SHOVELS, TROWELS, AND ICE CREAM SCOOPS: IN SEARCH OF THE RIGHT TOOL TO EXPLAIN SCIENTIFIC MANAGEMENT

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Article:

Each term, when covering the history of management, many students have difficulty identifying with "ancient" management figures such as Frederick Taylor and Frank and Lillian Gilbreth. Even in Birmingham, Alabama, the former "Pittsburgh of the South," Taylor's pig iron studies have little relevance. The bricklaying, sewing, and surgery studies by the Gilbreths fare only slightly better. The principles espoused by these figures have become so engrained in the field of management that students now see them as common sense.

To help students relate more easily to these figures and to understand the basic principles of scientific management, a familiar activity, dipping ice cream, can be used. This exercise and subsequent discussion can clearly demonstrate how these management principles are applied. Students learn firsthand that worker productivity can be improved by applying concepts developed by Taylor and the Gilbreths. An added benefit is that this exercise builds rapport among students early in the term.

Background

In contemporary society, people are time conscious to an extent never before seen. This mind-set should make the work of Taylor and the Gilbreths all more relevant to today's students. The principles of scientific management, the piece-rate system, Therbligs, and so forth are all topics familiar to management educators. The work of Taylor and the Gilbreths is chronicled in every principles of management text (e.g., Daft, 2000; Griffin, 1999; Schermerhorn, 1999) and therefore will only be discussed briefly here.

Taylor set out to improve productivity and better the working lives of laborers. As he stated in his book *Scientific Management*, "Under the management of „initiative and incentive' practically the whole problem is „up to the workman,' while under scientific management fully one-half of the problem is „up to the management'" (Taylor, 1911, p. 38). Although the foundation of Taylor's system was his time studies, it was the Gilbreths who elevated time and motion study to an art form.

By taking an interest in the workers' physical comfort and mental well-being, the Gilbreths greatly advanced management. The principles developed by Taylor and the Gilbreths can be effectively demonstrated by conducting the exercise described in this article. Using ice cream to illustrate management principles is not a new idea. Bacon and Stewart (1996) described an experiment using ice cream to clarify the customers' perception of quality.

Conducting the Exercise

Overview. In this exercise, students serve ice cream cones to their classmates. Elements of scientific management are introduced by iteratively varying the implements, training, and specialization involved in serving ice cream cones. Students track the productivity of the servers and compute the changes to productivity attributable to the changes introduced into the serving process.

Preparation. The following assignment may be given to the students as homework or an in-class exercise at the beginning of class:

> Evaluate the operations of a local ice cream shop. Specifically, you should decide on the appropriate measures of productivity as they relate to customer service. Develop a system to record your observations. Bring these items to class next time.

Because students often include too many elements in their scoring sheets, you may prefer to provide them with a scoring sheet (included in the appendix). Before beginning the exercise, you may choose to conduct a brief discussion of possible productivity measures.

Material requirements. The materials needed for the exercise are listed in Table 1. Keep the ice cream in a freezer as long as possible. To transport the ice cream to class, place a bag of ice in the bottom of the cooler with rock salt sprinkled on top. Place a plastic bag over the rock salt and ice mixture to keep from contaminating the ice cream. Serve the ice cream directly from the cooler(s) to postpone the serving of milkshakes instead of ice cream cones.

The Basic Exercise

The basic exercise will be discussed first. A variation to accommodate larger classes will then be presented. As can be seen in Table 2, the service encounter is affected by changes in training, equipment, menu selection, and specialization.

