Risk Theory and Student Course Selection

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Abstract

Risk theory is the study of the impact of possible outcomes on the process and consequences of decisions. Students make course selection (CS) decisions with varied return expectations, but also with a perception of the risk that those expectations will not be realized. This study presents the findings of an empirical analysis measuring the relative magnitudes of risk perceptions in four major categories that students consider in selecting upcoming courses – subject matter, professor, course environment, and grading. Participants were undergraduate and graduate students in a Business school and an Arts and Sciences school in a private liberal arts university. The results indicate that undergraduate and graduate students place importance on the surveyed risk elements in an inverse fashion. Results also show that course selection risk perception differs among students according to class standing but are similar between students in both Business and Arts & Sciences schools.

Keywords: Risk, Course Selection, Uncertainty, Perception, Exams, Course Environment, Professor, Grade

Introduction

Students make decisions throughout their college career, and decision-making is an important element in the learning process. F. Yates, Veinott, & Patalano (2003) define a decision as "…a commitment to a course of action that is intended to produce a satisfying state of affairs." Decisions are normally considered deliberatively or quickly or impulsively or even subconsciously in the context of a risk/return tradeoff. Both return and risk are situation-based variables, with their definitions a matter of context. The literature is extensive in its treatment of this tradeoff in a business context. However, little has been written on this tradeoff in an educational setting, specifically with respect to the student's decision on selecting upcoming courses when a choice exists among various courses or even alternative sections of the same course.

The course selection (CS) decisions of students are among the most defining in the success of their learning. The key (compound) question related to the course selection decision is: What are the expected returns/benefits this course will give me, and what is the risk that I will not receive those expected returns/benefits?

Throughout a student's college career, the CS process takes on many forms. At the beginning of that career, selection of courses is limited as required courses predominate in the student's schedule. There is, however, some selection latitude, as most required courses are offered in multiple sections and likely taught by more than one professor. As the student advances in the curriculum, the CS decision becomes more complex as elective courses and section decisions must be made. In CS situations, among the students' return expectations are 1) personal interest level of the course subject matter, 2) intellectual challenge and rigor, 3) demand on time, 4) grade potential, 5) assistance in achieving career goals, 6) enjoyment of the classroom experience, and 7) performance in the learning environment.

Yet no selection can be made based solely on return expectations. Return and risk are interrelated decision variables, both requiring consideration. All decisions result in consequences which occur in a future which is normally uncertain, thereby making few decisions risk-free. Within decision theory, decision-makers are assumed to be risk averse, which means they try to reduce the risk inherent in their decisions, although some decisions, such as buying a lottery ticket or paticipating in games of chance with adverse odds, exhibit risk-seeking tendencies. Students making CS decisions expect certain return elements to result, yet realize that risks exist that their expectations from taking the course may not materialize. They attempt to manage that risk by speaking with the professor who will be teaching the course, previewing the syllabus, reviewing information provided by the school such as the course description from the school bulletin or course evaluation scores from previous semesters, and tapping into the student network of positive and negative course referrals. This effort is made by the student prior to the CS decision in order to reduce the risk associated with that decision by either increasing the probability that their return expectations will be met or reframing their expectations based on a reassessment of the future.

The empirical research, described below, addresses the course selection decision within the context of the Decision Making under Risk and Uncertainty field of study (i.e., W. Edwards, Miles, & Von Winterfeldt, 2007; Schneider & Shanteau, 2003), focusing on the perceived elements of risk that students consider in their CS decision. Empirical results provide insights into the importance of the key risk factors in four major categories that students consider in selecting upcoming courses – Subject Matter, Professor, Course Environment, and Grading.

Course Selection

In the past, researchers on student course selection have identified linkages between course selection and various elements within the student environment. Babad (2001) examined differential considerations for selecting elective First Course and Last Course. She found that first courses were selected for their prospective intellectual level, expected quality of teaching, and students' potential learning and occupational gains. She also found that last courses were selected on the basis of comfort and ease and that quality of teaching was the only dimension separating satisfied and dissatisfied students in both first and last courses. In a follow-up study, Babad & Tayeb (2003) studied three dimensions of course selection – learning value, lecturer's style, and course difficulty – in the sequential decision-making process of course selection in a hypothetical choice situation. They concluded that students "chose to avoid hard work, giving strong preference to easy and moderately difficult courses." They also found that students gave high importance to the learning value and lecturer style dimensions.

Feather (1988) found support for the hypothesis that course selection decisions for students in mathematics and English courses are related to their self-concepts of ability in these subjects. Kerin, Harvey, & Crandall (1975) investigated the course selection process in a single non-requirement program. They found "Personal Interest in Subject Area", "Course Content", and "Compatibility with Major Field" of primary importance and "Friends" the most significant source of information in selecting courses by a wide margin (62%) of respondents.

Babad, Darley, & Kaplowitz (1999) analyzed the content of student course guides as it related to course selection. Specifically, they measured the correlation of that content with post-course student ratings of teaching for different level courses. From their findings, they argue that students have specific information (somewhat different for different levels of course) that will guide them in their course selection, and they search out that information in the student course guide.

Researchers also have studied the impact of professor/course reputation on course selection. Coleman & McKeachie (1981) found that courses with high ratings were selected more frequently by those who had reviewed the ratings. Leventhal (1976) studied section selection in multi-section courses and found that students using information on teacher reputation selected courses based on that information (also see Martin, 1989; Marsh & Yeung, 1997).

Student Perceptions

Risk in the context of course selection is predominantly a matter of perception. Students' perceptions have been the subject of various research efforts. Ramsden (1979) examined the perceptions of students in six departments of a British university and concluded that perceptions are important in the way in which students see themselves in a learning environment as well as their approaches to learning. Church, Elliot, & Gable (2001) studied the relationship among three factors - undergraduates' perception of their classroom environment, their adoption of achievement goals for the course, and their graded performance and intrinsic motivation - revealing that each of the three factors demonstrated a distinct antecedent profile. Lizzio (2002), Case & Gunstone (2003), and Struyven, Dochy, & Janssens (2005) conducted similar studies.

Another branch of perception research relates to students' perception of evaluation and assessment. Goldstein & Benassi (1996)) found that students' perceptions about assessment

significantly influence their approaches to learning and studying and prefer multiple-choice format exams to essay type questions. They note, however, that in comparison to more innovative assessment methods, students question the "fairness" of both multiple-choice and essay exams. Students' perceptions of teaching style also have been studied by Kember (1997) and Kember & Wong (2000).

