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Arup Mukherjee
University of West Florida

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Teaching about the Meaning and Importance of Quality in an Undergraduate Operations Management Course

Arup Mukherjee

Undergraduate business majors are often required to take a course in operations management. In the course, they learn about such techniques and topics as productivity, quality, product design, forecasting, project management, and supply chain management, among others. While each topic is important, a great deal of emphasis may be put on developing a good understanding of quality because this it may be the only required course in the undergraduate curriculum that covers this important topic. Two questions are of great importance in this context. First, students need to understand what quality means in a broad generic sense. Second, they

need to understand *why* it is important.

Text book authors define quality in many ways. The definition varies from one business function to another. For example, the Production definition is different from that of Marketing. The definition also varies from industry to industry. Further, simple assertions during lectures about the importance of quality did not appear to be impressing the students. Every time the segment on quality was taught, it gave me the feeling that I was not doing a good job of answering these two questions. Students would memorize specific definitions given in class but would fail to adapt the definition when challenged to do so in a different scenario. In addition, they would typically not have a personal feeling about the importance of quality. The students and I found this situation to be very frustrating. At the same time, I felt that it is important for students to have a focused grasp of

what it means in different contexts because quality is a critical attribute of products and services. I also wanted students to appreciate the role that quality plays in keeping customers satisfied. I have struggled with this issue for over 15 years. A search for a solution has led me to develop and use a class exercise that helps students discover a generic definition of quality and understand the impact that poor quality has on customer dissatisfaction. This exercise has been used successfully for over ten years and the results are very encouraging.

Two things happen when this class exercise is used. First, students are engaged in a complex task that requires them to reflect on the task. Second, during the discussion that follows, they are guided by the instructor to discover a generic meaning of quality. These two strategies are well known to educators. The first strategy is typically referred to as 'active learning' while the second

Arup Mukherjee, Ph.D., is professor and chair, Management and Management Information Systems Department, University of West Florida, Pensacola, FL 32514.

one is called 'discovery learning.'

Active learning has a large following among academics and trainers. Learning becomes active when students use their minds during the learning process. Over two thousand years ago, Confucius suggested that people forget what they hear, but remember what they see and understand what they do. Active learning is thus learning through doing. Silberman (1995, 1996) describes many strategies to incorporate active learning in courses and training sessions. Wassermann (1994) reaffirms the widely held belief that opportunities to engage students actively in analyzing complex situations promotes their habits of logical thinking. Meyers and Jones (1993) believe that active learning helps students to become self-directed life-long learners, an ability that will help them in adjusting to the continuous changes that they are likely to encounter in their work places and society.

Discovery learning basically refers to a process where the student discovers the knowledge that would otherwise have been presented to her via a process of lecture. Pure discovery refers to a process where the learner receives no guidance and is generally not favored by educators (Tuovinen & Sweller, 1999 & Mayer, 2004). Guided discovery learning is a process where the learners are guided to discover some pre-determined goal. Learners usually discover

the desired goal by studying specific scenarios (Mandrin & Preckel, 2009). In the remainder of this article discovery learning is used to mean guided discovery learning. Any activity which engages students and requires them to discover knowledge is inherently a mental challenge for them and usually succeeds in keeping their attention focused on the task at hand. An excellent reference is the book by Massalias and Zevin (1983). Smith and Lusterman (1979) suggest that in discovery learning, the teacher's role is primarily to help students think, question and evaluate for themselves. Further, it has been my experience that when students discover knowledge, they have a better understanding of that knowledge item, feel an ownership of the knowledge item, and typically find it easy to apply the knowledge to new scenarios.

At the same time, there is an important trade off that the instructor needs to be aware of. While the objectives of active and discovery learning are good, one has to remember that such an exercise takes time away from presentation of content. Further, it is also known that not all students are good at discovering knowledge on their own. Hence, the instructor needs to carefully monitor the activity and student participation in order to make sure that the objectives of the activity are achieved.

In this article, experiences with the use of a class exercise that helps

students discover a generic meaning of quality and understand its importance is described. First, some background information is presented to help the reader understand the context of the article. This is followed by a description of the class exercise and the process used to carry it out. A short summary of student performance is presented next for a few uses of the exercise along with a discussion of the benefits observed as a consequence of using this exercise.

