Journal of Information Systems Education

Volume 33
Issue 4
Fall 2022

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Recommended Citation: Torabi, E., Vaziri, B., & Connolly, A. J. (2022). How to Apply Service Operations Management Principles to Improve Student Engagement and Satisfaction. *Journal of Information Systems Education*, 33(4), 388-404.

Article Link: https://jise.org/Volume33/n4/JISE2022v33n4pp388-404.html

Initial Submission:	11 August 2021
Minor Revision:	17 December 2021
Accepted:	12 January 2022
Published:	15 December 2022

ISSN: 2574-3872 (Online) 1055-3096 (Print)

Journal of Information Systems Education, 33(4), 388-404, Fall 2022

How to Apply Service Operations Management Principles to Improve Student Engagement and Satisfaction

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ABSTRACT

Students complain that technical courses like operations management are boring, dry or unenthralling. If we characterize classroom learning between a student and an instructor as a knowledge-intensive service encounter, then students are a kind of "customer" who must interact with the classroom system and play a key role in their own learning. Without engagement and a modicum of satisfaction, student learning plummets. But where to start and how? How might we apply our non-classroom subject matter expertise to the classroom? To overcome students' negative opinions of the learning process in an operations management course, we applied tried and true principles from service operations management (SOM) to design a better service experience that is more engaging and interesting (without capitulating to the customer being right). Our study involves three phases across two different modalities. We identified and tested key components from SOM that might impact student learning (e.g., customer contact theory, the gap model of service quality, and the psychology of waiting) and linked these components to important suggestions for increasing engagement in the classroom. We then tested how applying the SOM framework improved student satisfaction as measured by assessment of learning and student evaluations. We discovered that applying service design principles to the learning process provides a systematic way to improve student engagement and satisfaction without sacrificing rigor.

Keywords: Active learning, Student engagement, Student satisfaction, Service operations management, Business analytics

1. INTRODUCTION

Students pursuing a business program generally perceive that technical courses such as operations management (OM) and analytics are difficult, dry, boring, or unengaging. Harder and less interesting courses receive lower evaluations (Sena & Crable, 2017) and have poorer student learning outcomes. With the emerging role of OM and analytics in information systems (IS) from both a pedagogical (Lawler & Molluzzo, 2015) and industrial (Guha & Kumar, 2018) perspective, it is imperative for students in IS programs to be literate in quantitative courses.

For new faculty aspiring to improve their teaching practice, particularly in technical courses, it is not enough to haphazardly toss in a few active learning exercises here or there and hope for the best. Rather, we need a systematic way to assess why students are not engaging within the course in order to determine how to address the interpersonal issues without sacrificing rigor. By "rigor," we mean the classic definition of challenging and held to a high standard (Glossary of Education Reform, 2013). Here we present such a system based on tried and true principles from service operations management (SOM).

Without a doubt, education is a knowledge-intensive service. The most important ingredient in a college education is knowledge. Whether or not students should be treated like "Customers" is debatable (and outside the scope of this paper), but the literature does agree that higher education involves two different processes: teaching and learning (Jauch & Orwig, 1997). In the teaching process, students are considered products and the teacher transmits knowledge to students. Conversely, in a learning process, students can be regarded as "customers" who interact with the system and play a key role in their own learning (Carvalho Pereira & Terra Da Silva, 2003). One might also characterize these systems as "active" versus "passive" learning.

Service operations management provides a framework to understand the key components involved in a knowledge-intensive service encounter, such as the learning process found in an operations management class. SOM principles also explain how to assess the encounter as to where it breaks down between student and instructor and how to improve that encounter, which leads to higher student engagement and perceived satisfaction, even in a technical course such as OM. By applying this framework to our OM course both in face-to-face and online instruction, we successfully identified specific ways to improve the learning process for students. We further show that these improvements increased students perceived engagement and satisfaction without sacrificing rigor.

The remainder of this paper is organized as follows. In Section 2, we briefly review the literature on student engagement and motivation. We then explain service theory and relevant principles of design of service experience in SOM that could be applied in the context of this study. In Section 3, we introduce the study design and sample survey data as well as our assessment process. In Section 4, we discuss the survey results and identify applicable SOM principles to create a more engaging learning experience for students. In Section 5, we present the results of implementing SOM principles and report on student opinions and outcomes. We finally conclude with a discussion of findings, limitations, and future research directions in Section 6.

2. BACKGROUND

In a pilot study we identify as Phase 0, we surveyed 69 out of 73 students about their best and worst classroom experiences (4 did not respond). Students' least favorite experiences were those in which they found class time boring. Students who are not engaged "are passive, do not try hard or give up easily," and "can be bored, depressed, anxious or even angry about their presence in the classroom" (Skinner & Belmont, 1993, p. 572). This lack of engagement negatively affects student learning outcomes (Gellin, 2003; Kuh, 2001; McClenney et al., 2012; Pascarella & Terenzini, 2005; Pike et al., 2003, 2012; Pike & Kuh, 2005). Based on this feedback, we aimed to make our class "less boring," but how to get students interested in optimization and supply chain formulae if they did not like it already? We started with the literature on teaching operations.

We found copious research on content management and how to align course objectives with market needs (Gupta & Raja, 2015; Phelps & Szabat, 2017), as well as tips about student engagement and how to deliver material (Brookshire & Palocsay, 2005; Eder et al., 2019; He & Yen, 2014; Rahal & Zainuba, 2016; Rochelle & Dotterweich, 2007), but they did not address our needs in terms of changing student perception of being bored in the classroom. Recognizing that the learning process is similar to a knowledge-intensive service encounter and knowing what we know (and teach) about SOM, we decided to apply our subject matter expertise to our classroom practice.

2.1 Student Engagement and Motivation

Few instructors will argue that student engagement leads to student success (Kahu, 2013; Reyes et al., 2012; Ruzek et al., 2016). Students generally tend to graduate when they feel engaged in the learning process. Tangentially, some instructors believe that engagement is a personal trait of the student (Urdan & Schoenfelder, 2006), but we prefer to side with those who treat student engagement as an outcome of the social process involved in the classroom. In which case, the social and emotional climate in the classroom becomes important, especially as it is created through instructor-student and student-student interactions (Patrick et al., 2007; Pianta et al., 2008).

Studies on the effects of student engagement on student outcomes fall into one of four categories: behavioral, psychological, sociocultural, and holistic. Kahu (2013)'s review of this literature proposes a conceptual framework linking student engagement with sociocultural influences. For example, students have an easier time learning technical content with high-quality student-instructor interactions (Pascarella & Terenzini, 2005; Sebastianelli & Tamimi, 2011; Vaziri et al., 2021). A positive classroom emotional climate is attributed to increased student engagement and student success (Reyes et al., 2012; Ruzek et al., 2016). Despite its importance, classroom emotional climate is more prevalent in K-12 education literature versus higher education.