Self-efficacy perceptions represent a more inward look by students. Boud & Falchikov (1989) provide a review of the literature in this area as it relates to the comparison of student-generated marks with those generated by teachers. Zimmerman & Bandura (1994) used path analysis to study the role of self-efficacy beliefs related to the academic attainment and regulation of writing, academic goals, and self-standards on writing course achievement for college freshman. They found that perceptions of self-efficacy in the student's writing influenced perceived academic self-efficacy and personal standards in the quality of writing that was considered self-satisfying. Marsh & Yeung (1998) also investigated self-concept in course-specific settings.

An area where students attempt to mitigate the risks perceived in course selection is with information provided through networks to which they have access. Perceived quality of the source of information influences the interpretation of the message. Hilton (1995) presented an attributional model of conversational inference and showed how manipulation of relevant source and message attributes affect respondents' judgments. Borgida & Nisbett (1977) found that face-to-face comments about a course have a substantial impact on course choices among undergraduates, while mean course evaluation scores of courses have little impact.

Wright, Luus, & Christie (1990) tested the hypothesis that group discussion moderates the tendency of attributors to under-use consensus information and found confirming results (also see Vinokur & Burnstein, 1974). Krosnick & Sedikides (1990) demonstrated that self-monitoring regulates the use of consensus information. They found that "[h]igh self-monitors are more responsive to complimentary consensus information than are low self-monitors, and low self-monitors are more responsive to threatening consensus information than are high self-monitors." Solomon, Drenan, & Insko (1981) studied the impact of consensus information as it relates to the mode in which the information is received and found a significantly weak effect of consensus when the information from a target-person was videotaped or the "other-people" information was written.

Students as Consumers

Another course selection research track investigates students as consumers of education and whether treatment, by the institution administration and professor, of the student as a consumer will provide benefits to the student and educational institution. The concept of risk has an important role in the decision-making process of consumers (i.e., Conchar, Zinkhan, Peters, & Olavarrieta, 2004; Mitchell, 1999). This conceptual framework, as applied to student decisions, has generated controversy and varied research conclusions. Pereira & Da Silva (2003) studied the teaching and research processes in higher education institutions. They concluded that the "education" process is divided into a teaching process and a learning process with the student an external customer in the teaching process and an internal customer in the learning process. Singh (2002) argued "that the practice of student evaluation of teaching or student ratings of teaching is clearly designed to position students as consumers." Modell (2005) studied the "student as consumer" issue by examining the political and institutional processes surrounding the

construction of consumer-orientated performance measurement practices in the Swedish university sector. He concluded that a more consumer-oriented performance measurement had difficulty emerging due to its incompatibility with a more dominant incumbent power base and institutional inconsistencies. (Also see Conant et al., 1985; Conant, Brown, & Mokwa, 1985).

Other researchers, however, have expressed concern over the "student as consumer" perspective. Baldwin & James (2000) argue that the attempt by government agencies in Australia to enhance the quality of higher education is based on the misplaced "assumption that students are informed consumers making rational choices of higher education courses and institutions." Schwartzman (1995) warns that "the unreflective transfer of language from business to education" is misplaced and may have negative consequences (also see McMillan & Cheney, 1996; George, 2007; Freeman & Thomas, 2005). The crux of the argument researchers have against the view that institutions of higher education should treat students as consumers is that it places the student outside the process of creating the learning environment and considers them strictly as a user, whereas students more accurately should be viewed as being an integral part of that creation.

Risk Theory

The present purpose of the empirical results presented below is not to extend the traditional CS research track or "student as consumer" inquiry, but to take the research into the direction of risk theory in the context of decision-making under risk and uncertainty. The development of risk theory has an interesting background, spanning six centuries, and has found application in the fields of mathematics (Escobar & Seco, 2008), philosophy (Schrader-Frechette, 1991), psychology (Plous, 1993), finance (H. Markowitz, 1952; H. M. Markowitz, 1959), economics (Friedman & Savage, 1948), banking (Cetin, Jarrow, Protter, & Yildirim, 2004), and insurance (Beard, Pentikainen, & Pesonen, 1984) as well as providing combinations of fields leading to a common line of research (Kahneman & Tversky, 1979a; Hansson, 2006).

Risk theory as we know it today started in 1491 with Luca Pacioli, a Franciscan monk, who posed the question, since known as "Pacioli's Puzzle": When a two-player game of chance is stopped before completion, how do you divide the stakes if one player is ahead of the other? That question remained unanswered for 163 years until Chevelier de Méré, a French nobleman, challenged the great French mathematician, Blaise Pascal, to solve Pacioli's Puzzle. Pascal accepted the challenge and with the aid of his colleague, Pierre de Fermat, solved the puzzle - the stakes should be divided based on the probability of each player winning the game - thereby introducing the calculation of probability and, thus, a theory of probability, which is the essential tool necessary for the development of the theory of risk.

The next fifty years saw significant activity in the development of tools used in risk measurement, culminating with the Swiss mathematician Jakob Bernoulli's (1713/1968) Law of Large Numbers, published eight years after his death. His work was the first attempt to measure uncertainty. This was followed quickly by de Moivre's (1718/1967) formulation of the Law of Averages and Daniel Bernoulli's (Jakob's nephew) mathematical expression of utility theory (1738/2005). The final pre-20th century development underpinning risk theory was the 1885 discovery by the English scientist, Sir Francis Galton (1886): of regression to the mean.

Frank Knight (1921), in his seminal book on Risk, Uncertainty, and Profit, was the first to make the important distinction between risk and uncertainty:

> "…Uncertainty must be taken in a sense radically distinct from the familiar notion of Risk, from which it has never been properly separated. The term "risk," as loosely used in everyday speech and in economic discussion, really covers two things which, functionally at least, in their causal relations to the phenomena of economic organization, are categorically different. … The essential fact is that "risk" means in some cases a quantity susceptible of measurement, while at other times it is something distinctly not of this character; and there are far-reaching and crucial differences in the bearings of the phenomenon depending on which of the two is really present and operating. …It will appear that a *measurable* uncertainty, or "risk" proper, as we shall use the term, is so far different from an *unmeasurable* one that it is not in effect an uncertainty at all."

