An Experimental Test of the Yield Shift Theory of Satisfaction in The Field

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Abstract

Satisfaction is a central concern to IS research and practice because people who feel dissatisfied by system experiences tend to abandon them even if they create substantial value, while those who feel satisfied tend to continue use. The literature offers many models of satisfaction that make conflicting predictions, yet there is ample empirical evidence to support each. Yield Shift Theory (YST) was derived to resolve this paradox. This paper reports an experimental study to test a counter-intuitive prediction of YST, i.e. that, under certain conditions, goal-replacement stimuli should invoke differing satisfaction responses toward identical system experiences. 211 students in an asynchronous online undergraduate course were assigned to positive or negative goal replacement treatments before reporting satisfaction with the learning experience. Positive-treatment students reported higher average satisfaction scores than did negative treatment students, although all had identical learning stimuli. Results offer support for the logic of YST's and suggest that it may be useful to IS professionals to improve stakeholder satisfaction toward the elements of information systems, thereby increasing the likelihood of system success.

1. Introduction: Does Satisfaction Matter?

Society can only realize the full potential of its information systems (IS) when IS stakeholders feel satisfied, because People who feel dissatisfied with a system, even for reasons unrelated to the technology, tend to stop using it [1, 2], sometimes even resorting to sabotage [3], while positive satisfaction responses are associated with continuance to use a system [e.g. 4]. We define *satisfaction as* an affective arousal toward some object that has relevance to goal attainment. In retail e-commerce, which is projected to exceed $6 trillion worldwide by 2023 [5], for instance, satisfaction predicts customer loyalty, repurchase intentions, repurchase behaviors [6-9], and profitability [10]. Further, the success [11, 12] and failure [13] of multimillion dollar information systems co-varies with stakeholder satisfaction. Thus, satisfaction responses must be central concern for IS research and practice.

Numerous factors correlate with satisfaction toward various aspects of IS, such as stakeholder involvement in development [14, 15], the quality of systems, of service, and of information [14, 15], usability [9], the accuracy of user expectations, [16], technostress (an inverse relationship) [17], and with variations in system support implementation [13], to name but a few. Organizations that overlook satisfaction concerns may therefore put their IS investments at risk. Thus, satisfaction responses must be a central concern to IS research and practice.

Researchers have approached satisfaction from a number of theoretical perspectives. Brown, Venkatesh and Goyal [18], identify several classes of satisfaction models, among them: Assimilation, Contrast (disconfirmation), General Negativity, Assimilation-contrast, Experience-only, and Expectations-only. Briggs, Reinig and De Vreede [19] identify three additional classes of models: Object-Attributes, Expectation Confirmation, and Goal Attainment. (For more detail on the logic, utility, and limitations of these models, see [19] and [18].) These models, though, produce conflicting, sometimes mutually exclusive predictions. Despite their contradictory predictions, though, there is robust empirical support for each model [for links to this research, see 18, 19]. This makes it difficult for practitioners to design systems on purpose to be both productive and satisfying. To address the theoretical paradox and serve the needs of IS professionals, researchers proposed Yield Shift Theory (YST) [19, 20].

YST is a general theory to explain and predict the onset, direction, and magnitude of satisfaction responses of any stakeholders toward any objects-of-satisfaction across all conditions. YST is of the class of type labeled by Gregor, "Theories that Explain and Predict" [21]. YST explains the effects represented in prior models, and predicts conditions under which those observed effects should and should not occur; it also explains other satisfaction effects for which prior models cannot account [19, 20]. The scientific utility of a general theory grows as a body of experimental studies demonstrates that hypotheses derived from its logic are consistent with measurable reality. This paper reports the results of such an experiment to test a counterintuitive hypothesis derived from Yield Shift Theory

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2. A Brief Summary of Yield Shift Theory

Locke and Latham [22] conjectured that satisfaction might be the product of some automatic subconscious mechanisms that assesses the extent to which objects-of-satisfaction advance or hinder one's goals. YST proposes such mechanisms.