Askham (2008) states, "there is an emotional intensity attached to the experience of learning that is often overlooked." In a recent study, Vaziri et al. (2021) investigated how student motivation affects students' outcomes and professor rankings in quantitative classes in a business school. Using the MUSIC model for academic motivation (Jones, 2009), they found that students who found the topic interesting and felt that their instructor cared for them tended to give a higher ranking to both the course and the instructor. The MUSIC model consists of five components of student opinions: eMpowerment (degree of control over their learning process), Usefulness (utility for their goals), Success (possibility of success if they put in effort), Interest (their interest in course material and learning activities), and Caring (instructor's caring about their success).

Vaziri et al. (2021) also found that how students perceive the usefulness of and their interest in the topic were significant factors in explaining the amount of effort they put into the course. Research shows that intentional consideration of these components in course design can increase students' academic motivation (Jones, 2009). Motivated students are more likely to engage with class and course material and ask for help (Schunk et al., 2008). Therefore, it is not enough to assume students want to learn the material; we must engage them in the classroom and attempt to improve how they view the material and the instructor.

On the practical spectrum of student engagement literature, we found multiple techniques to engage students, such as flipped classrooms, context-aware Question and Answer (Q&A) teaching framework (Knobloch et al., 2018; Zainuddin & Halili, 2016), mobile-based interactive teaching model (Dekhane et al., 2013; Lim, 2017), and Team-Based Learning (Goh et al., 2020; Shen et al., 2015; Taneja, 2014). These techniques produced mixed results – some positive, some negative (Akçayır & Akçayır, 2018; Blair et al., 2016; Palocsay & Stevens, 2008; Schwarz & Zhu, 2015) – leaving instructors with little guidance. For example, a systematic review of the literature on flipped classroom shows that only 52% of studies reported that using the flipped model improves learning outcomes, 18% reported an improvement in student satisfaction and 14% reported an improvement in student engagement (Akçayır & Akçayır, 2018). To remedy this, studies such as Jonsson (2015) use a blended model which combines multiple techniques (flipped classroom with just-in-time teaching (JITT)) to achieve better outcomes.

Since one size does not fit all, there is not a single formula that would work for all courses. On the other hand, the process of choosing one (or a combination) of these methods and implementing them is not trivial and would entail excessive preparation and course redesign. Therefore, a trial-and-error approach, potentially without meaningful improvement, is very inefficient in practice. To make this process more efficient and effective, based on these prior works and our own experience, we determined that a guiding framework would be beneficial to determine what to do and how. In this paper, inspired by SOM principles, we suggest a systematic framework to make the

classroom climate more positive and infuse student engagement (rather than exhaustion and boredom). For those readers unfamiliar with SOM, we briefly introduce major principles of SOM and explain their relevance and application to the knowledge-intensive learning process.

2.2. A Brief introduction to Service Operations Management (SOM) Theory

Classroom learning in higher education is a knowledge-intensive service. In knowledge-intensive services, knowledge is the most important ingredient in what is done, sold, bought, and made (Drucker, 1993). Knowledge work is by definition, "Nonrepetitive, nonroutine work that entails substantial levels of cognitive activity; it includes professional and specialists work." Knowledge work typically involves nonlinear activities which require mental skills for successful performance (Mohrman et al., 1995; Safferstone, 1998). In this context, the classroom is a service environment in which instructors are the knowledge workers, and students are a form of customers, clients, products, or producers in the process of learning. A more engaging service experience will be more effective. In a service experience, people most often feel bored when they're made to wait. In the context of students in a classroom, they may feel bored any time they do not feel engaged as they sit and wait for something to happen (while the instructor's assumption is that they should be busy learning). Therefore, one way to improve their classroom experience is to reduce boredom. The question for an instructor is, how?

As described above, Service Operations Management (SOM) provides a framework to understand the key components involved in a knowledge-intensive service encounter. It can explain how to assess an encounter as to where it breaks down between student and instructor, as well as how to improve that encounter, which leads to higher student engagement and perceived satisfaction. Therefore, in this section, we introduce some basic SOM principles that can be applied to classroom learning.

In services, the customer is the focal point of the process. The organization's strategy, support systems, and employees are all aligned and exist to serve the customer's needs. Services are delivered through a service package (Fitzsimmons & Fitzsimmons, 2004; Sasser et al., 1978). The service package comprises supporting facilities, facilitating goods, information, explicit services (benefits that are observable by the senses), and implicit services (psychological benefits the customer may sense only vaguely). Some of the characteristics of a well-designed service process as they apply to the learning process include: being consistent with the operating focus of the firm (in this case, the focus would be learning objectives and the institution's values), being user-friendly, being structured to maintain consistent performance, and being able to provide evidence of service quality to manage how customers rate the value of service provided (Stevenson et al., 2015).

The first law of services states that customer satisfaction equals the difference between a customer's expectation and their perception of service quality (Brown & Swartz, 1989). Therefore, understanding customer expectations and managing their perceptions is key to achieving business goals during the service experience (Parasuraman et al., 1991) and has to be considered when designing service processes (Jaakkola et al., 2015; Zomerdijk & Voss, 2010). The presence of customers in the production process (a.k.a. customer contact) poses specific challenges in the management of services. In services with higher levels of customer contact (such as classroom teaching), the delivery of the service is less efficient (in terms of cost to serve) but sales opportunity is higher and there is a better chance of exceeding customer expectations in service quality (Froehle & Roth, 2004; Sampson, 2001). However, services with a higher degree of customer contact are also more challenging to manage. Since the production and consumption of services happen at the same time and in the presence of the customer, recovery from failure is more difficult (Fitzsimmons & Fitzsimmons, 2004). Every instructor has attempted a new lesson plan or activity that didn't work quite as expected.

In services management, the service experience design is a crucial part of service design in which strategies for successful delivery, and proper failure recovery plans need to be considered. The three pillars of good design in the service experience are context, time, and engagement. The service context must: 1) have a theme or unifying story, 2) be learnable and usable, 3) be mutable (having flexibility for customers to create their own personal experience, 4) have a layout that encourages participation and reinforces themes, 5) include sensory elements to increase immersion, aid learnability, and support themes, and 6) provide an opportunity for social interaction between customer and service provider and/or fellow customers. Context elements are easily mapped to the design of a learning process, which we have done, as shown in Table 3.