In the years following Knight's contribution, the concept of utility (satisfaction) had its detractors due to its subjective nature. Allais (1953) and Ellsberg (1961) provided situations that lead to "paradoxical" behavior patterns in conflict with utility theory (also see Hogarth & Reder, 1987) and J. F. Yates, 1990). Herbert Simon (1955; 1956; 1978), the noted economist, argued that the implementation of utility theory by the average person is beyond normal cognitive limits and proposed the concept of "banded rationality" as a more suitable extension of UT.

However, when John von Neumann and Oskar Morganstern (VM) (1944) launched the field of game theory with their ground-breaking book, *Theory of Games and Economic Behavior*, they provided a means of measuring utility objectively. With the second edition of their book (1947), VM provided "an axiomatic treatment of utility", that is, the context for using utility functions in the analysis of decision-making under risky. They showed that an objectivity-based, expected utility model was possible based on rather simple axioms of consistent preference under risk and uncertainty. In the VM model, consequences of possible actions are objectively known a long as an independence condition is upheld.

Near-term refinements to the VM model were provided by Jacob Marschak (1950): Herstein & Milnor (1953): Marschak (1950): Samuelson (1952), Herstein and Milnor (1953). Savage (1948) and then Anscombe & Aumann (1963) extended the VM model to probability distributions which are subjectively determined. This subjective expected utility (SEU) model served as the basis for the emergence of the "decision theory" and "rational choice" fields of study, subsequently developed to a greater extent by Edwards (1962): Kahneman & Tversky (1979b): and Karmarkar (1978). Historical perspectives on the concept of risk are provided by (Bernstein, 1996; Hacking, 1975; Muir, 1996).

Methodology

In order to investigate students' perception of risk in making course selection decisions, the author conducted a survey of both undergraduate and graduate students in a private university. A total of 503 students responded to the survey, including 390 undergraduate and 113 graduate students. Among the undergraduate group, 62 were freshmen, 78 were sophomores, 107 were juniors, and 143 were seniors. The university's School of Business Administration (SBA) and Arts and Sciences (A&S) were represented in the population so that interdisciplinary as well as undergraduate/graduate comparisons can be made.

Two surveys instruments were developed. One instrument was used for undergraduate students (Exhibit A) and another for graduate students (Exhibit B). There were minor differences related to types of courses taken, not risk factors. Risk factor categories in both instruments were Subject Matter, Professor, Course Environment, and Grading. From prior interviews with students, this sequence of reasoning in evaluating the risk in selecting courses was the most intuitive. The survey instruments were shown to groups of undergraduate and graduate students prior to conducting the overall survey to elicit suggestions on question inclusion or omission, construct, and order. For example, feedback resulted in modifying an original version of the undergraduate survey to include a separate Subject Matter sections for assessing the risk in selecting General Education courses and Major courses. The survey instrument went through several revisions before the final version.

Prior to conducting the survey, students were told the purpose of the survey (assessment of risk in course selection), that their responses were purely subjective based on their thoughts and experiences in selecting courses, that they should consider the entire scale of degree of risk they perceive in making course selections, and that there are no right or wrong answers. The rating scale ranged from zero (no risk) to four (extreme risk). Students were given twenty minutes to complete the survey. All students completed the survey within that time frame.

Responses were segmented by major undergraduate and graduate student groups and further segmented for analysis based on undergraduate class standing (freshman through senior standing) and school (Arts & Sciences and Business). Strength of risk perception was determined by mean scores of response ratings were used to determine strength of risk perception and standard deviation of scores were used to measure the degree of divergence in risk perceptions.

Results

Table 1 shows the mean scores (M) and corresponding standard deviations (S) for risk elements for the entire population of students taking the survey, categorized by all undergraduates, class standing within undergraduates, school within undergraduates, and all graduate students.. The risk elements (in abbreviated descriptions) are shown in the order in which they appeared in the survey. In general, risk scores for all elements were in the 1.5 to 2.5 range, indicating that students perceived a mid-level of risk in CS. An interesting aspect of the results is the relative risk they perceive in the risk elements. Both absolute and relative risk perception results are described below.

Table 1. Student Risk Perception of Subject Matter Statistics
(M: Mean, Range:0-4; S: Standard Deviation)

	All UG	Fr	So	Ju	Se	UG Bus	UG A&S	All Grad
Count	390	62	78	107	143	202	188	113
Subject Matter (G.E. Courses)								
Will not match course description	M:1.33 S:0.86	M:1.53 S:0.88	M:1.33 S:0.87	M:1.24 S:0.87	M:1.31 S:0.84	M:1.25 S:0.83 (7;0.73)	M:1.35 S:0.86 (7;0.81)	n/a
Too difficult	M:1.87 S:1.10	M:1.90 S:1.09	M:2.13 S:1.04	M:1.98 S:1.19	M:1.64 S:1.05	M:1.80 S:1.11	M:1.88 S:1.08	n/a

Not personally interesting.	M:2.50 S:0.96	M:2.43 S:1.00	M:2.37 S:0.95	M:2.48 S:0.94	M:2.61 S:0.96	M:2.58 S:0.93	M:2.45 S:0.99	n/a
Will not assist in career path.	M:1.93 S:1.11	M:1.99 S:1.14	M:2.01 S:1.04	M:1.85 S:1.16	M:1.93 S:1.10	M:1.99 S:1.11	M:1.91 S:1.11	n/a
Subject Matter (UG Major Courses; Grad)								
Will not match course description	M:1.33 S:1.01	M:1.39 S:0.99	M:1.38 S:1.00	M:1.39 S:1.11	M:1.25 S:0.95	M:1.22 S:0.95	M:1.40 S:1.04	M:1.67 S:1.01
Too difficult	M:1.93 S:1.04	M:1.72 S:1.04	M:2.37 S:0.98	M:2.04 S:1.05	M:1.71 S:0.97	M:1.89 S:1.07	M:1.98 S:1.01	M:1.42 S:1.06
Not personally interesting.	M:1.80 S:1.11	M:1.64 S:0.98	M:1.72 S:1.16	M:1.86 S:1.13	M:1.86 S:1.13	M:1.87 S:1.11	M:1.74 S:1.12	M:2.36 S:1.09
Will not assist in grad school admission	M:1.56 S:1.15	M:1.60 S:1.07	M:1.69 S:1.20	M:1.60 S:1.15	M:1.44 S:1.15	M:1.55 S:1.13	M:1.59 S:1.15	n/a
Will not assist in career path.	M:1.69 S:1.16	M:1.64 S:1.18	M:1.89 S:1.23	M:1.73 S:1.14	M:1.57 S:1.12	M:1.68 S:1.18	M:1.74 S:1.14	M:2.37 S:1.12
Subject Matter (UG G.E. and Major Courses; Grad)								
Negative recommend-ation by other student	M:2.61 S:0.93	M:2.38 S:1.05	M:2.75 S:0.82	M:2.63 S:0.94	M:2.64 S:0.91	M:2.71 S:0.90	M:2.54 S:0.96	M:2.19 S:1.10

