, 2012; [d]Iowa Department of Education, 2013a; [e]Iowa Department of Education, 2013b; [f]Iowa Department of Education, 2013c

*not applicable

Table 3-6

Description of School District C Meal Program

Site	Site enrollment	Average daily lunch participation	Number of school meals employees	Facility descriptions
1	790 elementary[b]	700[a]	5[a]	Single story school building in excellent repair. Kitchen small, crowded but well supplied with newer equipment. Outdoor freezer and non-food storage.
2	980 middle high school[b]	850[a]	7[a]	Single story school building constructed in 2002 in excellent repair. Kitchen spacious, well laid out, well equipped with modern equipment[a].

[a]School district C (personal communication, May, 2012) [b] Iowa Department of Education, 2013a

Table 3-7

Large Equipment Inventory

	District A[a]	District B[b]		District C[c]	
	Site 1	Site 1	Site 2	Site 1	Site 2
Convection oven	2, stacked	1	2, side-by-side	2 stacked	2 stacked
Combination oven/steamer	0	0	0	1	1
6 burner range/oven	2	0	0	0	0
Steam jacketed kettle	0	1	2	0	0
Tilting skillet	0	0	0	0	1
Warmers	1, tall	1, half-height	0	2, tall	1, tall

[a]School district A (personal communication, August 3, 2012); [b]School district B (personal communication, July 24, 2012); [c]School district C (personal communication, May, 2012)

Table 3-8

Summary of Entrees Studied

Product	District A	District B		District C		Total
	Site 1 observa-tions	Site 1 observa-tions	Site 2 observa-tions	Site 1 observa-tions	Site 2 observa-tions	
Pasta meat sauce casserole	3	0	2	2	1	8
Macaroni cheese beef casserole	0	0	0	2	2	4
Noodle meat casserole	0	1	4	2	0	2
Chili	0	0	1	1	1	3
Total	3	1	7	7	4	22

Table 3-9

Summary of Video Segments Validated

Product/Site	A1	B1	B2	C1	C2
Pasta meat sauce casserole	2	0	1	1	0
Macaroni cheese beef casserole	0	0	0	1	1
Noodle meat casserole	0	2	1	0	0
Chili	0	0	0	0	1

CHAPTER 4. AN EVALUATION OF TIME-DRIVEN ACTIVITY-BASED COSTING: IS THE COST OF PRECISION WORTH THE EXPENSE?

Abstract

Purpose

This mixed-methods study sought to examine the perceptions of food production workers in child nutrition programs, who were video-taped in the course of preparing entrees, and if Time-Driven Activity-Based Costing (TDABC) techniques could be applied in child nutrition programs to measure labor.

Methods

Workers in three small school districts in the Midwest agreed to participate; specific entrees were selected for evaluation. Workers were interviewed to gather information about work conditions and benefits; pay rates, value of benefits, actual hours worked, and costs to operate the program were gathered from district records. Observations of workers preparing specific entrees in school meals programs were made using hand-held video recorders. Time measurements of specific tasks were determined by observing the videos. Workers participated in focus groups at the end of the observation period to describe their experiences and perceptions of the video recording process. Descriptive and inferential statistical analyses were conducted and themes identified.

Results

Five production steps comprised the majority of time spent preparing the food. Mean times for specific steps in pair-wise comparisons were not statistically different for one pair of mean times; all other pairs were significant. Analysis of themes from focus groups indicated workers did not find the video recording to be disruptive or uncomfortable, but being well

prepared by the researcher about the process to be employed and having trust in the researcher contributed to the lack of discomfort.

Application to Child Nutrition Professionals

TDABC is an effective method to measure labor required to prepare food in child nutrition programs. Video recording observations may be an effective method to gather observational research if workers are well prepared and trust the researcher.

Key words

Time-Driven Activity-Based Costing, National School Lunch Program, mixed methods, labor standards

Introduction and Review of Literature

Changes in the National School Lunch Program (NSLP) menu planning requirements aligned them more closely to the 2010 Dietary Guidelines for Americans (Healthy Hunger Free-Kids Act of 2010 [HHFKA], 2010; U. S. Department of Agriculture & and U.S. Department of Health and Human Services, 2010). The menu changes were expected to increase food costs for a lunch by ten cents (HHFKA, 2010; National School Lunch Program, 2012); while a stipend of six cents per lunch was made available to schools demonstrating menu-planning compliance (HHFKA, 2010), no estimate of changed labor requirements have been made.

School meals programs are accurate in determining the cost of food, but less able to recognize labor and other costs of a meal (United States Department of Agriculture, Food and Nutrition Services, Special Nutrition Programs, 2008). Allocation methods to determine costs per meal (Cater, Conklin, & Cross, 2005) obscure the differences between meals that are higher in cost and those that are lower in cost. Labor productivity measures used in school

meals programs are inconsistently applied and are based on cost allocation. Benchmarking data are generally limited.

A variety of factors influence the labor required to produce a meal or a menu item in school meals programs, including menu complexity, equipment, central-satellite versus on-site production methods, and size of operation (Sherrin, Bednar, & Kwon, 2009). Pannell-Martin and Applebaum (2000) specifically noted the need for more labor when food is prepared from raw ingredients, as compared to meals utilizing processed foods. Greater than 40% of school foodservice directors utilized their past experience to estimate labor needs as opposed to a productivity measure, such as meals per labor hour; productivity measures in general were used by directors in larger districts and not by directors of small districts (Sherrin, et al., 2009).

Hwang and Sneed (2004) noted limited data on benchmarking standards available across school meals programs, while a lack of consistency in metrics compromises comparisons between programs; the lack of consistency was also found by Sherrin, et al. (2009). Chambers and Johnson (2000) reported internal benchmarking, the comparison of an operation's performance to itself over time, the most frequent method used in non-commercial foodservice; they further found school meals programs frequently monitored percentage of cost attributable to labor and meals per labor hour as benchmarking standards.

While school meals programs are capable of determining the cost of food, they are generally unable to identify labor associated with operating a meal program or of accurately determining the cost of labor. Programs operating in districts enrolling 5000 students or fewer demonstrated the greatest inability to identify and quantify labor costs (United States Department of Agriculture, Food and Nutrition Services, Special Nutrition Programs, 2008).

Activity-Based Costing, first developed by Cooper and Kaplan (1990), is a cost accounting method commonly used in manufacturing (Everaert, Bruggeman, & De Creus, 2008; Greeson & Kocakulah, 2000), banking (Hicks, 1999), and medical services (DeMeere, Stouthuysen, & Roodhooft, 2009). Cooper and Kaplan noted that it was preferable to be generally correct in determining actual costs, than to be precise but wrong, particularly by using allocation methods (1990). Kaplan and Anderson (2007) simplified the process, modified it to measure cost per unit time, and called this method Time-Driven Activity-Based Costing (TDABC). Their goals were to establish a standard or expected time to be expended in a specific task, minimizing the effect of individual employee differences and facilitating planning for labor needs based on standards, and to identify efficiencies in production processes.

The process has been applied recently to restaurant foodservice (Raab, Mayer, Shoemaker, & Ng, 2009), a bakery (Vaughn, Raab, & Nelson, 2010), and a fast-food restaurant (Annaraud, Raab, & Schrock, 2008). In each study, researchers were able to determine the direct labor cost of specific products, identifying which products were contributing positively and which negatively to the over-all financial status of the operation, based on the relationship of the direct costs of product food and labor to the product selling price.

There are, however, issues with using TDABC in the workplace: time measurements are either estimated by employees or they are measured by observers. Employees are generally suspicious of observers and they are biased in their reports of time required to complete tasks (DeMeere, et al., 2009). The process can be perceived as a threat to jobs of both line workers and middle managers (Major & Hopper, 2005). Additionally, cost of implementation has been estimated to be as high as 0.3% of sales (Hicks, 1999).

This mixed-methods study sought to determine if Time-Driven Activity-Based Costing (TDABC) can be used effectively in school meals programs, to determine more accurately the direct labor required to prepare specific menu items. This study hypothesizes that the mean times for each of production steps are different, thereby demonstrating that standard times for each step can be determined and that they are distinctly different from each other.

These are the hypotheses:

H_o: $\mu 1 = \mu 2$

H_a: $\mu 1 \neq \mu 2$

The hypotheses are identical for each production step; for example, is the mean time for the adding ingredients different from the mean time for covering or uncovering pans?

In addition, this study examined the effect of the data-gathering processes on participants

Methodology

Selection of Study Sites, Participants, and Products

Three school districts each enrolling fewer than 2000 students agreed to participate; there were five participating production sites in the three districts. All food was prepared and served on site. The primary researcher was previously acquainted with the staff, program managers and/or district superintendents: the researcher had conducted state-agency meal program reviews at two of the three districts and more recently had provided short-term consultative services on program operations to all districts. Permission was granted by the district school boards to conduct the research. Staff employed in the production of school meals at each of the districts was asked to participate. Cover letters clearly explaining the purposes of this research, the methods to be employed, and assurance of confidentiality were distributed to workers at the school district foodservice work sites, as a recruitment tool.

Individual employee-participants were provided consent forms approved by the Institutional Review Board, describing the study, their role in the study, and the use of data gathered as part of the study. In particular, the consent form discussed the use of individual employee payroll records to determine labor cost and direct observation and video recording of work processes.

Entrees selected for study included pasta/tomato meat sauce casseroles, pasta/meat/cheese sauce casseroles, noodle/meat casseroles, and chili. Entrees selected for study were prepared using similar recipes, ingredients, and methods at two or more production sites, with the exception of one pasta/tomato meat sauce casserole prepared at only one site.

Data Collection

Each participating worker was interviewed individually by the primary researcher, to discuss their work schedules and work experiences. The interviews were audio-recorded. Workers also were asked to provide detailed written directions to complete each step of the production of the studied menu items. The interviews were conducted about a month prior to video recording commenced.

Workers were video recorded while preparing the studied menu items, using a small hand-held camera, over spring semester school year 2012-13. Usually, the researcher did the video recording but in a few instances a qualified helper operated the camera. Every effort was made to avoid filming faces of participating workers and to avoid filming others who were not participating in the study. The researcher and helpers engaged in conversation with the workers and asked clarifying questions about processes while filming.

At the conclusion of the filming, workers who had been filmed or who were routinely engaged in food production participated in focus groups to describe their experiences in the research project. The focus groups were audio recorded and transcribed verbatim.

Data Analysis

Data gathered in the interview were analyzed determine the cost of labor to produce the entrees, and the results are not included in this manuscript. The videos were reviewed off-site by the primary researcher, to identify steps of production and to determine the time spent on each step. This review focused on production steps that added value to the product; value adding labor includes cooking raw meat, pasta or noodles; preparing site-made sauces; or assembling casseroles in pans for baking, heating, or serving. Value-adding does not include receiving, storing, gathering ingredients from storage, opening packages, or cleaning up.

A representative sample of the videos was evaluated by at least three trained individuals, who reviewed the videos and measured the times. Descriptive and inferential statistical analysis was conducted using Microsoft Excel. Pairwise comparisons of mean times for the steps, as measured by the principal researcher, were conducted using an adaptation of Student's *t*-test more appropriate for samples with unequal variances (Howell, 1989). The transcripts of focus groups were initially examined using a priori queries for expressions of discomfort, suspicion, or worry about the use of findings, and the participants perceived value of the process. The a priori queries were based on the concerns raised by DeMeere, et al. (2009), and Major and Hopper (2005). Initial coding was simultaneous in vivo and magnitude coding, and final coding sought patterns (Saldaña, 2013). To arrive at themes, three researchers with experience in qualitative analysis independently read and coded each transcript, then met as a group to achieve consensus.

Results and Discussion

Participants' Characteristics

Sixteen workers agreed to participate. All were women, white/Caucasian and not Hispanic. Table 4-1 describes the participants' demographic characteristics in detail. Of the 16, one was a working manager, routinely splitting her time between program management and food production and service, four were managers not routinely engaged in production or service, and 11 did not have management responsibilities.

Insert Table 4-1 here

Steps of Production

Five major steps were identified in reviews of the video recordings, that comprised the majority of time spent preparing the items. These were adding ingredients during cooking, covering/uncovering hotel pans, measuring temperatures of products, moving pans of product from one location to another, and stirring. Final definitions for each step are provided in Table 4-2. Means for each step, at 95% confidence intervals, and standard deviations were calculated and are presented in Table 4-3.

Insert Table 4-2 here

Insert Table 4-3 here

Inferential statistical analysis (two-tailed *t*-test, for unequal variances) was conducted to test the null hypothesis. Differences between mean times for adding ingredients and measuring temperatures were found to be not significant. All other mean time pair comparisons were found to be significant. Measurements of time for these five steps of production can be differentiated from each other; the mean time for each step may be suitable for standard times to complete the step when preparing these entrees.

Employing the same analysis processes, the mean times for each step, as measured by the trained evaluators, were compared to the measurements for each step as measured by the researcher. Mean times were not significantly different for stirring and moving; differences between all other mean time measurements were significantly different

Focus Group Theme Identification

Three themes emerged from analysis. Sub-themes were identified for two themes. A summary is provided at Table 4-5.

Theme 1: Discomfort

Discomfort, expressed as nervousness, was identified by about half of participants.

Sub-theme 1.1: Performance issues

Participants who expressed discomfort focused most on nervousness related to job performance. Participants emphasized that the nervousness was fairly minor and transient.

Sub-theme 1.2: Personal exposure

Participants expressed awareness of the video- and audio-recording and the permanence of the records. In particular, participants sought reassurance that their confidentiality would be preserved and that the records would be destroyed at the conclusion of the study.

Sub-theme 1.3: Familiarity with the researcher and study process

Participants reported that knowing the researcher fairly well at the inception of the study contributed to their sense of comfort/relative lack of discomfort. Participants generally felt that the researcher was familiar enough with their operations to avoid work interruptions. This lack of discomfort, for the most part, extended to the filming helpers. Understanding the study process was also important to the sense of comfort.

Theme 2: Disruption or Need to Alter Work Processes

In a related way, participants for the most part indicated that they did little different to prepare for the video-recorded sessions and there was little if any disruption to the work process. Questions, however, by the camera operators were perceived as disruptive.

Theme 3: Value of research

Pride of workmanship and desire for recognition and validation were commonly expressed when participants were asked to quantify the value of the research. Participants were specifically asked what minimum degree of return would be necessary to cause them to agree to participate in a similar study. Four sub-themes emerged.

Sub-theme 3.1: Personal value

Participants expressed an interest in improving their own work performance, at a personal level. Of particular interest to them was to learn alternate ways of making the products or increasing their speed.

Sub-theme 3.2: Increasing understanding by others

Participants were vocal in expressing their frustrations with students and others who did not seem to understand or appreciate the degree of effort necessary to prepare meals.

Sub-theme 3.3: Value to specific meal program

Participants identified process improvements to their school meals programs as being particularly valuable.

Sub-theme 3.4: General altruism

Participants demonstrated a willingness to help, without an expectation of personal or organizational gain.

Insert Table 4-4 here

Conclusions and Application

Conclusions

Time-Driven Activity-Based Costing (TDABC) is an accurate way to measure time required to complete five specific steps (adding ingredients, covering or uncovering hotel pans, measuring temperatures of product, moving product in hotel pans, and stirring product,) in producing food items in school meals programs. Inferential statistical analysis found that means of time measurements for each step differed from each other to a significant degree. However, time measurements taken by trained evaluators, to validate the researcher's measurements, were statistically different from the researcher's measurements for all steps except stirring and moving.

Use of video recordings to gather TDABC data was an effective method. It permitted the researcher to take time measurements off-site and to review recordings repeatedly; it probably also contributed to the participants' perception of minimized intrusiveness. Participants expressed minimal levels of discomfort at being observed and video-recorded; the discomfort was overshadowed by the improvements they perceived were possible either as individuals, for others, or on the part of their meals programs. However, participants indicated that knowing the researcher well and being confident that the researcher was aware of the need to avoid interrupting the flow of work were important factors in being comfortable. Participants also sought reassurance that their identities would be protected, errors in work performance or inappropriate language would not be revealed, and the recordings would be destroyed when the study ended. They felt they had been well informed of the process and knew what to expect.

The TDABC and video recording combination to measure labor in school meals programs appears to be both an effective method to gather data and acceptable to study participants.

Implications

The steps identified and measured in this study (adding ingredients, covering and uncovering pans, measuring temperatures, moving product during production, and stirring) are required to produce all or almost all foods in a school meals program, though the number of times each step is employed will differ from product to product. Knowing the time required to complete each step and understanding how many instances of each step are required for a specific recipe will enable managers of school meals programs to accurately determine changes in labor time required when the quantity of product is changed. Managers experiencing difficulties getting some essential tasks done (such as measuring temperatures for food safety) can focus on efficiencies in other areas to free up time to take temperatures and can predict the time freed up. Eliminating three episodes of non-essential movement releases enough time to measure temperatures twice, for example.

Though additional research is needed, managers who are able to predict the time required to prepare products and to complete other necessary tasks will be able to develop menus requiring a more constant workload and to avoid "hard days" and "easy days."

Limitations and Future Research

This study should be replicated, in more locations, for more products, and in differing production processes, to assess wider applicability of the TDABC process. Further analysis of data gathered should be undertaken to identify the standard or effective times sought by Kaplan and Anderson (2007). The identification of standard or effective times could have broad

implications in establishing both internal and external benchmarks and in predicting labor needs.

The use of video recordings proved invaluable, in that validation of time measurements was possible. The methods of video recording may be improved if multiple fixed position over-head cameras were used; this would reduce the intrusiveness of having a researcher in the work area and could speed the process of workers' gaining comfort at being recorded. It would also greatly reduce the incidence of missed observations. However, it may have a negative effect on trust.

Validation of time measurements is important to ensure this process does, in fact, result in reliable measurements and can be used to establish standards. The process employed in this study was efficient, but more extensive work is needed to determine which and how many video segments must be reviewed to lend more than face validity to the results.

More evaluation of the factors associated with trust should be undertaken. In particular, the attributes of researchers and the research process that contribute positively to trust-building should be identified and emphasized in research planning. The effects of remote versus hand-held cameras and the provision of study details to participants should be investigated.

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Table 4-1

Participant Demographics

Characteristics		*N*=16
Gender	Male= 0	Female =16
Age	Mean (y) = 48.4	Range = 30-73
Years in district school meals program	Mean (y) = 7.8	Range = 0.5-30
Years in other schoolmeals program (n=2)	Mean (y) = 6	Range = 4-8
Previous foodservice experience, not school meals	*n*=7	% = 43.8
Other work experience*		
	Retail *n*= 5	% =31.3
	Personal service *n* =4	% =25.0
	Administrative/white collar *n* = 5	% =31.3
	Manufacturing *n* = 3	% =18.8
	Military *n* = 1	% =6.3
Marital Status	Married/Partnered *n*=13	Widowed *n*=2
Occupation of spouse/partner**	Personal service *n* =2	
	Administrative/white collar *n* = 2	
	Manufacturing *n* = 2	
	Agriculture *n* =5	
	Skilled trades *n*=2	
	Transportation *n*=1	
	Utilities *n*= 2	
Others residing in household***	School age children *n*=7	% = 43.8
	College student children *n*= 3	% = 18.8
	Other children *n* =3	% = 18.8
	None *n*= 8	% = 50.0

* Number of participants reporting various prior occupations. Sum greater than 16, percentage greater than 100% because participants reported multiple previous occupations.