Experiences are temporal, particularly in the classroom where meeting times are fixed; therefore, continuity, dynamism and memorabilia are important design factors. In order to connect this pillar to the learning process, consider a student who comes to class regularly and leaves the class with good notes against a student who does not attend regularly or does not take good notes to remind them of what happened in class. In the engagement pillar, we see two dimensions: customer participation (active versus passive) and environmental relationship (absorption versus immersion). Teaching practices can also be categorized along these two dimensions (active versus passive). For example, traditional lectures are passive absorption, whereas flipped classrooms are designed to achieve active immersion. The design of a service experience (in this case, classroom delivery design) needs to include close consideration of customer contact. Froehle and Roth (2004) identify five conceptual archetypes of customer contact under two main categories: face-to-face and face-to-screen customer contact. Four of these archetypes are well applicable to the learning process in higher education as we know today.

Information systems literature is replete with examples of information systems success and consumer acceptance of information technology (DeLone & McLean, 1992, 2003; Venkatesh et al., 2012). In SOM literature, motivated by Technology Acceptance Model (Davis, 1985), Froehle and Roth (2004) define ten constructs (pertaining to the theory of belief-attitude-intention (Fishbein & Ajzen, 1977)) for measuring customers' perceived quality of service experience in technology-mediated services. Paying attention to these constructs is key to designing a successful technology-mediated service experience. In considering student learning a knowledge-intensive service experience, this literature helps further inform the present study (see Figure 1).

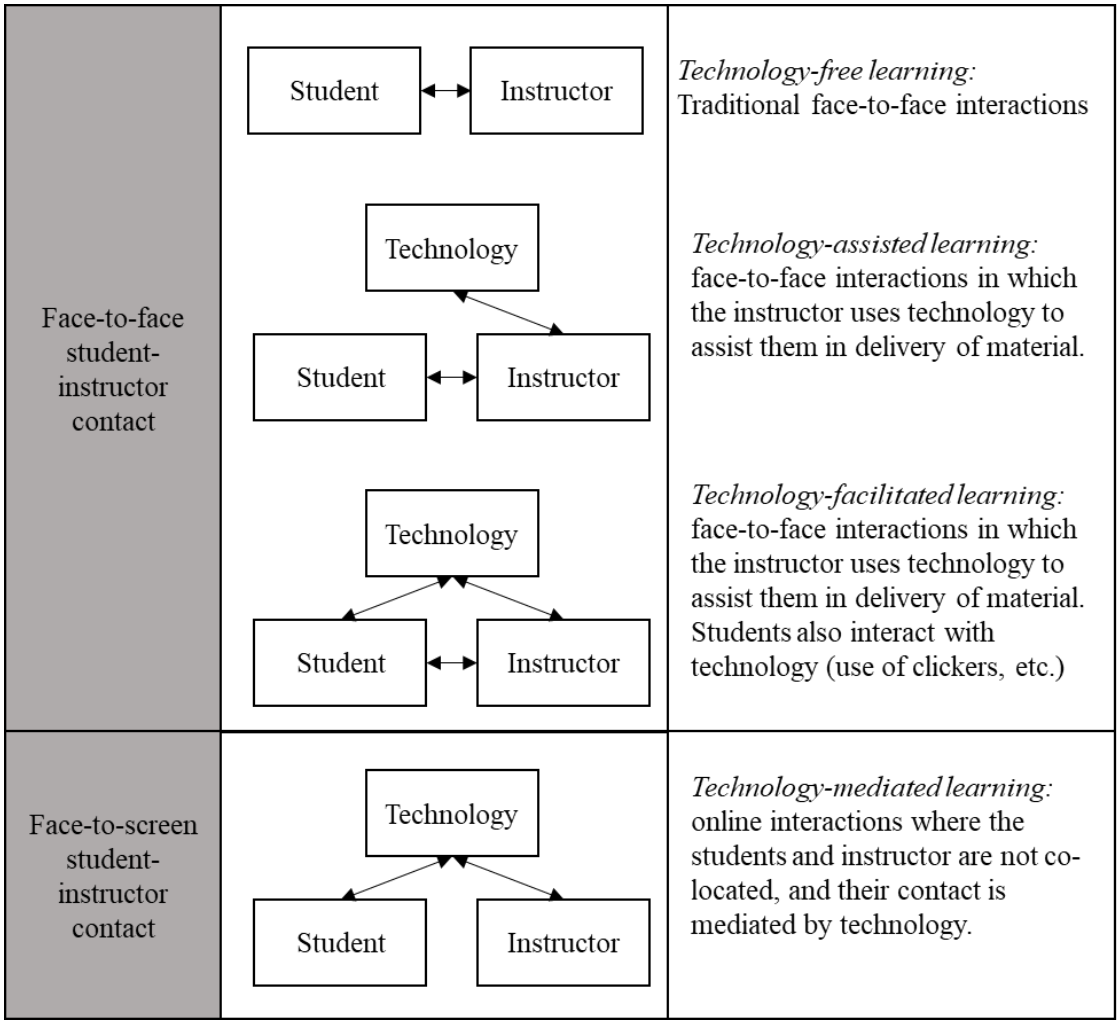

Figure 1. Archetypes of Student-Instructor Contact in the Learning Process (adapted from Froehle & Roth, 2004)

Studies such as Latif et al. (2019) and Rathee and Rajain (2013) treat higher education institutions as service organizations. Latif et al. (2019) developed a construct called Higher Education Service Quality (HiEduQual) to measure service quality in higher education. Similarly, and inspired by service value chains, Rathee and Rajain (2013) explored different models of value chains in higher education. Unlike these studies, which looked at higher education as a whole, we delve into *the classroom* as a service environment to identify key factors that affect how students view the learning process. As previously mentioned, students are customers who interact with the system and play a role in their own learning (Carvalho Pereira & Terra Da Silva, 2003). Considering the above discussion, we investigated how students viewed their learning experiences in the classroom. Then, using evidence from the extensive literature on the design of service experiences, such as customer-contact theory (Chase, 1981; Chase & Tansik, 1983) and the psychology of waiting in lines (Maister, 1984), we developed strategies and provide evidence for their effectiveness in mitigating student boredom which improves engagement. We then further extended the study to online classes.

3. STUDY DESIGN AND DATA COLLECTION

This study involved three phases over a five-year timeframe (see Table 1). In the Fall of 2016, when we first began this study, we conducted a pilot study to ask students about their best and worst classroom experiences (69 students responded to an anonymous survey). We found that students were bored, unengaged, and generally unhappy with their learning experience in the introductory operations management course. Although we had identified recurring themes in students' responses to the pilot survey, we were overwhelmed by the plethora of possible solutions. We quickly realized we needed a systematic, evidence-based approach to guide changes. Recognizing that the learning process is a knowledge-intensive service encounter and that we are experts in service operations management, we turned to SOM for solutions. We designed Phase 1 to identify SOM principles that would improve students' opinions of the learning experience.