Subject matter risk elements were divided into two categories, General Education (GE) courses, which included only undergraduate students, and Major courses, which included both undergraduate and graduate students. In the GE category, the potential risk perceived by students that the course would ultimately not provide the expected returns was ranked highest (highest mean score) when there was a negative recommendation by other students. This "network effect" was prevalent across all subject matter categories and in all class standings, with a mean score of 2.61 for undergraduates and a slightly lower score of 2.19 for graduates. Sophomores seemed to rely on the "network effect" to a greater degree than students in other class standings. Also, undergraduates in the SBA showed a slightly higher "network effect" than those in the A&S school. The "network effect" was consistently the highest risk condition across all academic standing groups with the exception of freshmen who ranked "not personally interesting" slightly higher.

The potential that the GE course would be "not personally interesting" to the student also showed high perceived risk with a mean score of 2.50, but dropped significantly in importance for students considering elective, major, or graduate courses (1.80). There was a high level of consistency in perceived risk for those elements related to GE courses with the exception that seniors ranked their perception that a course would be "too difficult" lower than students in other class rankings. Of course, seniors were looking retrospectively at GE courses, so their perception likely was skewed by their experience in those courses. Standard deviations were low for all risk elements across all student categories implying agreement among risk perceptions.

For risk elements related to courses in the students' major, which provide more decision alternatives, the "network effect" again predominated. Whereas for GE courses, students showed higher perceived risk in the course being "not personally interesting" than the course being "too

difficult", for major courses, those rankings were reversed for undergraduates, with "difficulty" having more perceived risk than "uninteresting." For graduate students the risk elements of "not personally interesting" (2.36) and "will not assist in career path" (2.37) showed a virtual tie for highest risk element and with very similar standard deviations. Undergraduate were not as concerned about the course not meeting their expectations that it would assist in their career path (1.69). Notably, sophomores and juniors showed higher scores in the career path risk element than seniors. The perceived risk that the course would be "too difficult" ranked relatively low (1.42).

The next set of risk elements presented in the survey concerned the professor (Table 2). The "network effect" ranked high when students considered risks associated with the professor teaching the course. Undergraduates relied more on the "network effect" (2.71) than graduate students (2.11) and freshman (2.46) somewhat less than all other undergraduates. Sophomores gave this risk element the highest score (2.88) found in any risk element category. The perceived risk that the professor would not present the material "in an interesting way" received high mean scores for both undergraduates (2.46) and graduate students (2.39). The importance of this risk element increased for undergraduates as class standing progressed and showed higher for SBA students than A&S students. For both UG and G class groups, the perceived risks of the professor being "too demanding" and "unavailable outside of class" were relatively low (1.83 and 1.69 for UG; 1.51 and 1.61 for graduates).

Differences in the manner in which students saw risk in this category were found in four elements. Juniors saw more risk than other subject groups in the degree to which the course description matched the manner in which the professor presented the course, possibly formed from experiences in courses where there was a mismatch. Other differences were in the lower risk assessment by graduate students (versus undergraduates) in the "too demanding", "uses Socratic method", and "negative recommendation" elements. The greater maturity and academic experience of graduate students relative to undergraduates may contribute to this difference.

Table 2. Student Risk Perception of Professor
(M: Mean, Range:0-4; S: Standard Deviation)

	All UG	Fr	So	Ju	Se	UG Bus	UG A&S	All Grad
Count	390	62	78	107	143	202	188	113
Professor								
The course presentation will not match course description	M:1.70 S:0.95	M:1.65 S:1.07	M:1.67 S:0.87	M:1.81 S:1.02	M:1.66 S:0.90	M:1.65 S:0.94	M:1.76 S:0.99	M:1.77 S:1.11
Not presented in interesting way.	M:2.46 S:0.88	M:2.32 S:0.91	M:2.40 S:0.92	M:2.48 S:0.81	M:2.53 S:0.90	M:2.51 S:0.89	M:2.42 S:0.91	M:2.39 S:1.01
Professor unavailable outside of class	M:1.69 S:1.07	M:1.68 S:1.03	M:1.88 S:1.13	M:1.72 S:1.01	M:1.58 S:1.08	M:1.66 S:1.07	M:1.68 S:1.08	M:1.62 S:1.09
Too demanding	M:1.83 S:1.05	M:1.73 S:1.00	M:1.98 S:1.05	M:1.89 S:1.11	M:1.77 S:1.03	M:1.90 S:1.06	M:1.73 S:1.02	M:1.51 S:1.01
Uses Socratic method	M:1.71 S:1.07	M:1.70 S:0.99	M:1.98 S:1.03	M:1.79 S:1.17	M:1.52 S:1.02	M:1.69 S:1.11	M:1.74 S:1.02	M:1.27 S:0.94

Negative recommend-ation by other student	M:2.71 S:1.02	M:2.46 S:1.14	M:2.88 S:0.96	M:2.75 S:1.01	M:2.69 S:0.98	M:2.78 S:0.99	M:2.64 S:1.06	M:2.11 S:1.11

The risk elements in the Course Environment category related to assignment (reading and writing) and exam types (Table 3). With regard to reading assignments, undergraduate students expressed the greatest risk perception for the potential that the GE course would have "too many reading assignments" (2.43): with sophomores seeing the highest risk in this element (2.76). UG showed less concern with this element for major courses (2.13). Graduate students saw less risk in reading assignments being too extensive (1.88) than that the reading material would not be interesting (2.12). The next highest perceived risks for UG were seen in the "reading material not interesting" and "too much busy work" elements, both receiving scores of 2.23.