A number of prior models frame a separate theory for each object-of-satisfaction, e.g. System Satisfaction or data satisfaction, and for each class of stakeholder, e.g. User Satisfaction or Customer Satisfaction. YST posits that a single set of cognitive mechanisms pertaining to goal attainment generates all satisfaction responses toward all objects-of-satisfaction. In YST, a *goal* is desired state or outcome [22]. YST assumes that an individual holds many different goals, from basic survival goals to esoteric desires for self-actualization. YST assumes, though, that human cognitive processing resources are limited, so one's mind cannot process all of one's goals simultaneously. In YST, goals that are currently subject to cognitive processing are called, *active goals.*

YST assumes that the mix of goals in the active set is fluid. External stimuli or internal trains of thought may *activate* a goal, fetching it from long-term memory and subjecting it to cognitive processing. As the number of active goals reaches the limits of available cognitive resources, activating a new goal would displace one-or-more other goals from the active set.

2.1 The Logic of Yield Shift Theory

To explain satisfaction responses, YST assumes:

Axiom 1: Goal Utility*. A subconscious mechanism automatically ascribes some level of utility to the attainment of each active goal.*

In YST, u*tility* is an overall sense of the goodness or benefit one might derive by attaining an active goal. YST conceives of goal utility as having a range from zero to one, where zero represents no utility, and one represents the maximum utility that an individual's mind can conceive.

Further, because cognitive resources are limited, one could choose to pursue higher-utility goals to the exclusion of lower-utility goals. This could become detrimental because some high-utility goals are difficult or impossible to achieve, so pursuing them could block the attainment of lower-utility goals that would nonetheless contribute to survival. YST therefore makes two more assumptions to explain how the mind addresses this issue:

Axiom 2: Goal Likelihood. *A subconscious mechanism automatically assesses a likelihood that an active goal may be attained.*

In YST, *Likelihood* is the degree to which one believes that an active goal may be achievable; it is a subjective probability that a desired state or outcome may be realized. YST assumes that likelihood assessments are fluid. They change in real time in response to external stimuli or internal trains of thought. The likelihood assessed for an active goal may range from no confidence to full confidence that the goal is attainable. It is therefore useful to conceive of likelihood as having a range from zero to one, were zero represents no confidence that the goal may be attained, and one represents no doubt that the goal will be attained.

Next, YST assumes that:

Axiom 3: Yield Synthesis: *A subconscious mechanism synthesizes a yield for an active goal that is proportional to its utility but reduced in inverse proportion to its likelihood.*

If one were certain that one could attain an active goal, its yield would be equivalent to its utility. If one were certain that one could not attain an active goal, its yield would be zero, regardless of its utility. Thus, a low utility goal with high likelihood could have a greater yield than a high-utility goal with low likelihood.

Reasoning from Axioms 1, 2, and 3, YST proposes:

Proposition 1: Goal Yield. At a given moment, the yield for an active goal is a function of its ascribed utility, moderated by its assessed likelihood.

Formula 1 presents a formal expression of the logic of Proposition 1:

Formula 1. Goal Yield: $Y_i = f(U_i L_i)$

$Where$:

$Y_i = Yield\ for\ Goal\ i$

$U_i = Utility\ ascribed\ to\ Goal\ i$

$L_i = Likelihood\ of\ attaining\ Goal\ i$

Axiom 3 and Proposition 1 may look similar, but they are distinct. Axiom 3 assumes a cognitive mechanism that performs a specific operation. Proposition 1, by contrast, proposes a causal relationship among three constructs. If the mechanisms of Axiom 3 were to hold, then by deductive logic, the causal relationships in Proposition 1 would also have to hold. Figure 1 illustrates the relationships of Proposition 1.