To that end, we distributed an anonymous online survey to 158 third-year students in the introductory operations management class at a College of Business, of which 128 responded (response rate 81%). These students had completed core business classes, including introductory analytics. The survey included three general measures: 1) overall self-reported Grade Point Average (GPA) as a proxy for academic standing, 2) perspective of how much they learn in the classroom versus how much time they spend studying outside the classroom, and 3) free-text questions about the top characteristics they most liked and disliked about their prior business classes. In addition, we asked students to disclose their gender. The free-text questions were intentionally broad in scope so students would not be too biased. In addition, the questions explicitly asked students to consider all the business classes they had taken so far. The survey questions are listed in Appendix A.

In Phase 1, we specifically derived SOM principles from the gap model of service quality (Parasuraman et al., 1985), customer-contact theory (Chase, 1981; Chase & Tansik, 1983), and the psychology of waiting lines (Maister, 1984). These concepts are described in detail in Sections 2 and 5. Based on results from Phase 1, we hypothesized that systematic implementation of SOM principles in the learning process will positively improve students' opinions (Hypothesis 1, H1) without negatively affecting student learning outcomes (Hypothesis 2, H2). In Phase 2, we tested these hypotheses by implementing the SOM principles in the same course in the Fall of 2018 and 2019.

We measured students' views based on their responses to course evaluations. We measured student learning outcomes using a standardized assessment of learning questions. Courses in the Fall of 2018 and 2019 were taught in-person (face-to-face instruction). In the Fall of 2020, as part of Phase 3, we extended this study to online instruction (as required by COVID-19 protocols). Table 1 summarizes the data collected in each phase. Because of concerns around the academic integrity of online testing environments, Assessment of Learning (AOL) data was not deemed reliable and was not collected in Phase 3. AOL are standardized measures given at the end of the semester to evaluate a student's understanding of learning outcomes from a given course, benchmarked against peers in the same course (Bennett, 2017).

4. DATA ANALYSIS

4.1 GPA, Gender, and Perceived Level of Engagement

The first four questions were multiple choice and collected information on gender, GPA, the extent of classroom learning, and an average number of hours studied outside of classroom. The respondents were 65% male and 35% female. The distribution of the respondents' self-reported GPA were normal. The distributions of gender and self-reported GPA are in Appendix B. To understand students' extent of classroom learning, we asked students to select a value between 0% and 100% to answer the question: *Assuming that a score of 100% shows your mastery of the course material, on average, what percentage is gained in the classroom*? We found that 50% of students believed they obtain between 50% and 75% of their mastery of the course material during class time. Although we first found this result reassuring (the numbers imply high degree of engagement while in class), we considered two counter-arguments: 1) what students perceive as mastery of knowledge might not be up to the standards set by the instructor, and 2) students might not study enough outside of the classroom.

To address the first argument, it is important to note that we used students' opinions of how much they learned in the classroom as a proxy for how engaged they felt (how much they thought they paid attention in class). Therefore, whether the students and instructors have the same definition of "mastery of knowledge" is irrelevant. As to the second argument, we analyzed the relationship between students' responses to this question and "How much time did you spend on average during a week to study outside of class?" On average, students claimed to have spent around six hours per week studying outside of class. In general, the distribution of hours studied is slightly normal, with little to no skew (as shown in Appendix B).

	Phase 0 (Pilot)	Phase 1 (Base Case)	Phase 2 (Face-to-Face)	Phase 3 (Online)
Semester	Fall 2016	Fall 2017	Fall 2018 & 2019	Fall 2020
Num. of students enrolled	73	158	291	153
Num. of sections	1	2	4	2
survey responses collected?	Yes	Yes	No	No
Num. of collected course evaluations	N/A	136	257	144
AOL Data available?	N/A	Yes	Yes	No*
Use of technology	N/A	Technology-assisted	Technology-assisted	Technology-mediated
Used SOM principles?	N/A	No	Yes	Yes

Table 1. Summary Information about Attributes of the Classes Involved in Each Phase of This Study (*Due to concerns about integrity of online testing, AOL data was not collected)

We investigated the correlation among the four items described above (i.e., gender, self-reported GPA, perception of mastery gained in the classroom, and the number of hours studied outside of class) to identify any significant relationships among them. More specifically, we were interested to see whether gender or GPA has a significant relationship with the amount of time studying outside of class versus absorbing knowledge in class. As shown in Figure 2, there is a weak negative correlation between hours of study and the percentage of mastery of knowledge gained in the classroom. In other words, we did not find that students' level of engagement affected the amount of effort they made outside of class. As Vaziri et al. (2021) suggest, student effort is a function of students' beliefs in the usefulness of and their interest in the topic. Therefore, if the goal is to motivate students to put in more effort, instructors must make sure that students are engaged in activities that would clearly show the usefulness of the topic and attempt to increase their interest in it.

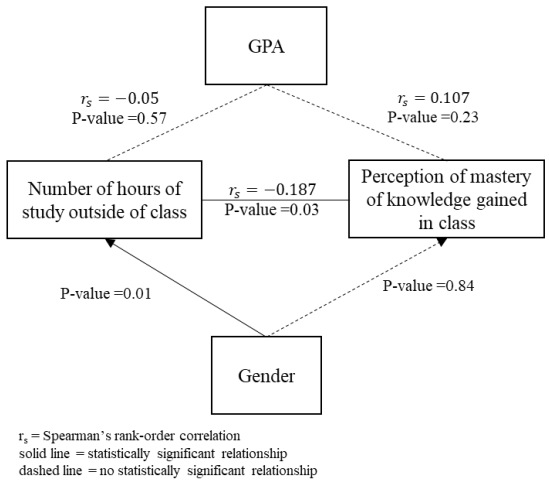

Figure 2. Relationships Between the Responses to Questions 1 to 4 of the Survey.

Gender did not have a significant relationship with engagement; however, female students reported studying longer hours outside of class. A more interesting observation is that the academic standing of students did not have an effect on their learning behavior. In other words, some students might learn better in class, and some might learn better on their own. This finding once again shows the importance of designing flexibility in delivery such that students have a chance to succeed regardless of their learning preferences and needs. In the free response questions, students described the characteristics of their best and worst learning experiences and ranked them in order of importance (Tier 1 or Tier 2). We then analyzed the responses under each tier, summarized below. As mentioned, a total of 128 free-text responses were recorded in this survey.