** Number of participants with spouses engaged in various occupations. Includes two spouses now deceased, simultaneous occupations.

*** Number of participants reporting others residing in household. Sum greater than 16, percentage greater than 100% because participants reported multiple others residing in home.

Table 4-2

Definitions for Five Main Steps

Step	Final Definition
Adding ingredient	first touch by worker hand to container holding ingredient, move ingredient to cooking vessel, pour ingredient into cooking vessel, to last touch by worker hand of container holding ingredient
Covering/ Uncovering	first touch by worker hands to lid/film/foil, to last touch by worker hands
Measuring temperature	first touch of thermometer to product, to last touch of thermometer to product
Moving product	first touch by worker hands to pan, move to destination, place pan in desired location, to last touch by worker hands
Stirring	first touch of worker hand to stirring utensil, utensil in contact with product, utensil in motion, to last touch of moving utensil to product

Table 4-3

Mean Times for Five Steps

Step/Statistic	Adding	Covering/ Uncovering	Measuring Temperature	Moving	Stirring
Mean	20.07 sec.	6.99 sec.	16.25 sec.	10.99 sec.	35.55 sec.
SD	39.81 sec.	5.44 sec.	13.10 sec.	10.17 sec.	37.60 sec.
% of DVAL	34.1	5.0	4.9	10.1	46.0

Note: DVAL = direct value-adding labor

Table 4-4

Themes

Number	Theme/Subtheme/Quotation
1.0	**Discomfort**
1.1	**Performance issues**
1.1.1	…I think I was more nervous about was doin' everything exactly by the book…
1.1.2	…I had a few moments where I was nervous because – when our equipment doesn't work the way we want it to…
1.1.3	First couple of times, I'd say, it made us a little nervous.
1.1.4	…it got more comfortable…
1.2	**Personal exposure**
1.2.1	Sometimes I wonder if I let somethin' slip that shouldn't be but…that's gonna be gone, right?
1.2.2	But they don't have any idea who we are anyway…. They don't see our faces.
1.2.3	But it's just… I guess it's just the idea of somebody there that's not usually in your kitchen, and they're mak- taking a movie of you.
1.3	**Familiarity with the researcher and study process**
1.3.1	…it could be a make or break point, depending on who was here doing the research. Umm…I think if there was someone here who wasn't observant, um, wasn't probably conscientious the whole time…
1.3.2	But I think it also ha-.knowing that you were, you came in knowing what our kitchen situation was like, and you were prepared for doing your best at staying out of the way…
1.3.3	…pretty much everything was explained before we went into it…Pretty much know what was gonna happen before it happened.
Number	**Theme/Subtheme/Quotation**
2.0	**Disruption or Need to Alter Work Processes**
2.1	It was business as usual.
2.2	…I mean, you really don't do anything different…
2.3	…when they ask questions, you kinda gotta stop what you're doin'…pay attention to what they ask…
2.4	And it got on people's nerves a little bit, just to be honest
Number	**Theme/Subtheme/Quotation**
3.0	**Value of research**
3.1	**Personal value**
3.1.1	…it wouldn't be worth it if it is just the same thing every day…
3.1.2	Only because I would wanna…make it faster.
3.2.	**Increasing understanding by others**

Table 4-4, continued	
3.2.1	Well, I'd hope they, anybody who watches it gets something out of it. I mean…the process. They don't, a lotta people don't understand the processes, especially with a kettle meal.
3.2.2	I'm just saying that I want other people to understand the process so I don't hear, "so what? It was a kettle meal." Well, you know what? It's not so what. It is an effort.
3.2.3	And now if we get kids that complain too about…nitpickin', we're all…we can deal with it a lot better.
3.2.4	…and then come back and appreciate us a little more
3.3	**Value to specific meal program**
3.3.1	For me, what I observed wasn't that much of an inconvenience to know that we have the potential of getting some valuable research coming back and helping us with recipe development and labor, um, cost factors,,,,
3.3.2	So it helps when someone else sees the process and goes, "Hey, you don't have to do that this way. You know, this can be better."
3.3.3	If your research included product quality, specifically, then I would definitely say that it, it could help prove the need for another piece of equipment.
3.4	**General altruism**
3.4.1	…hopefully you're, you know, whatever you're getting out of it and stuff and any information you can pass on to anybody else.
3.4.2	…it wouldn't bother me if you asked if you could do it again.
3.4.3	…it's just knowing that you're helping somebody accomplish what they need to do.

CHAPTER 5. WHERE HAS ALL THE LABOR GONE? CAPACITY AND VALUE-ADDING LABOR IN SCHOOL MEALS PROGRAMS

Abstract

The purpose of this study was to examine the use of Time-Driven Activity-Based Costing (TDABC) to measure direct, value-adding labor in school meals programs operated under the National School Lunch Program (NSLP), particularly to determine if a standard for labor can be identified. Conducted at one school district with one entrée and three observations, this study determined that the proportion of paid labor time actually available for work was much higher than other industries. The labor time required to prepare the entrée was approximately the same for all observations; the differences between the times required for the three observations were not significant. This study indicates that standard times for producing food are possible in school meals programs.

Keywords: Time-Driven Activity-Based Costing, National School Lunch Program, labor standards, value-added labor

Introduction and Review of Literature

The United States Department of Agriculture (USDA) published the School Lunch and Breakfast Cost Study II, to quantify the costs experienced by school meals programs to produce reimbursable meals in the National School Lunch Program (NSLP) and the School Breakfast Program (SBP). The study was based on financial records for school year 2005-06, when the maximum reimbursement rate for a school lunch was $2.51. The maximum reimbursement was comprised of $2.32 cash payment and $0.175 in donated commodities. Approximately 78% of schools reported costs less than the maximum payment. However, the study found few schools recognized all costs associated with operating the meals programs, with labor accounting for over 60% of the unreported/unrecognized costs. When all costs were

considered, the cost of producing a lunch in the NSLP was estimated at $2.91, and in more than two thirds of schools the full cost of lunch exceeded the maximum reimbursement rate. Labor and food costs each accounted for about 45% of all costs. About 20% of labor was attributed to administration and management (USDA, 2008).

The 2010 reauthorization of the NSLP, the Healthy Hunger Free Kids Act (HHFKA), implemented far-reaching changes in the program, including changes in foods offered on the menu, standards for food sold outside the meal program on school premises, minimum pricing requirements for meals and a la carte sales, and program staff education and training requirements (Healthy Hunger Free Kids Act of 2010, 2010). USDA notes that developing a menu meeting the required nutritional standards will likely require more on-site preparation of menu items and less use of commercially prepared items. USDA's final rule describing menu requirements and nutrition standards for NSLP meals estimated increased implementation costs of about five cents per meal for food and an additional five cents for labor (National School Lunch Program and School Breakfast Program, 2012).

Various methods have been used by schools to estimate productivity, here defined as the number of meals prepared and served per labor time unit, or meals per labor hour (MPLH). Reversed, the formula can be used to predict labor needs. This measure, unfortunately, lacks a common definition (Cater, Conklin, & Cross, 2005; Hanna, 2008; Hwang & Sneed, 2004; Sherrin, Bednar, & Kwon, 2009), rendering it inadequate as an external benchmarking tool. It further is based on straight-line allocation of costs to meals, without regard for differences in labor necessary to produce meals requiring more preparation or for changes in the array of foods offered on a menu.

Time-Driven Activity-Based Costing (TDABC), a simplification of Activity-Based Costing, is a method to assign costs to products by determining the value of time required to manufacture products it is sufficiently sensitive to discriminate between two similar products and to establish labor time requirements (labor standards) for production steps (Kaplan & Anderson, 2007). Recent studies of costs to produce menu items in commercial foodservice operations have employed TDABC, including identifying costs of individual products on buffets (Raab, Mayer, Ramdeen, & Ng, 2005), in bakeries (Vaughn, Raab, & Nelson, (2010), and at a quick serve restaurant (Annaraud, Raab, & Schrock, 2008).

Determining capacity is a critical requirement to apply TDABC, and is applicable to both machines and human labor. Theoretical capacity for labor is the sum of all time or resources available to do work; practical capacity is a subset of theoretical capacity that encompasses time actually available to do work. Capacity is an important concept in determining the cost of work; a machine that is idle half the time costs twice as much for each operating hour as a machine in continuous use. The calculation of practical capacity for labor involves deducting paid benefit time, paid breaks, paid training, and similar situations that reduce workers' time to do work, from theoretical capacity (Kaplan & Anderson, 2007; Turney, 2005). DeMeere, Stouthuysen, and Roodhooft, (2009) estimated that 85% of theoretical capacity was available for work in healthcare, while Kaplan and Anderson (2007) suggested using 80-85% as a rule-of-thumb for manufacturing .

This study sought to determine if TDABC was applicable to school meals programs. It sought to measure value-adding labor time requirements to produce a specific product, to quantify the cost of that labor, and to establish labor standards for specific products or steps. Adding value employs the talents and skills of workers to produce a product appealing to

consumers (Matthews, 2013). For foodservice, adding value is transformative, changing inedible or unpalatable raw materials into appealing foods and meals customers are willing to buy. For purposes of this study, value-adding labor included cooking raw meat, pasta or noodles, and vegetables; preparing site-made sauces; and assembling casseroles in pans for baking, heating, or serving. It does not include receiving, storing, gathering ingredients from storage, opening packages or containers, or cleaning up. Annaraud, et al. (2008) applied an abbreviated model of TDABC to quick serve restaurants, and further distilled tasks into three general categories: facility sustaining tasks, such as maintenance, general sanitation, accounting; process sustaining tasks, such as purchasing food and supplies, employee selection and supervision; and product sustaining tasks, including food production. Quick serve restaurants share with small school meals programs important similarities; they both prepare limited menus, provide limited service, and offer food for sale at low prices.

Methodology

A Midwest school district, enrolling fewer than 2000 students, preparing meals at two locations for on-site service was selected for study. Pasta meat sauce casserole was prepared at both sites using the same recipe, ingredients and methods. Four school meals program employees were provided cover letters explaining the purposes of this study, the methods to be employed, and assurance of confidentiality. Consent forms approved by the Institutional Review Board were provided to them, describing the study, their role in the study, and the use of data gathered as part of the study. The consent form specifically discussed the use of individual employee payroll records to determine labor cost and direct observation and video recording of work processes.

From payroll records and work schedules, annualized theoretical and practical capacities were determined, in the method of Turney (2005). The fraction of theoretical capacity comprised by practical capacity was calculated for each worker. The total annual compensation for each employee, including pay and the value of employer-paid benefits, was determined from district records. The value of labor, as dollars of total compensation per minute of practical capacity and per second of practical capacity, was calculated for each worker.

Workers and managers identified the production steps required to prepare the casserole, to produce bills of activity as employed by Raab (2003). The researcher developed standard definitions for each step of the bills of activity, to describe what specific actions were included in each step. For example, stirring using a hand utensil began with the first touch of the utensil to the product and concluded with the last touch of utensil to product.

Using hand-held video cameras, the researcher filmed workers preparing the pasta meat sauce casseroles a total of three times, twice at one site and once at the other. Working from the bills of activity, standard definitions, and the action observed in the videos, each video was evaluated to measure the time for each step. The time spent in each step, for each worker, was summed and converted to minutes. A representative sample of videos was evaluated by trained observers, to validate the measures of time. The value of each worker's labor in preparing the casserole was determined by multiplying the sum of the worker's time by the value of the worker's labor.

Results and Discussion

The four employees participating were all white women, mean age 46.25 years. One employee had only two years of foodservice experience, all at this school meals program; the

other three had between 7 and 18.5 years of foodservice each, in a combination of this school meals program and in health care settings. Table 5-1 describes the participants' characteristics.

Each employee was scheduled to work 6.5 paid hours per day. During their work time, these employees were expected to participate in the preparation of breakfast, to prepare the main entrée for lunch, and to assist in serving breakfast and lunch. They generally did not participate in clean-up activities such as washing dishes or pots and pans, sweeping or mopping floors, or removing trash. Many other employees were also employed at these facilities, who prepared the remainder of the meals, participated in meal service, and cleaned-up.

Capacity determinations for the four workers indicated practical capacity was far higher than the 80-85% noted by DeMeere, et al (2009) and Kaplan and Anderson (2007), as shown on Table 5-2. The four workers' percentage of available time ranged from 96.34% to 97.71%, inferring the workers generally did not take breaks, sick time, holiday or vacation time, did not attend meetings and received no training on paid time.

Insert Table 5-2 here.

Less than one hour of total labor was required to prepare the casseroles, leaving about 12 hours for other tasks. The workers prepared no other product during the observation period, and due to the high rate of practical capacity, direct value-adding labor and cost per portion were low (see Table 5-3). The differences in time required for each of the three observations were not statistically significant; this time may be a reasonable standard time to prepare this casserole at these production sites. The labor costs per portion were determined for each trial,. Value adding labor comprised less than 10% of these workers' practical labor capacity.

Insert Table 5-3 here.

The USDA cost study (2008) estimated administrative and management labor to comprise about 20% of all labor; they further estimated that 60% of unrecognized costs were labor costs. The administrative and management labor would reasonably be expected to fall within the facility sustaining and process sustaining categories, the value adding labor measured in this study in the product sustaining category in the method of Annaraud (2008) . With the finding of high practical capacity and less than an hour of value-adding labor required to prepare the casserole, an important question to answer is this: what tasks are being performed with the labor unaccounted for and how do these tasks fit into the categories described by Annaraud (2008)? It is important to note the differences in time spent by each of the four workers preparing this entrée and the differences in time and cost per portion. In this study, preparing larger quantities of food did not demonstrate economy of scale.

Future research should focus on these in inquiries:

a. Replication and repeated observations to help develop standards described by Kaplan and Anderson (2007) for performing the tasks associated with preparing food in school lunch programs, which were found to be inadequate by Sherrin, et al. (2009) and Hwang and Sneed (2004);
b. Determine what proportion of practical capacity is reasonably applied to facility- and process-sustaining tasks. Specifically, determine if the 20% estimate is reasonable, or if the unreported and unrecognized labor obscuring the quantification of resources needed to adequately manage the program;
c. Investigate if value-adding labor found in this study is applicable to other entrees at the school district studied and the same entrée prepared at another location;

d. Determine the proportion of theoretical capacity that should be earmarked for staff education and training;

e. Determine the level of non-value adding labor reasonable to sustain facilities, processes and products.

This study demonstrated that benchmarking and the identification of standards in school meal programs are possible. Future research should focus on identifying those standards, developing common definitions and benchmarking standards.

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Table 5-1

Participant Demographics

Characteristics		*N*=4
Gender	Female =4	
Age	Mean (y) = 46.25	Range = 30-57
Years in district school meals program	Mean (y) = 6.13	Range = 2-17
Total time in foodservice	Mean (y) = 11.13	Range = 2-18.5

Table 5-2.

Capacity and Value of Labor

Employee Designator	Hourly Pay Rate	Theoretical Capacity (minutes/month)	Practical Capacity (minutes/month)	Practical/Theoretical Capacity (%)	Labor Value Unit (Dollars/Minute)	Labor Value Units (Dollars/Second)
A	$16.89	8198.6	7898.6	96.34	0.3065	0.0051
B	$15.47	8198.6	7898.6	96.34	0.2807	0.0047
C	$15.47	9389.6	9149.6	97.44	0.2759	0.0046
D	$16.19	11116.4	10861.4	97.71	0.2861	0.0048

Table 5-3

Time and Labor Cost

	Trial 1, 400 portions			Trial 2, 400 portions			Trial 3, 300 portions		
Employee	D	C	Total	D	C	Total	A	B	Total
Minutes	34.13	8.29	42.42	27.70	11.53	59.22	12.37	11.47	23.84
Seconds	2047.93	497.53	2545.46	2861.70	691.60	3553.30	742.40	688.10	1430.50
Pay rate/ second	$0.0048	$0.0046		$0.0048	$0.0046		$0.0051	$0.0047	
Labor cost	$9.7669	$2.2877	$12.0546	$13.6478	$3.1801	$16.8279	$3.7921	$3.2192	$7.0113
Seconds/ portion			6.364			8.883			4.768
Labor cost/ portion			$0.0301			$0.0421			$0.0234

CHAPTER 6. CONCLUSIONS

Summary

Background

Recent sweeping modifications in the National School Lunch Program (NSLP) have changed the face of the program. Regulatory requirements have aligned nutrient standards to align with 2010 Dietary Guidelines for Americans, resulting in increased food and labor costs Americans (Healthy Hunger Free-Kids Act of 2010 [HHFKA], 2010; National School Lunch Program, 2012; National School Lunch Program and School Breakfast Programs, 2012; National School Lunch Program and School Breakfast Program, 2013; U.S. Department of Agriculture [USDA] & U.S. Department of Health and Human Services [HHS], 2010). Coupled with these changes are pricing requirements for reimbursable meals and foods sold in addition to reimbursable meals (HHFKA, 2010; National School Lunch Program, 2011). The pricing changes sought to address the expected increase in costs and the issues identified in the USDA cost study (USDA, 2008), where schools were found to be quite accurate in determining food costs, but did not recognize other costs associated with operating the program, a significant part of which were unrecognized labor costs.

The USDA cost study itself (2008) relied on allocation methods of cost assignment, consistent with the recommendations of Cater, Conklin, and Cross (2005) and National Food Service Management Institute (2010). A straight-line method such as this obscures the differences between higher cost menu items and meals and those with lower costs (Cooper & Kaplan, 1990). But no method is consistently applied in school meals programs, making between-school comparisons and external benchmarking difficult or impossible (Hanna, 2008; Hwang & Sneed, 2004; Sherrin, Bednar, & Kwon, 2009). Combined with the financial

pressures associated with the HHFKA (2010), school meal program managers need a better way to determine costs and apply the cost information when making menu decisions.

Study Purpose

There were three broad purposes in this study:

1. To determine if Time-Driven Activity-Based Costing (TDABC) is a better way to measure labor and labor costs in school meals programs than the traditional allocation method;
2. To determine if menu analysis, as employed in restaurant foodservice, is applicable in school meals programs, and if a modification of menu analysis, including the measured costs of labor, improve the usefulness of the process in school meals programs;
3. To determine if the outcomes of conducting TDABC and menu analysis processes justify the expenses incurred.

Six specific research questions were investigated, the results of which will be discussed below:

1. Can Time Driven Activity Based Costing (TDABC) be applied in school meals programs to measure direct labor associated with production?
2. Does TDABC-based measurements of labor costs differ from allocated labor costs in school meals programs?
3. Are TDABC-based measurements of labor costs for specific food products sufficiently sensitive to discriminate between the food products?
4. Can menu analysis processes be applied to school meals programs?
5. Does inclusion of costs of direct labor in menu analysis improve the usefulness of the process in school meals programs?
6. Does the cost associated with conducting TDABC justify its use, as demonstrated by cost benefit analysis?