TABLE 1
Basic Materials List

Item	*Quantity*	*Notes*
Round container: Ice cream	½ gallon per dozen students	Ease of dipping
Rectangular container: Ice cream	½ gallon per dozen students	Difficult dipping/waste
Sugar and wafer cones	1 cone per student	Students prefer sugar cones
Metal ice cream scoop	2	Professional model
Spring-loaded ice cream scoop	2 (two queue)	Home model
Container of rock salt	1	Used to lower melting point of ice—keep clear of ice cream
Ice chest(s)	1 (basic) or 2 (two queue)	Depending on number flavors and number of queues
Bags of ice	1 per cooler	
Napkins	1 per student	
Play money	Various denominations	Realistic touch
Container of warm water	1	For warming metal scoops

TABLE 2
Basic Design of Ice Cream Exercise

Variable	*Customer Group*	*Single Queue*
No training	First group (1/3 of class)	Professional scoop without water, round ice cream container
Training and water	Second group	Add training, warm water, and second scoop
Specialization	Third group	Add cashier or other form of specialization

The basic, or single queue, exercise works best in classes with 25 to 50 students. The class is divided into three groups of customers and is served from a single station with a single queue.

Single queue model. The instructor selects a single server and a single cashier, neither of whom should have any previous professional experience in a retail ice cream setting. The cashier waits outside while the server receives instructions and during the first two rounds of service variations. The server is instructed that he or she is responsible for all phases of the service encounter: friendliness, quality and quantity of the product, and money handling. The server should be given a bank of play money (the price of an ice cream cone is $1). While the server is arranging the materials, the class should be given various denominations of play money and should prepare to record the productivity of the server, using either the system developed as homework or the one provided (see the appendix). The class should be instructed that in addition to recording the productivity of the server, they should write down any general observations about the exercise. The students should also be instructed to note the beginning and ending time during the first service period. (Students who develop their own sheets often omit time as a productivity measure; astute students will time each service encounter sequentially to discover elements of the learning curve.) When the server is ready to begin, students in the first group of customers should form a single line and the serving of ice cream cones should begin.

Before the second customer group is served, the server will receive employee training, a container of warm water, and an additional ice cream scoop. In private, the server will be instructed to greet each customer with "Good day! How may I help you?" If you use multiple flavors of ice cream and different cones, the server should also be instructed to prompt the customer about the available choices. In some iterations of the exercise, servers failed to inform the customers of flavors and cone choices in an effort to speed service. Before the second round, the server is given the following training: (a) Inform the customer of the price, (b) make change as necessary, (c) dip the ice cream, (d) wrap the ice cream cone in a napkin, (e) present the cone to the customer, and (f) thank the customer and say, "Please come again." The server is also given instructions for more efficient use of the ice cream scoop: Use the scoop that has been in the water the longest; scoop against the edge of the container until an ample scoop is obtained; and invert the cone against the scoop to avoid dropping the ice cream and creating waste and a mess. After training is completed, the server returns to the room and serves the second customer group from a single queue.

In the third customer group variation of the basic exercise, specialization of labor is added by introducing a cashier. The cashier returns to the classroom and is instructed to take the customer's order and relay it to the server. While the order is being filled, the cashier makes change. It is the cashier's responsibility to greet the customer, take the money and make change, and thank the customer. The server is responsible for filling the order, then confirming the order as the cone is handed to the customer, and thanking the customer again. As in the previous two variations, the customer group forms a single queue.

Double queue model. This model uses two serving stations and attempts to show variations in efficiency by stacking the deck against one serving station by giving them inferior equipment, training, and support. In classes larger than 50 students, it also speeds the serving process, which allows the exercise and discussion to be completed in a 50-minute class period. The features of this approach are shown in Table 3.

In this design, the instructor selects 5 participants (4 servers and 1 cashier) with no previous professional experience in a retail ice cream setting. The cashier and all but two of the servers wait outside. The two remaining servers are instructed that they are responsible for all phases of the service encounter at their station. As in the single queue model, this would include friendliness, quality and quantity of the product, and money handling. The students should be given a bank of toy money to make change (the price of a cone is $1). Give the students a moment to arrange the materials at each of their stations. For the purpose of tracking productivity, each class member is assigned to observe one or the other serving station. As described in the basic exercise, the class is instructed about recording productivity and observations. For the double queue model, the class is divided into three customer groups—one for each round. When the servers are ready to begin, the students in the first customer group form two equal (if possible) lines, and various denominations of

play money are distributed to each customer. Just as in the single queue model, the beginning and ending time for the first service period should be noted.