4.2 Characteristics of Best Learning Experiences

Tier 1-Engaging, interactive classes; Personality and attitude of the professor; Using real-world example: Many students (n=42) emphasized engaging and interactive class sessions as their favorite parts of the classroom. Some (n=29) even mentioned hands-on activities and collaborative assignments as factors for positive classroom experience. Other students (n=74) listed personality traits of the professor and how they attributed to a positive classroom experience – namely, passionate, helpful, funny, engaging, and essentially "caring" about the student's well-being in the course. Several students (n=31) believed that using real world examples in class helped keep them engaged. Having problems that they can relate to made it easier to activate their learning in the classroom. These responses are well in line with the Caring and Usefulness dimensions of the MUSIC model for student motivation (Jones 2009).

Tier 2: Exercises and practice; Teamwork; Responsiveness; Explaining logic behind concepts and formulas: Students (n=20) enjoyed having additional practice during and outside of class to help them prepare for exams. This may not have a direct relationship with being engaged in the classroom, but it was a prevalent item listed, nonetheless. Students (n=18) thoroughly enjoyed working in teams (which is a substantial part of this particular course) on the class projects. Some students (n=9) mentioned that developing rapport with the team during the project helped them establish relationships with students they otherwise would not have. Thus, they had more people to study with and prepare for exams. Many students (n=13) appreciated having a professor that was helpful and simply available during office hours. Another commonly listed item (n=9) was that students enjoyed having the professor explain the intuition behind concepts and formulas. Apparently, having that connection to "why it matters" in an everyday setting improved the classroom experience for many students.

4.3 Characteristics of Worst Learning Experiences

According to students' responses, the top characteristics of a bad learning experience are: *Tier 1: boring lectures, professors ignoring questions:* Students (n=21) listed "boring" as the top detractor from a positive classroom experience. Other prevalent detractors listed were: "Not passionate" (n=18), "Too much lecture" (n=19), "Teaching at you instead of to you" (n=12), "Reads off of PowerPoint slides" (n=10). The general theme of these items is when a professor lacks individualistic or creative manners in relaying the course material. Not being passionate, reading off slides, and talking at the student are common to one another in that they remove the personal aspect of the classroom experience. Students (n=14) also mentioned that ignoring questions was prohibitive of a positive learning experience in the classroom. This could be ignoring questions during class time or not responding to emails, etc. These results emphasize the importance of the classroom emotional climate even at the university level. As we mentioned before, efforts in creating a positive emotional climate should not stop after grade school (K-12).

Tier 2: Too much material: Another student concern that can be mapped to curriculum is that students felt that courses with too much material can be overwhelming. This is usually the case for introductory classes where students are exposed to multiple aspects of a specific field within one course. While the faculty team can revisit curriculum design, there are ways to change students' opinions in this regard. Paying attention to the context pillar (creating a unifying story or theme) in design of service experience is the key to this problem.

5. IMPLEMENTATION OF SOM PRINCIPLES IN THE LEARNING PROCESS

5.1 SOM Principles in Action

In service, "perception is everything." How students interpret the classroom experience can affect engagement and satisfaction. By considering learning as a service experience for students, instructors need to better: 1) understand student expectations, 2) acknowledge the difference between expectation and perception, and 3) intentionally manage those expectations and perceptions. In this section, we discuss the SOM principles that we applied to the learning process and provide specific tips on how to manage expectations and perceptions in the classroom.

Not all student expectations are valid. For example, a class of 30 students will never agree on which day of the week is "best" for turning in assignments. However, perception can influence expectations and perceptions can be better informed or influenced. In knowledge-intensive services, the service provider has superior knowledge about what is best for the customer (even when the customer doesn't agree). Students' expectations can be influenced by past experiences, word of mouth about the course and its instructor, or any number of factors. We recommend managing student expectations in two steps 1) clarify what students can expect, then 2) clarify that what they want may not necessarily be what would is good for them. Clear syllabus instructions together with periodic reminders about the value of specific skills to the workplace can help manage student expectations.

On the other hand, managing student perception is equally important yet more challenging than managing expectations and requires more effort. One of the main characteristics of services (unlike physical products) is that the production and consumption of the service happen at the same time and, in the case of face-to-face services, happen in the customer's presence. Therefore, recovery from failure may be challenging unless proper fail-safe features and recovery plans are built into the design. Since students mentioned that their worst experiences were when they got bored in the classroom, we sought strategies to reduce boredom. Bored students in a classroom reminded us of bored customers waiting in line at the supermarket. Although students in the classroom are supposed to be engaged in the learning process, their comment about being bored inspired us to use Maister (1984)'s analysis of the psychology of waiting lines. Maister provides eight propositions about waiting, which we have shown in Table 2. We then mapped Maister's principles to themes found in student comments and suggested teaching strategies to systematically address each concern.

The second most common unfavorable student comment was an overwhelming amount of material in the course. The key to overcoming students' frustration with volume and difficulty of material lies in how we design the context of the service experience (in this case, the learning process). We made the following changes to the course based on SOM principles. As mentioned in Section 2, design of the context has five major elements; therefore we

I. created a unifying story: Provided a big-picture visual showing the relationships of topics. Started each chapter with the big picture, then drilled-down to the part relevant to the current chapter. Encouraged students to question the relevance of the topic if they were confused.

II. made the experience more learnable and useful: More resources do not necessarily mean more learning; provided how-to videos and guides to help students navigate through the textbook, online material, etc.; ensured rules were clear.

III. provided flexibility for students to create their own personal experience: acknowledged diverse learning styles. If possible, used blended learning (Ahmed, 2010; Asarta & Schmidt, 2013). If 100% flexibility was not practical, included some assignments that allowed students have control over their learning process (empowerment element of the MUSIC model).

IV. designed a layout that encouraged participation and reinforced the theme: included sensory elements to increase immersion, aid learnability, and support the theme; careful choice of learning technology, textbook, and other course material.

V. provided an opportunity for social interaction: class discussions, teamwork, study groups, availability outside of classroom, etc.

All the points discussed so far apply to both face-to-face and online classes. However, since engaging students in online classes is more challenging, we went a step further to investigate how SOM manages customer satisfaction in a technology-mediated setting. In order to increase student satisfaction in the online phase we mapped the constructs of customer satisfaction in technology-mediated services (as explained in Section 2.2) to student satisfaction in the learning process. We use eight of these ten constructs which relate to belief and attitude. Since the intention domain is mainly a proxy for customer royalty, we argue that it is not directly applicable to classroom learning process. Table 3 summarizes these eight constructs, their definition in SOM and how they can be applied to the online learning process. While the specifics of the design of the online learning process might be different depending on factors such as course content, academic level of students, teaching style of individual instructors, the constructs of psychology of student's satisfaction is unchanged. Therefore, we suggest that instructors consider these constructs when designing or improving their online course content and delivery method.