Overall, graduate students perceived less risk in the elements of Course Environment than UG. Higher scores for graduate students were found in "reading material not interesting" (2.12) and "too much busy work" (2.05). "Demanding writing assignments" were seen as having higher perceived risk by sophomores (2.30) and seniors saw the highest perceived risk in "demanding writing assignments" (2.24) than any subject category.

The survey revealed that the perceived risk associated with the type of exam given in the course was low relative to the other risk elements. Only freshmen in non-science courses revealed somewhat high perceived risk that exams would be essay-type (2.18). Graduate students showed very low risk perception for the exam type elements.

Table 3. Risk Perception of Course Environment
(M: Mean, Range:0-4; S: Standard Deviation)

	All UG	Fr	So	Ju	Se	UG Bus	UG A&S	All Grad
Course Environment								
Reading material not interesting	M:2.23 S:0.95	M:2.14 S:0.94	M:2.29 S:0.82	M:2.17 S:0.94	M:2.27 S:1.03	M:2.25 S:1.05	M:2.22 S:0.87	M:2.12 S:1.01
Textbook too difficult.	M:1.81 S:0.97	M:1.93 S:0.89	M:2.11 S:0.90	M:1.83 S:1.02	M:1.60 S:0.97	M:1.79 S:1.05	M:1.81 S:0.91	M:1.52 S:1.01
For G.E., too many reading assignments	M:2.43 S:1.04	M:2.39 S:1.04	M:2.76 S:0.93	M:2.39 S:1.03	M:2.31 S:1.07	M:2.50 S:1.03	M:2.36 S:1.06	n/a
For major, too many reading assignments	M:2.13 S:0.99	M:2.15 S:1.07	M:2.22 S:0.92	M:2.16 S:0.93	M:2.05 S:1.02	M:2.09 S:0.97	M:2.23 S:1.00	M:1.88 S:1.17
Know less than other students about subject at start	M:1.66 S:1.01	M:1.72 S:0.89	M:1.72 S:1.05	M:1.70 S:1.08	M:1.56 S:1.00	M:1.59 S:1.06	M:1.76 S:0.97	M:1.52 S:1.08
Reading material not interesting	M:2.23 S:0.95	M:2.14 S:0.94	M:2.29 S:0.82	M:2.17 S:0.94	M:2.27 S:1.03	M:2.25 S:1.05	M:2.22 S:0.87	M:2.12 S:1.01
Textbook too difficult.	M:1.81 S:0.97	M:1.93 S:0.89	M:2.11 S:0.90	M:1.83 S:1.02	M:1.60 S:0.97	M:1.79 S:1.05	M:1.81 S:0.91	M:1.52 S:1.01

For G.E., too many reading assignments	M:2.43 S:1.04	M:2.39 S:1.04	M:2.76 S:0.93	M:2.39 S:1.03	M:2.31 S:1.07	M:2.50 S:1.03	M:2.36 S:1.06	n/a
For major, too many reading assignments	M:2.13 S:0.99	M:2.15 S:1.07	M:2.22 S:0.92	M:2.16 S:0.93	M:2.05 S:1.02	M:2.09 S:0.97	M:2.23 S:1.00	M:1.88 S:1.17
Know less than other students about subject at start	M:1.66 S:1.01	M:1.72 S:0.89	M:1.72 S:1.05	M:1.70 S:1.08	M:1.56 S:1.00	M:1.59 S:1.06	M:1.76 S:0.97	M:1.52 S:1.08
Demanding writing assignments	M:2.19 S:1.02	M:2.13 S:1.01	M:2.30 S:0.98	M:2.06 S:0.96	M:2.24 S:1.08	M:2.20 S:0.99	M:2.18 S:1.06	M:1.59 S:1.10
Too much busy work	M:2.23 S:1.07	M:2.04 S:1.05	M:2.14 S:1.00	M:2.19 S:1.08	M:2.38 S:1.10	M:2.32 S:1.05	M:2.11 S:1.09	M:2.05 S:1.10

The last general category of risk presented to the student for evaluation related to grading (Table 4). This category was broken down into "Grading" and "Historical Grade Distribution". Within the "Grading" risk category, grading elements showed the highest risk scores than any other category. Undergraduates attributed significant risk (fourth highest among all risk elements) to the professor being a demanding grader (2.48): with sophomores giving this element the highest risk score (2.63) of any class standing. Graduate students gave a lower risk score (1.95) to this element than undergraduates, either because they were more certain of their exam-taking ability or the perception, based on experience, that professors give higher grades in graduate school.

Table 4. Risk Perception of Grading Policy
(M: Mean, Range:0-4; S: Standard Deviation)

Grading								
	All UG	Fr	So	Ju	Se	UG Bus	UG A&S	All Grad
Professor will be a demanding grader.	M:2.48 S:0.93	M:2.39 S:0.88	M:2.63 S:0.91	M:2.54 S:0.98	M:2.41 S:0.93	M:2.46 S:0.87	M:2.55 S:0.97	M:1.95 S:1.03
Grading not clearly defined	M:2.17 S:1.13	M:2.03 S:0.96	M:2.41 S:1.28	M:2.26 S:1.10	M:2.05 S:1.13	M:2.28 S:1.15	M:2.06 S:1.13	M:1.89 S:1.16
No curve.	M:1.95 S:1.05	M:2.24 S:0.96	M:2.01 S:1.01	M:1.88 S:1.10	M:1.85 S:1.06	M:1.95 S:1.11	M:1.95 S:1.01	M:1.66 S:1.20
Grading too subjective.	M:2.16 S:1.04	M:2.10 S:1.04	M:2.16 S:0.99	M:2.20 S:1.02	M:2.15 S:1.08	M:2.28 S:1.04	M:2.01 S:0.98	M:1.85 S:1.04
Grade will include class participation.	M:1.86 S:1.17	M:2.21 S:1.11	M:1.83 S:1.21	M:1.70 S:1.21	M:1.82 S:1.14	M:1.93 S:1.21	M:1.80 S:1.14	M:1.61 S:1.18
Grade will include class attendance.	M:1.81 S:1.22	M:2.13 S:1.13	M:1.73 S:1.27	M:1.50 S:1.14	M:1.91 S:1.25	M:1.83 S:1.27	M:1.81 S:1.21	M:1.41 S:1.25
Small number of	M:2.36	M:2.60	M:2.55	M:2.32	M:2.18	M:2.33	M:2.44	M:1.58