TABLE 3
Design of Ice Cream Exercise Using Two Queues

Variable	*Customer Group*	*Double Queue "Advantaged"*	*Double Queue "Disadvantaged"*
No training, equipment different	First group (1/3 of class)	Professional scoop without water, round ice cream container	Spring-loaded scoop without water, rectangular ice cream container
Training and water	Second group	Same server; add training, warm water, and second scoop	New server; same as above
Specialization	Third group	Same server; add cashier	New server; same as above or add second worker without specialization

In the second customer group under the double queue model, training, the container of warm water, and an additional scoop are added to only one of the serving stations. The server at the "disadvantaged" station does not receive training. The now experienced server at the "advantaged" station receives training as described in the second customer group of the single queue model. After completing the brief training, one of the excluded servers reenters the classroom and is positioned at the disadvantaged station. As the second customer group forms two lines, the new server is informed that he or she is responsible for all phases of the service encounter. After briefly allowing the new server to arrange his or her serving area, begin serving the second customer group.

Again, the event should be timed. The addition of the training, container of water, the second scoop, and the softening of the ice cream should result in a decrease in serving time for each encounter. The learning curve should also be evident as the now experienced server is entering his or her second round of serving compared with the new server at the disadvantaged station.

The third customer group under the double queue model adds specialization of labor by introducing a cashier to one of the serving stations. The instructions for training of the cashier and server found in the third customer group of the single queue model are used. After covering these items, the remaining server reenters the room and is positioned at the disadvantaged station. As done in the previous round, the new server is instructed that he or she is responsible for all phases of the service encounter. As in previous rounds, the third customer group forms two equal lines and is given play money. The third round is conducted as previous rounds were. After completing this round, the servers should tidy up the area and serve themselves before taking a seat.

Variations. The number of variations on this exercise is only limited by your own ingenuity. The following variations have been used with some success. First, the advantaged server is given ice cream in a cooler without ice, thus speeding up the softening process and making dipping easier. Obviously, if the room is too warm, this option may not be feasible, as there is a fine line between softened (easier to scoop) and melted ice cream. Conversely, the ice cream for the disadvantaged server is frozen to a rock-hard consistency. Varying the type of containers (round vs. rectangular) used at each station has also been used to illustrate task design issues. Round containers allow for scoops to be formed in one continuous motion and reduce the waste associated with ice cream left in the corners of the rectangular containers. Finally, customers in the advantaged line are provided with more exact change ($1 bills) and disadvantaged customers are given larger denominations, thus requiring more change counting. "Shorting" the bank of the disadvantaged serving station disrupts the serving activity because the server must "go to the bank" to get more change.

Another variation is related to the introduction of specialization. Students often complain that the third round of the double queue model is too rigged. They argue that a cashier and server will always out-produce a single server who must dip and make change. To make a fairer test but still preserve the specialization step, you may add a cashier to the advantaged station and an additional dipper at the disadvantaged station. Each worker at the disadvantaged station performs all functions (serving and making change) versus the specialization at the advantaged station.

Other obvious variations include adding to the menu items, such as multiple flavors of ice cream and cones. However, the addition of ice cream flavors does not appreciably alter serving time as students merely enter one side versus another side of the ice chest to retrieve different flavors. The same logic holds for cones as well. Adding toppings such as sprinkles, nuts, or chocolate syrup does increase the serving time. (Hint: The toppings also create a bigger mess!) The variations do not add significantly to the goals of the exercise.

Another substantial variation involves the division of labor and functional supervision. Server teams can be used to create the need for coordination and teamwork in the exercise. Functional bosses can be used to illustrate Taylor's (1911) concept of supervision. In this variation, students would perform the training of the servers. By creating large serving teams, the old adage that "too many cooks spoil the soup" can also be illustrated.

Any simple food processing activity could be used in lieu of dipping ice cream. In the winter, we suggest serving hot chocolate, coffee, and cider with marshmallows, cinnamon sticks, chocolate shavings, whipped cream, and so forth.