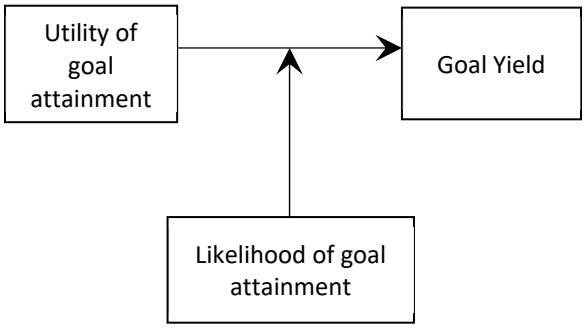

Figure 1. Yield Shift Theory proposes that, at a given time, the yield for an active goal is a function of the perceived utility ascribed to its attainment moderated by the perceived likelihood it may be attained.

2.2 Shifts-in-Yield for the Set of Active Goals

YST assumes that, at a given moment, the total yield for the current collection of active goals, the *active goal set,* is equivalent to the sum of the yields of the goals in the active set. A change-in-yield for any goal in the active set would constitute a change the overall yield for the whole set.

To explain satisfaction responses, YST further assumes that:

Axiom 4: Yield Shift Detection. *A subconscious cognitive mechanism tracks the overall yield for the active goals to detects changes-in-yield for the active goal set.*

Note that Axiom 4 does not assume that one makes a deliberate, conscious, goal-by-goal assessment of utility and likelihood for each goal in the active set to arrive at a calculated yield for the goal set as a whole. Rather, it posits an automatic subconscious mechanism that detects shifts in overall yield of the active goal set as a whole.

YST assumes that the mechanism of Axiom 4 detects a yield shift by contrasting the yield of the current active goal set with the yield of a remembered or imagined *reference goal state.* The reference state could be e.g. the state of a prior active goal set (e.g. the state that was current just before the yield shift, a remembered state that from a time past, or an imagined goal state (e.g. How good things could be if one's enterprise management system were to provide sales personnel with real-time information on inventory and pricing). A difference-in-yield between the active goal set and a reference state would constitute a positive or negative yield shift.

Next, YST assumes:

Axiom 5. Affective Responses to Yield Shifts. *A subconscious mechanism automatically triggers an affective arousal proportional to, and in the direction of a yield shift for the set of active goals.*

Thus, a positive satisfaction response could be caused by an overall increase in the total yield for the active goal set, or by an overall decrease in yield for the reference state. Likewise, a decrease in the overall yield for the active goal set or an increase in overall yield for the reference state should trigger a negative affective response. YST assumes, however, that there are physiological limits on the amount of affective arousal one can experience. Therefore, beyond some threshold, incremental increases in the magnitude of a yield shift should cause smaller and smaller increases in affective arousal, which implies that the relationship between yield shift and a satisfaction response should be an ogive function – a curvilinear function with a positive but decreasing slope that approaches a limit.

YST therefore proposes:

Proposition 2: Satisfaction Responses. *A Satisfaction response will be an ogive function of the absolute value of the magnitude of a shifts-in-yield for the set of active goals, with a valence corresponding to the direction of the yield shift.*

Figure 2 illustrates Proposition 2.

Figure 2. *Yield Shift Theory proposes that Satisfaction Responses are an ogive function of shifts-in-yield for the set of active goals.*

Formula 2a presents a formal expression of the logic of Proposition 2:

Formula 2a. Satisfaction Responses.

$S = f(\Delta Y)$

$Where$:

$S = \ Satisfaction\ Response$

$Y = \ Yield\ for\ the\ Active\ Goal\ Set$

Formula 2b represents ΔY (yield shift) as a contrast between the yield for a current active goal set and the yield for a reference goal state:

Formula 2b. Satisfaction Responses.

$$S = f\left(\sum_{i=1}^{a} U_i L_i - \sum_{j=1}^{r} U_j L_j\right)$$

Where:
S = satisfaction response
a = number of goals in the active set
r = number of goals in the reference state
Ui = utility of goal i in the active set
Li = likelihood of attaining goal i
Uj = utility of Goal j in the reference state
Lj = likelihood of attaining Goal j in the reference state

Several exploratory studies of YST observed correlations consistent with its logic across several conditions [e.g. 23, 24, 25], which suggests that it may be useful attempt a more rigorous falsification of the theory with an experimental study. The remainder of this paper reports such an experiment.