Summary of Methods

The study was patterned after similar TDABC and menu analysis studies in restaurant foodservice (Annaraud, Raab, & Schrock, 2008; Raab, 2003; Raab, Hertzman, Mayer & Bell, 2006; Raab & Mayer, 2007; Raab, Mayer, Shoemaker, & Ng, 2009; Vaughn, Raab, & Nelson, 2010), but with three important differences:

1. This research employed direct observation techniques to measure labor rather than rely on worker reports. Workers have been found to be suspicious of the TDABC process and biased in their reports of required time to complete tasks (DeMeere, Stouthuysen, & Roodhooft, 2009; Major & Hopper, 2005); therefore, direct observation was employed in addition to worker reports, to counter the reporting bias. Due to the small production areas at many of the study sites and the need to minimize the number of observers, video recording was used. Use of video recordings facilitated the direct observation of workers and allowed measurements of time to be made off-site and outside the observation event.
2. The field of inquiry was narrowed to include only labor considered "value adding," labor expended to prepare meals through production to the point at which the product is ready for service, but not receiving, storing, assembling ingredients from storage, opening packages, measuring, or cleaning up. Direct value-adding labor was assumed to comprise the bulk of labor expended in preparing the entrees. The work was expected to occur in a limited number of locations and by few employees, improving the ability to observe the work in its entirety,
3. Workers were asked to provide input about their experiences in the research process, to assess whether the video recording technique was an improvement over eyes-on observation.

Three Iowa school districts, where four types of entrees were prepared at five production sites, participated in this study. Details about the districts and the products studied are provided at Appendix B (kitchen floor plan sketches); Appendix I (equipment utilized in preparing the entrees and a summary of the observations); Tables 3-2 through 3-6 (descriptions of the three districts and their meals programs); Table 3-8 (details about the products observed).

Workers and managers were interviewed at the beginning of the study and were asked to provide socio-demographic information; a summary is at Appendix H. During the interviews, workers and managers were asked to identify aspects of the work environment that would affect the amount of time available for work, specifically work schedules, paid and unpaid breaks, paid and unpaid time off, replacement of absent workers with substitutes, and practices to address weather-related school closures. Using this information, theoretical capacity (workers' total paid time) and practical capacity (the workers' time actually available for work) were determined in the manner of Turney (2005). The information obtained in interviews was compared to district payroll records for confirmation. Interview protocols are included at Appendices F and G.

Workers and managers were asked to evaluate recipes for the selected entrees and identify the specific steps of production. The steps of production were organized into bills of activity, in the manner of Raab (2003), though these bills of activity were adjusted during observations to address ad hoc changes made due to ingredient availability and program needs. The final bills of activity are provided at Appendix K. As one part of developing the bills of activity, workers were asked to report the time required to complete each step; workers were

unable to provide time estimates, in part because of the ad hoc changes. Estimates provided by workers are at Appendix O.

District payroll records were examined to determine pay rates of the participating workers and the value of benefits. For each worker preparing entrees, labor value units were calculated to adjust pay and benefit rates based on practical capacity. The results are included at Appendix N. Program costs and revenues and meals served were analyzed in the method of Cater, et al. (2005) to determine allocated costs per meal equivalent, presented at Appendix S.

Actual food costs for the studied entrees were calculated based on district purchase records; the results are at Appendix T. Allocated labor costs per entrée, in the method used in the USDA cost study (2008) were calculated, and are presented at Appendix U.

Twenty-two video recorded observations were conducted. The video recordings were analyzed by the researcher. Based on the final bills of activity and the analysis of the video recordings, definitions for each step of production were developed. The time required to complete each step was determined by the researcher and the data were entered on Microsoft Excel spreadsheets, an example of which is at Appendix R.

Descriptive and inferential statistical analyses were conducted. At least three trained evaluators reviewed samples of the videos, employing the definitions for each step and the Microsoft Excel spreadsheets, to validate the time measures; a summary of the video segments reviewed is included at Table 3-9. Pair-wise comparisons of mean times for each of the five major steps, as measured by the researcher and as validated by the trained observers, were conducted.

Focus groups with participating employees were held at the conclusion of filming; the interview protocol is at Appendix X. Appendices Y and Z provide the synopsis of themes and theme quotes.

Menu analysis, a process commonly used in restaurant foodservice to classify menu items by their contribution to profit, was conducted. Many factors, such as popularity and relative profit, are common in menu analysis; when menu analysis considered food costs and labor costs of production, rather than just food costs, the classification of menu items changed (Annaraud, et al., 2008; Raab, & Mayer, 2007; Raab, et al., 2006; Raab, et al., 2009). In this study, menu analysis compared the entrees based on two metrics, calculated food costs plus allocated labor costs and calculated food costs plus measured direct value adding labor costs.

Summary of Findings

District characteristics. Differences between the districts were meaningful in many ways. Districts A and B experienced annual deficits between revenue and expenses, based on their reported costs, while District C annually reported revenue in excess of revenue. Allocated food costs per meal equivalent were similar (between $1.50 and $1.60), but District B's cost of labor per meal equivalent was more than $0.60 lower than District A and more than $0.40 lower than District C. The metric, meals per labor hour, was highest for District B, lowest for District A.

Capacity. Practical capacity, as a percentage of theoretical capacity, was above 96% at all districts, and higher than estimates for other industries (DeMeere, et al., 2009; Kaplan & Anderson, 2007). Because the difference between theoretical and practical capacities is the sum of breaks, time off, attendance at meetings, and participation in training, this finding infers that workers generally take no breaks or time off and participate in no meetings or trainings. This very high level of practical capacity results in labor value units only slightly higher than

hourly pay rates plus the cost of school-paid benefits. A summary of capacity findings and value of labor is at Table 5-1.

Production methods. Two production methods were used at the five sites. The production methods have been labeled "bulk method" and "pan method." "Bulk method" generally means that the product was prepared in a single cooking vessel, such as a steam jacketed kettle or tilting skillet. "Pan method" involved preparing the product in smaller amounts, in standard hotel pans, with every pan of product identical as to ingredients.

Steps of production. Steps of production generally fell into five broad categories plus one miscellaneous category. The five broad categories are adding ingredients to the food, covering and uncovering hotel pans in which the food was prepared and/or served, measuring temperatures of the food, moving the food during production, and stirring the food. The five broad categories represent over 80% of total time expended in producing entrees included in this study and generally were part of the production of every entrée at every site. Overarching definitions for the five steps were developed and are presented at Table 4-2, while all definitions are included at Appendix P.

There were differences in how frequently the five steps were observed at each site, for each product, and for the two production methods. In general, bulk production methods resulted in few observations of covering/uncovering, moving product, and measuring temperature. Pan production methods, in contrast, yielded repeated measures for these steps, because the steps had to be taken for every pan. Times for stirring, on the other hand, were longer for bulk production methods and for products with sticky ingredients (such as the cheese macaroni beef casserole), but were much more frequent for pan methods.

Analysis

The sums of time required to complete each of the five steps were compared pair-wise with two-tailed *t* - tests assuming unequal variances. When time measurements for the five major steps, for methods of production, product and site, were combined and a single mean calculated for each major step, significant results ($p = .009$) were found between the mean times for measuring temperatures and moving. Differences between mean times for adding ingredients and measuring temperatures were found to be not significant ($p = .159$). All other mean-pair comparisons were found to be significant ($p<.001$). However, comparison of mean times for steps when production methods were taken into account yielded different results. For bulk methods of production, there was no statistical difference in mean time measurements found for any evaluated pair. Inadequate data did not permit comparisons of four pairs.

For pan methods, non-significant results ($p=.111$) were found for the adding ingredient-measuring temperature pair; significant results ($p< .001$) were found for all other pairs. See Table 6-1 for details. These findings are important because they demonstrate the inadequacy of allocation methods to estimate labor. These five steps comprised the majority of direct value-adding labor time spent preparing the entrees, though each entrée required different quantities of each step. Therefore, if the times per step are different and the number of each step are different for each entrée, the total times for each entrée should differ.

For the pan production method, each pan produced results in about the same volume of product and requires the same numbers of each step. Each pan does not result in the same number of servings, because younger children are served less than are older children. Total time per serving would differ for older and younger children.

These five steps of production can be differentiated from each other for some pairs; the mean time for each step may be suitable for standard times to complete the step when preparing these entrees using the pan method, but findings may not be well-applied to bulk preparation methods.

Insert Table 6-1 here.

Comparing mean times for each step, between bulk and pan production methods, found non-significant results for adding ingredients (p = .160) and measuring temperatures (p = .501). Comparisons between bulk method and pan method were significant for moving product (p = .003) and stirring (p <.001). Inadequate data prevented making comparisons for covering. The differences in time per step for the two methods could be discerned, indicating that comparisons between the two methods are not useful.

Of note, District B Site 2 experienced equipment malfunctions; workers were not able to rely on the equipment to heat as expected. At District C Site 1, during one observation, cheese macaroni beef proceeded to service on time and as expected; at the other observation, a weather emergency necessitated closing school in early afternoon and required lunch service times to be moved about an hour earlier.

Using the same analytic process, pair-wise comparison of mean times for each of the five major steps, as measured by the researcher and as validated, were not significantly different for stirring (p = .620) and moving (p = .945). Mean time measurements were significantly different for adding ingredients (p = .023); differences between mean time measurements for covering and measuring temperatures were significant (p <.001). Descriptive statistics are presented at Table 6-2; results of pair-wise comparisons are at Table 6-3..

Insert Table 6-2 here.

Insert Table 6-3 here.

Conclusions

Each of the six research questions will be addressed in turn.

1. **Can Time Driven Activity Based Costing (TDABC) be applied in school meals programs to measure direct labor associated with production?**

This research, the first of its kind in school meals programs, sought to demonstrate that the TDABC can be applied to measure labor. Activity Based Costing and TDABC have been successfully applied in other industries and in foodservice (Annaraud, et al., 2008; DeMeere, et al., 2009; Everaert, et al., 2008; Greeson & Kocakulah, 2000; Hicks, 1999; Raab & Mayer, 2007; Raab, et al., 2006; Raab, et al., 2009; Vaughn, et al. 2010)

Using video-recorded observations, measurements were made for four categories of product (pasta meat sauce, meat noodle casserole, cheese macaroni beef casserole, and chili), at five production sites in three small school districts. Five broad steps generally common to each product at each site were identified. Two distinctly different methods of production were identified, preparing products in bulk and preparing products in smaller batches in hotel pans.

With one exception, mean time measurements for the five steps were statistically different when compared pair-wise for pan production methods and when bulk and pan methods were combined. Results were less favorable when the five steps were compared for bulk production methods, though these results were clouded by the relative lack of data to make four pair-wise comparisons. This indicates that TDABC is applicable to school meals programs.

2. **Does TDABC-based measurement of labor costs differ from allocated labor costs in school meals programs?**

Examination of the data at Appendix V indicates there is a difference between allocated

labor costs and direct value-adding labor costs. This study indicates that direct, value-adding labor is a very small fraction, less than 7%, of allocated labor expended in producing these entrees in school meals. These findings demonstrate clearly that TDABC-measured labor is different from allocated labor, though the data are insufficient to conclude that TDABC-based measurements of ALL labor costs differ from allocated labor costs. This study did not evaluate the total measured labor cost to prepare the entrees, but the difference between the allocated cost for each portion of entrée and the measured cost of production suggests that a difference exists.

3. **Are TDABC-based measurements of labor costs for specific food products sufficiently sensitive to discriminate between the food products?**

The differences in mean times for each step of production were significantly different from each other, for pan production methods and when pan and bulk production methods were combined. Kaplan and Anderson (2007, p. 49) note "…a cost rate is valid only if the mix of resources supplied is about the same for each activity and transaction performed." In this study, it appears that the "resources," that is, the value of labor associated with the steps required to produce the entrée, can be quantified. This finding indicates that standards can be established for steps, and as further research is completed and all steps associated with making particular products are studied, standards can be determined.

4. **Can menu analysis processes be applied to school meals programs?**

Menu analysis proved to be difficult for three reasons, but research findings were insightful nevertheless. Firstly, the method used by USDA (2008) to allocate labor to specific products, applies the product's food cost as a percentage of all food costs to labor. This results in items with a high proportion of food costs also to be allocated a high proportion of labor. In

reality, pre-prepared, heat-and-eat items are generally higher in purchase cost per portion but quite low in labor cost; the USDA allocation method reverses this. Comparing the measured direct value adding labor cost to the allocated cost found a wide difference between the two; see Appendix V for details.

For many entrees studied, many ingredients were donated as part of the USDA commodity program; this included pasta, cheese sauce, raw and pre-cooked ground beef, pasta sauce, cooked diced chicken. Market value of these foods, which must be used when computing costs and placing value on inventory, is very different from the cash outlay made by schools (Cost Principles for State, Local, and Indian Tribal Governments, 2005; Iowa Department of Education, 2013). Some of the ad hoc changes made by schools were because commodity products made available on short notice required much less cash to acquire. Two of the three districts experienced expenses in excess of revenue, so reducing cash expenditures was a high priority. This, combined with the USDA method for labor allocation (2008), resulted in reductions in cost calculations for labor when the low-cash product was used, when in fact more time was required to prepare the entrees using these ingredients.

Thirdly, direct value-adding labor was found to be a very small fraction of all labor expended by the study participants. It would be important to know what other work is occurring, and whether it would be reasonable to include some in the cost of the entrée.

However, Figures 3-2, 3-3, and 3-4 demonstrate rather graphically that different entrees carry different costs, even when allocation methods are used. One product, beef noodles at District B Site 2, appears to have a calculated food cost plus allocated labor cost of $1.80, and a calculated food cost plus measured direct value-adding labor cost less than $1.20. The difference between these two values is substantial; the $1.80 cost may well cause a manager to

consider eliminating the product from the menu, while the $1.20 cost may be within reason. But without better data about the cost of labor, this decision is speculative.

5. **Does inclusion of costs of direct labor in menu analysis improve the usefulness of the process in school meals programs?**

Allocated labor costs, in the method employed in the USDA study (2008), do not discriminate between entrees in meaningful ways. As noted above, tying food cost percentages to extrapolate labor cost percentages yield very little useful information. However, direct value-adding labor has been found to be such a small fraction of all labor that questions continue unanswered about other activities occurring that should be included in direct labor and the cost to produce the entree Therefore, this question cannot be answered.

6. **Does the cost associated with conducting TDABC justify its use, as demonstrated by cost benefit analysis?**

Total time spent by the researcher and filming assistants is displayed at Appendix W. A total of 6669 portions of the entrees studied were prepared under observation, for an average of 1.69 minutes per entrée portion. Because the direct value-adding labor values, both in minutes and in dollars, are strongly suspected to be underestimates of total labor to produce a product, and because the value of allocated labor is not necessarily related to labor requirements for reasons discussed above, there is no way to determine if there is a relationship between time or cost of labor to product the entrees, and the time to conduct the research.

However, there is one bright spot in this analysis: these workers did not find the video recording to be disruptive or offensive. While they expressed some initial nervousness and some concern that their performance would be found lacking, these were not seen as serious impediments to the use of videos. The workers expressed interest in viewing the videos, in

taking the opportunity to see their own performance and the performances of others, to improve. Most indicated willingness to participate in similar research in the future.

This is contrary to the findings of others using TDABC (DeMeere, et al., 2009; Major & Hopper, 2005). The participants in this study cited their degree of familiarity with the process and a level of trust in the researcher as the causes for their lack of discomfort. This is particularly important: recorded observations can be gathered with less obtrusiveness than observers measuring time, the analysis can be conducted off-site, and the observations can be validated.

TDABC in combination with menu analysis has been successful in other foodservice applications (Annaraud, et al., 2008; Raab, 2003; Raab & Mayer, 2007; Raab, et al.,, 2006; Raab, et al., 2009; Vaughn, et al., 2010). This study indicates that TDABC can be an effective tool in measuring the mean time per step, across products and production sites. With more observations, resources (labor) per transaction (food product) can be determined, as suggested by Kaplan and Anderson (2007).

Recommendations for Future Research

The This study should be replicated with some modifications, specifically changing the kind of camera used. This study should be replicated in similar situations but using overhead cameras with overlapping fields of observation. This single change could address the need to make estimations of time when observations were somehow lacking, whether due to obscured vision or competing action that could not both be filmed. It would also allow measurements of time spent doing work contemporaneously, which would allow identification of other steps and the establishment of standard times for those steps. Use of video recording improves the ability of the researcher to "see" all the work and conduct measures of all the work, to gain a

more complete picture of the work being done and the time required to complete it. The ability to validate measurements using multiple reviewers is a strong reason to use recorded observations. At least in these districts with these workers, filming was not found to be offensive. As cameras become more ubiquitous, the resistance to using video recordings should further diminish.

More investigation is needed in the definition of labor, particularly how labor is divided into value-adding or non-value-adding, as in this study, or into facility-sustaining, process-sustaining, and product-sustaining, as described by Annaraud, et al., (2008) in quick serve restaurants. The wide disparity in measured direct value-adding time in this study and practical capacity must be investigated. The disparity between allocated labor and measured direct value-adding labor must also be analyzed. School districts would benefit from knowing which labor directly contributes to preparing food, which is necessary for participating in the program but does not directly contribute to food preparation, and which is generally required to maintain the premises, particularly when making decisions about out-sourcing and automated processes, and about using pre-prepared products instead of foods prepared from raw ingredients. When replacing equipment, knowing the potential labor savings would be an important factor.

A method to utilize menu analysis in school meals programs should be investigated, and it should be based on actual food costs and measured labor. The allocation method is a disservice to managers and planners and must be replaced with a method nimble enough to capture small but important changes but still be reliable and reproducible.

The study should be conducted in districts of different sizes, with different equipment, and focusing on different food products. These products, though initially selected because the

recipes appeared to include more preparation of raw ingredients, ended as little more than the combination of products with quite a bit of pre-preparation as purchased.

Further investigation into capacity should be undertaken. Investigation should center on the affect of regular training and informational meetings on productivity.

The issue of trust proved important in this study. More study on trust in research settings, what affects trust, and how to engender and ensure it will be important for observational research employing recordings in the future.

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Table 6-1

Results of t*-tests for Pair-wise Comparisons of Five Steps of Production*

Step-Pair/Production Method	Bulk Method	Pan Method	Both Methods Combined
Move-stir	p =.791.	p<.001	p<.001
Move-temperature	p =.063	p<.001	p=.009
Move-cover	Insufficient data	p<.001	p<.001
Move-add	p=.085	p<.001	p<.001
Add-stir	p=.056	p<.001	p<.001
Add-temperature	p=.702	*p=.111*	*p=.159*
Add-cover	Insufficient data	p<.001	p<.001
Stir-temperature	p=.052	p<.001	p<.001
Stir-cover	Insufficient data	p<.001	p<.001
Temperature-cover	Insufficient data	p<.001	p<.001

Table 6-2

Validation of Time Measurements Comparison (in Seconds)

Step/ Statistic	Adding Ingredients	Covering/ Uncovering	Measuring Temperature	Moving	Stirring
Mean study	20.07	6.99	16.25	10.99	35.55
Mean validation	14.71	14.17	5.29	11.07	33.56
SD study	39.81	5.44	13.10	10.17	37.60
SD validation	13.12	12.16	1.98	11.89	39.34

Table 6-3

Comparisons of Means

Adding	Covering/ Uncovering	Measuring Temperatures	Moving	Stirring
p=0.023	p<0.001	p<0.001	p=0.945	p=0.602

APPENDIX A: HUMAN SUBJECTS APPROVAL

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Institutional Review Board
Office for Responsible Research
Vice President for Research
1138 Pearson Hall
Ames, Iowa 50011-2207
515 294-4566
FAX 515 294-4267

Date: 10/17/2012

To: Nancy Christensen
31 MacKay Hall

CC: Dr. Susan Wohlsdorf Arendt
9E MacKay Hall

From: Office for Responsible Research

Title: Labor in School Meals Programs: Measurement of Direct Costs and Their Influence on Menu Planning

IRB ID: 12-461

Approval Date:	10/17/2012	**Date for Continuing Review:**	10/1/2014
Submission Type:	New	**Review Type:**	Full Committee

The project referenced above has received approval from the Institutional Review Board (IRB) at Iowa State University according to the dates shown above. Please refer to the IRB ID number shown above in all correspondence regarding this study.