5.2 Results of Implementation

In order to test the effectiveness of the SOM principles, we implemented them in Face-to-face (Phase 2) and online (Phase 3) classes. To assess changes in student outcome, we performed hypothesis test comparing the percentage of students who answered the question correctly for each of the 24 AOL questions. Comparing AOL data of Phase 1 and Phase 2, we found that when SOM strategies were implemented, student learning outcomes either improved or not changed for 87.5% of the questions (See Appendix C). Therefore, in order to improve students' opinions (and as a result their satisfaction), instructors do not need to sacrifice academic rigor. Unfortunately, due to concerns about the reliability of AOL results in an online testing environment, AOL questions were not used in Phase 3. Therefore, we do not have a basis for assessing student outcome in online classes.

#	Proposition	Keywords From Student Comments	SOM Strategy	Possible Teaching Strategy
1	Occupied time feels shorter than unoccupied time	Class activity, interactive classes.	**Animate:** keep customers busy, Distract and/or entertain, social interaction Make activities related and beneficial	Use a mix of activities for each class, keep students engaged with a related activity, keep them engaged before they lose interest by switching to another type of activity.
2	Pre-Process Waits Feel Longer than In-Process Waits	Engaging	**Involve:** Start service process ASAP, provide immediate interaction, "Lock in" the customer	Start out with a hook. Use before class assignments or just-in-time teaching. Visually show the progression through the semester.
3	Anxiety Makes Waits Seem Longer.	Responsiveness, passionate	**Communicate:** Communicate frequently, use physical surroundings to reduce anxiety	Take quizzes at the beginning of the class. Empower students they can succeed. Use mock tests and study guides for tests.
4 & 5	Uncertain or unexplained Waits Are Longer than Known, Finite Waits	Responsiveness, overwhelming amount of material	**Communicate:** Keep up dialogue with customers to remind them they have not been forgotten **Automate:** Put customer in charge, Remove rework	Set clear expectations about classroom timing, have an accurate lecture schedule, and share updates with students. Communicate the plan and objectives for each class.
6	Unfair Waits Are Longer than Equitable Waits	Class discussion, availability outside of class, fair grader	**Moderate:** Manage perceived "justice" of the experience	Clarify objectives and strategies to reach them. Clarify office hour policy, first-come-first-served or by appointment? Allow open discussion, make sure nobody feels left out
7	The More Valuable the Service, the Longer the Customer Will Wait	The logic behind facts, using real world examples, useful in my job	**Service Value Chain**	Explain the importance of the topic and how it connects to their career success.
8	Solo Waits Feel Longer than Group Waits	Teamwork	**Congregate**: Misery loves company	Assign teamwork and group discussions. Encourage peer interactions.

Table 2. Maister (1984) Propositions of Psychology of Waiting and Application to the Learning Process

For assessing the change in students' opinions, we used the student course evaluations. The questionnaire includes four free-text questions on what students liked or disliked about the course, their suggestion for improvement and their overall experience. There are also 17 Likert scale questions (1-5 scale). These questions are listed in Appendix D. In order to understand students' degree of engagement, we examined the four free-text questions in the student course evaluations survey focusing on terms and keywords that might imply boredom and degree of engagement (e.g., boring, interesting, class discussion, interactive). In the students' course evaluations in Phase 1, a significant number of students (39%) mentioned that the lectures were boring. They used words such as boring, dull, long, dry, lost, confusing, and "could not engage" to describe their experience. However, in Phase 2, only 3% of students expressed lack of engagement in class. In Phase 2, majority of unfavorable comments (if any) are about the level of difficulty of the tests, and usefulness of the textbook. This observation suggests that students' engagement increased. Another interesting observation is that when student seemed to be less frustrated about their classroom experience, they gave more constructive comments when asked about their suggestions for improving the course.

Then we compared student responses to each of the 17 Likert scale questions (hypothesis test comparing the mean score of the same question in the two respective treatments). The first comparison has been performed on Phase 1 versus Phase 2 responses. In this comparison, the only change between the phases is the use of SOM principles in course delivery.

	Construct	Definition	SOM Design Element	Application to online learning process
Belief	Information Richness	average of four variables: feedback speed, the type(s) of channels used, the major topic of discussion, and the kind of language used (Kellogg & Chase, 1995)	Context: Interactions, unifying story; Engagement, Time (memorabilia)	Focus is on content, responsiveness and language (both written and spoken). Provide multiple channels for communication between instructor and students or among students.
	Learning	Customer's belief that they increased their knowledge during the service episode	Context: Learnable and useable	Engage, reinforce, and help students retain knowledge.
	Usefulness	The degree to which the service episode fulfills the customer's needs and desires	Context: Mutable	Clarify learning objectives. If you use multiple technology, clarify what is the role and purpose of each. Build flexibility into the delivery system to accommodate more learning styles
	Duration appropriateness	Customers belief about the duration of contact episode	Time: dynamic, continuity	Be mindful of the timing and length of assignments individually (dynamic) and with respect to other assignment (continuity)
	Intimacy appropriateness	Mutual confiding and trust (more intimacy does not necessarily lead to higher satisfaction)	Engagement	Connect with the students. Create trust that you understand them and are responsive. Consider Synchronous video conferencing and use of multiple channels of communication.
Attitude	towards contact medium	Immediate satisfaction/ dissatisfaction about using the medium	Context: Sensory elements	The aesthetics of online teaching content and ease of use of the technology is important. Provide How-to videos and engage tech-support.
	towards contact episode	General level of satisfaction/ dissatisfaction with service content	Context: theme and unifying story, layout	Modify course material to fit the medium. If you have multiple options, pick one that best fits your teaching style and is closer to your face-to-face classroom environment
	towards provider	General level of satisfaction/ dissatisfaction with service provider at the end of service	Context, Engagement	Do not lose sight of the big picture, everything must come together at the end. All elements of content and technology must support each other in a meaningful way.

Table 3. Constructs of Customer Satisfaction in Technology-Mediated Service as Applied to Student Learning Process

The second comparison is between Phase 2 (face-to-face delivery) and Phase 3 (online delivery). In both of these phases, SOM principles have been implemented. Comparing Phase 1 (base case, no SOM) to Phase 2 (Face-to-face, SOM principles implemented), student opinion showed statistically significant improvements in 14 questions. There were three questions in which there was no statistically significant change on student perceptions: 1) degree of challenge in the course, 2) the amount of material from previous courses duplicated, and 3) usefulness of the textbook. It is interesting to see that to increase student satisfaction, an instructor does not necessarily need to sacrifice rigor. Also, since the SOM strategies target students' views of classroom learning, we did not expect to see a change in perception about the textbook and coverage of material. A comparison of Phase 2 (face-to-face implementation) and Phase 3 (online implementation) showed that students' opinions improved (in 16 out of 17 questions) or didn't change significantly (1 out of 17). We anticipated that the transition to online teaching would result in less student satisfaction, but it did not, perhaps because we took additional steps to improve the learning experience.