Background Information

Undergraduate students at many AACSB accredited business school are required to take a course on operations management. The subject school is located in the South East United States and is part of a regional comprehensive university. The business school enrolls around 1,700 students. The text book used in the course is a custom version of the *Principles of Operations Management* text by Heizer & Render (2008). The list of topics covered includes productivity, quality management, statistical process control, design of goods and services, forecasting, project management, capacity planning, and supply chain management. Typically, students take this course in their junior year.

Class Exercise

The class exercise used for the above mentioned purpose has been presented in Appendix 1. The student

is presented with eight scenarios and asked to answer three questions for each scenario. The scenarios include examples that students are familiar with and can easily relate to. For example, one scenario talks about donuts becoming too hard to eat. Another is a scenario where a box of dozen donuts is found to contain only 11 when it is opened. A third scenario describes a situation where a pizza is delivered late and has the wrong toppings. A fourth scenario describes a situation where a seat belt failed to deploy during a car accident. These eight scenarios were carefully picked to bring out different issues pertaining to the meaning of quality. For each scenario, the student had to answer three questions. The first task was to identify what attribute of quality was being revealed in this scenario (e.g. weight, length, timeliness, cleanliness, safety etc). The second task was to rate the level of dissatisfaction if this situation happened to them. The purpose of this task was to bring out the difference that existed in the level of dissatisfaction when firms fail to meet quality expectations in different dimensions. The third task was to rate the level of importance of this specific quality dimension. The purpose of this task was to bring out how much difference existed among customers in the weight that they assigned to a specific dimension of quality. For example, did all students assign the same

importance rating to a donut becoming too hard to eat or was there a lot of difference in student ratings on this scenario. Another purpose of the last two tasks was to highlight the difference that existed in how customers viewed the different dimensions of quality. For example, did customers consider a donut missing from a box to be as important as a seat belt not deploying? Would they be equally dissatisfied if a donut was missing from a box of dozen donuts as they would be if they received wrong toppings on their pizza?

Process

The class is first introduced to important concepts pertaining to quality in a 60 minute lecture. This lecture includes definitions of quality from the perspective of two functions. The Production function defines quality as 'conformance to standards.' The Marketing function believes that 'better performance is higher quality.' Both these definitions are from the text used in the course. Other items covered in this lecture include Total Quality Management, ISO 9000 standards, Inspection, and Determinants of Service Quality. The class exercise is done in the next 60 minute segment. In the summer term, these two happen on the same day. In a regular semester, the class exercise is held on the next day.

There are three essential steps to conducting this class exercise. These steps

have been refined over a period of ten years and are all important. The steps are described below.

Step 1:

The class exercise form is passed out and instructions are read out to students. Many students have difficulty with the first task that requires them to identify quality dimensions. Hence, before students work on these 8 scenarios, it has been useful to describe another quality related scenario, and work the three tasks in front of the class. Students are given 20 – 25 minutes to complete the tasks in this exercise.

Step 2:

This is a 15 – 20 minute period when the class comes to know of the answers given by other students. For each scenario, the instructor calls on 3 to 4 students to share with the class their answer about the quality dimension revealed in this scenario. Then the instructor asks students to raise their hand if they rated their dissatisfaction at a 4 or 5 for this scenario (high in dissatisfaction). Finally, the instructor asks students to raise their hand if they rated the importance of dimension at 4 or 5 (high in importance).

Step 3:

This a 10 – 15 minute period when the class is asked to makes sense of

the information in front of them from the perspective of trying to identify what was the underlying theme that connected the dimensions in all these scenarios.

The class exercise is graded and returned the next class meeting. The exercise accounts for around 3 percent of the total grade in the course. The most important criterion used for grading is seriousness of effort. In other words, it is pointed out to students that there is no right or wrong answer. The most important objective is to put in their best effort on these tasks. As long as they made a serious effort, they had nothing to be afraid of. Once students understood that they had nothing to be afraid of, they typically put in their best effort on the different tasks.

Typical Results and Discussion

Students have done this exercise whenever the instructor taught the course (which was at least once each year for over ten years). However, copies of student work were kept only for the terms Summer 2006 and Fall 2006. So, results presented in this section are from a summary of responses received in those two terms. The class exercise was conducted as recently as Summer 2009 and the instructor observed similar results.

During the exercise, importance of quality is

discovered before the class develops a generic meaning of quality and is hence discussed first.