To ensure compliance with federal regulations (45 CFR 46 & 21 CFR 56), please be sure to:

- **Use only the approved study materials** in your research, **including the recruitment materials and informed consent documents that have the IRB approval stamp**.
- **Retain signed informed consent documents for 3 years after the close of the study,** when documented consent is required.
- **Obtain IRB approval prior to implementing any changes** to the study by submitting a Modification Form for Non-Exempt Research or Amendment for Personnel Changes form, as necessary.
- **Immediately inform the IRB of (1) all serious and/or unexpected adverse experiences** involving risks to subjects or others; and (2) **any other unanticipated problems involving risks** to subjects or others.
- **Stop all research activity if IRB approval lapses,** unless continuation is necessary to prevent harm to research participants. Research activity can resume once IRB approval is reestablished.
- **Complete a new continuing review form** at least three to four weeks prior to the **date for continuing review** as noted above to provide sufficient time for the IRB to review and approve continuation of the study. We will send a courtesy reminder as this date approaches.

Please be aware that IRB approval means that you have met the requirements of federal regulations and ISU policies governing human subjects research. **Approval from other entities may also be needed.** For example, access to data from private records (e.g. student, medical, or employment records, etc.) that are protected by FERPA, HIPAA, or other confidentiality policies requires permission from the holders of those records. Similarly, for research conducted in institutions other than ISU (e.g., schools, other colleges or universities, medical facilities, companies, etc.), investigators must obtain permission from the institution(s) as required by their policies. **IRB approval in no way implies or guarantees that permission from these other entities will be granted.**

Upon completion of the project, please submit a Project Closure Form to the Office for Responsible Research, 1138 Pearson Hall, to officially close the project.

Please don't hesitate to contact us if you have questions or concerns at 515-294-4566 or IRB@iastate.edu.

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Institutional Review Board
Office for Responsible Research
Vice President for Research
1138 Pearson Hall
Ames, Iowa 50011-2207
515 294-4566
FAX 515 294-4267

Date: 12/18/2012

To: Nancy Christensen
31 MacKay Hall

CC: Dr. Susan Wohlsdorf Arendt
9E MacKay Hall

From: Office for Responsible Research

Title: Labor in School Meals Programs: Measurement of Direct Costs and Their Influence on Menu Planning

IRB ID: 12-461

Approval Date:	12/18/2012	**Date for Continuing Review:**	10/1/2014
Submission Type:	Modification	**Review Type:**	Expedited

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Assigned IRB ID: **12-461**

INSTITUTIONAL REVIEW BOARD (IRB)
Amendment for Personnel Changes

Title of Project: Labor in School Meals Programs: Measurement of Direct Costs and Their Influence on Menu Planning

Principal Investigator (PI): **Nancy Christensen**		Degrees: MSEd
University ID: **577320744**	Phone: 515-230-4936	Email Address: nancyc@iastate.edu

RECEIVED
DEC 17 2012
By IRB

FOR STUDENT PROJECTS (*Required when the principal investigator is a student.*)		
Name of Major Professor/Supervising Faculty: Susan Wohlsdorf Arendt		
University ID: 44243760223	Phone: 515-294-7575	Email Address: sarendt@iastate.edu

Changes in Key Personnel:

Key personnel includes any individuals who will have contact with the participants or the participants' data (e.g., interviewers, transcribers, coders, etc.). This information is intended to inform the committee of the training and background related to the specific procedures that each person will perform on the project. For more information, please see Human Subjects - Persons Required to Obtain IRB Training. Personnel who will have contact with human blood, specimens, or other biohazardous materials must also complete Bloodborne Pathogens Training. *If the principal investigator has or will change, a complete new IRB application is required.*

List any individuals to be removed from the study staff:

Complete the following table to list any new key personnel:

NAME	Interpersonal contact or communication with subjects, or access to private identifiable data?	Involved in the consent process?	Contact with human blood, specimens, or other biohazardous materials?	Other Roles in Research	Qualifications (i.e., special training, degrees, certifications, coursework, etc.)	Human Subjects Training Date
Tianshu Zheng	☒	☐	☐	data analysis	PhD, ISU IRB training certificate 426918	4/1/2010
YuShih Chiang	☒	☐	☐	video assistant	ISU Master's student; ISU IRB training certificate 733693	8/27/2011
Elsey Hartman	☒	☐	☐	video assistant	ISU IRB training certificate 972340	10/2/2012
Kelly Mayfield	☒	☐	☐	video assistant	ISU PhD student; ISU IRB training certificate 241570	6/19/2009
Ungku Fatimah Ungku Zainal Abidin	☒	☐	☐	data analysis	ISU PhD candidate; ISU IRB training certificate 172772	2/1/2009
	☐	☐	☐			
	☐	☐	☐			
	☐	☐	☐			

	☐	☐	☐			
	☐	☐	☐			

FOR IRB USE ONLY	☑ All human subjects training requirements have been met.
IRB Reviewer Signature	Kerry A Ignitsch *Date* Dec. 18, 2012

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Institutional Review Board
Office for Responsible Research
Vice President for Research
1138 Pearson Hall
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Date: 10/2/2013

To: Nancy Christensen
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CC: Dr. Susan Wohlsdorf Arendt
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From: Office for Responsible Research

Title: Labor in School Meals Programs: Measurement of Direct Costs and Their Influence on Menu Planning

IRB ID: 12-461

Approval Date:	10/2/2013	**Date for Continuing Review:**	10/1/2014
Submission Type:	Modification	**Review Type:**	Expedited

The project referenced above has received approval from the Institutional Review Board (IRB) at Iowa State University according to the dates shown above. Please refer to the IRB ID number shown above in all correspondence regarding this study.

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- **Complete a new continuing review form** at least three to four weeks prior to the **date for continuing review** as noted above to provide sufficient time for the IRB to review and approve continuation of the study. We will send a courtesy reminder as this date approaches.

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Upon completion of the project, please submit a Project Closure Form to the Office for Responsible Research, 1138 Pearson Hall, to officially close the project.

Please don't hesitate to contact us if you have questions or concerns at 515-294-4566 or IRB@iastate.edu.

Assigned IRB ID: **12-461**

INSTITUTIONAL REVIEW BOARD (IRB)
Amendment for Personnel Changes

Title of Project: Labor in School Meals Programs: Measurement of Direct Costs and Their Influence on Menu Planning

Principal Investigator (PI): Nancy Christensen			Degrees: MSEd
University ID: 577320744	Phone: 515 230 4936	Email Address: nancyc@iastate.edu	

RECEIVED
SEP 30 2013
By IRB

FOR STUDENT PROJECTS (*Required when the principal investigator is a student*)		
Name of Major Professor/Supervising Faculty: Susan Wohlsdorf Arendt PhD		
University ID: 44243760223	Phone: 515 294 7575	Email Address: sarendt@iastate.edu

Changes in Key Personnel:

Key personnel includes any individuals who will have contact with the participants or the participants' data (e.g., interviewers, transcribers, coders, etc.). This information is intended to inform the committee of the training and background related to the specific procedures that each person will perform on the project. For more information, please see Human Subjects - Persons Required to Obtain IRB Training. Personnel who will have contact with human blood, specimens, or other biohazardous materials must also complete Bloodborne Pathogens Training. *If the principal investigator has or will change, a complete new IRB application is required.*

1. **List any individuals to be removed from the study staff:** Elsey Hartman, Kelly Mayfield, Ungku Fatimah Ungku Zainal Abidin

2. **Complete the following table to list any new key personnel:**

NAME	Interpersonal contact or communication with subjects, or access to private identifiable data?	Involved in the consent process?	Contact with human blood, specimens, or other biohazardous materials?	Other Roles in Research	Qualifications (i.e., special training, degrees, certifications, coursework, etc.)	Human Subjects Training Date
Andrew Doherty	☒	☐	☐	Data Analysis	NIH training certificate #1273631	9/19/2013
Mareah Sletten	☒	☐	☐	Data Analysis	NIH training certificate #1275332	9/19/2013
Chen Du	☒	☐	☐	Data Analysis	NIH training certificate #1152460	3/31/2013
Mattea Rainforth	☒	☐	☐	Data Analysis	NIH training certificate #1273384	9/17/2013
Hillary Hayes	☒	☐	☐	Data Analysis	NIH training certificate #964056	8/26/2012
Vemala Devi Balakrishnan	☒	☐	☐	Data Analysis	NIH training certificate #1276859	9/20/2013
Kylie Thompson	☒	☐	☐	Data Analysis	NIH training certificate #1225575	8/19/2013
Carsen Petersen	☒	☐	☐	Data Analysis	NIH training certificate #1052561	11/25/2012
Brotherson, Mary Jane	☒	☐	☐	Data Analysis	PhD, Professor, ISU	2/20/2002

Morgan Bax	☒	☐	☐	Data Analysis	NIH training certificate #1151391	3/31/2013
	☐	☐	☐			
	☐	☐	☐			

☐ Yes ☒ No	3.	Does your study include children (persons under age 18) as research subjects?
		If ***Yes***, please read and respond to the following: ISU policy requires that background checks be completed for all researchers and key personnel who will have any contact with children involved in this research project. Details regarding this policy can be found here. **Principal Investigators and faculty supervisors are responsible** for ensuring that background checks are completed BEFORE researchers or key personnel may have any contact with children. Records documenting completion of the background checks must be kept with other research records (e.g., signed informed consent documents, approved IRB applications, etc.) and may be requested during any audits or Post-Approval Monitoring of your study.
☒ Agreed	3.a.	**Please check here to indicate that you have read this information and agree that you will comply with these requirements.**

FOR IRB USE ONLY	☑ All human subjects training requirements have been met.
IRB Reviewer's Signature	*Date* 10/11/13

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Institutional Review Board
Office for Responsible Research
Vice President for Research
1138 Pearson Hall
Ames, Iowa 50011-2207
515 294-4566
FAX 515 294-4267

Date: 10/21/2013

To: Nancy Christensen
31 MacKay Hall

CC: Dr. Susan Wohlsdorf Arendt
9E MacKay Hall

From: Office for Responsible Research

Title: Labor in School Meals Programs: Measurement of Direct Costs and Their Influence on Menu Planning

IRB ID: 12-461

Approval Date:	10/21/2013	**Date for Continuing Review:**	10/1/2014
Submission Type:	Modification	**Review Type:**	Expedited

The project referenced above has received approval from the Institutional Review Board (IRB) at Iowa State University according to the dates shown above. Please refer to the IRB ID number shown above in all correspondence regarding this study.

To ensure compliance with federal regulations (45 CFR 46 & 21 CFR 56), please be sure to:

- **Use only the approved study materials** in your research, **including the recruitment materials and informed consent documents that have the IRB approval stamp**.
- **Retain signed informed consent documents for 3 years after the close of the study**, when documented consent is required.
- **Obtain IRB approval prior to implementing any changes** to the study by submitting a Modification Form for Non-Exempt Research or Amendment for Personnel Changes form, as necessary.
- **Immediately inform the IRB of** (1) **all serious and/or unexpected adverse experiences** involving risks to subjects or others; and (2) **any other unanticipated problems involving risks** to subjects or others.
- **Stop all research activity if IRB approval lapses**, unless continuation is necessary to prevent harm to research participants. Research activity can resume once IRB approval is reestablished.
- **Complete a new continuing review form** at least three to four weeks prior to the **date for continuing review** as noted above to provide sufficient time for the IRB to review and approve continuation of the study. We will send a courtesy reminder as this date approaches.

Please be aware that IRB approval means that you have met the requirements of federal regulations and ISU policies governing human subjects research. **Approval from other entities may also be needed.** For example, access to data from private records (e.g. student, medical, or employment records, etc.) that are protected by FERPA, HIPAA, or other confidentiality policies requires permission from the holders of those records. Similarly, for research conducted in institutions other than ISU (e.g., schools, other colleges or universities, medical facilities, companies, etc.), investigators must obtain permission from the institution(s) as required by their policies. **IRB approval in no way implies or guarantees that permission from these other entities will be granted.**

Upon completion of the project, please submit a Project Closure Form to the Office for Responsible Research, 1138 Pearson Hall, to officially close the project.

Please don't hesitate to contact us if you have questions or concerns at 515-294-4566 or IRB@iastate.edu.

Assigned IRB ID: **12-461**

INSTITUTIONAL REVIEW BOARD (IRB)
Amendment for Personnel Changes

Title of Project: Labor in School Meals Programs: Measurement of Direct Costs and Their Influence on Menu Planning			
Principal Investigator (PI): **Nancy Christensen**			Degrees: MSEd
University ID: **577320744**	Phone: 515-230-4936	Email Address: nancyc@iastate.edu	

RECEIVED
OCT 17 2013
By IRB

FOR STUDENT PROJECTS (*Required when the principal investigator is a student.*)		
Name of Major Professor/Supervising Faculty: Susan Wohlsdorf Arendt		
University ID: 44243760223	Phone: 515-294-7575	Email Address: sarendt@iastate.edu

Changes in Key Personnel:

Key personnel includes any individuals who will have contact with the participants or the participants' data (e.g., interviewers, transcribers, coders, etc.). This information is intended to inform the committee of the training and background related to the specific procedures that each person will perform on the project. For more information, please see Human Subjects - Persons Required to Obtain IRB Training. Personnel who will have contact with human blood, specimens, or other biohazardous materials must also complete Bloodborne Pathogens Training. *If the principal investigator has or will change, a complete new IRB application is required.*

List any individuals to be removed from the study staff:

Complete the following table to list any new key personnel:

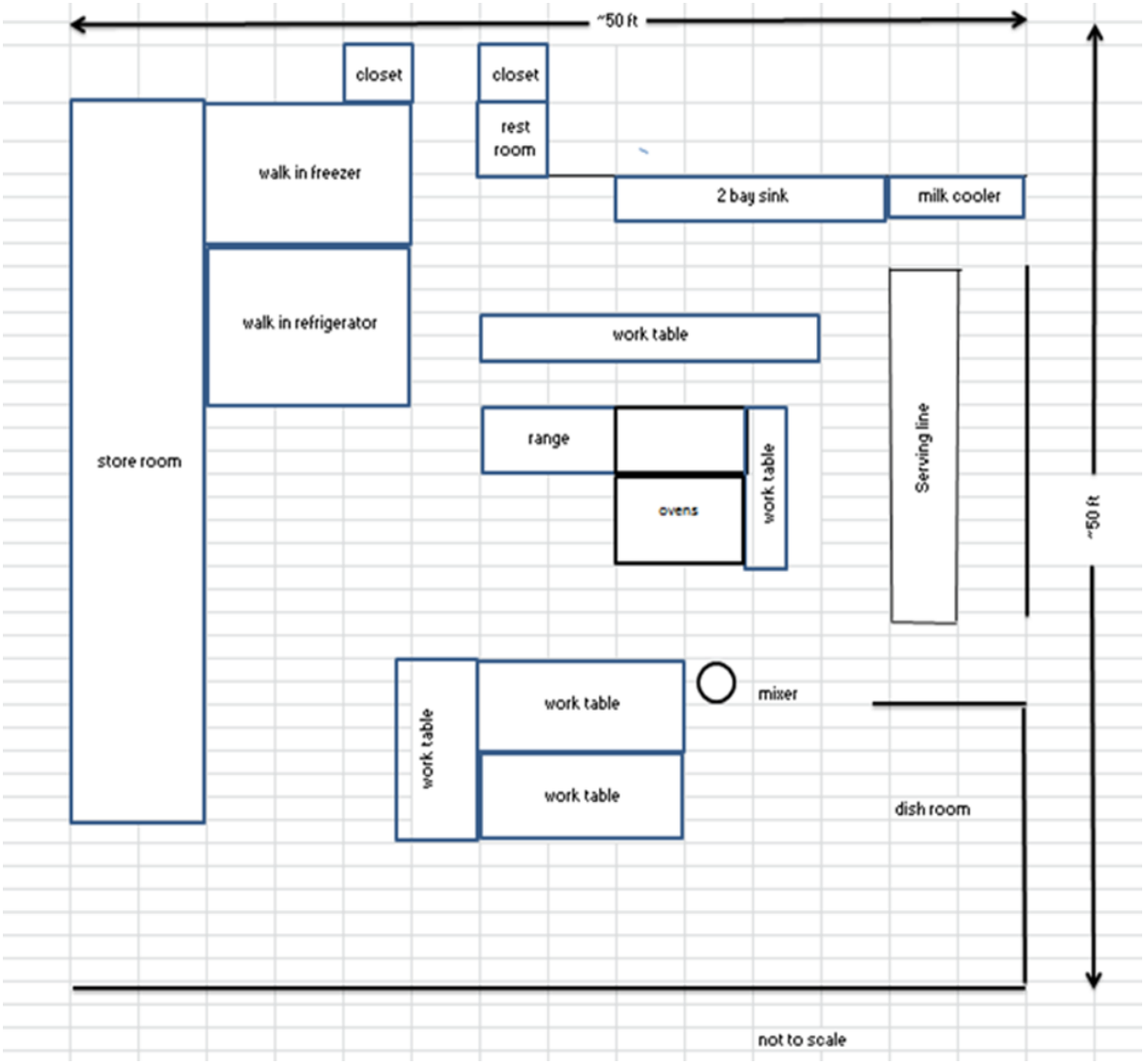
NAME	Interpersonal contact or communication with subjects, or access to private identifiable data?	Involved in the consent process?	Contact with human blood, specimens, or other biohazardous materials?	Other Roles in Research	Qualifications (i.e., special training, degrees, certifications, coursework, etc.)	Human Subjects Training Date
√ **Gerrie du Rand**	☒	☐	☐	data analysis	**Philosophiae Doctor, University of Pretoria; NIH training certificate # 1305024**	**10/16/2013**
	☐	☐	☐			
	☐	☐	☐			
	☐	☐	☐			
	☐	☐	☐			
	☐	☐	☐			
	☐	☐	☐			
	☐	☐	☐			
	☐	☐	☐			
	☐	☐	☐			

FOR IRB USE ONLY	☑ All human subjects training requirements have been met.
IRB Reviewer Signature	Kerry A Agritsel *Date* October 21, 2013