large exams	S:1.11	S:1.08	S:0.90	S:1.21	S:1.11	S:1.08	S:1.12	S:1.04
Grading too much weighted toward paper.	M:1.98 S:1.08	M:2.25 S:1.04	M:2.03 S:1.03	M:1.83 S:1.11	M:1.93 S:1.08	M:1.96 S:1.04	M:1.99 S:1.11	M:1.41 S:0.97
Historical Grade Distribution (If Known)								
% of "A" grades	M:1.61 S:1.37	M:1.68 S:1.40	M:1.71 S:1.42	M:1.66 S:1.39	M:1.48 S:1.32	M:1.62 S:1.38	M:1.60 S:1.34	M:1.60 S:1.21
% of "B" grades	M:1.68 S:1.10	M:1.90 S:1.13	M:1.81 S:1.01	M:1.65 S:1.11	M:1.53 S:1.13	M:1.62 S:1.08	M:1.75 S:1.12	M:1.44 S:1.03
% of "C" grades	M:1.98 S:1.07	M:1.96 S:0.98	M:2.27 S:1.02	M:1.97 S:1.05	M:1.84 S:1.12	M:1.96 S:1.10	M:2.07 S:1.06	M:1.56 S:1.20
% of "D" grades	M:2.25 S:1.36	M:2.17 S:1.29	M:2.51 S:1.36	M:2.26 S:1.36	M:2.14 S:1.38	M:2.26 S:1.43	M:2.26 S:1.29	M:1.67 S:1.50
% of "F" grades	M:2.42 S:1.55	M:2.39 S:1.54	M:2.64 S:1.63	M:2.44 S:1.52	M:2.30 S:1.54	M:2.45 S:1.60	M:2.35 S:1.52	M:1.73 S:1.61
No grade distribution consistency	M:2.20 S:1.11	M:2.13 S:1.03	M:2.33 S:1.06	M:2.34 S:1.18	M:2.07 S:1.10	M:2.28 S:1.08	M:2.10 S:1.11	M:1.83 S:1.30

Undergraduate students also saw higher risk in their grade being weighted too much on a small number of large exams (2.36) with the risk decreasing as class standing progresses. The same risk-decreasing progression was found for the "no curve" element, with the need for risk resolution by their grade being adjusted in the event that an exam results in low grades for all students declining with student experience. Relatively higher risk scores were given by all UG subject groups to the elements "Grading not clearly defined" (2.17) and "Grading too subjective" (2.16). Overall, graduate students perceived less risk in CS than UG in the grading policy of the course.

In response to the perceived risk in CS when they know the historical grade distribution, all students were given the following (written) survey instructions: *Assume that you know the historical grade distribution for a particular course offered by a particular professor. Please indicate the degree to which you would consider each of the following in your assessment of the risk associated with taking the course.* Below those instructions, the survey showed six elements – *The percentage of "x" grades*, where x equaled A through F, and *There has been a wide dispersion of grades (that is, grades of A, B, C, D, and F are typically given each time the course is given).* The results showed increasing perceived risk for increasing percent of poorer grades, as would be expected. Furthermore, lack of grade distribution consistency showed relatively high perceived risk, more so for UG (2.20) than for G (1.83).

Within the academic standing groups, freshmen gave high risk scores to all grading categories while, in general, the grading risk scores declined as academic standing advanced. This indicates that students are more concerned about the risk of not achieving their desired grade earlier in their academic career than later. Standard deviations in the "D" and "F" risk elements were higher than for any other elements, demonstrating that some students were very concerned about getting a "D" or "F" in the course while others had more confidence that their performance would warrant a higher grade

DISCUSSION AND IMPLICATIONS

The CS decision throughout a student's college career involves both expected return and perceived risk. Risk Theory provides a foundation upon which these decisions can be analyzed. The related field of Decision-Making under Risk and Uncertainty ties together these two decision elements. The importance of this area of study cannot be overstated as it is integrated into many fields – business, investments, science, military, politics, medicine, and education.

The results of the present survey lead to the inference that students enroll in a course hoping for a positive outcome but realizing that the outcome is not certain. A student's expectations may not be met due to many factors. The survey addresses academic factors, but personal and emotional factors may also contribute to the risk. With respect to those academic factors, the survey results indicate a contrast between the high perceived grade grade-related risk and low subject matter-related risk of UG students and the inverse risk perception of G students relative to UG. We learned that UG and G students perceive risk differently. UG students perceive grade factors as representing the highest risk, and G students perceive subject matter as the highest risk. Risk perceptions also differ across class standing among UG students, but are very consistent between UG Business and Arts & Sciences students.

If we assume that students are risk averse in their CS, then the task facing college administrators in a position to influence CS is to reduce the perceive risk of that decision. Risk cannot be eliminated as expected returns may be multi-dimensional and outside the control of administrators. Students in a class will have varied expectations, all of which cannot be met in full. For example, even if a student were guaranteed an "A" in a course, thereby eliminating the risk that their grade expectation would not be met, their expected "subject matter is interesting" or "relevance to career path" return may not be met. Some students in the same class may be willing to sacrifice grade for a rigorous learning experience related to subject matter of high interest.

The results indicate that enhanced access to relevant information about courses will contribute to reducing the perceived risk of CS and provide a realized return closer to the expected return, thereby reducing the risk of the decision. Mintzberg (1998), using the leadership style of Maxwell Tovey, then artistic director and conductor of the Winnipeg Symphony Orchestra, proposed that leadership/managing is to act invisibly, unobtrusively, to guide through "nuances and constraints" and not "obedience and harmony." Enhancements in the information technology infrastructure of most academic institutions provide the foundation for administrators to "act invisibly and unobtrusively", reducing CS risk through wider and more accessible and organized channels of information flow. Greater course information access among students may contribute to higher quality of learning experience through a clearer understanding by administration and faculty of student expectations.