3. Hypothesis

If Axioms 4 and 5 hold, then there would be two obvious strategies for invoking a satisfaction response:

1. Utility Shift Strategy: Change the perceived utility of one or more goals in the active set or the reference state.
2. Likelihood Shift Strategy: Change the perceived likelihood of attaining one or more goals in the active set or the reference state.

There is, however, a less obvious approach that supports to a counterintuitive prediction that it should be possible to invoke a satisfaction response without changing perceptions of utility or likelihood for goals in the active set:

3. Goal Replacement Strategy: Change the goals that compose the active set or the reference state.

If an experimental treatment were to activate new goals into the active set, and the new combination of active goals had a different yield than the prior state, that would constitute a yield shift for the overall set of active goals, and so should trigger a satisfaction response, even though perceptions of utility and likelihood for goals in the original set have not changed. The same could happen if the mix of goals in the reference state were changed. To clarify the goal replacement strategy, consider the following scenario:

Mentee: "I feel so frustrated! I really thought I had that nasty bug fixed for good! It just popped up again.!"
Mentor: "Yes, but remember, three months ago we had 837 high severity/high importance bugs in the prototype, and you fixed them all but this one in record time, for which you just got a promotion!"
Mentee: "Oh. Well. Yes, I do feel good about that."

The current goal state ("The is not fixed") has lower likelihood, and so lower yield than the prior reference state, ("The bug is fixed at last"). This constitutes a negative yield shift from full likelihood to a lower likelihood for the bug-fix goal, triggering a negative satisfactoin response. The mentor then replaces goals in the recent reference state with those from an earlier reference state ("Three months ago I had 837 severe bugs"), and activates an additional high-yield goal (I only have one bug left, AND you got that promotion!). The yield of new active set is greater than that of the prior reference state, which constitutes a positive yield shift, and so a positive satisfaction response even though the severe bug remains.

To test Proposition 2, this study derives a hypothesis based on the Goal-Replacement strategy. YST assumes that one can invoke a yield shift by using external stimuli to activate different goals thereby changing the composition of the active set or the reference state, (Axiom 4), thereby triggering a satisfaction response (Axiom 5). If these assumptions hold, then a treatment that asks users to reflect on the negative aspects of a system experience should tend to activate goals that were hindered by the experience, and so have low likelihood. The activation of low-yield goals would reduce the net yield for the active set, triggering a negative satisfaction response (unless the user were already contemplating goals of even lower yield before the activation event). Likewise, asking users to reflect on the positive aspects of a system experience would tend to activate goals with high likelihood (in some cases they may already have been attained, and so have a likelihood of 1.0) which could constitute a positive yield shift, and so trigger a positive satisfaction response (unless the user were already contemplating goals of even higher yield before the activation event.) The goal replacement effect should be most pronounced when people perceive a significant personal stake in the outcome of the experience, so the activated goals would have high utility. If the utility were small, then the goal replacement might trigger only minor affective arousal. Thus, one way to stimulate goal activation would be to ask people to reflect on what they like or dislike about some object-of-satisfaction. If Proposition 2 holds, then:

Hypothesis 1: *People who are first asked to reflect on the positive aspects of a system-supported experience in which they perceive substantial utility will subsequently report higher average satisfaction toward the experience, than will people who are first asked to reflect on the negative aspects of the same system experience.*

Note that H1 does not predict that people who have a better experience will feel more satisfied than do people who have a worse experience. Rather, it predicts that people will report higher satisfaction scores toward the same experience if they first reflect on what went well than if they first reflect on what went poorly.

4. Experimental Methods

4.1 Subjects

Two-hundred forty-five undergraduate students who enrolled in online asynchronous sections of a three-unit Principles of Information Systems course over a period of four semesters were invited to participate in the study. Two hundred eleven students chose to participate. Of those, 113 were female; 98 were male. The mean (std. dev.) age of participants was 20.19 (2.70) years and mean (st. dev.) work experience was 2.68 (2.61) years.