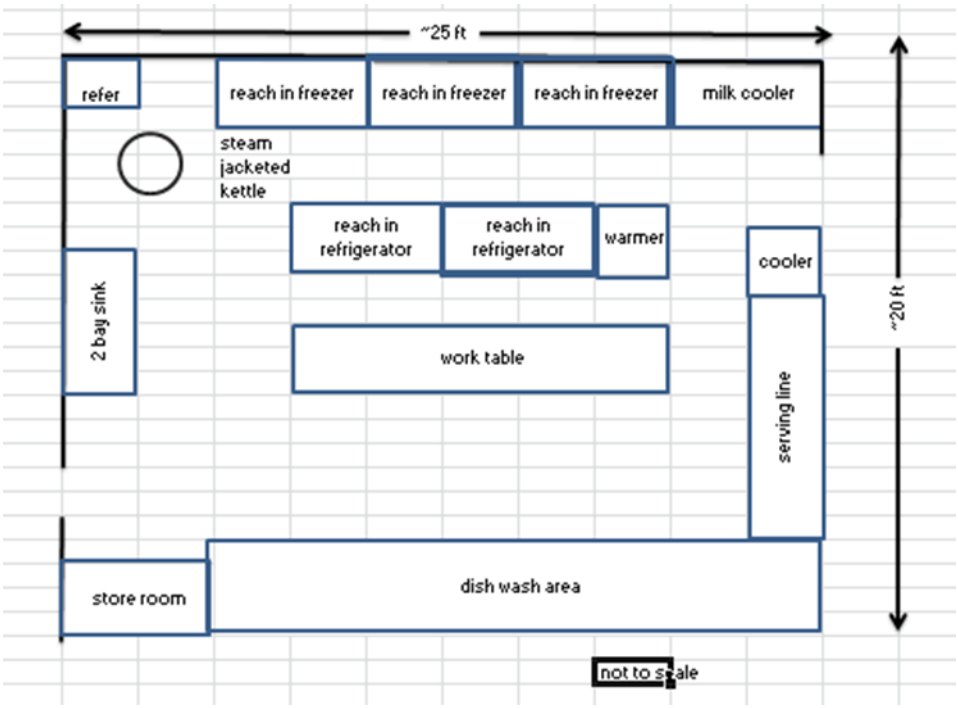
RB

APPENDIX B: KITCHEN FLOOR PLAN SKETCHES

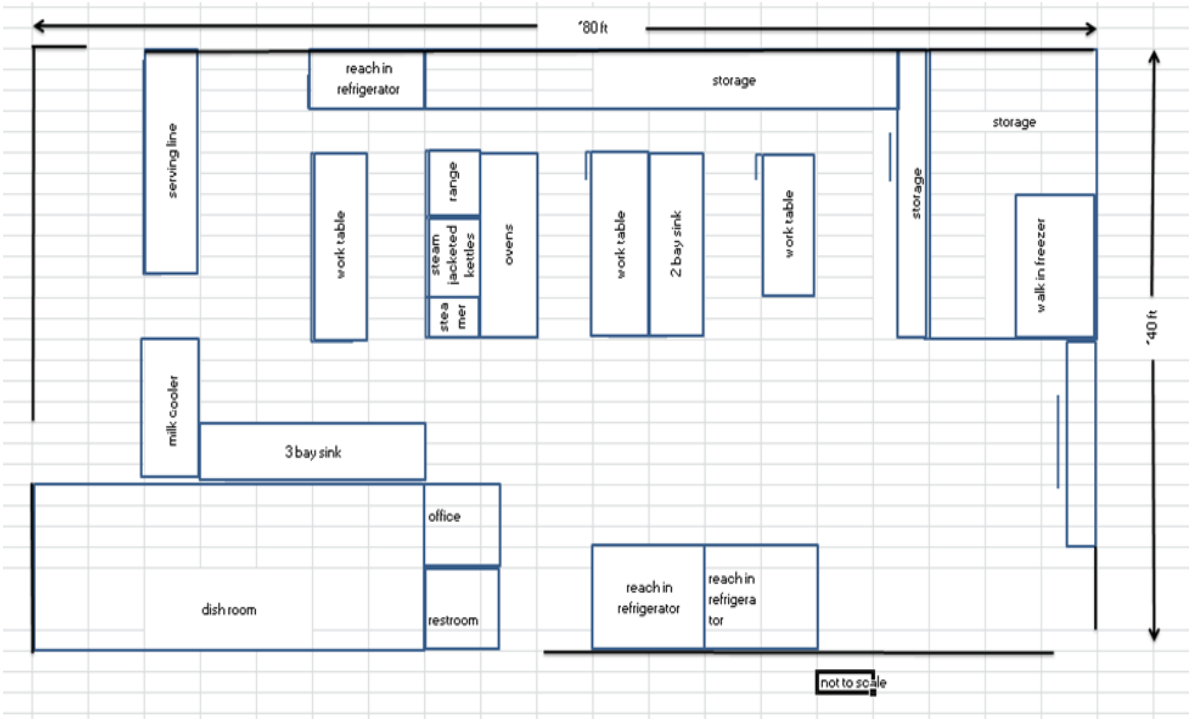
District A, Site 1



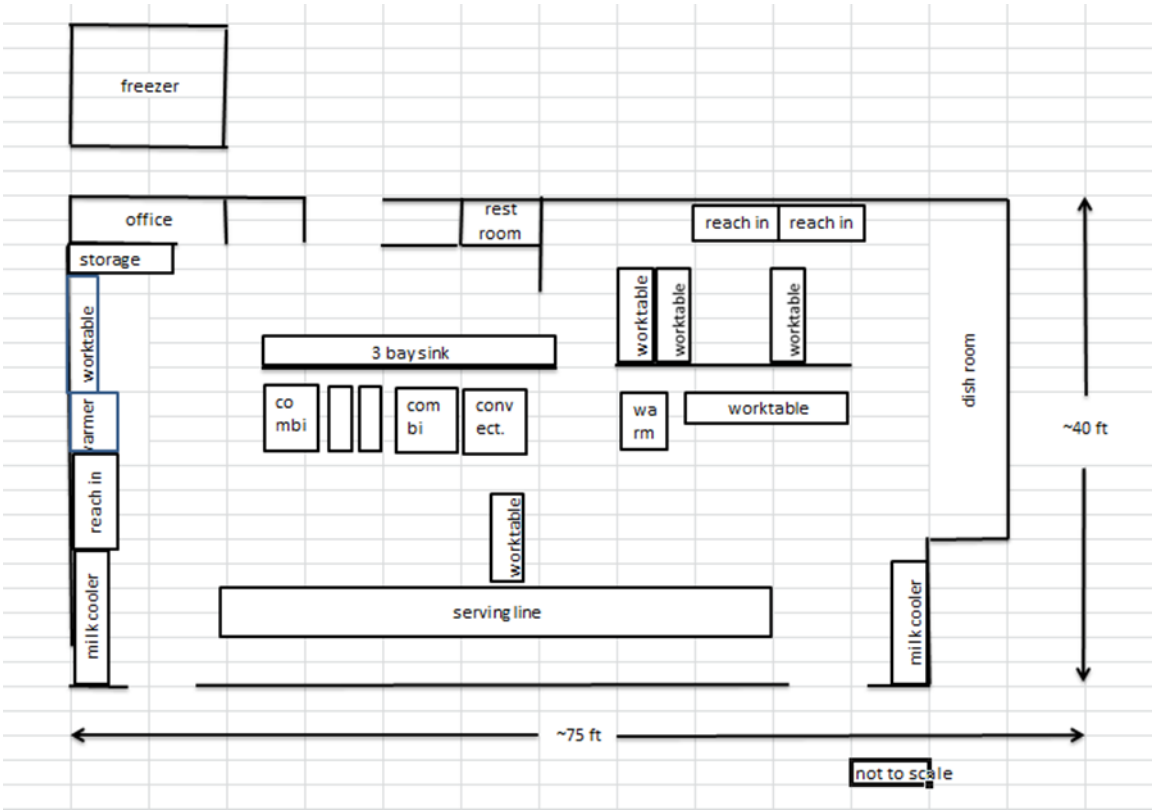
District B, Site 1



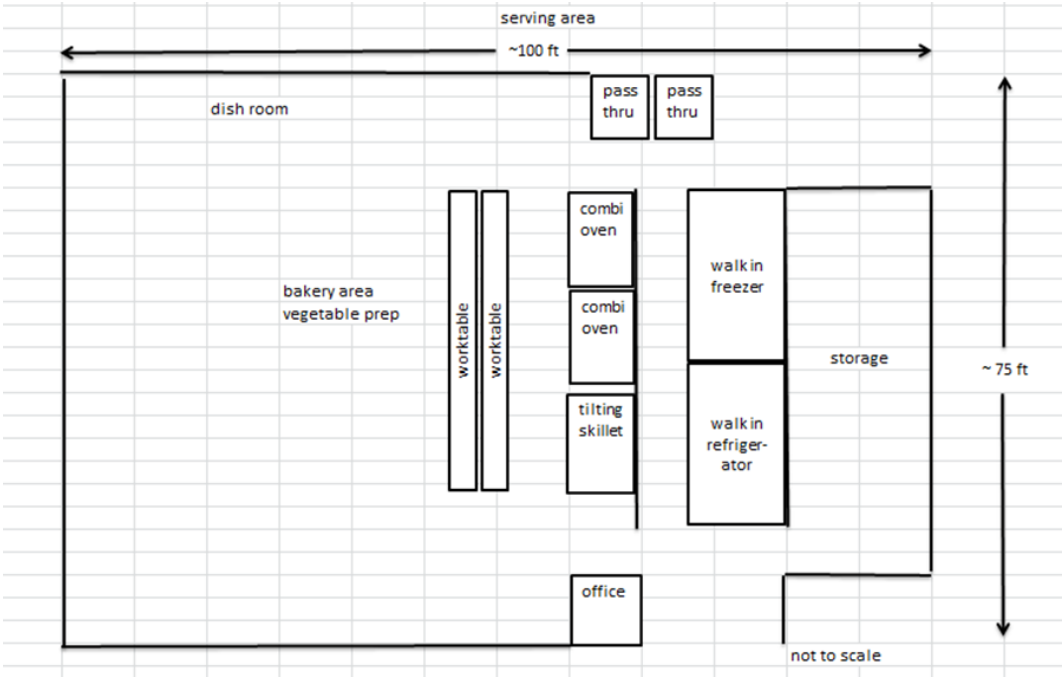
District B, Site 2



District C, Site 1



District C, Site 2



APPENDIX C: REDACTED APPROVAL BY SCHOOL BOARDS

District A

Board Work Session
Monday, July 30, 2012
6:30, Library -[redacted]/Jr/Sr High Learning Center, [redacted] IA.

3. Action Item
   - Approve Nancy Christensen PhD research with [redacted]SD – Moved by [redacted] seconded by [redacted] to approve Nancy Christensen to conduct PhD research at [redacted] chools. AYES – All. Motion carried 5-0.

District B

Regular Meeting
January 18, 2012

The Board of Directors of the [redacted] Community School District met in regular session on January 18, 2012 in the South Grade School Conference Room.

Nancy Christensen, a former employee of the Department of Education Nutrition division and current private consultant who has worked with the District, presented an overview of her ISU doctoral candidate research project. She would like to work with the District in comparing frozen entrees vs. on-site prepared entrees and white grains vs. whole grains but she requires the Board's approval before moving forward. Following discussion, motion by Hagen, seconded by [redacted] to approve the District's involvement in Ms. Christensen's research project. Motion carried 4-0.

District C

REGULAR MONTHLY BOARD MEETING — [redacted] Community School District
Regular Monthly Board Meeting, Monday, August 13, 2012

MEAL COST STUDY — Motion by [redacted], seconded by [redacted] it was RESOLVED:
To approve the research study of "School Meals Labor Costs" conducted by Nancy Christensen in partial fulfillment of a doctoral degree at Iowa State University.
Aye: [redacted], [redacted], [redacted], [redacted]
Nay:

APPENDIX D: RECRUITMENT AND INFORMATION LETTER

Recruitment and Information Letter

Dear School Nutrition Staff Member:

As you may know, the requirements for meals served in the National School Lunch Program have undergone many changes in the last year. One of the most significant changes involves the kinds and amounts of foods you must offer to students every day. Another major change is the requirement that schools raise their paid meal prices to about the same level as federal reimbursement for free meals. We do not yet know how these changes will affect student participation or the financial health of school meals programs.

This research is focused on a technique used in other industries to measure the amount of staff time it takes to prepare specific foods. It has been used in restaurants and bakeries, and it has helped managers of those foodservice operations to decide which menu items are too expensive to serve for the price charged, which menu items are priced correctly, and which are priced too high. School meals programs, because all meals are sold for the same price, must plan menus that balance the menu items' costs to stay within the price charged. It is important that school meals programs consider food cost and the cost of labor to prepare the food when making these decisions. For example, is it less expensive to purchase higher priced frozen pizza that takes very little labor to bake, or is it less expensive to spend more money on labor but less on ingredients and make pizzas at the school?

We as researchers will investigate whether this technique will be helpful to school meals programs, to plan menus within the meal price by balancing higher cost foods with lower cost foods. Results of this research will help school meals programs in their menu planning decisions.

We need your help in this process. We have selected some menu items you make often, and we want to gather some information about the time it takes to make them and the cost of that time. Some of the information will be gathered with a researcher, which will take about 30 to 60 minutes to complete. To protect your identity, you will be assigned a code that will be used instead of your name on all documents. The codes will be kept in a locked office on a secure electronic file, and only the researchers will have access to the codes and the files.

Other information will be gathered by observing you making the menu items and measuring the time required. The observations will be audio and video taped. Your identity will be protected, your face will not be shown, and your name will not be used on the tapes.

Your participation is voluntary. You may refuse to participate. If you decide to participate and change your mind, you may withdraw from the study. If you do not feel comfortable

answering an interview question, you may skip it. If you are interested in participating, we can schedule an interview now, or you can contact me at the phone number or email address below.

If you have any questions, please contact one of us at the emails or phone numbers below. Thank you in advance for your help with this project.

Nancy Christensen, 515-230-4936; 31 MacKay, Iowa State University, Ames IA; nancyc@iastate.edu

Susan Arendt, 515-294-7575; 9E MacKay, Iowa State University, Ames IA; sarendt@iastate.edu

APPENDIX E: CONSENT TO PARTICIPATE

Consent to Participate

Informed Consent for Interviews, Direct Observation, Access to Payroll Records, and Focus Groups

Title of study: Labor in School Meals Programs: Measurement of Direct Costs and Their Influence on Menu Planning

Investigators: Nancy Christensen, PhD Candidate; Susan Arendt, PhD.

This is a research study. Please take your time deciding if you want to participate. Please feel free to ask questions at any time.

Introduction

The purpose of this study is to learn if it is possible to measure the cost of labor in preparing school lunch meals. The research will study whether including the cost of labor helps to make menu planning decisions. You are being invited to participate in this study because your school district has agreed to act as a participating site and you participate in meal preparation at your school.

Description of Procedures

If you agree to participate in this study, you first will be interviewed and then directly observed while you are doing your work. For this interview, your participation will last about thirty to sixty minutes while we conduct the interview. During this portion of the study, you may expect the following procedures to be used: you will be asked questions and while you are talking, notes will be taken by the interviewer. If questions about your responses arise after the interview, a researcher will contact you for clarification. The interviews and any follow-up contacts for clarification will be recorded using a digital audio recorder. After the study is completed, the recordings will be destroyed. At the conclusion of each interview or clarification, you will be asked to review the notes and make any corrections you feel are needed.

During the direct observation part of this study, you will be observed doing your work and you will be video recorded and audio recorded as you work by a researcher or an assistant. There will be several sessions of observation during the study period. The researcher or assistant may take notes during the observation and take measurements of time. You may be asked questions by the researcher or assistant. At the conclusion of the study, the recordings will be destroyed.

You will participate in a short focus group session at the conclusion of the observations. In this focus group, the researcher will ask you to describe your experiences of participating in the interviews and the observations. The focus group will last about thirty minutes. The focus group will be audio recorded. At the conclusion of the study, the recordings will be destroyed.

Your manager will not be present in the focus group. You will be given the option to participate in this part of the study in an individual interview rather than as a member of a focus group. If there are too few participants for the focus group, you will be interviewed individually.

To calculate the cost of labor, your payroll and benefit records will be examined. Information such as your hourly or annual rate of pay, and the dollar value of the benefits provided to you by the school district will be gathered.

Risks

There are no foreseeable risks at this time from participating in this study. The information from all the participants in this study will be added together for analysis. Your information will not be presented separately. Your identity, the town or school where you work, and your school district are all coded to help maintain confidentiality for you. Individual results will not be presented or discussed with school district administrators. You may experience some inconvenience during the study, particularly regarding the video recordings.

Benefits

If you decide to participate in this study, there will be no direct benefit to you. It is hoped that this information will be of benefit to school meals programs, including your own, to help them plan menus within their budgets.

Costs and Compensation

It will not cost you anything to participate in this study. The interview and focus group will be done on non-work time and as a token of appreciation you will receive a $10 gift card..

Participant Rights

Your participation in this study is completely voluntary and you may refuse to participate or leave the study at any time. If you decide to not participate in the study or leave the study early, it will not result in any loss of benefits to which you are otherwise entitled or penalty, such as a reduction in your pay or work hours. If you choose not to participate or leave the study early, this will not be reported to school district administration. During the interview and focus group, you can skip any questions that you do not wish to answer.

Your participation in the study will be terminated if you choose to stop working in the school meals program at your district.

Confidentiality

Records identifying participants will be kept confidential to the extent permitted by applicable laws and regulations and will not be made publicly available. However, federal government regulatory agencies, auditing departments of Iowa State University, and the Institutional Review Board (a committee that reviews and approves human subject research studies) may inspect and/or copy your records for quality assurance and data analysis. These records may contain private information.

To ensure confidentiality to the extent permitted by law, the following measures will be taken: 1) participants each will be assigned a unique code, known only to the participant and the researchers. This code will be used on all documents, during the interview, and in all recordings. The key to the code will be maintained in a secure, password protected electronic file on an external drive, and the drive will be maintained in a locked cabinet or locked office. Only the researchers will have access to the codes and the files. The key to the code will be maintained separate from the data; 2) video recordings will not include the face of any participant; 3) the research records and data will be stored on an external hard drive. The external drive will be maintained in a locked cabinet. Only the identified researchers will have access to the research records. The data and research records will be maintained separate from the key to the code. If the results are published, your identity will remain confidential.

Questions or Problems

You are encouraged to ask questions at any time during the interview or during any observation.

For further information about this study, please contact:

Nancy Christensen, 515-230-4936; 31 MacKay, Iowa State University, Ames IA; nancyc@iastate.edu

Susan Arendt, 515-294-7575; 9E MacKay, Iowa State University, Ames IA; sarendt@iastate.edu

If you have any questions about the rights of research subjects or research-related injury, please contact the IRB Administrator, 515-294-4566, IRB@iastate.edu, or Director, Office for Responsible Research, Iowa State University, 1138 Pearson Hall, Ames IA 50011-2200, 515-294-3115.

Participant Signature

Your signature indicates that you voluntarily agree to participate in this study, that the study has been explained to you, that you have been given enough time to read the document, and

that your questions have been satisfactorily answered. You will receive a copy of the written informed consent prior to your participation in the study.

Participant's name (printed or typed)_____

Participant's Signature Date

Investigator Statement

I certify that the participant has been given adequate time to read and learn about the study and all their questions have been answered. It is my opinion that the participant understands the purpose, risk, benefits, and procedures that will be followed in this study and has voluntarily agreed to participate.