There are other areas of Risk Theory and Decision Making Under Risk and Uncertainty that provide research paths to enhance the understanding of students' course selection. Regret Theory, normally stated in terms of a pairwise choice between alternatives, states that a decision-maker desires to avoid the disutility of the post-decision perception that they have made the wrong decision even if the decision was made maximizing expected utility (Loomes & Sugden, 1982; Sugden, 1993; Quiggin, 1989). Another area is an investigation of the cross-cultural differences of risk perceptions of U.S. and non-U.S. students in selecting courses (i.e., Marris, Langford, & O'Riordan, 1998; Renn & Rohrmann, 2000; E. Weber & Hsee, 2000; E. U. Weber

& Hsee, 1999). A prospective research area that would be particularly interesting to university administrators in providing systematic approaches to risk perception is decision-making support systems, which are generally thought of as computerized organizational (university) systems to support both student and administrative decisions (i.e., Mora, Forgionne, Gupta, Cervantes, & Gelman, 2003; Power, 2002; Power & Sharda, 2007).

EXHIBIT A
UNDERGRADUATE STUDENT "COURSE SELECTION RISK" SURVEY

If you have already completed this short questionnaire, please do not complete it again.   Simply return it without response to your professor.

This survey does not apply to the course in which you are now sitting, but to courses you might take in general. There are no "correct" responses to this survey.   Your responses are your personal analyses of the issues inherent in the questions.   The questions pertain to your course selection evaluation and, in particular, your personal assessment of the risk factors in choosing the courses in which you have a choice and not those which you are required to take.

In responding to the questions below, please describe your own personal thinking as best you can. Do not sign your name, as your responses will be anonymous.

Thank you for your cooperation.

Potential Course Risk Factors (Please respond to the following as they pertain to any course you are considering and not exclusively to the course in which you are currently sitting. If you consider any other course risk factors that are not shown below, please write them in the blank rows and indicate their risk levels for you.)	Please circle the number in the column representing the level of risk you perceive in each potential course risk factor.				
	No Risk (0)	Low Risk (1)	Moderate Risk (2)	High Risk (3)	Extreme Risk (4)
Subject Matter (G.E. Courses)					
The subject matter presented in a course for a G.E. Requirement will not match the course description in the school bulletin.	0	1	2	3	4
The subject presented in a course for a G.E. requirement will be too difficult for me to handle and achieve my grade objective.	0	1	2	3	4
The subject matter in a course for a G.E. requirement will not be personally interesting to me.	0	1	2	3	4
I will find that at the end of a G.E. course, it will not assist me towards choosing a major or eventually embarking on my career path.	0	1	2	3	4
	0	1	2	3	4
Subject Matter (Major Courses)					
The subject presented in a course for my major will not match the course description in the school bulletin.	0	1	2	3	4
The subject presented in a course for my major will be too difficult for me to handle and achieve my grade objective.	0	1	2	3	4
The subject matter in a course for my major will not be personally interesting to me.	0	1	2	3	4
I will find that at the end of a course required for my major, it will not assist me towards getting into the graduate school of my choice.	0	1	2	3	4
I will find that at the end of a course required for my major, it will not assist me embarking on my career path.	0	1	2	3	4
	0	1	2	3	4

Subject Matter (G.E. and Major Courses)					
A friend or fellow classmate has told me negative things regarding the subject matter taught in either a G.E. or major course.	0	1	2	3	4

Potential Course Risk Factors (Please respond to the following as they pertain to any course you are considering and not exclusively to the course in which you are currently sitting. If you consider any other course risk factors that are not shown below, please write them in the blank rows and indicate their risk levels for you.)	**Please circle the number in the column representing the level of risk you perceive in each potential course risk factor.**				
	No Risk (0)	**Low Risk (1)**	**Moderate Risk (2)**	**High Risk (3)**	**Extreme Risk (4)**
Professor					
The course professor will not present the course material as specified in his/her course syllabus.	0	1	2	3	4
The course professor will not present the course material in an interesting way.	0	1	2	3	4
The course professor will not be available to assist me with the course work outside the classroom.	0	1	2	3	4
The course professor will be too demanding of my active participation during class, i.e., answering questions and participating in class discussions.	0	1	2	3	4
The professor extensively uses the Socratic method, that is, instead of lecturing in class, the professor asks a sequence of questions and, through answering, the student eventually comes to the desired knowledge.	0	1	2	3	4
A friend or fellow classmate has told me negative things regarding a professor.	0	1	2	3	4
	0	1	2	3	4

Potential Course Risk Factors (Please respond to the following as they pertain to any course you are considering and not exclusively to the course in which you are currently sitting. If you consider any other course risk factors that are not shown below, please write them in the blank rows and indicate their risk levels for you.)	Please circle the number in the column representing the level of risk you perceive in each potential course risk factor.				
	No Risk (0)	Low Risk (1)	Moderate Risk (2)	High Risk (3)	Extreme Risk (4)
Course Environment					
The textbook and other reading material will not be interesting to me.	0	1	2	3	4
The textbook reading will be too difficult.	0	1	2	3	4
In a course for a G.E. requirement, the amount of reading in the course will be very demanding.	0	1	2	3	4
In a course required for my major, the amount of reading in the course will be very demanding.	0	1	2	3	4
The other students in the course will know more about the subject at the beginning of the course than I know.	0	1	2	3	4
There will be a lengthy writing requirement for the course such as large research papers.	0	1	2	3	4
There will be a lot of busy work assigned for this class.	0	1	2	3	4
In classes for a liberal arts major (i.e., English, Philosophy, Political Science, etc) exams will be essay-writing format.	0	1	2	3	4
In classes for a non-liberal arts major (i.e., Business, Math, Chemistry, etc) exams will be essay-writing format.	0	1	2	3	4
In classes for a liberal arts major (i.e., English, Philosophy, Political Science, etc) exams will be multiple choice and application- based format.	0	1	2	3	4
In classes for a non-liberal arts major (i.e., Business, Math, Chemistry, etc) exams will be multiple choice and application-based.	0	1	2	3	4
	0	1	2	3	4