Goal : Importance of Quality

In the class exercise, for each scenario, students are asked how dissatisfied they would be if they experienced such a scenario and the level of importance of the particular quality dimension revealed in the scenario. In Step 2 of the exercise they are asked to raise their hand if they rated the level of dissatisfaction at 4 or 5 (high in dissatisfaction). The next question asks them to raise their hand if they rated the dimension to be at 4 or 5 in importance. When the question is framed in terms of dissatisfaction, there is a great deal of emotion attached to the answer. It is easy for me to tell that they feel strongly about their answer; however, when the question is framed in terms of importance, students answered the question but there appeared to be little conviction in the answer. In Table 1, details of typical results observed on these two questions are presented.

Students are surprised to find that not all experiences cause the same level of dissatisfaction. Neither are all dimensions considered to be of equal importance. For example, all 100 percent of respondents (N = 79 for all the percent-ages reported in this section) are likely to be dissatisfied (rating of 4 or 5 on dissatisfaction) if seat belts do not deploy in an accident. The same 100

percent felt this dimension to be important (4 or 5 on importance). Similarly, all 100 percent are likely to be dissatisfied if they experienced the situation of having to vomit after eating fried food. Around 99 percent felt this dimension to be important.

At the other extreme, only 10 percent of respondents indicated that they will be dissatisfied if songs were repeated by a radio station during the no repeat hour. But, 15 percent considered this dimension to be important. Similarly, only 16 percent would be dissatisfied if they found a 5 lb bag of apples to have only 4.5 lbs. But, around 24 percent considered this dimension to be important. Finally, around 25 percent would be dissatisfied if dog refused to eat dog food that was advertised to be very attractive to dogs. But, 38 percent felt that this was an important dimension. Students are surprised to find that sometimes, even if the dimension is important, consumers do not necessarily experience proportionate dissatisfaction.

One important lesson is that consumers are likely to experience dissatisfaction whenever personal safety was at stake (seat belt not deploying or fried chicken causing vomiting). Yet, this did not carry through for all health related dimensions. Around 99 percent of respondents indicated that they would be dissatisfied if the pizza had wrong toppings or were delivered late compared to 16 percent

Table 1
Typical Results in Exercise—
Percentage of Respondents Reporting Different Rating Levels
[N = 79]

Scenario	Level of Dissatisfaction*			Level of Importance**		
	1 or 2	3	4 or 5	1 or 2	3	4 or 5
1. 11 donuts in a box of 12	20	24	56	14	24	62
2. Donuts too hard to eat	14	25	61	16	20	64
3. Pizza with wrong toppings and delivered late	0	1	99	0	6	94
4. Vomiting after eating fried chicken	0	0	100	0	1	99
5. Apple bag had 4.5 lbs in place of 5 lbs	51	33	16	44	32	24
6. Dog refused to eat advertised dog food	37	38	25	35	27	38
7. Two songs repeated by radio station in no repeat hour	61	29	10	56	29	15
8. Seat belt failed to deploy in an accident	0	0	100	0	0	100

* 1 or 2 is low dissatisfaction; 4 or 5 is high dissatisfaction

** 1 or 2 is low importance; 4 or 5 is high importance

dissatisfied respondents if they experienced shortage in a bag of apples. This contrast always seems to lighten up the discussion and get the class to burst into laughter. The feeling here seems to be “Don’t mess with my pizza toppings and its delivery.” They are willing to eat less of healthy apples. Getting the class to laugh has been found to be important in the context of the next step where they will be pushed to discover a generic meaning of quality.

It is easy for students to appreciate the relationship between dissatisfaction and loyalty. They relate to these

scenarios because they are very realistic. They immediately understand that a customer is less likely to return to a firm that has been a source of dissatisfaction in the past. It is easy at this point to come to a conclusion about the role that quality plays in keeping customers happy. Failure to meet customer expectations relative to quality may cause the customer to flee to an alternate vendor. This conclusion has conviction because it is something that they discovered. It was not drilled into them.

Goal : Meaning of Quality

In Step 1 of the exercise students are asked to identify the different dimensions of quality revealed in the different scenarios. Some typical results are shown in Table 2.