The study took place at a large university in the Southwestern United States. The course was required for all students in the College of Business, and for several majors outside the College. Students had to pass the course, and to maintain an overall GPA of at least a 2.9 to be eligible for upper division courses in their majors. We chose this subject pool because they were accessible, and because they would need to use an information system for an extended period to work toward long-term goals in which they perceived a substantial personal stake (high utility).

4.2 The Setting

The online learning system was an ideal platform for an experimental study because it provided a complex, and yet invariant object-of-satisfaction. All participants had to access identical learning stimuli, e.g. identical recorded video lectures, identical assessments, articles, tutorials, assignments, quizzes, exams, and other course materials delivered by an integrated learning management system. They also used an online tutorial system to learn spreadsheet and database skills, and

completed eight projects, which they submitted to the system for automatic grading and automatic interactive coaching. Some students also sent questions to the instructors and received feedback via email. Thus, all students had a protracted, nearly identical system-supported experiences while working through the online course.

4.3 Dependent Variable

This experiment tests YST's Proposition 2. The consequent construct for Proposition 2 is Satisfaction. The object-of-satisfaction for this experiment was the system-supported learning experience. We measured the consequent construct (Satisfaction) with a four item, five-point semantic anchor satisfaction scale derived from the YST definition of a *satisfaction response* as an affective arousal with a positive or negative valence toward some object-of-satisfaction that has relevance to goal attainment [19]. Each of the four questions called for affective responses:

S1: I (disliked / liked) the online course.
S2: I have (negative/positive) feelings towards the online course.
S3: I felt (dissatisfied/satisfied) with the online course.
S4: I was (unhappy/happy) with the online course.

This four-item scale had been validated elsewhere, e.g. [23]. We revalidated it for this study. We also added a five-point Likert-scale question as an indirect measure of satisfaction:

S5: I would recommend the online course to a friend. (Strongly disagree/Strongly agree)

4.4 Experimental Treatments

The independent variable for this study comprises two treatments for manipulating the causal construct, yield shift, by invoking goal replacement to cause either positive or negative yield shifts. The questions for Treatment 1, the positive-tone treatment, were:

1. *Which aspects of the software for the online course did you like best?*
2. *What did the instructor do well in terms of managing the online course?*
3. *Overall, what was the one best thing about the online course?*

The questions for Treatment 2, the negative-tone treatment, were:

1. *Which aspects of the software for the online course were the most difficult or annoying?*
2. *Where did the instructor fall short in managing the online course?*
3. *Overall, what was the one worst thing about the course?*

It is important to note that these open-ended questions are not the dependent variables for this study. They are not used to measure satisfaction. Rather, they are *external stimuli to invoke goal-replacement*. If the logic of YST holds, then the two treatments should activate goal sets with differing overall yields, and so invoke differing yield shifts, which should cause differing levels of satisfaction toward the same system-supported learning experience – the object-of-satisfaction in this study.

4.5 Manipulation Checks

To check whether the treatments had actually manipulated the value of the yield shifts, YST's causal

construct, we used a three-item five-point semantic anchor scale to measure perceived utility shift:

U1: I got (less/more) from the online course than I had anticipated.

U2: I benefited (less/more) from this online course than I expected.

U3: I gained (less/more) from the online course than I believed I would

.

We used a three-item five-point semantic anchor scale to measure perceived likelihood shift:

L1: Because of the online course I am (less/more) likely to succeed on something I care about.

L2: I am (less/more) likely to attain my goals because of this online course.

L3: Due to this online course I am (less/more) likely to get what I want.

If the treatments functioned as intended, then subjects assigned to the Positive Treatment should report, on average, that that they benefited more than they expected from the experience than they expected (a positive utility shift) and/or that they were more likely to get something they want from the experience (a positive likelihood shift) than would subjects assigned to the Negative treatment. The results of the manipulation check suggested that the treatments did manipulate the values of the causal construct in the intended directions.