Potential Course Risk Factors (Please respond to the following as they pertain to any course you are considering and not exclusively to the course in which you are currently sitting. If you consider any other course risk factors that are not shown below, please write them in the blank rows and indicate their risk levels for you.)	Please circle the number in the column representing the level of risk you perceive in each potential course risk factor.				
	No Risk (0)	Low Risk (1)	Moderate Risk (2)	High Risk (3)	Extreme Risk (4)
Grading					
The professor will be a demanding grader.	0	1	2	3	4
The grading policy will not be completely defined.	0	1	2	3	4
The professor will not grade on a curve.	0	1	2	3	4
The grading will be too subjective.	0	1	2	3	4
A portion of my grade will be determined by active class participation.	0	1	2	3	4
My grade will be influenced by my class attendance.	0	1	2	3	4
My grade will be weighted too much on a small number of large exams.	0	1	2	3	4
My grade will be weighted too much on large writing assignments such as research papers.	0	1	2	3	4
	0	1	2	3	4
	0	1	2	3	4
Historical Grade Distribution					
Assume that you know the historical grade distribution for a particular course offered by a particular professor. Please indicate the degree to which you would consider each of the following in your assessment of the risk associated with taking the course.					
The percentage of "A" grades	0	1	2	3	4
The percentage of "B" grades	0	1	2	3	4
The percentage of "C" grades	0	1	2	3	4
The percentage of "D" grades	0	1	2	3	4
The percentage of "F" grades	0	1	2	3	4
There has been a wide dispersion of grades (that is, grades of A, B, C, D, and F are typically given each time the course is given).	0	1	2	3	4
There has been high volatility in grades	0	1	2	3	4

(that is, some semesters the professor gives higher grades and some semesters the same professor gives lower grades, with no overall consistency from semester to semester).					
	0	1	2	3	4
	0	1	2	3	4

EXHIBIT B
GRADUATE STUDENT "COURSE SELECTION RISK" SURVEY

If you have already completed this short questionnaire, please do not complete it again.   Simply return it without response to your professor.

This survey does not apply to the course in which you are now sitting, but to courses you might take in general. There are no "correct" responses to this survey.   Your responses are your personal analyses of the issues inherent in the questions.   The questions pertain to your course selection evaluation and, in particular, your personal assessment of the risk factors in choosing the courses in which you have a choice and not those which you are required to take.

In responding to the questions below, please describe your own personal thinking as best you can. Do not sign your name, as your responses will be anonymous.

Thank you for your cooperation.

Potential Course Risk Factors (Please respond to the following as they pertain to any course you are considering and not exclusively to the course in which you are currently sitting. If you consider any other course risk factors that are not shown below, please write them in the blank rows and indicate their risk levels for you.)	Please circle the number in the column representing the level of risk you perceive in each potential course risk factor.				
	No Risk (0)	Low Risk (1)	Moderate Risk (2)	High Risk (3)	Extreme Risk (4)
Subject Matter					
The subject presented in the course will not match the course description in the school bulletin.	0	1	2	3	4
The subject presented in the course will be too difficult for me to handle and achieve my grade objective.	0	1	2	3	4
The subject matter presented in the course will not be personally interesting to me.	0	1	2	3	4
When the course is complete, I will find that the material I learned will not assist me in advancing through my career path.	0	1	2	3	4
A friend or fellow classmate has told me negative things regarding the subject matter taught in the course.	0	1	2	3	4
	0	1	2	3	4
Professor					
The course professor will not present the course material as specified in his/her course syllabus.	0	1	2	3	4
The course professor will not present the course material in an interesting way.	0	1	2	3	4
The course professor will not be available to assist me with the course work outside the classroom.	0	1	2	3	4
The course professor will be too demanding of my active participation during class, i.e., answering questions and participating in class discussions.	0	1	2	3	4
The professor extensively uses the Socratic method, that is, instead of lecturing in class, the professor asks a	0	1	2	3	4

sequence of questions and, through answering, the student eventually comes to the desired knowledge.					
A friend or fellow classmate has told me negative things regarding a professor.	0	1	2	3	4
	0	1	2	3	4
	0	1	2	3	4

Potential Course Risk Factors (Please respond to the following as they pertain to any course you are considering and not exclusively to the course in which you are currently sitting. If you consider any other course risk factors that are not shown below, please write them in the blank rows and indicate their risk levels for you.)	Please circle the number in the column representing the level of risk you perceive in each potential course risk factor.				
	No Risk (0)	Low Risk (1)	Moderate Risk (2)	High Risk (3)	Extreme Risk (4)
Course Environment					
The textbook and other reading material will not be interesting to me.	0	1	2	3	4
The textbook reading will be too difficult.	0	1	2	3	4
The amount of reading in the course will be very demanding.	0	1	2	3	4
The other students in the course will know more about the subject at the beginning of the course than I know.	0	1	2	3	4
There will be a lengthy writing requirement for the course such as large research papers.	0	1	2	3	4
There will be a lot of busy work assigned for this class.	0	1	2	3	4
The exams will be essay-writing format.	0	1	2	3	4
The exams will be multiple choice and application-based.	0	1	2	3	4
	0	1	2	3	4
	0	1	2	3	4

Potential Course Risk Factors (Please respond to the following as they pertain to any course you are considering and not exclusively the course in which you are currently sitting. If you consider any other course risk factors that are not shown below, please write them in the blank rows and indicate their risk levels for you.)	Please circle the number in the column representing the level of risk you perceive in each potential course risk factor.				
	No Risk (0)	Low Risk (1)	Moderate Risk (2)	High Risk (3)	Extreme Risk (4)
Grading					
The professor will be a demanding grader.	0	1	2	3	4
The grading policy will not be completely defined.	0	1	2	3	4
The professor will not grade on a curve.	0	1	2	3	4
The grading will be too subjective.	0	1	2	3	4
A portion of my grade will be determined by active class participation.	0	1	2	3	4
My grade will be influenced by my class attendance.	0	1	2	3	4
My grade will be weighted too much on too few exams.	0	1	2	3	4
My grade will be weighted too much on too few writing assignments.	0	1	2	3	4
	0	1	2	3	4
	0	1	2	3	4
Historical Grade Distribution					
Assume that you know the historical grade distribution for a particular course offered by a particular professor. Please indicate the degree to which you would consider each of the following in your assessment of the risk associated with taking the course.					
The percentage of "A" grades	0	1	2	3	4
The percentage of "B" grades	0	1	2	3	4
The percentage of "C" grades	0	1	2	3	4
The percentage of "D" grades	0	1	2	3	4
The percentage of "F" grades	0	1	2	3	4
There has been a wide dispersion of grades (that is, grades of A, B, C, D, and F are typically given each time the course is given).	0	1	2	3	4
There has been lots of volatility in grades (that is, some semesters the	0	1	2	3	4

professor gives higher grades and some semesters the same professor gives lower grades, with no overall consistency from semester to semester).					
	0	1	2	3	4
	0	1	2	3	4

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