We changed the course delivery method with consideration of belief and attitude constructs. Based on customer contact theory, we needed to make more effort in managing student opinions because in the online setting, the degree of contact is lower, so the sales opportunity (i.e., learning outcome) goes down. To make up for this loss of student contact, we increased mutability and gave students the chance to personalize their

learning experience (empowerment element of the MUSIC model). It is important to note that we deemed this principle useful because of the nature of the course and the academic level of students. As Vaziri et al. (2021) indicate, students in lower academic levels might not have a favorable view of empowerment. Therefore, we flipped the classroom and used the concepts of blended learning (Ahmed, 2010; Asarta & Schmidt, 2013; Dang et al., 2016) and Just in Time Teaching (Novak et al., 1998). This combination enabled personalization, a rapid feedback cycle, and multi-channel interactions with peers and the instructor. For implementation, we used Top Hat (Tophatmonocle Corp.) as the learning platform.

6. CONCLUSION, LIMITATIONS, AND FUTURE DIRECTIONS

We found that many students identified boredom during class as a major characteristic of their worst learning experience, and it detracted from their engagement in and opinions about the quality of the learning experience. If we treat the classroom as a service system, then mitigating boredom should increase students perceived engagement and satisfaction. We used SOM principles to improve the learning experience. It is important to note that we do not debate whether students are customers or products of the education system; rather, we seek to provide useful, practical ways to make the learning experience more engaging and satisfying for students.

Our findings suggest that how students perceived the classroom experience improved in Phases 2 and 3 when the instructor implemented teaching strategies directly aligned with SOM strategies. The strategies listed in Tables 1 and 4 were effective in our study, but we understand that instructors might use other methods to achieve similar outcomes, and we encourage instructors to tailor these ideas to fit the scope of their classroom experiences. The findings of this study also suggest that at the very least, student performance did not worsen and in some cases, improved.

There are some limitations of this study to note. Firstly, we understand that the results of this study are limited to one instructor teaching one course over multiple semesters. Though we control for instructor variability, there may be different effects and experiences for various instructors and their teaching styles. Next, the COVID-19 pandemic hindered our ability to measure changes in learning outcomes between Phases 2 and 3, since common assessment questions could not be used. Additional improvements in the classroom experience may have been confounded by the effects of an online class. Lastly, this study was limited to a course at the third-year undergraduate level. Some of these findings may not necessarily extend to first- and second-year students. Finally, it would be interesting to test this approach in other business classes.

This study should be of interest to most of the academic IS community – specifically, educators that are interested in improving the classroom experience for students. Again, the increasing role of OM and analytics in IS should provide motivation for educators in the field. The lead author tried these solution techniques in their classes and as a result students' evaluation scores for both the professor, course and the textbook increased over a three-year period as techniques were adopted and adjusted to fit specific classes. While many of the techniques used exist in the higher education literature, our paper shows that aside from evidence in the above literature, SOM theory also proves those techniques to be useful and provides a structure and systematic way to improve student engagement and satisfaction.

Our paper contributes to the literature on teaching and learning in the following ways: a) to the best of our knowledge, no study so far has looked at the classroom as a knowledge-intensive service encounter and applied SOM principles to classroom learning; b) the principles of waiting psychology provide practical and easily implemented tips that can be applied in the classroom to increase student engagement with minimal or no fundamental changes to teaching techniques per se, c) we expanded these findings to online teaching and provide theory-based tips with evidence from implementation. This paper provides a guiding framework for instructors looking for ways to improve students' classroom experiences without sacrificing academic rigor, rooted in service theory and backed by evidence in Scholarship of Teaching and Learning (SoTL) literature.

Our approach and achievements in this study suggest that there is value to applying SOM principles to teaching and learning. More specifically, it would be interesting to apply findings of Transformative Service Research (TSR) into student learning and even in higher education in general. TSR's main idea is that service experiences can be transformative and uplift individuals and communities if designed carefully (Ostrom et al., 2010). TSR could lead to improvements in contexts of vulnerability, such as discrimination, access, and inclusion (Mick et al., 2012). This makes the topic particularly interesting as business schools grapple with issues of diversity and relevance.

7. ACKNOWLEDGEMENTS

The authors would like to acknowledge and thank Dr. Susan Kruck for her support and contributions to earlier versions of this work.

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APPENDICES

Appendix A. Survey Questions

1. What gender do you most identify with?
2. What is your overall GPA?

Considering all the courses you have taken so far at the College of Business, answer the following questions:

3. Assuming that 100% shows your mastery of the course material, on average, what percentage of it is gained in the classroom?
4. For a three (3) credit hour course, how many hours per week on average do you spend studying outside of the classroom?
5. What did you most like about your learning experience in the classroom?
6. What did you most dislike about your learning experience in the classroom?