Signature of Person Obtaining Informed Consent Date

APPENDIX F: COMBINED MANAGER INTERVIEW GUIDE

Hi, _____. You have agreed to participate in this study. Are you still OK with participating? _____ Do you have any questions? _____

OK. Then let me turn on the recorder and make sure it works. Today is _____ and I am interviewing Participant _____. Today we will be talking about the amounts of time employee are scheduled to work, the amounts of breaks they have, time they spend at meetings, and any other thing that comes up to take their time during the work day. We'll be talking about how you handle substitutes for when your regular employees are sick or need to take some time off, and what happens when you have a delayed start or early out for weather, or a snow day. I removed the names of the employee from the schedule and substituted letters. I'd appreciate it if we used just the letters to discuss each employee and not their names, to maintain their confidentiality. I'll be taking notes and filling out this spreadsheet. OK?
_____

1. I have a copy of the work schedule for the period of _____ to _____. This is 20 days of work or four consecutive weeks. Can you take a look at it and tell me if this is how you usually schedule workers? (take detailed notes)
2. So let's go over the schedule again to make sure I have it correctly. (recap comments). Is that right? _____ (repeat this question until manager is satisfied. Take detailed notes).
3. Do you or the school district have meetings with your staff? _____
   a. Is this during regular work time or is it scheduled separately? _____
   b. Are your staff paid for these meetings? _____
   c. About how often do you have meetings in a year? _____ About how long do they last? _____
   d. Is there anything else I need to know about meetings?
4. Do you or the school district have trainings with your staff? _____
   a. Is this during regular work time or is it scheduled separately? _____
   b. Are your staff paid for these training sessions? _____
   c. About how often do you have trainings in a year? _____ About how long do they last?
   d. Is there anything else I need to know about training sessions?
5. Are there any other things that would call your staff away from their work during the day (union meetings, etc. Take detailed notes)?
   _____
6. Let's talk about snow days, early outs and delayed starts.
   a. When you have a snow day, are you or your staff paid for the day?_____
   b. What happens if someone gets to school before school is called off for snow? Do they get paid for the time they were at work? _____
   c. On days with delayed starts, what time is your staff expected to come in?_____

d. How are they paid if they come in later?_____
Earlier?_____

e. On days when you have an unplanned early out, what time are staff released from work? _____

f. Are your staff paid if they leave early? _____ Are they paid if they stay later? _____

g. Does your district allow employee to make up lost time due to weather issues? _____

h. About how many times in an average year is school delayed ?_____ How many times do you have an early out? _____ How many snow days do you usually have?_____

i. Is there anything else about these weather related schedule changes I need to know?

7. When people call in sick or need to take a day off, do you call in a substitute? _____ (probe about any variations in how situations may be handled)

a. When you call in a substitute, does the substitute usually work the same times as the regular worker? (probe about any deviations from the regular schedule) _____

b. When you call in a substitute, does the substitute usually do the same work as the regular worker?_____ About how often does it happen that you call in a substitute and they work the same hours as the regular worker?_____

c. When you need to call in a substitute, do you ever move people around to different work sites?_____ How often does this happen?_____

d. How do you handle it when someone needs to leave early or come in late?

i. Do you bring in a substitute?_____ How often does this happen?_____

ii. Move people to different jobs to fill the gap?_____ How often does this happen?

iii. Ask people to come in earlier than their regular start time or stay after their regular quitting time?_____ How often does this happen?

e. Can you estimate about how often you have someone ask for a day off, and you get a substitute?_____ Don't get a substitute? _____

f. Can you estimate about how often someone calls in without notice and you get a substitute?_____ Don't get a substitute?_____

g. Is there anything else about substitutes that I need to know?

8. Let's talk about breaks and how they are handled here.

a. Are your staff required to take their breaks? _____

b. Do you think your staff take more break time than they are allowed? (probe)_____

c. Do you think your staff take less break time than they are allowed? (probe) _____

d. Are your staff allowed to work through their breaks and then leave early? (probe)_____

9. Let's talk about you as a manager, and your time.
   a. Do you consider yourself a working manager, someone who does the "book work" but also cooks or serves? _____
   b. About what percentage of your time is spent on cooking? _____ Serving? _____ Cleaning up? _____ Doing other things like putting away groceries? _____
   c. How often do you substitute for a worker rather than bring in a substitute?
   d. Are you paid over time for working extra? _____ do you ever take a day off without pay? _____
   e. Do you come in on your days off or on snow days to do work?_____ Do you take work home?_____
10. OK, then let's go down the list and talk about each employee and their breaks and time off. For employee A:
   a. Lunch break:
      i. Does this person usually get a lunch break? _____ How often do you think this person does NOT get a lunch break?
      ii. About how long is the lunch break supposed to be?_____
      iii. Does A get paid for this time? (may need to explain this more) _____
      iv. Is there anything else I need to know about this person's lunch break?
   b. Rest breaks (may need to explain this is usually a short break, like a coffee break or smoke break):
      i. Does this person usually get a rest break? _____ How often do you think this person does NOT get a rest break?
      ii. About how long is the rest break supposed to be?_____
      iii. Does A get paid for this time? (may need to explain this more) _____
      iv. Is there anything else I need to know about this person's rest break?
11. repeat for all employees

APPENDIX G: COMBINED EMPLOYEE INTERVIEW GUIDE

Hi, _____. You have agreed to participate in this study. Are you still OK with participating? _____ Do you have any questions? _____

OK. Then let me turn on the recorder and make sure it works. Today is _____ and I am interviewing Participant _____. Today we will be talking about the amounts of time you are scheduled to work, the amounts of breaks you have, time you spend at meetings, and any other thing that comes up to take up your time during the work day. We'll be talking about how substitutes are handled for when regular employees are sick or need to take some time off, and what happens when you have a delayed start or early out for weather, or a snow day. I'll be taking notes and filling out this spreadsheet. OK? _____

1. I have a copy of your work schedule for the period of _____ to _____. This is 20 days of work or four consecutive weeks. Can you take a look at it and tell me if this is how you usually work? (take detailed notes)
2. So let's go over the schedule again to make sure I have it correctly. (recap comments). Is that right? _____ (repeat this question until employee is satisfied. Take detailed notes).
3. Do you have staff meetings at work? _____
   a. Is this during regular work time or is it scheduled separately? _____
   b. Are you paid for these meetings? _____
   c. About how often do you have meetings in a year? _____ About how long do they last? _____
   d. Is there anything else I need to know about meetings?
4. Do you have trainings at work? _____
   a. Is this during regular work time or is it scheduled separately? _____
   b. Are you paid for these training sessions? _____
   c. About how often do you have trainings in a year? _____ About how long do they last?
   d. Is there anything else I need to know about training sessions?
5. Are there any other things that would call you away from work during the day (union meetings, etc. Take detailed notes)? _____
6. Let's talk about snow days, early outs and delayed starts.
   a. When you have a snow day, are you paid for the day?_____
   b. What happens if you gets to school before school is called off for snow? Do you get paid for the time you were at work? _____
   c. On days with delayed starts, what time are you expected to come in?_____
   d. How are you paid if you come in later?_____ Earlier?_____
   e. On days when you have an unplanned early out, what time are you released from work? _____

f. Are you paid if you leave early? _____ Are you paid if you stay later? _____

g. Does your district allow you to make up lost time due to weather issues? _____

h. About how many times in an average year is school delayed ?_____ How many times do you have an early out? _____ How many snow days do you usually have?_____

i. Is there anything else about these weather related schedule changes I need to know?

7. When people call in sick or need to take a day off, is a substitute called in? _____ (probe about any variations in how situations may be handled)

a. When a substitute is called in, does the substitute usually work the same times as the regular worker? (probe about any deviations from the regular schedule) _____

b. When a substitute is called in, does the substitute usually do the same work as the regular worker?_____ About how often does it happen that a substitute is called in and they work the same hours as the regular worker?_____

c. When a substitute is called in, are people moved around to different work sites?_____ How often does this happen?_____

d. How does it work when someone needs to leave early or come in late?

i. Is a substitute called in?_____ How often does this happen?_____

ii. People are moved to different jobs to fill the gap?_____ How often does this happen?

iii. People are asked to come in earlier than their regular start time or stay after their regular quitting time?_____ How often does this happen?

e. Can you estimate about how often someone asks for a day off, and a substitute is called in?_____ No substitute is called in? _____

f. Can you estimate about how often someone calls in without notice and a substitute is called in?_____ No substitute is called in?_____

g. Is there anything else about substitutes that I need to know?

8. Let's talk about breaks and how they are handled here.

a. Are you required to take your breaks? _____

b. Do you usually get a lunch break? _____ How often do you think you DO NOT get a lunch break? (probe)_____

c. About how long is the lunch break supposed to be?_____

d. Do you usually get a rest break (may need to explain this is usually a short break, like a coffee break or smoke break)?_____

e. About how long is the rest break supposed to be?_____

f. Do you get paid for break time? (may need to explain this more)
_____

g. Do you usually take more than, less than or the break time you are allowed?

h. Are you allowed to work through your breaks and then leave early? (probe)_____

i. Is there anything else I need to know about breaks?

APPENDIX H: SOCIODEMOGRAPHIC CHARACTERISTICS OF STUDY PARTICIPANTS

Characteristics		*N*=16
Gender	Male= 0	Female =16
Age	Mean (y) = 48.4	Range = 30-73
Years in district school meals program	Mean (y) = 7.8	Range = 0.5-30
Years in other schoolmeals program (n=2)	Mean (y) = 6	Range = 4-8
Previous foodservice experience, not school meals	*n*=7	% = 43.8
Other work experience*		
	Retail *n*= 5	% =31.3
	Personal service *n* =4	% =25.0
	Administrative/white collar n = 5	% =31.3
	Manufacturing *n* = 3	% =18.8
	Military *n* = 1	% =6.3
Marital Status	Married/Partnered *n*=14	Widowed *n*=2
Occupation of spouse/partner**	Personal service *n* =2	
	Administrative/white collar *n* = 2	
	Manufacturing *n* = 2	
	Agriculture *n* =5	
	Skilled trades *n*=2	
	Transportation *n*=1	
	Utilities *n*= 2	
Others residing in household***	School age children *n*=7	% = 43.8
	College student children *n*= 3	% = 18.8
	Other children *n* =3	% = 18.8
	None *n*= 8	% = 50.0

* Sum greater than 16, percentage greater than 100% because participants reported multiple previous occupations.

** Includes two spouses now deceased, simultaneous occupations.

*** Sum greater than 16, percentage greater than 100% because participants reported multiple others residing in home.

APPENDIX I: EQUIPMENT INVENTORY AND SUMMARY OF PRODUCTION

A. Equipment used in preparation of products studied

	District A	District B		District C	
	Site 1	Site 1	Site 2	Site 1	Site 2
Convection oven	2, stacked	1	2, side-by-side	2, stacked	2, stacked
Combination oven/steamer	0	0	0	1	1
6 burner range/oven	2	0	0	0	0
Steam jacketed kettle	0	1	2	0	0
Tilting skillet	0	0	0	0	1
Warmers	1, tall	1, half-height	0	2, tall	1, tall

B. Summary of production methods and equipment used per product studied

Product	District A	District B		District C	
	Site 1	Site 1	Site 2	Site 1	Site 2
Pizza flavored casserole	Stovetop, pan mixing,				
Spaghetti casserole	Stovetop, bulk mixing				Combination steamer oven, pan mixing
Pasta meat sauce casserole			2 steam jacketed kettles, bulk mixing	Combination steamer oven, pan mixing	Combination steamer oven, pan mixing
Macaroni cheese beef casserole				Combination steamer oven, pan mixing	Combination steamer oven, tilting skillet, pan mixing

Table B, continued					
Noodle beef casserole			Steam jacketed kettle, bulk mixing		
Noodle chicken casserole		Steam jacketed kettle, bulk mixing	Steam jacketed kettle, bulk mixing		
Noodle turkey casserole				Combi-nation steamer oven, pan mixing	
Chili			Steam jacketed kettle, bulk mixing	Combi-nation steamer oven, pan mixing	Tilting skillet, bulk mixing

C. Photographs of equipment and production methods

Stovetop production method

Bulk production, steam jacketed kettle, stirring

Bulk production, tilting skillet, stirring

Pan production method, stirring

Pan production method, combination steamer oven

APPENDIX J: INITIAL BILLS OF ACTIVITY

Bill of Activity, Pasta or Noodle Casserole, School District A B C

Activity	Minutes	Notes
Preparing water for pasta/noodles		
Boiling pasta		
Draining, rinsing pasta		
Preparing vegetables for sauce		
Preparing sauce		
Preparing meat		
Assembling casserole		
Portioning casserole into pans		
Preparing casserole for baking		

Bill of Activity, Scalloped Ham and Potato Casserole, School District A B C

Activity	Minutes	Notes
Preparing potatoes		
Cooking potatoes		
Draining, rinsing potatoes		
Preparing vegetables for sauce		
Preparing sauce		
Preparing meat		
Assembling casserole		
Portioning casserole into pans		
Preparing casserole for baking		

Bill of Activity, Entrée with Sauce, School District A B C

Activity	Minutes	Notes
Preparing vegetables for sauce		
Preparing sauce		
Preparing meat		
Assembling sauce with meat		
Portioning casserole into pans		

Bill of Activity, Chili, School District A B C

Activity	Minutes	Notes
Preparing vegetables for chili		
Preparing beans		
Preparing meat		
Assembling chili		
Portioning chili into pans		

Bill of Activity, Sandwich, School District A B C

Date:_____ Employee Designator:_____ Interview/Observation

Activity	Start-Stop times	Minutes	Employee designator	Rate	Labor Value (Minutes x Rate)
Preparing bread/roll/wrap					
Preparing vegetables for sandwich					
Preparing protein					
Assembling sandwich					
Preparing sandwich for heating or cooking					
Cutting and wrapping sandwich					

APPENDIX K: FINAL BILLS OF ACTIVITY

Bill of Activity, Pizza Flavored Casserole District A

Activity	Start-Stop Times	Seconds	Employee Designator	Rate	Labor Value (Seconds x Rate)
Preparing water for pasta/noodles					
Boiling pasta					
Draining, rinsing pasta					
Preparing pan					
Adding meat to pan					
Adding sauce to pan					
Adding pasta to pan					
Stirring					
Covering/uncovering pan					
Moving pan during production					
Taking temperature					
Adding ingredient by layering					
TOTAL					

Bill of Activity, Pasta Meat sauce Casserole, Bulk Mixing, School District A B

Activity	Start-Stop Times	Seconds	Employee Designator	Rate	Labor Value (Seconds x Rate)
Preparing water for pasta/noodles					
Boiling pasta					
Draining, rinsing pasta					
Adding meat to kettle					
Adding sauce to kettle					
Adding pasta to kettle					
Adding miscellaneous to kettle					
Stirring					
Preparing pan					
Portioning casserole to pan					
Covering/uncovering pan					
Moving pan during production					
Taking temperature					
TOTAL					

Bill of Activity, Pasta Meat sauce Casserole, Pan Mixing, School District C

Activity	Start-Stop Times	Seconds	Employee Designator	Rate	Labor Value (Seconds x Rate)
Preparing pan					
Adding raw pasta to pan					
Adding water for pasta					
Boiling pasta					
Draining, rinsing pasta					
Adding meat to pan					
Adding sauce to pan					
Adding cooked pasta to pan					
Stirring					
Covering/uncovering pan					
Moving pan during production					
Taking temperature					
TOTAL					

Bill of Activity, Cheese Macaroni Beef Casserole, Pan Mixing, School District C

Activity	Start-Stop Times	Seconds	Employee Designator	Rate	Labor Value (Seconds x Rate)
Preparing pan					
Adding raw pasta to pan					
Adding water for pasta					
Boiling pasta					
Draining, rinsing pasta					
Heating cheese sauce					
Adding meat to pan					
Adding cheese sauce to pan					
Adding cooked pasta to pan					
Stirring					
Covering/uncovering pan					
Moving pan during production					
Taking temperature					
TOTAL					

Bill of Activity, Meat Noodle Casserole, Bulk Mixing, School District B

Activity	Start-Stop Times	Seconds	Employee Designator	Rate	Labor Value (Seconds x Rate)
Adding meat to kettle					
Preparing sauce in kettle					
Adding noodles to kettle					
Adding miscellaneous to kettle					
Stirring					
Preparing pan					
Portioning casserole to pan					
Covering/uncovering pan					
Moving pan during production					
Taking temperature					
TOTAL					

Bill of Activity, Turkey Noodle Casserole, Pan Mixing, School District C

Activity	Start-Stop Times	Seconds	Employee Designator	Rate	Labor Value (Seconds x Rate)
Preparing pan					
Heating turkey gravy					
Adding noodles to pan					
Adding water for noodles					
Adding turkey gravy to pan					
Stirring					
Covering/uncovering pan					
Moving pan during production					
Taking temperature					
TOTAL					

Bill of Activity, Chili, Pan Mixing, School District C

Activity	Start-Stop Times	Seconds	Employee Designator	Rate	Labor Value (Seconds x Rate)
Preparing pan					
Adding meat to pan					
Adding chili mix to pan					
Adding water					
Stirring					
Covering/uncovering pan					
Moving pan during production					
Taking temperature					
TOTAL					

Bill of Activity, Chili, Bulk Mixing, School District C

Activity	Start-Stop Times	Seconds	Employee Designator	Rate	Labor Value (Seconds x Rate)
Adding meat to kettle					
Preparing sauce in kettle					
Adding beans to kettle					
Adding miscellaneous to kettle					
Stirring					
Preparing pan					
Portioning chili to pan					
Covering/uncovering pan					
Moving pan during production					
Taking temperature					
TOTAL					

APPENDIX L: THEORETICAL CAPACITY

Theoretical Capacity

District	Employee	Hours scheduled in test period	Minutes scheduled in test period	Minutes unpaid lunch in test period, manager report	Minutes unpaid lunch in test period, employee report	Mean minutes unpaid lunch	Minutes unreplaced sick or personal time, manager report, annual	Minutes unreplaced sick or personal time, employee report, annual	Mean minutes unreplaced sick or personal time	Mean minutes unreplaced sick or personal time, interpolated	Minutes unpaid time for weather, manager report, annual	Minutes unpaid time for weather, employee report, annual	Mean minutes unpaid time for weather	Mean minutes unpaid time for weather, interpolated	Theoretical capacity, minutes
A	1	160.00	9600.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	202.5	45.0	123.8	13.8	9586.3
A	2	160.00	9600.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9600.0
A	3	120.00	7200.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	202.5	45.0	123.8	13.8	7186.3
A	4	70.00	4200.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	202.5	45.0	123.8	13.8	4186.3
B	5	160.00	9600.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9600.0
B	6	130.00	7800.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7800.0
B	7	110.00	6600.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6600.0
B	8	130.00	7800.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7800.0
B	9	130.00	7800.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7800.0
C	10	140.00	8400.0	400.0	400.0	400.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8000.0
C	11	143.31	8598.6	400.0	400.0	400.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8198.6
C	12	143.31	8598.6	400.0	400.0	400.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8198.6
C	13	140.00	8400.0	280.0	400.0	340.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8060.0
C	14	163.16	9789.6	400.0	400.0	400.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9389.6
C	15	191.94	11516.4	400.0	400.0	400.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11116.4
C	16	160.00	9600.0	400.0	400.0	400.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9200.0