4.6 Common Methods Variance Checks

Because satisfaction responses and manipulation check items were measured with questions on the same survey instrument, there was some risk of risk of a common methods variance (CMV) bias. To test for CMV in our manipulation checks, we asked subjects to respond a set of marker questions about academic integrity in online classes [adapted from 26], and about global awareness [adapted from 27]. The results ruled out a CMV bias between the satisfaction questions of the dependent variable and the Manipulation Check questions.

It is important to note, though, that there was no possibility of a CMV bias between the questions and the dependent variables. The study does not a) contrast the value of satisfaction scale across answers to the treatment questions, or b) contrast the value of the satisfaction scale across answers to the manipulation check scales. The study contrasts the value of the satisfaction scale by treatment, not by the answers the students gave to the treatment questions. The treatment questions manipulate, not measure the causal construct.

4.7 Control Variables

We also included several control variables on the instrument. These were: a) the semester that a student completed the course, b) self-report items for age, sex, work experience, and class level (freshman through senior); and c) the expected grade for the course.

In a university course, a student's grade is a proximate high-stakes goal that facilitates numerous high-stakes distal goals. We conjectured that there might be a positive association between expected grade and satisfaction with the online course because students who reported an expectation for a high grade from an online course may experience higher utility or likelihood shifts from the experience than people who reported an expectation for a lower grade. However, we did not make this a formal experimental hypothesis because we did not derive a hypothesis from a theoretical proposition to predict a relationship, and we did not manipulate the value of expected grade; we only measured it. We therefore report the analysis of control variables as exploratory findings.

4.8 Instrument Validation

We began validation by testing the reliability and construct validity using principle components analysis. The results suggested a five-factor model in which items intended to measure the same construct loaded heaviest on a single, shared factor, and that items did not tend to load highly on multiple factors (Table A1). Taken together, these findings demonstrate the convergent and divergent validity of the measures. The Cronbach's alpha statistics ranged from .863 to .961 indicating acceptable inter-item reliability.

The cross-loadings were examined to compare the marker variables to the constructs used in the study. Factor 1 in Table A1 represents the Satisfaction construct. The Factor 1 (satisfaction) cross-loadings with perceived utility shift (U) and perceived likelihood shift (L) are substantially higher in every case, ranging from .405 to .547 for U and from .344 to .402 for L than to any of the Factor 1 (satisfaction) cross-loadings for the marker items which ranged from -.025 to .093 for academic dishonesty (D) and .068 to .195 for global awareness.

We then used confirmatory factor analysis to compare a one-factor model to a five-factor model (Table A2). The multi-factor model evidenced superior fit to the one-factor model. The multi-factor model satisfied the recommended values [28] for the various fit indices whereas the one-factor model did not meet the recommended targets. The CFA loadings are presented in Table A3. Thus, we concluded that CMV bias is not a threat to the manipulation check.

4.9 Procedures

Subjects enrolled in a 16-week online Principles of Information Systems course. On the Monday of the last week of the course, participants received a standard email message from the instructor via the course management system inviting them to click a link to

respond to a survey about their experiences with the online course. The message offered students the opportunity to earn five points extra credit points by completing the questionnaire. Students could earn a maximum of 1000 points for their regular course work during the semester. Respondents completed the questionnaire before taking the final exam.

Students who followed the link reached a landing page bearing a welcome message. The survey system used a random number generator to assign each student to one of the two treatments. Students in the *Positive* treatment responded first to the positive-tone treatment questions, and then in order, the manipulation check questions, the satisfaction questions (DV), the CMV check questions, then the negative-tone treatment questions, and finally the control questions. Students in the *Negative* treatment responded first to the negative-tone treatment questions, then in sequence, the manipulation check questions, the satisfaction questions (DV), the CMV check questions, then the positive-tone treatment questions, and finally the control questions.

Each multi-item scale appeared on a separate page in the online questionnaire. When students moved to a new page of questions, they could not go back to change their previous answers. Thus, answers to the satisfaction questions could not be influenced by the subsequent questions in the instrument.

When students finished answering the questions, a thank-you message appeared, and students exited to a web page containing another random number generator that provided the student with a completion code to email to the instructor to receive extra credit. There was no link between the students' responses and the randomly generated completion code.

