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MOTIVATING STUDENTS: AN INITIAL ATTEMPT TO OPERATIONALIZE THE CURIOSITY GAP MODEL

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ABSTRACT

Gentry and Burns (1996) and Burns and Gentry (1998) attempted to incorporate Loewenstein's (1994) Curiosity Gap Model into a theory of the motivation of students in class settings. This paper attempts to measure the curiosity gap and then relate it to student performance measures. The preliminary results reported here come from only one small (n=16) class; however, much larger data collections are in progress and will be included in the presentation in San Diego. The preliminary results indicate support for the Gap Model, and lead us to conclude that instructors should actively attempt to manage the level of the curiosity gap.

INTRODUCTION

Business education has a history of emphasizing cognitive elements, and in the process there has been diminished concerns for motivational aspects to learning. Loewenstein (1994, p. 93) noted that "educators know much more about educating motivated students than they do about motivating them in the first place." Similarly, when discussing the more specific experiential learning context, Yakonich, Cannon, and Ternan (1997, p. 330) noted, "Not withstanding the general recognition that simulations increase student motivation, there is little discussion of how this might take place."

In this paper, we will adopt the suggestions of Burns and Gentry (1998) and Gentry and Burns (1996) to incorporate Loewenstein's Curiosity Gap Model in an attempt to predict students' motivation levels. We will operationalize Gap measures and then relate them to performance measures. The results reported here reflect only a pilot study in one class (n=16). However, multiple data collections across the US and at universities in Canada and China were conducted during the Fall 2000 semester and their results will also be reported in San Diego.

THE CURIOSITY GAP MODEL

Curiosity has a strange history because several streams of research have viewed it in a negative light. After all, curiosity killed the cat and left us with Pandora's box. Curiosity is also listed as a motive behind such behaviors as voyeurism, drug and alcohol experimentation, and arson. In the domain of education, however, curiosity is almost uniformly viewed in a positive light because it compels students to learn. For example, if educators were asked to choose one trait expected in a good doctoral student, curiosity would be a very frequent response. Its appreciation

by educators is so great that Coie (1974) found that teacher ratings of the curiosity of their students were actually measures of intelligence. So, at least in the domain of education, the stimulation of curiosity is believed to facilitate the learning process.

Loewenstein (1994) bases his definition of curiosity largely on the natural human need for understanding one's environment. Interestingly, humans actively seek uncertain situations in which they can solve problems, as evidenced by the popularity of puzzles and mysteries. The key, as noted by Hebb (1949), is that humans seek moderate levels of uncertainty, which are more pleasurable and less averse than either high or low levels of uncertainty. The intensity of one's curiosity directed to a particular item of information is related positively to its ability to resolve uncertainty (Loewenstein, 1994, p. 88).

Loewenstein's model (1994) of curiosity is based on the notion of manageable gaps in one's knowledge. Motivation tends to increase as an individual realizes that a gap exists between the current knowledge level and a desired knowledge state. Furthermore, Loewenstein (1994) notes that the key to understanding curiosity seeking "lies in recognizing that the process of satisfying curiosity is itself pleasurable" (p. 90). Thus, students should find learning fun because closing manageable gaps is pleasurable. However, the operant term is *manageable*. "To stimulate curiosity, it is necessary to make students aware of manageable gaps in their knowledge" (Loewenstein 1994, p. 94). Gaps that are too great discourage learning: Students who consider the new learning level to be unattainable will be deterred from attempting to gain the new level. Similarly, when gaps are too small, learners are apathetic to the challenge. A failure to appreciate what one does not know would constitute an absolute barrier to curiosity (Loewenstein 1994, p. 91). The enlightened individual is one who knows what he or she does not know, whereas a curious person is motivated to close the knowledge gap. Loewenstein's information gap perspective implies a wonderful circularity that curiosity should be related to one's knowledge in a particular domain. The more curious one is, the more knowledge one acquires, making other information gaps more manageable and thus creating higher levels of curiosity.