Appendix B. Distribution of GPA, Mastery of Knowledge and Hours of Study

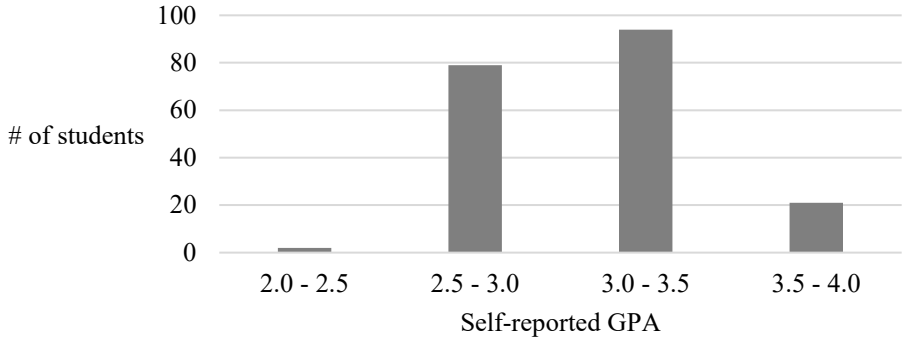


Figure B-1. Distribution of Students' Self-Reported GPAs

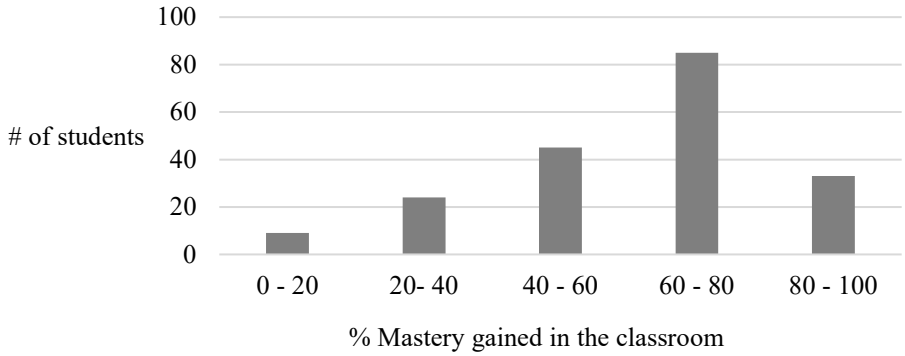


Figure B-2. Percentage of Mastery of Knowledge Gained in the Classroom

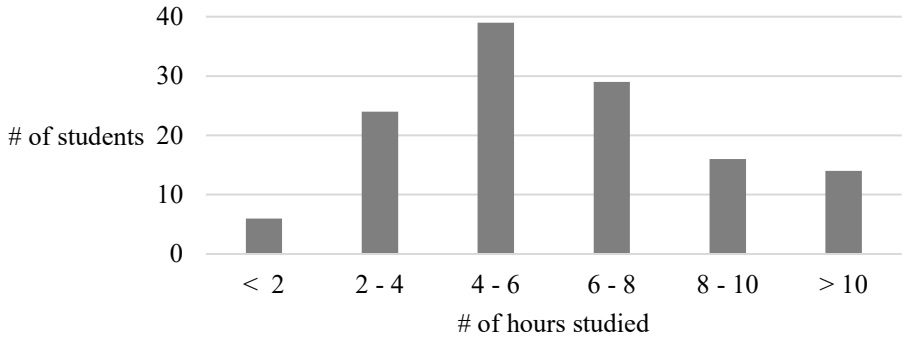


Figure B-3. Number of Hours of Study Outside of Classroom per Week for a 3-Credit Hour Course

Appendix C. Comparison of Student Learning Outcome

In order to impact on students' learning outcome, we compared AOL results for Phase 1 versus Phase 2. For each question, the proportion of students who answered it correctly is presented. The p-value for the statistical comparison of proportions is presented as well. We hypothesized that implementation of SOM strategies will improve this metric.

Table C-1. Differences Between Proportion of Students with Correct Answer for Individual AOL Questions

	Phase 1	Phase 2	Comparison
#	% of students with correct answers	% of students with correct answers	p-value
1	42%	49%	0.077
2	66%	52%	0.999
3	50%	48%	0.623
4	72%	97%	0.000**
5	92%	82%	0.998
6	52%	43%	0.960
7	18%	58%	0.000**
8	28%	60%	0.000**
9	87%	88%	0.390
10	85%	82%	0.737
11	87%	82%	0.925
12	97%	97%	0.483
13	77%	84%	0.042*
14	44%	47%	0.267
15	89%	94%	0.030*
16	95%	82%	1.000
17	75%	74%	0.542
18	63%	65%	0.341
19	97%	97%	0.554
20	94%	93%	0.731
21	70%	72%	0.312
22	55%	50%	0.839
23	44%	53%	0.047*
24	54%	69%	0.001**

*p-value < 0.05, **p-value < 0.001

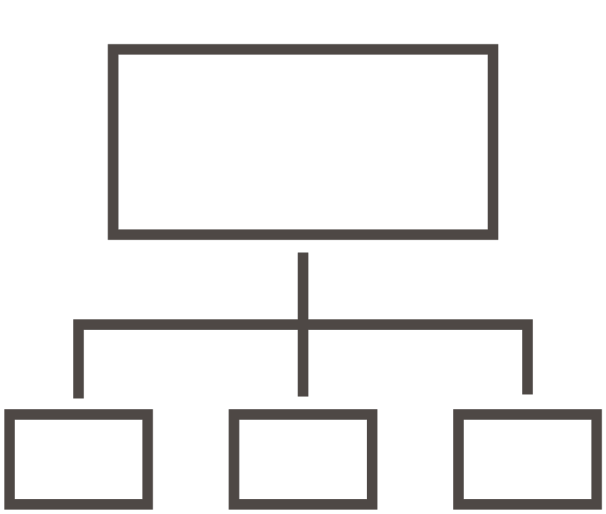
Appendix D. Comparison of Student Course Evaluations

Table D-1. Comparison of Student Course Evaluations (only p-values are presented not scores)

#	Students Course Evaluation Question	Phase 1 vs Phase 2	Phase 2 vs Phase 3
1	Compared to all other classes taken, evaluate the **degree of challenge** in this class.	0.174	0.013*
2	Compared to all other professors taken, evaluate this professor's **interest in teaching you.**	0.004*	0.015*
3	Compared to all other professors taken, evaluate this professor's **preparation for class.**	0.000**	0.414
4	Compared to all other professors taken, evaluate this professor's **help and advice outside of class** when needed.	0.000**	0.000**
5	Compared to all other professors taken, evaluate this professor's **fairness and impartiality in dealing with students.**	0.000**	0.000**
6	Evaluate this professor in **comparison with all other professors** taken.	0.000**	0.000**
7	The **level of difficulty** of this course was suitable for the subject matter.	0.002*	0.000**
8	The **amount of material from previous courses** duplicated in this course was about right for its subject matter.	0.166	0.000**
9	How well did the **previous courses** you have taken prepare you for learning the subject matter of this course?	0.010*	0.000**
10	Overall, the **instructor's performance** is:	0.000**	0.000**
11	Are **the evaluations (exams, performance tests, etc.)** appropriate for the way the course is conducted?	0.000**	0.000**
12	Does the instructor explain how the course material may be **applied outside** a strictly academic environment?	0.000**	0.000**
13	How **clear and understandable are the explanations and examples** given by the instructor in lectures?	0.000**	0.000**
14	Does the instructor **permit open discussion** where appropriate?	0.001**	0.000**
15	Would you **take/recommend** this instructor for another course?	0.000**	0.000**
16	The way in which the **textbook** presents its material is:	0.042*	0.000**
17	As an aid in understanding the subject matter of this course, the **textbook** was:	0.226	0.003*

*p-value < 0.05, **p-value < 0.001

Note: p-values less than 0.05 indicate that there was indeed a statistically significant improvement in student evaluation scores for that particular question. For example, for Question #1, there was NOT a significant difference in Phase 1 vs. Phase 2 (p-value = 0.174) in terms of perception of degree of challenge. However, for Question #1, there was a significant difference in Phase 2 vs. Phase 3 (p-value = 0.013) in terms of perception of degree of challenge.



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ISSN 2574-3872