5. Results

We conducted two different tests of Hypothesis 1. First, we compared the mean satisfaction scores across the two treatments. The subjects in the Positive Treatment reported statistically significantly higher mean satisfaction scores than did subjects in the Negative Treatment for all individual items ($t \geq 2.80$, $p < .01$) and for the average response across the satisfaction scale ($t = 3.22$, $p < .01$) (Table 1).

Second, we regressed the mean satisfaction response on a dummy variable for treatment (coded 1=Negative else 0) and expected grade (coded according to grade's equivalent GPA score such as A=4.0 and C-=1.7). We initially included the nuisance variables such as sex and age in the regression model, but these were eliminated by backwards elimination. The reduced model supported the hypothesis in that the dummy variable representing the Negative treatment had a statistically significant negative coefficient. Expected grade, and age as observational relationships, had statistically significant positive coefficients (Table 2). We also tested an alternative framing of the Expected Grade effect using categorical variables for each letter grade level (A, B, C, D, or F) rather than a single ratio variable. The second analysis yielded similar results with respect to fit indices (both had $R^2 = .297$) and coefficient estimates for treatment and age (Table 3).

6. Discussion

The results offer robust support for Hypothesis 1. Under the conditions of this study, people who first contemplated the positive aspects of their system-supported work subsequently reported higher average scores on the satisfaction scale than did people who first contemplated the negative aspects of the same experience. From a theoretical perspective, these findings suggest that a goal replacement strategy can be used to invoke satisfaction responses, which, offers empirical support for the Yield Shift Theory of Satisfaction.

The treatments in this experiment were subtle – they manipulated the positive vs. negative framing of three open-ended questions about the system-supported learning experience. The data suggest the treatments were nonetheless sufficient to manipulate the causal construct, yield shift because students in the Positive treatment reported more-positive *likelihood* and *utility*

Table 1. Satisfaction with online learning system items and statistical summary of responses across two experimental treatments.

Satisfaction Item	Treatment 1: Positive; M(S), n=107	Treatment 2: Negative; M(S), n=104	Test of Means $H_a: \mu_{PYT} > \mu_{NYT}$
S1: (disliked / liked) course.	3.78 (1.17)	3.27 (1.29)	t=2.99, p<.01
S2: (negative/positive) feelings about course.	3.72 (1.09)	3.23 (1.22)	t=3.07, p<.01
S3: (dissatisf/satisf) with course.	3.75 (1.11)	3.31 (1.17)	t=2.80, p<.01
S4: (unhappy/happy) with course.	3.79 (1.12)	3.29 (1.20)	t=3.12, p<.01
S5: Would recommend course to friend.	3.91 (1.16)	3.41 (1.24)	t=2.98, p<.01
S: Mean response on items S1 to S5	3.79 (1.05)	3.30 (1.14)	t=3.22, p<.01

Note: Satisfaction Items were scaled so that higher values represent greater amounts of satisfaction. Positive is Positive Yield-shift treatment; Negative is Negative Yield-shift Treatment

Table 2. Regression results with satisfaction with online learning system regressed on Treatment and control variables

Variable	Coeff	Std. Err	Test stat.	VIF
Intercept	1.100	0.515	---	---
Treatment	-0.424	0.130	t=-3.26, p<.001	1.00
Expected Grade	0.559	0.072	t=7.92, p<.001	1.02
Age in yrs	0.056	0.024	t=2.30, p<.05	1.01

Note: N=211; R^2=.297, Adj. R^2=.287, $F_{(3,207)}$=29.11, p=.000; VIF=variance inflation factor;

Note: Treatments were coded 0 = Positive; 1 = Negative

Table 3. Regression results for satisfaction with online learning system regressed on Treatment and control variables including categorical framing of expected grade

Variable	Coeff	Std. Err	Test Stat.	VIF
Intercept	3.313	0.523	---	---
Treatment (0=Positive, 1=Negative)	-0.437	0.132	t=-.319**	1.01
Exp. Grade				
B+, B, B-	-0.531	0.176	t=-3.016**	1.58
C+, C, C-	-0.995	0.171	t=-5.806***	1.61
D+, D, D-	-2.041	0.363	t=-5.627***	1.12
F	-2.028	0.448	t=-4.522***	1.09
Age in Years	0.055	0.024	t=2.264*	1.02