To elaborate, information gaps that are too great may stimulate learned helplessness as opposed to curiosity. The inverted-U relationship between curiosity and the size of the gap in knowledge is analogous to McClelland, Atkinson, Clark, and Lowell's (1953) theory of achievement motivation. Loewenstein (1994) notes that curiosity requires a pre-existing knowledge base. This perspective converges with the logic underlying Bloom's taxonomy (Bloom, Englehart, Furst, Hill, and Krathwohl 1956). In this taxonomy, the lower levels deal more with one's declarative knowledge of the domain (i.e., acquiring a cultural literacy in the area). The higher levels build on this declarative knowledge as one develops procedural knowledge of the tacit processes and behaviors in the field. Without a declarative knowledge base, learners are intimidated when they are forced into learning procedural knowledge. For example, it is not uncommon to hear instructors using simulation games, live cases, and other types of experiential exercises discussing the frustrations faced by students when the information gaps created in the learning experience are too large. Hebb (1949) noted that minor violations of expectations create a manageable gap and induce curiosity but that major violations produce a fear-like avoidance reaction.

Similarly, the Gap Model's logic is similar to processes observed in the education literature summarized by Cross and Steadman (1996, p. 25). Teachers who expect high performance will usually get it and, in the process, win the respect of their students. "The literature consistently shows, contrary to faculty belief, that students give higher ratings to difficult courses in which they have to work hard" (Sorcinelli 1991, p. 21). Research on cognition and motivation, however, suggests that there is an optimal level of expectation; if expectations are set too low, students will do less than they are capable of; if expectations are too high, students will engage in any number of counterproductive ego-protective devices (Corno and Mandinach 1983; Covington and Berry 1976).

Another model of student motivation from the education literature is that of Pintrich (1989), which lists three components: (1) students' beliefs about the importance and value of the task, (2) students' beliefs about their ability to perform the task, and (3) students' feelings about themselves or their emotional reactions to the task. These components relate directly to the Curiosity Gap Model. The upper end of the gap will be more important if it is reachable; in fact, we will attempt to operationalize this end of the gap by using an Importance measure. Second, the self-efficacy component should relate to whether the gap is manageable or not. Finally, the Curiosity Gap Model implicitly incorporates affect, noting that closing the gap is in itself pleasurable.

OPERATIONALIZING THE "GAP"

Asking students directly about the difference between what they know and what they want to know is somewhat problematic, especially given their relative unawareness of what the course will entail. Previous attempts to ascertain what students want to learn in a course (Gentry and Burns 1997) yielded virtually nothing of substance. Even in the case in which students are taking an elective in their major (which was true for most of the students in the data reported in Gentry and Burns 1997), there was very little comprehension shown in terms of their expectations as to the nature of the course. Whereas students may have some idea as to what they know about a topic, there is reason to question their perception (at the beginning of the course) of what they would like to know about the topic.

Consequently, we attempted to measure the gap in terms of two constructs: "Confidence" and "Importance." Further, these issues were measured in the context of

specific issues deemed to be those that the instructor wants students to take from the course.

Confidence. "Confidence" captures the lower end of the gap, as it deals with what the student brings to the course. At the same time, it also captures some aspects of the "gap" itself, as awareness of the amount to be understood should restrict one's estimate of confidence.

Importance. On the other hand, "Importance" would seem to capture the upper end of the gap, with "greater importance" being logically associated with more "need to know." Rather than "low importance" being associated with little knowledge coming in, it might be that prior knowledge would be represented by greater variance in the importance ratings. For example, the student who sees every topic as being extremely important may have no clue as to what is relevant to his/her personal growth.

Difference Variable. A third operationalization of the "gap" is the difference in our proxy for what the student knows ("Confidence") and our proxy for what the student wants to know ("Importance"). As discussed earlier, neither operationalization deals solely with the particular end of the gap that it was intended to measure. Still, it is intuitive that the person who has high confidence in his/her knowledge and also sees the material as being somewhat important will have relatively less incentive to close that gap than someone with less confidence. On the other hand, the individual with relatively low confidence but high perceptions of importance may be prone to learned helplessness. From a mechanical perspective, the measure is fallible as one student had a higher level of confidence than perceived importance (resulting in a "gap" of -3).

The context in which these constructs were measured was that of specific knowledge (in the case of the pilot study, in terms of Consumer Behavior). The instrument required the researcher to contemplate just what was desired in terms of what the student was to take away from the course. Twenty concepts were incorporated into "Confidence" and "Importance" contexts. For instance, the items for which students showed the most confidence was "How confident are you that you understand the relationship between one's lifestyle and one's consumption," whereas the item with the lowest confidence was "How confident are you that you understand the relationship between how the Chinese (as opposed to Americans) process new information and their recall of ad content?" This latter item was also deemed to the least important to their understanding, while the item the most important to understand was "How important to you is understanding how consumers use information to make choices once they have obtained it?"