The main goal of this step is for students to discover that quality has many different attributes or dimensions. Sometimes it is about weight; sometimes it is about freshness; at other times it may be about timeliness of order execution or equipment reliability. So

Table 2
Typical Quality Dimensions Identified by Students in different Scenarios

Scenario	Typical Quality Dimensions
1. 11 donuts in a box of 12	Accuracy of count
2. Donuts too hard to eat	Freshness; shelf life; longevity
3. Pizza with wrong toppings and delivered late	Accuracy of order; Timeliness of order execution
4. Vomiting after eating fried chicken	Safety; cleanliness; preparation; hygiene; cooking time
5. Apple bag had 4.5 lbs in place of 5 lbs	Accuracy of weight
6. Dog refused to eat advertised dog food	Hype in marketing claims; taste appeal; honesty in advertising; unpredictable dog taste
7. Two songs repeated by radio station in no repeat hour	Follow through by radio DJ; DJ incompetence
8. Seat belt failed to deploy in an accident	Safety; reliability of sensors and equipment

how can one create a generic meaning of the term quality when there are simply an infinite number of different dimensions that customers look at when they refer to quality? This is very confusing and frustrating for students. So what does quality mean in a generic sense?

In Step 3 of the exercise, the class attempts to extract the meaning of quality. This a 10 – 15 minute period when the class is asked to make sense of the information in front of them from the perspective of trying to identify what was the underlying theme that connected the dimensions in all these scenarios. This particular step needs a lot of prodding from the instructor. Repeatedly, the instructor has to compare dimensions in the different

scenarios and ask the class to identify the common theme. For example, one scenario deals with having one donut short in a box of 12. Another scenario deals with dogs not eating a brand of dog food that was advertised claiming that the ‘dog will kill for this food.’ Repeatedly, the class has to be asked about the customer’s expectation in a particular scenario. The class has to be asked about what led to the expectation. Often, the instructor has to prod them by starting a scrabble session and indicating that the answer starts with the letter ‘p’. After a number of false starts, the class gets to the point that quality is about meeting promises that have been made to a customer. After coming to this point, the instructor needs to

clarify that promises may be explicit or implicit. For example a bag labeled as a 5 pound bag of apples is an explicit promise. On the other hand, fried chicken sold by the firm will be free of germs or cooked properly is an implicit promise. The conclusion is that quality in its generic sense is a measure of the extent to which we have kept promises made to the customer. It is a big sigh of relief for the students at this point because the instructor stops prodding them to discover the underlying theme. At the same time they are comfortable with such a simple generic meaning of quality.

Additional Benefits

The foregoing step provides a clear advantage to the instructor. Once, this

definition has been accepted, it provides the instructor with an easy lead into the next topic by asking the question 'What system characteristics can tell us whether promises will be kept?' Thus the instructor is able to start a discussion about Statistical Process Control [SPC] and explain that SPC is a statistical technique that investigates the question whether a process is in control (i.e. stable). A stable process has the advantage that it is predictable and one can make promises with the expectation that the system will continue to behave like in the past and continue to produce products as promised. Thus the instructor is able to ease into the chapter on statistical process control which answers the question whether a process is stable. The class exercise is an active learning exercise that required students to evaluate potential dissatisfaction with realistic scenarios. In addition, students evaluated dimensions of quality in terms of importance. During discussions they attempted to discover a generic meaning of quality. Thus they found themselves engaged in a fairly challenging cognitive activity and this appeared to have increased their interest in the material. The exercise also acted as useful way to break the monotony of a primarily lecture oriented course.

Drawback

The major drawback was that careful planning had to

be done to free up a class period of 60 minutes for conducting the exercise. In other words, less time was available for covering content.

However, the benefits of [a] having discovered a generic meaning of quality that was easily applicable to other scenarios, [b] better understanding of importance of quality, and [c] greater interest in the topic of quality, clearly exceeded the drawback.

Conclusion

Undergraduate business majors at this school are required to take a course in Operations Management. In such a course they learn about such techniques and topics as Productivity, Quality, Product Design, Forecasting, Project Management, and Supply Chain Management, among others. While each topic is important, a great deal of emphasis is put on developing a good understanding of Quality because this is the only required course in the undergraduate curriculum that covers this important topic. Two questions are of great importance in this context. First, students need to understand what quality means in a broad generic sense. Second, they need to understand why it is important.