Guidelines for Debriefing

The debriefing can be conducted with the class as a whole or by dividing into small discussion groups. In either format, students should average their productivity measures and place them on the blackboard. The differences between rounds for the single queue model or between rounds and serving stations for the double queue model should be discussed. The exercise and debriefing using either the single or double queue model can be conducted in 1 hour. The serving usually takes less time than the setup and debriefing.

A typical discussion might follow basic differences related to the design of the study. Specific attention should be given to any differences attributable to equipment (e.g., scoops, water, container shape, etc.) for the first customer group. Then, the discussion should proceed to the effect of training and the learning curve based on the second customer group experience. Finally, the effects of the specialization of labor provided by the addition of the cashier should be discussed.

Additional issues related to the exercise worth discussing include the quality and quantity of the scoops furnished by the servers, the opportunity costs associated with inefficient service, and the benefits of more efficient process, such as freeing up the server to bus tables, take inventory, wash glassware, and so forth.

Finally, students should describe the layout for the typical ice cream shop. Ask them whether the ice cream is stored in a way that is efficient for dipping. Better students should indicate that it is not but that service efficiency is sacrificed for several reasons. First, the freezer arrangement allows the product to stay colder and fresher, thereby reducing product waste and controlling quality. Having the ice cream stored in a low position allows customers to visually inspect the product, which aids in the marketing of the various flavors (something unnecessary in a chocolate- and vanilla-only exercise). Furthermore, the visual display aids the customer in selecting a flavor and placing the order and ensures that the order is properly filled because the customer is watching the server take the scoop of ice cream. Be sure to point out the advantages (less waste and ease of scooping) of the large round containers found in ice cream shops versus the rectangular boxes found at the grocery store.

This exercise has been refined over several attempts that met with varying degrees of success. On one occasion, the disadvantaged station actually served customers more quickly by dispensing with most customer courtesies, pre-preparing cones, and skimping on the serving size. Even this unanticipated result was successful in illustrating the Model T approach to ice cream—any flavor you want as long as it is vanilla. It also gave us the opportunity to discuss customer service issues and product quality. Instructors should be prepared to integrate unexpected events in the experiment into the discussion.

By conducting this hands-on exercise, students gain an understanding of scientific management principles and their effect on productivity. The application of the work of Taylor and the Gilbreths with a familiar activity brings the historical concepts alive in a tasteful and memorable fashion. Through this exercise, students learn that even in dipping ice cream, there is one best way, or at least a better way.

Appendix
Scoring Sheet for Productivity

	Round 1		*Round 2*		*Round 3*	
Measurement	*Queue 1*	*Queue 2*	*Queue 1*	*Queue 2*	*Queue 1*	*Queue 2*
1. Service start time[a]						
2. Service time for each customer T1 T2 T3 T4 T5 T6 T7 T8 T9 T10 T11 T12 T13 T14 T15 T16						
3. Service end time						
4. Elapsed time (3 – 1)						
5. Learning curve (T1–Tn)						
6. Penalties[b]						
7. Overall time (4 + 6)						
8. Average time per customer (7/number of customers)						
9. Improvement (7Q1-7Q2)						
10. Round improvement (7Q1R1–7Q1R2, 7Q1R2–7QR3, etc.)						

(continued)

Appendix Continued

NOTE: T = time; Q = queue; R = round. Queue 1 represents the "advantaged" servers (those receiving better equipment, training, etc.).
a. To more accurately simulate the method used by Taylor, a student can be given a stopwatch and clipboard to record events, which also simplifies some of the calculations.
b. Penalties of 5 to 10 seconds might be assessed for lack of courtesy, poor-quality cones, and so forth.

References

Bacon, D. R., & Stewart, K. A. (1996). The ice cream experiment: An exercise in understanding customer perceptions of quality. *Journal of Management Education*, *20*(2), 265-275.
Daft, R. L. (2000). *Management* (5th ed.). Fort Worth, TX: Dryden Press.
Griffin, R. W. (1999). *Management* (6th ed.) Boston: Houghton Mifflin.
Schermerhorn, J. R., Jr. (1999). *Management* (6th ed.). New York: John Wiley. Taylor, F. W. (1911). *Scientific management* (3rd ed.). New York: Harper & Brothers.