Dependent Variables. The operationalizations of the curiosity gap are to be related to performance measures [in the pilot study, these measures were the grade on the individual class project (students could choose from a long list of alternatives), the grade on the essay final, the number of absences, the number of in-class contributions made, and the class participation grade (which was correlated .98 with the number of in-class contributions)].

SAMPLE

Data were collected in a variety of classes (mostly marketing classes, but some at the secondary level as well) across the United States, as well as at universities in Canada and the People's Republic of China. The results presented here come from a pilot study conducted during a summer pre-session Consumer Behavior course at a large midwestern state university (well, OK, at the University of Nebraska-Lincoln). Seventeen students attended the class the first day, but one dropped after that class.

RESULTS

Single Case Analysis. As this study concerns motivation, it was deemed important to evaluate the data for the student who dropped after the first day. It was clearly an elective course for this student, as he is a finance major. He indicated very little confidence in his prior knowledge of the topic (mean rating less than 3.0 on a seven-point scale), as his total (summed over the 20 items) confidence score was tied for the second lowest for the 17 students. On the other hand, his importance score (mean rating less than 5.0 on a seven-point scale) was the *lowest* of the students in the class. He did not know a lot about consumer behavior, but he did not want to either. While it is ludicrous to put much weight on a sample size of one, wild speculation might suggest that in the instructor's first lecture more emphasis should be placed on increasing the perception of the importance of the material rather than being concerned with the level of prior knowledge. [This premise will be investigated systematically in the future data collections.]

Relationships between Confidence and Performance. One's confidence was uncorrelated with performance (correlations ranging from .02 to -.10). Given the nature of Loewenstein's theory, this is to be expected as those with moderate confidence levels would be expected to be the most curious, the most motivated, and the best performers. Thus, the data set (though inappropriately small) was investigated using chi-square analysis with three levels of confidence compared to two levels of performance, and the frequencies are shown in Table 1.

The ideal pattern would be to have the bulk of the frequencies for those with both low and high confidence to be low performers, while the bulk of those with moderate confidence being high performers. The pattern shown for class contributions resembles the expected one, but it is not significant ($p=.59$). Again, this issue will be evaluated more systematically when the data from the fall semester are obtained. In general, the patterns resemble the expected one.

Relationships between Importance and Performance. The importance placed on understanding selected relationships was correlated with most of the performance measures (r=.24, p< .36 for the individual project; and r=.42, p< .12 for the participation grade). [Given the extremely small sample size and the very exploratory nature of the pilot study, an alpha of .40 is being used. When the entire data set is obtained, a more conventional alpha level will be used.] However, some relationships made less sense, as Importance was correlated with the number of absences (r=.35, p<.20) and inversely but non-significantly correlated with the performance on the essay final (r=-.17), which was supposed to capture the students' understanding of the issues covered in the first-day questionnaire. Thus, the Importance of the material in the class is associated with their in-class and out-of-class efforts, but not with their test performance.

The frequency patterns shown in Table 2 indicate that those rating the items as being less important fared more poorly on the project grade and participated less in class. Rather than a curvilinear effect, this appears to be a linear one.

As noted earlier, the variance in the Importance ratings may be a proxy for one's prior understanding of the material. For example, one student assessed a rating of "7" (Extremely Important) for all 20 issues, reflecting little insight about personal relevance. The standard deviation of the Importance ratings was correlated with several constructs. Its correlation of r=-.33 (p<.21) with one's Confidence indicates some evidence of convergent validity. Further, the construct was highly correlated with the grade on the individual project (r=.28, p< .29 and class participation (r=.41, p<.11), possibly reflecting better ability to assess which project option would stimulate the most personal interest and to pursue issues not yet understood by asking questions. On the other hand, the construct was not correlated with performance on the final (r-.002, p>.4) nor with the number of absences (r=-.12,p>.4).

While none of the chi-square analyses shown in Table 3 are significant, there is a consistent pattern indicating that those unable to discriminate the importance of the items (those with small standard deviations in importance) performed more poorly across the various measures.