APPENDIX M: PRACTICAL CAPACITY

Practical Capacity										
District	Employee	Theoretical capacity, minutes	Minutes paid breaks in test period, manager report	Minutes paid breaks in test period, employee report	Mean minutes paid breaks	Minutes paid meetings, annual, manager report	Minutes paid meetings, annual, employee report	Mean minutes in meeting, interpolated	Practical capacity, minutes	Practical capacity as % of theoretical capacity
A	1	9586.3	400.0	400.0	400.0	0.0	0.0	0.0	9186.3	95.83
A	2	9600.0	400.0	400.0	400.0	0.0	0.0	0.0	9200.0	95.83
A	3	7186..3	400.0	400.0	400.0	0.0	0.0	0.0	6786.3	94.43
A	4	4186.3	400.0	400.0	400.0	0.0	0.0	0.0	3786.3	90.44
B	5	9600.0	600.0	600.0	600.0	40.0	40.0	40.0	8995.6	93.70
B	6	7800.0	600.0	600.0	600.0	0.0	0.0	0.0	7200.0	92.31
B	7	6600.0	600.0	600.0	600.0	0.0	0.0	0.0	6000.0	90.91
B	8	7800.0	0.0	300.0	150.0	0.0	0.0	0.0	7650.0	98.08
B	9	7800.0	0.0	300.0	150.0	0.0	0.0	0.0	7650.0	98.08
C	10	8000.0	300.0	300.0	300.0	0.0	0.0	0.0	7700.0	96.25
C	11	8198.6	300.0	300.0	300.0	0.0	0.0	0.0	7898.6	96.34
C	12	8198.6	300.0	300.0	300.0	0.0	0.0	0.0	7898.6	96.34
C	13	8060.0	300.0	300.0	300.0	0.0	0.0	0.0	7760.0	96.28
C	14	9389.6	180.0	300.0	240.0	0.0	0.0	0.0	9149.6	97.44
C	15	11116.4	210.0	300.0	255.0	0.0	0.0	0.0	10861.4	97.71
C	16	9200.0	300.0	300.0	300.0	0.0	0.0	0.0	8900.0	96.74

APPENDIX N: LABOR VALUE UNITS

Labor Value Units							
District	Employee	Hours scheduled in test period	Minutes scheduled in test period	Theoretical capacity, minutes	Practical capacity, minutes	Labor value unit, dollars per minute	Labor value unit, dollars per second
A	1	160.00	9600.0	9586.3	9186.3	0.1937	0.00323
A	2	160.00	9600.0	9600.0	9200.0	0.2933	0.00489
A	3	120.00	7200.0	7186..3	6786.3	0.1789	0.00298
A	4	70.00	4200.0	4186.3	3786.3	0.1837	0.00306
B	5	160.00	9600.0	9600.0	8995.6	0.2659	0.00443
B	6	130.00	7800.0	7800.0	7200.0	0.2021	0.00337
B	7	110.00	6600.0	6600.0	6000.0	0.2114	0.00352
B	8	130.00	7800.0	7800.0	7650.0	0.2388	0.00398
B	9	130.00	7800.0	7800.0	7650.0	0.2293	0.00382
C	10	140.00	8400.0	8000.0	7700.0	0.4011	0.00669
C	11	143.31	8598.6	8198.6	7898.6	0.3065	0.00511
C	12	143.31	8598.6	8198.6	7898.6	0.2807	0.00468
C	13	140.00	8400.0	8060.0	7760.0	0.2791	0.00465
C	14	163.16	9789.6	9389.6	9149.6	0.2759	0.00460
C	15	191.94	11516.4	11116.4	10861.4	0.2861	0.00477
C	16	160.00	9600.0	9200.0	8900.0	0.4840	0.00807

APPENDIX O: ESTIMATES BY WORKERS OF TIME PER STEP

PASTA NOODLE CASSEROLE

	Minutes			
Activity	District A	District B	District B	District C
Preparing water for pasta/noodles	5	18		
Boiling pasta	10	8	8-10	12
Draining, rinsing pasta	10	18		
Preparing vegetables for sauce	20	0		
Preparing sauce	10	10		
Preparing meat	45	30-45		
Assembling casserole	20			
Portioning casserole into pans	20			
Preparing casserole for baking	25			

APPENDIX P: GENERAL AND STEP DEFINITIONS

GENERAL DEFINITIONS

Cooking vessel: kettle, pan, steam jacketed kettle, or tilting skillet

Kettle: open topped, cylindrical pot with bail handle

Lid: half or full steam table lid

Pan: half or full steam table pan of any depth, or full sheet pan

Pitcher: open topped container with ear-shaped handle used primarily for fluid measure

Saucepan: 1 ½ quart long handled saucepan used primarily to transfer product from one container to another, quickly and with some precision

Utensil: flexible rubber scraper/spatula, stiff metal pancake turner with off-set head, metal or plastic oar-shaped implement

MOVEMENT

Overall definition: Move: first touch by worker hands to pan, move to destination, place pans in desired location, to last touch by worker hands

Move to oven/warmer: first touch by worker hands to pan, pans into oven/warmer, to last touch by worker hands

Move to steamtable (carry): first touch by worker hands to pan, carry to destination, place pans into steamtable, to last touch by worker hands

Move to steamtable (cart): first touch by worker hands to cart moving pans, lift pans from cart, place pans into steamtable, to last touch by worker hands of pans

Remove pans from oven: first touch by worker hands to pan, pans removed, to last touch by worker hands

COVERING/UNCOVERING

Overall definition: first touch by worker hands to lid/film/foil, to last touch by worker hands

Cover product with film: first touch by worker hand to pan or film to last touch by worker hand pan or film

Cover product with foil: first touch by worker hand to pan or foil to last touch by worker hand to foil or pan

Cover product with lid: first touch by worker hand to lid to last touch by worker hand to lid

Remove film from pan: first touch by worker hand to pan or film to film removed and released from hand

Remove foil: first touch by worker hand to pan or foil to foil removed and released from hand

Remove lid: first touch by worker hand to lid to last touch by worker hand to lid

ADDING INGREDIENTS WITH OR WITHOUT MEASUREMENT

Overall definition: first touch by worker hand to container holding ingredient, move ingredient to cooking vessel, pour ingredient into cooking vessel, to last touch by worker hand of container holding ingredient

A. With measurement

Add ingredient to cooking vessel using pitcher: first touch by worker hand to pitcher, carry to sink, turn on tap, fill pitcher, turn off tap, walk back, add water to last drop

Second water partial pitcher: first touch by worker hand to pitcher, carry to sink, turn on tap, fill pitcher, turn off tap, transfer part from large to small pitcher, add water to last drop

Transfer ingredient to cooking vessel: first touch by worker hand to saucepan to last quantity of ingredient added and saucepan empty

Measure and add ingredient: first touch by measuring container to ingredient to last quantity of ingredient added and container empty

B. Without measurement

Add ingredient pre-measured into bag to pan: first touch by worker hand to individual bag, bag opened, pour in pan until bag empty, bag to trash, to last touch by worker hand

Add pre-measured ingredient to cooking vessel: AFTER MEASURING, first touch by worker hand to container holding ingredient, pour ingredient into cooking vessel, to last touch by worker hand of container holding ingredient

Add pre-measured ingredient to pan by layering: AFTER MEASURING, first touch by worker hand to container holding ingredient, layer ingredient into pan, to last touch by worker hand of container holding ingredient

Add ingredient in commercial package to cooking vessel: AFTER OPENING PACKAGE, first touch by worker hand to ingredient package, pour ingredient into cooking vessel to last quantity of ingredient added and package empty, to last touch by worker hand of container

STIR

Overall definition: first touch of worker hand to stirring utensil, utensil in contact with product, utensil in motion, to last touch of moving utensil to product

Stir product by hand: first touch of hand to product to last touch of hand to product

Stir product by paddle: first moment worker hand is on paddle, paddle is in contact with product, and paddle is in motion

Stir product by utensil: first touch of utensil to product, to last touch of utensil to product

MEASURE TEMPERATURE

Measure temperature: first touch of thermometer to product, to last touch of thermometer to product

MISCELLANEOUS

Set up pans for product: first touch by worker hands to pan, spray pan, to last touch by worker hands to pan or spray

Set up pans for product with liner: first touch by worker hands to pan, position liner, spray liner, to last touch by worker hands to pan or spray

Set up pans for product with liner and water: first touch by worker hands to pan, add water, position liner, spray liner, to last touch by worker hands to pan or spray

Set up water in kettles to boil pasta: first touch by worker hands to kettle, carry to sink, turn on tap, add water to kettle, turn off tap, carry to stove, to last touch by worker hands

Add water to pan to cook pasta: first touch by worker hands to pan, carry to sink, turn on tap, add water, turn off tap, carry to cook center, to last touch by worker hands

Add water to pan using pitcher: first touch by worker hands to pitcher, carry to sink, turn on tap, fill pitcher, turn off tap, walk to cook center, add water to pan, to last touch by worker hands to pitcher

Add pasta to water in kettle: first touch by worker hands to container of raw pasta, carry to kettle, empty container of pasta into kettle, put lid on, to last touch by worker hands to lid

Break up canned meat and remove solid fat: first touch by worker hand to meat, break up meat, remove fat and discard, to last touch of worker hand to meat/fat

Break up raw meat: first touch by worker hand to meat, break up meat, to last touch of worker hand to meat

Heat cheese sauce in oven: first touch by worker hand to pans on storage rack, place bags of cheese sauce on pans, remove labels, place pans in oven, to last touch of worker hand to pan

Heat cheese sauce in tilting skillet: first touch by worker hand to bags of cheese sauce, remove labels, pick up bags and drop in water, to last touch of worker hand to last bag in water

Drain pasta cooked in kettle: first touch by worker hands to kettle, kettle removed from stove, carry to sink, drain, return pasta to work area, to last touch by worker hands

Drain pasta cooked in pan: first touch by worker hands to lid, place lid on pan, remove from oven, carry to sink, drain, return pan and pasta to work area, to last touch by worker hands

To cook: first touch of oven door by worker hands, open door, pick up pan, put pan in oven, close door, set timer to last touch by worker hands

Scrape pans: first touch of utensil to product, to last touch of utensil to product

Dissolve cornstarch: first touch by worker hand to pan, carry pan to sink, add water, stir, return pan to counter, to last touch of worker hand

Portion product to service pans from bulk vessel: first touch by LARGER pitcher to product, to last drop of product into pan from last pitcher

Portion product to service pans from bulk vessel: first touch by saucepan to product, to last drop of product into pan from last saucepan

APPENDIX Q: SUMMARY OF COMPLETE AND INCOMPLETE MEASUREMENTS

Product	A1 Pasta meat sauce		B1 Meat noodle		B2 Pasta meat sauce		B2 Meat noodle		B2 Chili		C1 Pasta meat sauce	
Step	U	N	U	N	U	N	U	N	U	N	U	N
Move to oven	23	15	0	0	0	0	0	0	0	0	17	6
Remove from oven/ warmer	14	8	0	0	0	0	0	0	0	0	21	20
Move to steamtable/ warmer	3	0	3	0	5	5	5	3	2	0	20	10
Move to other location	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL MOVE	40	23	3	0	5	5	5	3	2	0	58	36
Remove foil	15	2	0	0	0	0	0	0	0	0	0	0
Cover with foil	22	6	0	0	0	0	0	0	0	0	0	0
Remove plastic film	0	0	0	0	0	0	0	0	0	0	0	0
Cover with plastic film	0	0	0	0	0	0	0	0	0	0	0	0
Remove lid	0	0	0	0	0	0	0	0	0	0	16	15
Cover with lid	0	0	0	0	0	0	0	0	0	0	21	7
TOTAL COVER	37	8	0	0	0	0	0	0	0	0	37	22
Note: U = usable; N = not usable												

Summary of Complete and Incomplete Measurements, continued to page 173

Summary of Complete and Incomplete Measurements, continued to page 174

Appendix Q, continued

Summary of Complete and Incomplete Measurements, continued from page 172

Product	C1 Meat noodle		C1 Cheese mac beef		C1 Chili		C2 Pasta meat sauce		C2 Cheese mac beef		C2 Chili		TOTAL	
Step	U	N	U	N	U	N	U	N	U	N	U	N	U	N
Move to oven	18	6	6	0	5	1	1	0	12	3	0	0	82	31
Remove from oven/ warmer	32	5	3		5	2	5	3	0	0	0	0	80	38
Move to steamtable/ warmer	23	5	14	0	6	5	1	1	0	0	5	2	87	31
Move to other location	0	0	4	0	0	0	5	1	0	0	0	0	9	1
TOTAL MOVE	73	16	27	0	16	8	12	5	12	3	5	2	258	101
Remove foil	0	0	0	0	0	0	0	0	0	0	0	0	15	2
Cover with foil	0	0	0	0	0	0	0	0	0	0	0	0	22	6
Remove plastic film	2	2	0	0	0	0	0	0	0	0	0	0	2	2
Cover with plastic film	6	1	4	0	0	0	0	0	0	0	0	0	10	1
Remove lid	11	20	0	0	0	0	0	0	0	0	0	0	27	35
Cover with lid	19	6	0	0	6	1	6	1	0	0	1	6	53	21
TOTAL COVER	38	29	4	0	6	1	6	1	0	0	1	6	129	67

Note: U = usable; N = not usable

Summary of Complete and Incomplete Measurements, continued to page 175

Appendix Q, continued

Summary of Complete and Incomplete Measurements, continued from page 172

Product	A1 Pasta meat sauce		B1 Meat noodle		B2 Pasta meat sauce		B2 Meat noodle		B2 Chili		C1 Pasta meat sauce	
Step	U	N	U	N	U	N	U	N	U	N	U	N
ADD	69	20	15	2	28	7	85	32	0	25	36	10
STIR	45	10	21	3	45	6	44	15	21	4	43	10
TEMP.	10	5	4	0	3	0	4	1	4	0	11	5
Drain pasta	4	0	0	0	6	1	0	0	0	0	9	5
Set up water	2	0	0	0	0	0	0	0	0	0	7	8
Set up pans	1	0	0	0	2	1	3	4	0	0	1	0
Add pasta to water	1	0	0	0	0	0	0	0	0	0	0	0
Portion to pans	0	0	3	0	8	2	8	4	4	0	0	0
Scrape	0	0	0	0	0	0	0	0	0	0	7	3
Cheese sauce to skillet	0	0	0	0	0	0	0	0	0	0	0	0
Break up meat	0	0	0	0	0	0	2	0	0	0	0	0
Dissolve corn starch	0	0	0	0	0	0	5	3	0	0	0	0
TOTAL MISC.	8	0	3	0	16	4	18	11	4	0	27	16
TOTAL	209	66	46	5	97	22	156	62	31	29	212	99

Note: U = usable; N = not usable

Summary of Complete and Incomplete Measurements, continued on page 175

Appendix Q, continued

Summary of Complete and Incomplete Measurements, continued from page 173

Summary of Complete and Incomplete Measurements, continued from page 174

Product	C1 Meat noodle		C1 Cheese mac beef		C1 Chili		C2 Pasta meat sauce		C2 Cheese mac beef		C2 Chili		TOTAL	
Step	U	N	U	N	U	N	U	N	U	N	U	N	U	N
ADD	23	4	11	0	11	2	35	9	45	1	20	0	378	112
STIR	30	9	6	0	11	2	9	3	4	0	4	3	283	65
TEMP.	5	0	6	0	1	0	2	0	1	0	1	0	52	11
Drain pasta	0	0	6	0	0	0	0	0	8	9	0	0	33	15
Set up water	0	0	4	0	10	2	0	0	0	0	0	0	23	10
Set up pans	8	0	3	0	1	0	0	0	1	1	1	5	21	11
Add pasta to water	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Portion to pans	0	0	0	0	0	0	0	0	0	0	3	6	25	12
Scrape	0	0	0	0	0	0	0	0	0	0	0	0	7	3
Cheese sauce to skillet	0	0	0	0	0	0	0	0	4	0	0	0	4	0
Break up meat	0	0	0	0	0	0	0	0	0	0	0	0	2	0
Dissolve corn starch	0	0	0	0	0	0	0	0	0	0	0	0	5	3
TOTAL MISC.	12	0	13	0	11	2	0	0	22	17	4	11	138	61
TOTAL	181	58	67	0	56	15	64	18	84	21	35	22	1238	417

Note: U = usable; N = not usable

APPENDIX R: COMPLETED MICROSOFT EXCEL TIME MEASUREMENT SHEET

Step	Definition		Pan 1	pan 2	Pan 3	pan 4	Pan 5
1. move to oven	first touch by worker hands to pan, pans into oven, to last touch by worker hands)						
		start	0:07	1:34	2:49		
		stop	0:14	1:42	2:56		
			0:07	0:08	0:07	0:22	
		identifier	5295	5295	5295		
	Action interrupted? Y N	start					
		stop					
		identifier					
2. Remove pans from oven	first touch by worker hands to pan, pans removed, to last touch by worker hands)						
		start	0:15	1:42			
		stop	0:21	1:49			
			0:06	0:07		0:13	
		identifier	5295	5295			
	Action interrupted? Y N	start					
		stop					
		identifier					
3. Remove foil	first touch by worker hand to foil to last touch by worker hand to foil)						
		start	0:29	1:52			
		stop	0:40	1:55			
			0:11	0:03		0:14	
		identifier	5295	5295			
	Action interrupted? Y N	start					
		stop					
		identifier					
4. Stir product	first touch of utensil to product, to last touch of utensil to product						
		start	0:41	0.08			
		stop	1:01	2:35			
			0:20	0:38		0:58	
		identifier	5295	5295			
	Action interrupted? Y N	start					
		stop					
		identifier					
5. Cover product with foil	first touch by worker hand to foil to last touch by worker hand to foil)						
		start	no	1:11	2:38		
		stop	0:03	1:23	2:45		
				0:12	0:07	0:19	
		identifier	5295	5295	5295		
	Action interrupted? Y N	start					
		stop					
		identifier					

APPENDIX S: SUMMARY OF COSTS PER MEAL EQUIVALENT

	District A	District B	District C
Meal Equivalents	75519.1	191087.0	388465.9
Meal Equivalents/Labor Hour	9.32	15.44	13.11
Food Cost/Meal Equivalent	$1.507	$1.598	$1.563
Food Cost as % of Total Cost	47.53%	60.44%	47.00%
Food Cost as % Revenue	53.61%	69.38%	46.79%
Labor Cost/Meal Equivalent	$1.664	$1.029	$1.467
Labor Cost as % of Total Cost	52.47%	38.93%	44.09%
Labor Cost as % Revenue	59.20%	44.69%	43.98%
Total Cost	$239,479.04	$505,152.33	$1,292,211.12
Total Revenue	$212,283.83	$440,053.30	$1,298,018.91

Actual Food Costs and Proportion of Allocated Food Costs per Entree

	Site A1		Site B1		Site B2		Site C1		Site C2	
Allocated Food Cost/ME	$1.507		$1.598		$1.598		$1.563		$1.563	
Product	Cost/ Portion	% Cost/ ME	Cost/ Portion	% Cost/ ME	Cost/ Portion	% Cost/ ME	Cost/ Portion	% Cost/ ME	Cost/ Portion	% Cost/ ME
Pizza Bake	$0.520	34.51%								
Pasta Meat Sauce	$0.545	36.16%			$.0638	39.92%	$0.704	45.04%	$1.054	67.43%
Chicken Noodle			$0.505	31.60%	$0.842	52.69%				
Beef Noodle					$1.095	68.52%				
Turkey Noodle							$0.642	41.09%	$0.856	81.20%
Chili					$0.515	32.23%	$0.694	44.04%	$0.682	43.63%
Cheese Mac Beef							$0.326	20.85%	$0.489	31.28%