Notes: N=211; *R^2=.297, Adj. R^2=.276;* N=211, $F_{(6,204)}$=14.35, p=.000. VIF=variance inflation factor.
Reference category for Expected Grade is A or A-.
* P<.05. ** P <.01. *** P<.001

shifts on average than did students in the Negative treatment. Thus, the results revealed differing satisfaction responses by treatment toward the same object-of-satisfaction. Thus, results are consistent with the logic of Yield Shift Theory.

From a practical perspective, there are many objects-of-satisfaction in the IS domain, among them, hardware, software, procedures, policies, standards, data, information, user interfaces, system interfaces, development and deployment methodologies, infrastructures, user support, and other stakeholders, to name a few, and dissatisfaction toward any success-critical element increases the risk of system failure. If further experimental research continues to support YST, IS professionals may find it useful for predicting the satisfaction responses toward technology design choices, shaping the policies and procedures, designing, developing, deploying, and operating information systems in ways that not only create value for the stakeholders, but also leave them feeling satisfied.
Online providers of goods and services may find it useful to inform design choices for online buying experiences, customer policies, offerings, marketing messages, and other elements in their environment so as to deliver goods and services that customers find not only valuable, but also more satisfying. Organizations may be able to use YST to anticipate, prevent, diagnose and/or redress stakeholder dissatisfaction issues that increase the risk of system failures.

7. Limitations and Future Research

Although the results of this study are promising, no single experiment is sufficient to validate or refute a theory. A body of experimental studies that test the theory in a variety of ways will be required to validate its scientific utility. This study used:

a) treatments based on a goal replacement strategy
b) a survey instrument to manipulate yield shift
c) a self-reported satisfaction measure
d) undergraduate student subjects
e) an education context
e) a system-supported learning experience as the object-of-satisfaction.

A future body of experiments should vary one, some, or all of the elements; treatments, measures, subjects, contexts, and conditions to establish the requisite intersubjective concurrence [29] that YST is (or is not) a sound model to explain and predict satisfaction responses.

We discovered a positive relationship between students' expected-course-grades and their satisfaction responses. This exploratory finding merits further investigation. It may be useful, to devise future experimental treatments that manipulate grade expectations to further test the theory.

We also discovered a statistically a significant positive relationship between age and satisfaction. It may be that older students are better prepared to foresee (likelihood) or appreciate the potential benefit (utility) of a learning experience, e.g. for improving their professional knowledge and skills. It would not be possible, though, to conduct an experimental test of a causal relationship between age and satisfaction, because one could not randomly assign subjects to treatments that manipulate the age of the subject. We suspect, though, that the observed correlation between age and satisfaction is not causal, but instead incidental to other constructs that correlate with age. Future research may discover, and then manipulate these phenomena so as to demonstrate that the effect for age disappears.

8. CONCLUSIONS

Satisfaction is a core concern in for Information Systems professionals because it correlates with system success and failure. Prior models of satisfaction were not sufficiently general to explain all satisfaction responses toward all objects-of-satisfaction across all contexts and conditions in the IS domain. The Yield Shift Theory of Satisfaction offers a general theory of satisfaction that seeks explain and predict the onset, magnitude, and direction of satisfaction responses of any stakeholders toward any object across any conditions. This experiment used subtle, counterintuitive treatments that nonetheless produced the predicted satisfaction responses. This offer strong empirical support for logic the logic of YST, and suggests that the theory may be useful to IS practitioners, as they could use it to predict the satisfaction responses toward their design, deployment, and operational choices. It may help IS professionals to design information system that are not only effective and efficient, but also satisfying. We recommend experimental replications across contexts, conditions, and objects-of-satisfaction, and yield shift manipulation strategies in the IS and other related domains to further validate or refute its scientific utility.

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