TABLE ONE

CROSS-TABULATIONS OF CONFIDENCE AND PERFORMANCE

Performance Construct	Level	Confidence Level Low	Moderate	High
Project Grade	Low	4	2	2
	High	1	4	3
Participation Grade	Low	3	3	3
	High	2	3	2
Essay Exam	Low	2	3	3
	High	3	3	2
Class Contribution	Low	3	2	3
	High	2	4	2
Absences	None	3	3	4
	Some	2	3	1

TABLE TWO

CROSS-TABULATIONS OF IMPORTANCE AND PERFORMANCE

Performance Construct	Level	Importance Level Low	Moderate	High
Project Grade	Low	4	4	0
	High	1	2	5
Participation Grade	Low	5	2	2
	High	2	3	3
Essay Exam	Low	3	3	2
	High	2	3	3
Class Contribution	Low	5	2	1
	High	0	4	4
Absences	None	4	4	2
	Some	1	2	3

TABLE THREE

CROSS-TABULATIONS OF STD. DEV. OF IMPORTANCE AND PERFORMANCE

Performance Construct	Level	Std. Dev. of Importance Level Low	Moderate	High
Project Grade	Low	4	2	2
	High	2	3	3
Participation Grade	Low	5	2	2
	High	1	3	3
Essay Exam	Low	4	2	3
	High	1	3	3
Class Contribution	Low	4	2	2
	High	2	3	3
Absences	None	4	3	3
	Some	2	2	2

Relationships between Performance and the Differences between Importance and Confidence. Our operationalization of the Curiosity Gap as the difference between Importance and Confidence was uncorrelated with most performance measures, as would be expected from Loewenstein's conceptualization (which is non-linear in nature). However, the correlation between the difference and the number of absences was significant ($r=.46$, $p<.07$). Thus, it appears that a large difference between what is known and what is desired to be known can result in "giving up" (assuming that class attendance leads to gap closure).

The small sample size in the pilot study resulted in non-significant chi-square values when the difference score was associated with the performance measures (see Table 4). However, the patterns appear to be of the expected nature.

TABLE FOUR

CROSS-TABULATIONS OF DIFFERENCE SCORE AND PERFORMANCE

Performance Construct	Level	Difference Score Level Low	Moderate	High
Project Grade	Low	3	2	3
	High	2	3	3
Participation Grade	Low	3	2	4
	High	2	3	2
Essay Exam	Low	3	2	3
	High	2	3	3
Class Contribution	Low	3	2	3
	High	2	3	3
Absences	None	5	3	2
	Some	0	2	4

CONCLUSIONS

This paper extends the work of Burns and Gentry (1998) and Gentry and Burns (1996) by attempting to operationalize the Curiosity Gap specified by Loewenstein (1994). An instrument was developed for one specific class and the gap constructs were related to student performance measures. The tentative results from the small (n=16) class offer support for Loewenstein's model in predicting student performance as a function of motivation. Obviously, more rigorous testing is needed and that will be accomplished through data collections in the Fall 2000 semester at a variety of schools and in a variety of classes. The analyses reported here are extremely limited in meaning due to the small sample size, but they represent only the tip of the iceberg.

In passing, it is worth noting that the development of each class' questionnaire is in itself valuable for the instructor. Focusing on twenty relationships which you wish students to take away from the class is quite different from the more holistic perspective of the course domain that instructors often use as their basis for structuring the class. In a small way, it is a movement towards determining the course-based tacit knowledge that will help contribute to the student's success in the work place, an approach advocated by Macintosh, Gentry, and Stoltman (1993).

To the extent that the more systematic data collections and analyses provide support for the Loewenstein Gap Model of Curiosity, we will call attention to the need to manage the magnitude of the gap. For those who underachieve because of the perception of too small a gap, instructors should focus on increasing the "need to know" component of the gap. On the other hand, for those students who perceive too large a gap, instructors should attempt to increase the students' perceptions of their prior knowledge. Given that most classes have students with curiosity gaps of both extremes, instructors may need to increase and decrease gaps simultaneously. Such efforts are obviously difficult, and we do not have easy solutions to offer at this point. One approach might be to investigate the role of individual differences. For example, are those with higher levels of self-efficacy able to manage larger gaps? Are those with learning versus performance orientations (Dweck and Elliott 1983) more curious?

Hopefully, though, we will be able to present evidence indicating that curiosity gap management is crucial to the

development of curious students. Further, we are offering an approach for measuring the gap so that instructors can determine better which students need their gaps increased and which ones decreased.

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