Note: ME = Meal Equivalent

APPENDIX U: LABOR COST ALLOCATED TO ENTREES

Labor Costs Allocated to Entrees

	Site A1			Site B1			Site B2			Site C1			Site C2		
Allocated Labor Cost/ME	$1.664			$1/029			$1.029			$1.467			$1.467		
	Food Cost/ Portion, Dollars	% Food Cost/ ME	Labor Cost/ Portion	Food Cost/ Portion, Dollars	% Food Cost/ ME	Labor Cost/ Portion, Dollars	Food Cost/ Portion, Dollars	% Food Cost/ ME	Labor Cost/ Portion, Dollars	Food Cost/ Portion, Dollars	% Food Cost/ ME	Labor Cost/ Portion, Dollars	Food Cost/ Portion, Dollars	% Food Cost/ ME	Labor Cost/ Portion, Dollars
Pizza Bake	0.520	34.51	0.574												
Pasta Meat Sauce	0.545	36.16	0.602				0.638	39.92	0.411	0.704	45.04	0.661	1.054	67.43	0.989
Chicken Noodle				0.505	31.60	0325	0.842	52.69	0.542						
Beef Noodle							1.095	68.52	0.705						
Turkey Noodle										0.642	41.09	0.289	0.856	81.20	1.191
Chili							0.515	32.23	0.332	0.694	44.40	0.313	0.682	43.63	0.640
Cheese Mac Beef										0.326	20.85	0.147	0.489	31.28	0.459

ME = Meal Equivalent

APPENDIX V. COMPARISON OF ALLOCATED AND MEASURED DIRECT VALUE-ADDING LABOR COSTS PER MEAL PORTION

Comparison of Allocated and Measured Direct Value-Adding Labor Cost per Portion									
	Site A1			Site B1			Site B2		
Allocated Labor Cost/ME	$1.664			$1.029			$1.029		
	Allocated Labor Cost/Portion, Dollars	DVAL Costs/Portion, Dollars	Variance, Dollars	Allocated Labor Cost/Portion, Dollars	DVAL Costs/Portion, Dollars	Variance, Dollars	Allocated Labor Cost/Portion, Dollars	DVAL Costs/Portion, Dollars	Variance, Dollars
Pizza Bake 1	0.5742	0.0652	0.5090						
Pizza Bake 2	0.5742	0.0382	0.5360						
Pasta Meat Sauce 1	0.6017	0.0182	0.5835				0.4108	0.0237	0.3871
Pasta Meat Sauce 1							0.4108	0.0132	0.3976
Chicken Noodle 1				0.3252	0.0127	0.3125	0.5422	0.0052	0.5370
Chicken Noodle 2							0.5422	0.0080	0.5342
Beef Noodle 1							0.7051	0.0142	0.6915
Beef Noodle 2							0.7051	0.0186	0.6865
Turkey Noodle 1									
Turkey Noodle 2									
Chili							0.3316	0.0133	0.3183
Cheese Mac Beef 1									
Cheese Mac Beef 2									
Note: DVAL = Direct Value Adding Labor; ME = Meal Equivalent									

Comparison of Allocated and Measured Direct Value-Adding Labor Cost per Portion, continued						
	Site C1			Site C2		
Allocated Labor Cost/ME	$1.467			$1.467		
	Allocated Labor Cost/Portion, Dollars	DVAL Costs/Portion, Dollars	Variance, Dollars	Allocated Labor Cost/Portion, Dollars	DVAL Costs/Portion, Dollars	Variance, Dollars
Pizza Bake 1						
Pizza Bake 2						
Pasta Meat Sauce 1	0.6608	0.0301	0.6306	0.9893	0.0234	0.9659
Pasta Meat Sauce 1	0.6608	0.0421	0.6187			
Chicken Noodle 1						
Chicken Noodle 2						
Beef Noodle 1						
Beef Noodle 2						
Turkey Noodle 1	0.2893	0.0383	0.2510			
Turkey Noodle 2	0.2893	0.0290	0.2603			
Chili	0.3125	0.0175	0.2951	1.1911	0.0161	1.1750
Cheese Mac Beef 1	0.1468	0.0616	0.0852	0.6401	0.0231	0.6170
Cheese Mac Beef 2	0.1468	0.0222	0.1246	0.4589	0.0070	0.4518
Note: DVAL = Direct Value Adding Labor; ME = Meal Equivalent						

APPENDIX W: TIME SPENT CONDUCTING RESEARCH

Time estimates

Initial employee interviews: 30 minutes

Initial manager interviews: 45 minutes

Filming: 3 hours per session

Film review: 5 hours per session

Focus groups: 45 minutes each

	Initial Interviews		**Filming**		**Film Review**		**Conducting Focus Groups**		**Total**
Dist.	**No.**	**Min.**	**No.**	**Min.**	**No.**	**Min.**	**No.**	**Min.**	**Min.**
A	**4 employees, 1 manager**	**165**	**3**	**540**	**3**	**900**	**1**	**45**	**1650**
B	**4 employees, 1 manager**	**165**	**8**	**1440**	**8**	**2400**	**1**	**45**	**4050**
C	**4 employees, 3 managers**	**255**	**11**	**1980**	**11**	**3300**	**2**	**90**	**5625**
Total		**585**		**3960**		**6600**		**180**	**11325**

APPENDIX X: SUBJECTIVE EVALUATION INTERVIEW PROTOCOL

Date_____ District A B C Site 1 2 3

Employee Designators_____

Instructions:

1. When setting up the interview, ask EACH employee if they prefer to be interviewed in a group or individually. Set up interviews or groups accordingly.
2. Insert date, circle district designator. Circle site designators where employee participants typically work (may circle more than one).
3. Script: This interview is a kind of checking-in, to give you an opportunity to describe your experience in this process. I am particularly interested in knowing if this study process made you nervous or uncomfortable, if the process got in the way of your work, and things like that. I will read a very general question, then you will be able to spend as much time as you like to answer it. I may ask you to elaborate on a point. I will be recording this interview for review later, just like I did when we talked about recipes and your work time. And like the other interviews, if you are uncomfortable with any question you can skip it. You can stop this interview at any time. Do you have any questions about the process? Are you ready to begin?
4. Turn on recorders and test.

Questions

1. There were observations made at your kitchen on several occasions this year. Some were videotaped and some were recorded using an audio recorder and me taking notes. How did you feel about those sessions?
2. Did you feel uncomfortable at all? (probe) What would have made it better?
3. Did you put extra effort into preparing for the observations? (probe)
4. Did the observation process get in the way of your work? (probe) What would have made it better?
5. One of the questions about my research is whether this is worth the effort. We do this kind of decision making all the time: For example, is it worth the effort to go to a second grocery store to save a little money on groceries? Sometimes we can imagine a line, that it is worth the effort for this amount of return but not for anything less. Sometimes the line we imagine is in money, but sometimes it is measured in how we feel about ourselves, or how much we help others. So think about the "return" on this process. What would be the minimum "return" that would make this process worthwhile?
6. Are there any other things I should know about your experience in this process?

APPENDIX Y. QUALITATIVE SYNOPSIS OF THEMES

1. There were observations made at your kitchen on several occasions this year. Some were videotaped and some were recorded using an audio recorder and me taking notes. How did you feel about those sessions?

Reviewer 1	Reviewer 2	Reviewer 3	Theme/Subtheme
Mostly knew what to expect	Accepted the researcher	Forgot about observer	Discomfort/familiarity with researcher and study process
Some initially a little nervous, 2^0 being recorded	Initial awareness/ nervousness	A little nervous	Discomfort/personal exposure
Others not nervous at all		Fine	Minimal discomfort
Some concerns about not following protocol/rules/expectations, or when equipment did not work as expected	Necessary to get the task done- that of more importance	Nervous when equipment didn't work	Discomfort/ performance issues

2. Did you feel uncomfortable at all? (probe) What would have made it better?

Reviewer 1	Reviewer 2	Reviewer 3	Theme/Subtheme
Generally conscious of observer presence but they went about their regular duties	Felt comfortable	Not uncomfortable	Minimal discomfort
Some concerns about who would see films/hear audio, and there would be repercussions		Concerned that "let something slip that shouldn't be"	Discomfort/personal exposure
	Knew the researcher /feeling of knowing what to expect		Discomfort/familiarity with researcher and study process

Appendix Y, continued			
Some concerns that they would not follow protocols	Researcher knew what was occurring in the kitchen therefore put them at ease that it was a research procedure not an inspection	Concerned doing things right-food safety, "doing things by the book"	Discomfort/performance issues
Some sense of being "on display"			Discomfort/personal exposure
	Equipment replacement		Value of research/value to specific meal program

3. Did you put extra effort into preparing for the observations? (probe)

Reviewer 1	Reviewer 2	Reviewer 3	Theme/Subtheme
Slight difference in preparation for the filming over usual practices	Mental preparedness ; pre-preparation to ensure correct procedures	Sometimes	Disruption/need to alter work processes
	Checks – safety procedures (use of gloves)	*Mis en place* ('make sure where everything was")	Disruption/need to alter work processes
		Not like when inspector comes-wondering where he is at, looking for hairnets	Disruption/need to alter work processes

4. Did the observation process get in the way of your work? (probe) What would have made it better?

Reviewer 1	Reviewer 2	Reviewer 3	Theme/Subtheme
Little expressed about inconvenience	No		Disruption or need to alter work processes

Appendix Y, continued			
Some concern about being aware they were being filmed		When alternate observer followed employees around and asking questions appeared to make others nervous (assessment by participant)	Discomfort/personal exposure
Questions asked of the workers were perceived as disruptive	but if it were everyday would become a problem	As long as the observer was not in the way ("if there was someone here who wasn't observant, wasn't conscientious, the whole time that they've been here about spatial issues, that could be a make or break point")	Disruption or need to alter work processes
		Appeared to be OK with alternate observers as long as some relationship to primary observer- "and it's because, you know, I did know you"	
PI was knowledgeable about the work situation, stayed out of the way	Researcher knew how to facilitate the procedure of recording the tasks without getting in the way		Discomfort/familiarity with researcher and study process
	Some instances it helped		Value of research

5. One of the questions about my research is whether this is worth the effort. We do this kind of decision making all the time: For example, is it worth the effort to go to a

second grocery store to save a little money on groceries? Sometimes we can imagine a line, that it is worth the effort for this amount of return but not for anything less. Sometimes the line we imagine is in money, but sometimes it is measured in how we feel about ourselves, or how much we help others. So think about the "return" on this process. What would be the minimum "return" that would make this process worthwhile?

Reviewer 1	Reviewer 2	Reviewer 3	Theme/Subtheme
No Big Deal	Worthwhile		
A way to have others recognize their efforts and work	Good for the research	As long as it will help others- "helping somebody accomplish what they need to do"- helps others understand the process (e.g. kettle meals) a. Length/complication of process b. Overcome negative perceptions of final product (kettle meal)	Value of research/Increased understanding by others
A favor to the PI			Value of research/general altruism
	Would improve procedures		
Learning and improving their processes; pride of workmanship	Other advantages such as better tasting food; use of equipment;	Yes: "return helpful back to our district, more effective, bottom line"	Value of research/Value to specific meal program

6. Are there any other things I should know about your experience in this process?

Reviewer 1	Reviewer 2	Reviewer 3	Theme/Subtheme
Unappreciated. Extend the study to more clearly demonstrate the work involved			Value of research/Increased understanding by others
Watch the "game tapes" to learn and improve	Training opportunity; could review the process compare and improve procedures	They can learn from one another-viewed as good thing	Value of research/personal value; value to specific meal program

APPENDIX Z. THEME QUOTES

1. There were observations made at your kitchen on several occasions this year. Some were videotaped and some were recorded using an audio recorder and me taking notes. How did you feel about those sessions?
    - First couple of times, I'd say, it made us a little nervous (3421, p1-2). Make you nervous at first (3421 p1-2) …at first it was a little weird getting used to it and, and everything (3320 p1-1)
    - But then it was fine….now, it doesn't bother me at all (3421, p1-2). …I'd say for me they were…fine (2342 p1-1)
    - Doesn't bother me at all (3421, p 2-2)
    - …I think I was more nervous about was doin' everything exactly by the book (3421, p2-3)
    - …but we're always nervous, I think, with somebody videotapin' it (3421, p3-3)
    - They were ok for the most part (2342 p2-1)
    - …pretty much everything was explained before we went into it….Pretty much know what was gonna happen before it happened(2342 p2-7)
    - Hmm…I had a few moments where I was nervous because … when our equipment doesn't work the way we want it to, oh, and…)05, p4-1)
    - Felt fine! Wasn't any… bother (05, p1-1)
    - It didn't bother me (05, p2-1)
2. Did you feel uncomfortable at all? (probe) What would have made it better?
    - I had to stop and think a lotta times, who was in my back (3421, p2-2)
    - …we had a lotta stuff that sometimes…we weren't sure we were doin' it <right> (3421, p3-3)
    - …I was, ah, probably…more conscientious to be doing everything…exactly as, um, you know, making sure that I wasn't touching anything with gloves other than the food. So, but, I, I wouldn't call that uncomfortable (3320 p2-1)
    - Um, I think at first, um, maybe it was being more aware of, of how you're doing things, using the proper procedures and, and then, um, you know, as time went on, there was several times that, um, that you taped us and everything then, um, it got more comfortable and, and you weren't you just went through your normal routine and, and everything (3320 p1-2). …we just kind of went through our own normal routine of getting the food prepared (3320 p3-2)
    - …not really (2342 p 2-1). No (2342 p1-1).
    - Sometimes I wonder if I let somethin' slip that shouldn't be but…that's gonna be gone, right? (2342 p2-2)
    - But they don't have any idea who we are anyway (2342 p2-2). They don't see our faces (2342 p1-2)
    - You were just there (05, p1-1)

- Except for every once in awhile I forgot and got in the way (05, p2-2)

3. Did you put extra effort into preparing for the observations? (probe)
    - Not really (3421 p1-3)
    - I don't think so (3421 p3-3)
    - We always prepare the day before (3421, p2-3)
    - No. Same as we always do (2342 p1-2)
    - It was business as usual (2342 p2-2)
    - Sometimes…we were prepared…. It was to make sure where everything was… (05, p3-3)
    - No, no, I just did my own thing… (05, p2-3)

4. Did the observation process get in the way of your work? (probe) What would have made it better?
    - I don't think so (3421 p3-4)
    - …I think I was walking in circles around the table making you move a lot! (3421 p2-4)
    - No. For the most part it was…just forget that somebody was there (2342 p2-2).
    - …I mean, you really don't do anything different…say anything different, obviously sometimes. But it's just…I guess it's just the idea of somebody *there* that's not usually in your kitchen, and they're mak- taking a movie of you. (2342 p2-4)
    - Um, I don't think so. I think, um, we're always dealing with, um, you know, people havin' to shift or equipment havin' to shift or carts, or, you know…things like that (3320 p1-2)
    - It just seemed like a normal day (3320 p2-2)
    - But I think it also ha-, knowing that *you* were, you came in *knowing* what our kitchen situation was like, and *you* were prepared for doing your best at staying out of the way of, of all the employees, too (3320, p2-2, 3)
    - Not for me 'cause I knew you were gonna be there by noon (05, p2-4)
    - No, you were just…always know where to be and to watch …(05, p2-4)

    4a. Q: did the questions disrupt what you were doing?
        - A: …when they ask questions, you kinda gotta stop what you're doin'…pay attention to what they're ask… (2342 p2-3)
        - Well, you ask very few questions. And, the truth be known, he followed other employees around, askin' them questions. And it got on people's nerves a little bit, just to be honest (2342 p2-5)

5. One of the questions about my research is whether this is worth the effort. We do this kind of decision making all the time: For example, is it worth the effort to go to a second grocery store to save a little money on groceries? Sometimes we can imagine a line, that it is worth the effort for this amount of return but not for anything less. Sometimes the line we imagine is in money, but sometimes it is measured in how we feel about ourselves, or how much we help others. So think about the "return" on this process. What would be the minimum "return" that would make this process worthwhile?
    - …it's really not that big of a hassle to do this (3412 p3-5)
    - …it wasn't that big of a deal….it wouldn't bother me if you asked if you could do I again. (3412 p1-5)
    - I would say change. Only because I would wanna …make it faster (3412 p3-6)
    - I think if it was played back to us…so we could actually see what we're doin'….(3412 p1-6)
    - …it wouldn't be worth it if it is just was the same thing every day….if you're not gonna gain any of that, then…it wouldn't be worth it to me (3412 p2-8)
    - …you do it to help somebody out (2342 p2-3).
    - …it's just knowing that you're helping somebody accomplish what they need to do. (2342 p2-4)
    - …it'd be different if we had to do something that we don't normally do, but it's already stuff we make anyway so …it's not an issue. You're just filming us instead of us just bein' there doin' it. It's not a big deal. (p2-4)
    - …I would say that the return would be helpful back to our district, knowing how we can make specific recipes, um, more efficient, um bottom line in improving the cost of the recipes…(3320, p2-3)
    - For me, what I observed wasn't *that* much of an inconvenience to know that we have the potential of getting some valuable research coming back and helping us with recipe development and labor, um, cost factors… (3320 p2-4)
    - …I'm not looking so much at the cost factors, um, as, um, if it helps the process, um, be more efficient, um, of how we can actually do this maybe more efficiently. (3320, p1-4)
    - I didn't really go into it expecting to get ourselves, personally, anything out of it (3320, p2-7)
    - Well, I'd hope they, anybody who watches it gets something out of it. I mean…the process. They don't, a lotta people don't understand the processes,, especially with <a> kettle meal (05, p4-5)
    - …I'm just saying that I want other people to understand the process so I don't hear, "So what? It was a kettle meal." Well, you know what? It's not so what. It, it is an effort. (05, p4-5)

- So it helps when someone else sees the process and goes, Hey, you don't have to do that this way. You know, this can be better." (05, p4-6)
- …so actually, both sides are comin' out ahead, you know? We're learnin' somethin' and, you know, hopefully you're, you know, whatever you're getting' out of it and stuff and any information you can pass on to anybody else…(05, p4-7)

6. Are there any other things I should know about your experience in this process?

- And now if we get kids that complain too about…nitpickin', we're all…we can deal with it a lot better (3412 p1-9)
- Maybe some of our kids need to go to China and see what it's like there, and then come back and appreciate us a little more (2342 p2-6)
- If your research included product quality, specifically, then I would definitely say that it, it could help prove the need for another piece of equipment. (3320, p2-5)
- …I think …it could be a make or break point, depending on who was here doing the research. Umm…I think if there was someone here who wasn't observant, um, wasn't probably conscientious the whole time that they've been here about spatial issues, um, that could be a make or break point (3320, p3-6)
- Q: Do you think that it would be useful for you to have the videotapes to look at afterwards? A: I think that it'd be interesting to do (3320, p1-6)
- We all stand to maybe learn from each other (3320, p2-7)
- But I do think it woulda been, if you could've with your, your timing and, you know, how long it takes. I, I don't, I thought always you should've timed to see how long it takes from the beginning of settin' up the kettle to the cleaning of the kettle. (05, p2-7)

3412 pages 6-8: improved product quality, better liked by students, more efficient operation. General pride of workmanship. Learning.

3320 page 2: kept track of *mise en place,* which was not part of the study and not requested.

3320 pages 4-6: working without major piece of equipment, and have had to adapt to producing with reduced resources.

3320 page 7: learning as an outcome

05 page 2: learned from one filming person (3320)

05 page 6: learning new technique.