A class exercise has been conducted for over ten years to answer these two questions. Students discovered that quality is important because failing to meet customer expectations on quality dimensions leads to dissatisfaction. A

dissatisfied customer may take business elsewhere or sue the firm in extreme situations. Both are undesirable consequences. Students also discover that not all dimensions cause equal dissatisfaction. For example, all 100 percent were likely to be dissatisfied if seat belts did not deploy in a car accident compared to only 10% likely to be dissatisfied if songs were repeated by a radio station during it's no repeat hour.

Students discovered that, in the generic sense, quality is a measure of the extent to which the firm has kept promises made to a customer. This is a simple yet widely applicable way to approach quality related issues. During the exercise, students found themselves engaged in a fairly challenging cognitive activity. The instructor has found this exercise to be quite useful in getting students interested and curious about quality.

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Appendix A Class Exercise

Introduction to Quality: Quality expectations may be expressed in terms of diverse dimensions or characteristics (weight, length, timeliness, cleanliness, safety, etc). For example, for a car, one dimension would be reliability of stopping when brakes are applied. For a box of cereal one dimension would be whether it has the promised weight. In the case of a restaurant some dimensions may include cleanliness, courtesy towards customers, and timeliness in taking orders. This class exercise has been designed to develop some intuitive ideas about quality. In this exercise, 8 scenarios are presented to you. For each of these scenarios, you are required to answer three different questions:

Question 1: What is (are) the quality dimension (s) that get(s) revealed in this scenario?

Question 2: How dissatisfied would you be if this incident happened to you?

{Circle your level of dissatisfaction; 5 is 'highly dissatisfied' and 1 is 'Not at all dissatisfied'}.

Question 3: How important is this dimension of quality to you as a buyer of this product/service?

{Circle level of importance; '5' is 'extremely important' and '1' is 'Not at all important'}.

Scenario 1: "You buy a box of dozen donuts on your way back from work. When you open the box you find that there are only 11 donuts."

a) Quality dimension(s):

b) Level of dissatisfaction if this was to happen to you: 1 2 3 4 5

c) Level of importance of this dimension to you: 1 2 3 4 5

Scenario 2: “You buy a dozen donuts on your way back from work. When you try to eat them the next morning, you find that they have become too hard.”

a) Quality dimension(s):

b) Level of dissatisfaction if this was to happen to you: 1 2 3 4 5

c) Level of importance of this dimension to you: 1 2 3 4 5

Scenario 3: “One night you ordered pizza at 7 p.m. for home delivery. You asked for ‘sausage and pepperoni’ toppings. You were promised a delivery within 45 minutes. The pizza arrived at 8:15 p.m. When you opened the box you found that it had ‘onion and mushroom’ toppings.”

a) Quality dimension(s):

b) Level of dissatisfaction if this was to happen to you: 1 2 3 4 5

c) Level of importance of this dimension to you: 1 2 3 4 5

Scenario 4: “Last Saturday, you bought fried chicken from the local grocer. Within 30 minutes of eating this chicken, some of your family members started vomiting.”

a) Quality dimension(s):

b) Level of dissatisfaction if this was to happen to you: 1 2 3 4 5

c) Level of importance of this dimension to you: 1 2 3 4 5

Scenario 5: “You bought a 5lb-bag of apples. At home you weighed the bag and found it to be 4.5 lbs.”

a) Quality dimension(s):

b) Level of dissatisfaction if this was to happen to you: 1 2 3 4 5

c) Level of importance of this dimension to you: 1 2 3 4 5

Scenario 6: “You bought a dog food after reading the claim, ‘Your dog will kill for this food,’ but when you served the item to your dog, he refused to eat it.”

a) Quality dimension(s):

b) Level of dissatisfaction if this was to happen to you: 1 2 3 4 5

c) Level of importance of this dimension to you: 1 2 3 4 5

Scenario 7: “You were listening to your favorite radio station from 7 p.m. to 8 p.m. This is their official ‘NO Repeat Hour.’ You found that two songs were repeated during this time period.”

a) Quality dimension(s):

b) Level of dissatisfaction if this was to happen to you: 1 2 3 4 5

c) Level of importance of this dimension to you: 1 2 3 4 5

Scenario 8: “Recently you were involved in an accident on the Interstate highway. You were wearing seat belts. However, the airbags did not deploy and you were severely injured.”

a) Quality dimension(s):

b) Level of dissatisfaction if this was to happen to you: 1 2 3 4 5

c) Level of importance of this dimension to you: 1 2 3 4 5

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